CITY OF GATESVILLE

CID 01 – STILLHOUSE BRANCH WASTEWATER TREATMENT FACILITY IMPROVEMENTS

TWDB CWSRF NO. 73776

PROJECT MANUAL

MAY 24, 2023

PROJECT NUMBER 2-01590

Conformed Per Reduced Scope of Work Negotiated with Matous Construction in Letter dated August 15, 2023.

PROJECT MANUAL
as part of
the
Bidding Documents

PROJECT MANUAL
as part of
the
Contract Documents
(including Addenda numbers 1 to 4, inclusive)

Re-issued per Addendum No. 1

Walker Partners
engineers | surveyors

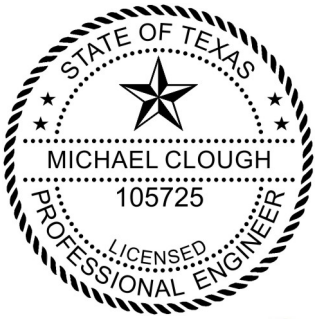
T.B.P.E. Registration No. 8053

Titles and Certifications

City of Gatesville
Stillhouse Branch Wastewater Treatment Facility Improvements

ENGINEER

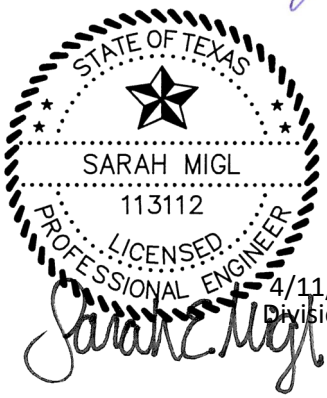
Walker Partners, LLC
6504 Bridge Point Parkway, Suite 200
Austin, Texas 78730
Firm Registration Number: 8053



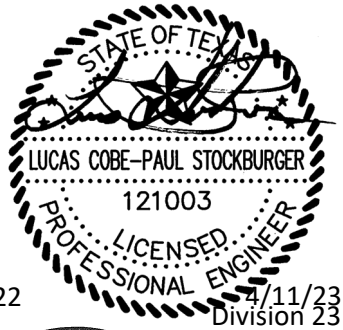
4/13/2023

JRSA Engineering, Inc.
6101 West Courtyard Drive, #1-200
Austin, Texas 78730
Firm Registration Number: 3997

Encotech Engineering Consultants
8500 Bluffstone Cove, Suite B-103
Austin, Texas 78759
Firm Registration Number: 1141

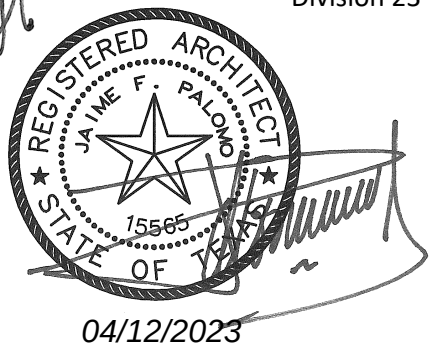


4/11/23
Division 22



4/11/23
Division 23

FGM Architects Inc.
3711 South Mopac Expressway, Building Two, #150
Austin, Texas 78746
Firm Registration Number: BR 2880



04/12/2023

Encotech Engineering Consultants
8500 Bluffstone Cove, Suite B-103
Austin, Texas 78759
Firm Registration Number: 1141

04/11/2023

DOCUMENT 00 01 10

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INVITATION TO SUBMIT PROPOSALS

City of Gatesville (Owner) is requesting Competitive Sealed Proposals for Stillhouse Branch Wastewater Treatment Facility (WWTF) Improvements from qualified contractors to be received until 3:00 p.m. on June 20, 2023, in its offices located at City of Gatesville City Hall, 803 E. Main Street, Gatesville, TX 76528. Sealed competitive proposals will be publicly opened and read aloud at shortly thereafter at same location. Proposals are invited for furnishing all labor, equipment, and materials necessary for construction of the following:

2-01590 – City of Gatesville – Stillhouse Branch Wastewater Treatment Facility Improvements

Stillhouse Branch WWTF consists of Upgrade of Stillhouse Branch WWTF to 2.7 MGDAA and improvements to influent pumping, aeration, RAS pumping, chlorine contact basins and effluent pumping. Project will be awarded to proposal providing best value to Owner based on a number of factors including cost, experience of contract, and prior work performance.

A pre-submittal conference will be held at 10:00 a.m. local time on May 22, 2023 at City of Gatesville Stillhouse Water Treatment Facility, 402 Stillhouse Road, Gatesville, TX 76528. Representatives of Owner and Engineer will be present to discuss the Project. Offerers are encouraged to attend and participate in the conference.

Any contract or contracts awarded under this Invitation for Bid (IFB), Request for Proposals (RFP), or Request for Qualifications (RFQ) are expected to be funded in part by financial assistance from the TWDB. Neither the U.S. Environmental Protection Agency (EPA) or the State of Texas, nor any of its departments, agencies, or employees, are or will be a party to this IFB, RFP, RFQ, or any resulting contract.

The Davis-Bacon prevailing wage requirements apply to Contractors and Subcontractors performing on federally funded or assisted contracts in excess of $2,000 for the construction, alteration or repair (including painting) of a treatment works project under the CWSRF. For additional information on Davis-Bacon wage rate, please consult TWDB Guidance No. DB-156.

Any contract(s) awarded under this Invitation for Bids is/are subject to the American Iron and Steel (AIS) requirements of Section 608 of the Federal Water Pollution Control Act.

This contract is subject to the Environmental Protection Agency's (EPA) Disadvantaged Business Enterprise (DBE) Program, which includes EPA-approved fair share goals toward procurement of Minority and Women-owned Business Enterprise (M/WBE) businesses. EPA rules require that applicants and prime contractors make a good faith effort to award a fair share of contracts, subcontracts, and procurements to M/WBEs through demonstration of the six affirmative steps. For more details of the DBE Program and the current, applicable fair share goals, please visit http://www.twdb.texas.gov/dbe.

Equal Opportunity in Employment - All qualified Applicants will receive consideration for employment without regard to race, color, religion, sex (including pregnancy), sexual orientation, gender identity, national origin, age (40 or older), disability, or genetic information. Bidders on this work will be required to comply with the Department of Labor regulations at 41 CFR Part 60-4, relating to Construction Contractors--Affirmative Action Requirements, which include the President's Executive Order No. 11246, as amended by Executive Order No. 11375 and Executive Order No. 13672, in the award and administration of contracts awarded under TWDB financial assistance agreements. Failure by the Contractor to carry out these requirements is a material breach, which may result in the termination of the awarded financial assistance.

This contract is subject to the federal requirements of Subpart C of 2 CFR Part 180 and Part 1532 regarding Debarment and Suspension. The Contractor will comply with the assurances provided with the bid that leads to a contract.

Proposals must be submitted on forms provided in Proposal Documents and accompanied by a Proposal Security in the penal sum of not less than five percent (5%) of base proposal amount, payable without recourse to Owner. Proposal Security may be in either form of a cashier's check or Offerer's Bond from a security company approved to conduct business in State of Texas as a guarantee that offerer will enter into a contract and execute a 100% payment bond within fifteen (15) days after issuance of a notice of award to that Offerer. Proposals not accompanied by such Security or received after designated proposal time will not be considered. Refer to other proposal requirements described in Document 00 21 13 – Instructions to Offerers.

Copies of Proposal Documents (Project Manual and Drawings) are on file and may be examined at office of Engineer. Copies of the Proposal Documents can be obtained electronically online from CivCast (www.civcastusa.com). All questions must be submitted electronically through CivCast's Question and Answer feature. For more information, contact Amy Jo Moreno at (254) 714-1402 or amoreno@walkerpartners.com.

Owner reserves the right to reject any or all Proposals and to waive informalities and irregularities.

END OF SECTION

SECTION 00 21 13

INSTRUCTIONS TO OFFERERS

COMPETITIVE SEALED PROPOSALS

1. Overview of Request for Proposal Process.
   1.1 Objective of Request for Proposal (RFP) process is to competitively procure services with a qualified contractor whose Proposal provides best value for Owner for the City of Gatesville Stillhouse Branch Wastewater Treatment Facility Improvements. Proposals will be received, publicly opened, and names and monetary Proposals of each Offeror read aloud. Subsequently, Proposals will be ranked according to criteria described in this RFP Document. Both cost and non-cost factors will be evaluated and scored. One or more Offerers may be invited back for discussions or to present their Proposal to Owner before final rankings are made. Owner may enter into contract negotiations with highest ranked firm for completion of Work. If negotiations with highest ranked firm are unsuccessful, Owner will formally close negotiations with this firm and initiate contract negotiations with next highest ranked firm. Upon agreement between both parties, a Contractor-executed Contract may be recommended for approval by Owner's governing body. Upon approval, Contract will be executed by Owner.
   1.2 This contract is contingent upon release of funds from the Texas Water Development Board.
   1.3 Any contract(s) awarded under this Invitation for Bids is/are expected to be funded in part by a loan or loan with principal forgiveness from the Texas Water Development Board and a grant from the United States Environmental Protection Agency, U.S. EPA. Neither the State of Texas, the U.S. EPA, nor any of it's departments, agencies, or employees, are or will be a party to this Invitation to Bids or any resulting contract.

2. Defined Terms.
   2.1. Definitions for the following terms used in these Instructions do not replace definitions for similar terms that may be contained within other sections of Contract Documents.
   2.2. Certain additional terms used in these Instructions to Offerers have meanings indicated below and are applicable to both singular and plural thereof.
      2.2.1. Addendum or Addenda- Additions, deletions, and/or changes to any part of RFP issued in writing by Owner prior to Proposal due date and time.
      2.2.2. Apparent Best Value Offeror-Offering Firm whose Proposal for completion of Work provides best value for Owner as defined by ranking criteria detailed in Article 11 of Instructions to Offerers.
      2.2.3. City Council – Governing body of Owner.
      2.2.4. Contract Negotiations- Discussions which take place between Owner and Apparent Best Value Offeror in an effort to reach agreement on contract scope of work, cost, and other contractual requirements.
      2.2.5. Contractor – Successful Offeror to this RFP who enters into a contractual relationship with Owner for completion of Work.
      2.2.6. Engineer - Walker Partners, LLC
      2.2.7. Issuing Office - Location from which RFP Documents are issued. For this project issuing office is Walker Partners, 6504 Bridge Point Parkway, Suite 200, Austin, TX 78730.
      2.2.8. Offeror, Offering Firm- Firm which responds to an RFP by submitting a Proposal directly to Owner. Offeror and Offering Firm shall have same meaning in the Instructions to Offerers.
      2.2.9. Owner – City of Gatesville.
      2.2.10. Proposal- Offeror's submittal which conforms to requirements set forth in this RFP.
      2.2.11. Proposal Form- As detailed in requirements of this RFP, contains unit pricing for all parts of Work and their aggregate as detailed and affirmed on Proposal Form and may include additional forms supplied by Offeror and or Owner that relate to Offeror's proposed cost for completing Work.

2.2.12. RFP Document- abbreviation of Request for Proposals Document, document used to request Competitive Sealed Proposals for procurement of goods and services as authorized under Government Code Chapter 2269, Subchapter D.

2.2.13. Statement of Qualifications, (SOQ) - Offeror submitted documents which describe Offering Firm's qualifications for performing Work and contain no pricing or cost data. Requirements for the Statement of Qualifications (SOQ) are set forth in Article 8 and Article 10 of Instructions to Offerers (this RFP).

2.2.14. Subcontractor - Any contractor or Supplier hired by Contractor to furnish materials and services specified in this RFP.

2.2.15. Successful Offeror - Firm who has completed negotiations with Owner and may enter into a Contract with Owner to complete Work.

2.2.16. Supplier- Same as Contractor

3. Schedule.

3.1 Advertisement: May 15, 2023, May 20, 2023, and May 27, 2023
Deadline for Questions and Inquiries: June 12, 2023
Last Addenda/Addendum Issued: June 14, 2023
Proposal Submission Deadline: June 20, 2023
Anticipated Construction Start: September 19, 2023

4. Request for Proposal Documents/Copies.

4.1. This Request for Competitive Sealed Proposals (RFP) consists of the following documents:

4.1.1. Invitation to Submit Proposals (00 11 12);

4.1.2. Instructions to Offerers (00 21 13);

4.1.3. Statement of Qualifications (00 21 14);

4.1.4. Proposal Form (00 41 00);

4.1.5. All Contract Documents referenced in this RFP;

4.1.6. Addenda to this RFP issued by Engineer;

4.1.7. Any attached forms; and

4.1.8. Proposal Security (00 43 13 - Offeror's Bond)

4.2. Complete set of RFP Documents may be accessed at Walker Partners, 6504 Bridge Point Parkway, Suite 200, Austin, TX 78730.

4.3. Complete sets of RFP Documents must be used in preparing Proposals; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from use of incomplete sets of RFP Documents.

4.4. Owner and Engineer, in making copies of RFP Documents available on above noted terms, do so only for purpose of obtaining Proposals for Work and do not confer a license or grant for any other use.

5. Competitive Sealed Proposal Process\Contract Documents.

5.1. All questions about Competitive Sealed Proposal Process or meaning or intent of Contract Documents are to be directed to Engineer.

Contact: Michael Clough, PE
Walker Partners
6504 Bridge Point Parkway, Suite 200,
Austin, TX 78730
(512) 382-0021

5.2. All questions must be submitted electronically through CivCast's Question and Answer feature.

5.3. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda. Oral interpretations or clarifications are not binding.

6. Pre- Submittal Conference.

6.1. A pre-submittal conference will be held at 10:00 a.m. local time on May 22, 2023 at City of Gatesville Stillhouse Water Treatment Facility, 402 Stillhouse Road, Gatesville, TX 76528. Representatives of Owner and Engineer will be present to discuss the Project. Offerers are encouraged to attend and participate in the conference. Engineer will transmit to all prospective

Offerers of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

7. Estimated Budget.
   7.1. Engineer's Opinion of Probable Construction Cost (project cost estimate) has been generated by Engineer. If an award is made, actual contract amount may vary.
   7.2. Engineer's Opinion of Probable Construction Cost for this project is $9,800,000.00.

8. Basis for Ranking of Proposals.
   8.1 Owner will consider qualifications (Statement of Qualifications) of each Offeror and their respective proposed Contract Price (Proposal Form) when evaluating Proposals to determine which Offeror, in sole opinion of Owner, will provide best value to Owner. All procurements shall conform to Chapter 2269 of State of Texas Government Code. Proposals will be evaluated using the following criteria and weighting:
      8.1.1. Proposed Project Cost: Offeror's Proposed Cost of Performing Work shall be indicated in Section 00 41 00 – Proposal Form, Subtotal Base Proposal.
      8.1.2. Experience/Past Performance of Offeror: Provide general information about Organization and a Statement of Qualifications. Include information on similar Projects on which Offeror has had significant involvement in the last five (5) years, or that demonstrate experience with similar Projects. This list is to include name and a current telephone number of references for each of these Project assignments. Offerers are to include a list of current Project assignments for each of the individuals proposed, anticipated completion date for this assignment and percentage of time they will have available to devote to this Project. Refer to Section 01 10 00 – Summary for a description of measures needed to ensure that the Stillwater WWTF maintains compliance with the TCEQ permit during construction. Address Organization plan and experience in other projects involving work on operating WWT Facilities.
      8.1.3 Experience/Qualifications of Superintendent: Provide information on Superintendent's qualifications including information on similar Projects on which Superintendent has been in charge of in the last five (5) years, or that demonstrate experience with similar Projects. This list is to include name and a current telephone number of references for each of these assignments. Superintendent must be dedicated to this Project full time for duration of Project and may not be changed without written approval by Engineer.
      8.1.4. Ability to Meet Proposed Budget and Time for Construction: Provide information to demonstrate ability of Organization to complete Projects within budget and on time.
      8.1.5. Other Factors: Owner will consider other factors in evaluating Proposals, including the following:
         8.1.4.1. Quality of Work: Demonstrated quality of Work on completed Projects as determined by site visits or discussions with references for Projects. Quality considerations may include appearance of completed Work, amount of warranty or rework required, durability and maintainability of completed Project, and quality of documentation provided.
         8.1.5.2. Safety: Demonstrated success in implementation of a site safety program.
         8.1.5.3. Claims Experience and Litigation History: Provide a list all claims or litigation involving construction Projects that have been filed by Offeror or Owner within last five (5) years, or that are currently outstanding.
   8.2. Table of criteria and weighting for the ranking of Offeror's Proposals.

Category	Description	Weighting Points
1	Proposed Project Cost	35
2	Experience/Past Performance of Offeror	30
3	Experience/Qualifications of Superintendent on Project	20
4	Ability to Meet Proposed Budget and Time for Construction	10
5	Other Factors (Safety/Claims/Litigation History)	5
	Total	100

9. Proposal Form.

9.1. Proposal Form (00 41 00) is included with RFP Documents.
9.2. All blanks on Proposal Form must be completed in ink, by hand, or electronically printed.
9.3. Proposal price shall include such amount as Offeror deems proper for overhead and profit.

10. Offering Firm's Statement of Qualifications (SOQ).
10.1. Provide information required on form Section 00 21 14 - Statement of Qualifications.

11. Ranking of Offeror's Proposals.
11.1. Owner will consider qualifications (Statement of Qualifications) of Offerers and Offeror's subcontractors and consultants, in addition to proposed cost(s) (Proposal Form) when evaluating Proposals to determine which Proposal offers best value to Owner. Owner will rank each of Offeror's Proposals based on criteria and criteria weighting described in Article 8, Basis for Ranking of Proposals.
11.2. Evaluation and ranking of Proposals will be completed no later than 45th calendar day from date of Proposal opening. Offerers are requested not to withdraw their Proposals within 60 calendar days from date on which Proposals are opened. Proposal Security of highest ranking firms will be held by Owner until contract negotiations are finalized.
11.3. In evaluating Proposals, Owner will consider selection criteria set forth in Article 8 of these Instructions to Offerers and whether or not Proposals comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested by Owner.
11.4. Owner may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of Work, as to which the identity of Subcontractors, Suppliers, and other persons and organizations must be submitted as provided in General Conditions. Owner may also consider the operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in Work when such data is required to be submitted prior to recommendation of award.
11.5. Owner may conduct such investigations as Owner deems necessary to assist in evaluation of any Proposal and to establish the responsibility, qualifications and financial ability of Offerers, proposed Subcontractors, Suppliers and other persons and organizations to perform and furnish Work in accordance with Contract Documents to Owner's satisfaction within prescribed time.
11.6. Owner, at its discretion, may also choose to conduct interviews with top ranking Offerers to provide Offerers a better opportunity to demonstrate they can provide best value to Owner for this Project. Should Owner choose to conduct interviews with top ranking Offerers, they will be notified of:
11.6.1. Time and place for interview.
11.6.2. Interview format and agenda.
11.6.3. Questions to prepare for interview.
11.6.4. Individuals that are expected to participate in the interview. Failure to participate in interview may result in disqualification from consideration for project.

12. Award of Contract.
12.1. It is intent of Owner to award this contract to Offering Firm whose Proposal for completion of Work provides best value for Owner after consideration of relative importance of costs and other evaluation factors described in Basis for Ranking Offerers set forth in Article 8 of these Instructions to Offerers.
12.2. Owner reserves right to adopt most advantageous interpretation of Proposals submitted in case of ambiguity or lack of clearness in stating Proposal Prices, to reject any or all Proposals, and/or waive informalities.
12.3. Owner reserves right to reject any or all Proposals, including without limitation rights to reject any or all nonconforming, non-responsive, unbalanced, or conditional Proposals and to reject the Proposal of any Offeror if Owner believes that it would not be in best interest of Project to make an award to that Offeror, whether because Proposal is not responsive or Offeror is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by Owner.

12.4. Owner also reserves the right to waive all informalities not involving price, time or changes in Work and to negotiate contract terms with Apparent Best Value Offeror. Discrepancies between multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between indicated sum of any column of figures and correct sum thereof will be resolved in favor of correct sum. Discrepancies between words and figures will be resolved in favor of words.

12.5. Qualifications of a firm shall not deprive Owner of right to accept a Proposal, which in its judgment offers best value to Owner. In addition, Owner reserves the right to reject any Proposal where circumstances and developments have, in opinion of Owner, changed qualifications or responsibility of firm.

12.6. Material misstatements in material submitted for evaluation may be ground for rejection of Offeror's Proposal on this project. Any such misstatement, if discovered after award of contract to such firm, may be grounds for immediate termination of contract. Additionally, Offeror will be liable to Owner for any additional costs or damages to Owner resulting from such misstatements, including costs and attorney's fees for collecting such costs and damages.

12.7. If Contract is to be awarded, it will be awarded to Apparent Best Value Offeror following successful Contract Negotiations.

12.8. If Contract Negotiations with Apparent Best Value Offeror are unsuccessful, Owner will formally close Contract Negotiations with this Firm and attempt to open Contract Negotiations with next highest-ranked firm according to selection criteria set forth in Article 8 of these Instructions to Offerers.

12.9. If Contract is to be awarded, Owner will notify Successful Offeror of intent to submit contract for approval by Owner within sixty (60) days after day of Proposal opening. Following approval Owner shall execute contract.

12.10. Offeror may submit exceptions or alternatives not in accordance with terms and conditions of Contract Documents, or for Work that is not in strict compliance with Contract Documents. Describe intent and substance of changes in Proposal in adequate detail so they are clearly understood. Alternates will not be considered in ranking and evaluation of Proposals. Upon selection of Proposal that offers the best value to Owner, Owner and Engineer may consider proposed alternates in negotiating a final Contract scope, schedule and price.

12.11. Addenda may be issued to clarify, correct, or change Contract Documents, Addenda or related supplemental data as deemed advisable by Owner or Engineer.

13. Interpretation, Addenda, and Alternate Proposals.

13.1. All questions about meaning or intent of Request for Proposal and Contract Documents are to be directed to Engineer electronically through CivCast's Question and Answer feature. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by written Addenda.

13.2. To properly qualify his Proposal, each Offeror shall, prior to submitting his Proposal, check receipt of all Addenda and acknowledge such receipt on Proposal Form and on the acknowledgement line of Addendum Cover page. Proposals submitted without such acknowledgment of all issued Addenda and letters of clarification may cause Proposal to be considered non-responsive. Such Addenda and letters of clarification shall become a part of the executed contract and modify contract documents accordingly.

13.3. Questions received after deadline for Questions and Inquiries may not be answered.

13.4. Only questions answered by formal written Addenda issued by Owner will be binding. Oral and other interpretations or clarifications will be without legal effect.

13.5. Addenda may also be issued to modify RFP Documents as deemed advisable by Owner or Engineer.

13.6. Owner or Engineer will not be held liable for any failure by Engineer for notification to reach Offeror. Offerers are encouraged to contact Engineer after legal limit for filing addenda (48 hours prior to Proposal due date and time) has passed to ensure receipt of all addenda.

14. Confidentiality of Proposal Information.

14.1 All materials submitted to Owner will become public property and are subject to Texas Public Information Act, Government Code Chapter 552. If an Offeror does not desire proprietary

Information in SOQ to be disclosed, each page must be identified and marked proprietary at time of submittal. Owner will, to extent provided by law, endeavor to protect such information from disclosure. Final decision as to what information must be disclosed, however, lies with Texas Attorney General. Failure to identify proprietary information will result in all unmarked sections being deemed non-proprietary and available upon public request. Proposers shall not be permitted to mark entire Proposal as proprietary.

15. Examination of Contract Documents and Site.

15.1. It is the sole responsibility of each Offeror before submitting a Proposal:

15.1.1. To examine thoroughly Contract Documents and other related data identified in RFP Documents (including "technical data" referred to below):

15.1.2. To visit Site to become familiar with and satisfy Offeror as to general, local and Site conditions that may affect cost, progress, performance or furnishing of Work;

15.1.3. To consider federal, state and local Laws and Regulations that may affect cost, progress, performance or furnishing of Work;

15.1.4. To study and carefully correlate Offeror's knowledge and observations with Contract Documents and such other related data; and

15.1.5. To promptly notify Engineer of all conflicts, errors, ambiguities or discrepancies which Offeror has discovered in or between Contract Documents and such other related documents.

15.2. Information and data shown or indicated in Contract Documents with respect to existing Underground Facilities at or contiguous to Site are based upon information and data furnished to Owner and Engineer by Owners of such Underground Facilities or others, and Owner and Engineer do not assume responsibility for accuracy or completeness thereof or for Offeror's interpretation of such information and data. Contractor is advised to coordinate closely with Owner, Engineer and Utility Operator(s) prior to the commencement of any underground construction activities.

15.3. Provisions concerning responsibilities for adequacy of data furnished to prospective Offerers with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in Contract Documents due to differing or unanticipated conditions appear in Article 6 of Agreement and Article 4 of General Conditions.

15.4. Before submitting a Proposal, each Offeror will be responsible for obtaining such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and underground facilities) at or contiguous to site or otherwise, which may affect cost, progress, performance or furnishing of Work, or which relate to any aspect of means, methods, techniques, sequences or procedures of construction to be employed by Offeror and safety precautions and programs incident thereto or which Offeror deems necessary to determine its Proposal for performing and furnishing Work in accordance with time, price and other terms and conditions of Contract Documents.

15.5. On request, Owner will provide each Offeror access to site to conduct such examinations, investigations, explorations, tests and studies, as each Offeror deems necessary for submission of a Proposal. Offeror must fill any resultant holes and clean up and restore Site to its former condition upon completion of such explorations, investigations, tests, and studies.

15.6. Reference is made to Specification Section 01 10 00 - Summary of Work for the identification of general nature of Work that is to be performed at Site by Owner or others (such as utilities and other prime Contractors) that relates to Work for which a Proposal is to be submitted. On request, Owner may provide to each Offeror for examination access to or copies of Contract Documents (other than portions thereof related to price) for such Work.

15.7. Submission of a Proposal will constitute an incontrovertible representation by Offeror that Offeror has complied with every requirement of this Article 15, that without exception Proposal is premised upon performing and furnishing Work required by Contract Documents and applying specific means, methods, techniques, sequences or procedures of construction (if any) that may be shown or indicated or expressly required by Contract Documents, that Offeror has given Owner or Engineer written notice of all conflicts, errors, ambiguities and discrepancies that Offeror has discovered in Contract Documents and written resolutions thereof by Engineer is acceptable to

Offeror, and that Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing Work.

15.8. Provisions of 15.1 through 15.8, inclusive, do not apply to Asbestos, Polychlorinated biphenyls (PCBs), Petroleum, Hazardous Waste or Radioactive Material covered by Article 4.06 of General Conditions.

15.9. Addenda may also be issued to modify RFP Documents as deemed advisable by Owner or Engineer.

16. Proposal Security.

16.1. Each Proposal must be accompanied by Proposal Security made payable to Owner in the amount not less than five percent (5%) of total Proposal Amount, including any Cash Allowances and Alternates, and shall be in form of a cashier's check or Offeror's Bond.

16.2. Offeror's Bond must be on the form provided within Contract Documents (RFP) and must bear impressed seal of Surety, and be signed by Offeror and an authorized individual of Surety. Bonds will only be accepted from Sureties authorized to execute a bond order and in accordance with state law.

16.3. Proposal Security of Successful Offeror will be retained until such Offeror has executed Agreement, furnished required contract securities and met other conditions contained in Specification Section 00 41 00 – Proposal Form, whereupon Proposal Security will be returned. If Offeror fails to execute and deliver Agreement and furnish required contract security within thirty (30) days after contract award notification, Owner may annul its award and Proposal Security of that Offeror will be forfeited. Proposal Security of other Offerers whom Owner believes to have a reasonable chance of receiving award may be retained by Owner until the earlier of seventh day after Effective Date of Agreement or ninety-first day after Proposal opening, whereupon Proposal Security furnished by such Offerers will be returned. Proposal Security submitted in form of a cashier's check with Proposals which are not competitive will be returned.

17. Contract Times.

17.1 Number of days (calendar days) within which, or dates by which, Work is to achieve Substantial and Final Completion are set forth in Section 00 52 00 – Agreement between Owner and Contractor.

18. Substitutes and "Or-Equal" Items.

18.1 Contract, if awarded, will be on basis of materials and equipment described in Drawings or specified in Specifications with consideration for possible substitute or "or equivalent" items. Whenever it is indicated in Drawings or specified in Specifications that a Substitute or "or-equal"/"or equivalent" item of material or equipment may be furnished or used by Contractor if acceptable to Engineer and Owner, application for such acceptance may be prior to Contract award in accordance with Texas Government Code 2269.155.

19. Subcontractors, Suppliers and Others.

19.1. If Owner requests the identity of certain Subcontractors, Suppliers or other persons or organizations (including those who are to furnish the principal items of material and equipment) to be submitted to Apparent Best Value Offeror, and any other Offerers so requested, shall within five (5) days from request submit to Owner a list of all such Subcontractors, Suppliers or other persons or organizations proposed for those portions of Work for which such identification is requested. 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, person or organization if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, other person or organization, Owner may, before giving notice of its intent to recommend Award, request that Apparent Best Value Offeror submit an acceptable substitute without an increase in price. If Apparent Best Value Offeror declines to make any such substitution, Owner may formally close contract negotiations with Offeror and enter into contract negotiations with next most highly-ranked Offeror that proposes to use acceptable Subcontractors, Suppliers, and other persons and organizations. Declining to make requested substitutions will not constitute grounds for sacrificing

Proposal Security of any Offeror. Any Subcontractor, Supplier, other person or organization listed and to whom Owner or Engineer does not make written objection prior to giving notice of its intent to recommend Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after Effective Date of Agreement as provided in Article 6.06 of General Conditions.

19.2. No Contractor shall be required to employ any Subcontractor, Supplier, other person or organization against whom Contractor has reasonable objection.

20. Preparation and of Proposals.

20.1. Prepare one (1) unbound original of complete Proposal Package, including completed Proposal Form 00 41 00.

20.2. Original Proposal is Proposal containing Original Signature of a person authorized to sign on behalf of Offering Firm.

20.3. Proposals shall be enclosed in an opaque sealed Envelope (or Package), marked with RFP name in addition to name and address of Offering Firm.

20.4. Each Original Proposal submitted by an Offeror shall contain the following:

20.4.1. Offerers Statement of Qualifications (Form Section 00 21 14 - Statement of Qualifications

20.4.2. Completed Proposal (Form Section 00 41 00 - Proposal)

20.4.3. Proposal Security (Form Section 00 43 13 - Offerer's Bond)

20.4.4. Any other Documentation required by terms of this Request for Proposal.

20.5. Proposals submitted by corporations must be executed in corporate name by president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and corporate seal must be affixed and attested by the secretary or an assistant secretary. Corporate address and state of incorporation must be shown below signature.

20.6. Submitted Proposals by partnerships must be executed in partnership name and signed by a partner, whose title must appear under signature and official address of partnership must be shown below signature.

20.7. All names must be typed or printed in ink below signature.

20.8. Proposal shall contain an acknowledgment of receipt of all Addenda (numbers of which must be filled in on Proposal Form).

20.9. Address and telephone number for communications regarding Proposal must be shown.

20.10. Evidence of authority to conduct business in the State of Texas shall be provided in accordance with 00 41 00 – Proposal Form.

21. Submission of Proposals.

21.1. Proposals shall be submitted at time and place indicated in Invitation to Submit Proposals (00 11 12) and shall be enclosed in an opaque sealed envelope with name and address of Offering Firm and accompanied by Proposal Security and other required documents.

21.2. If Proposal is sent through mail or other delivery system sealed envelope shall be enclosed in a separate envelope with notation "SEALED PROPOSAL ENCLOSED" on face of it. Proposals not received by time or at location specified will be returned unopened to Offeror.

21.3. Clock used by Owner at place used for receiving Proposals shall conclusively determine time that Proposals are received.

21.4. Proposals sent by facsimile or electronic mail or delivered to any other location other than address provided in Invitation to Offerers will NOT be accepted.

22. Modification and Withdrawal of Proposals.

22.1. Proposals may be modified or withdrawn by a document duly executed (in same manner that a Proposal must be executed) and delivered to place where Proposals are to be submitted prior to date and time for opening of Proposals.

22.2. If, within twenty-four (24) hours after Proposals are opened, any Offeror files a duly signed written notice with Owner and promptly thereafter demonstrates to reasonable satisfaction of Owner that there was a material or substantial mistake in preparation of its Proposal, that Offeror may withdraw its Proposal. Proposal Security may be retained by Owner if Offeror cannot clearly demonstrate to Owner evidence of a material or substantial mistake in its Proposal. Thereafter, that

Offeror may be disqualified from responding to a reissued RFP for Work to be furnished under these Contract Documents.

23. Opening of Proposals.

23.1 Proposals will be opened and (unless obviously non-responsive) names and Monetary Proposals of Offering Firms read aloud at a public opening. An abstract of Proposals will be made available no later than seventh day after Contract is awarded.

24. Proposals to Remain Subject to Acceptance.

24.1 All Proposals will remain subject to acceptance for ninety days (60) after date of opening, but Owner may, in its sole discretion, release any Proposal and return Proposal Security prior to that date.

25. Davis-Bacon Wage Rate Requirements.

25.1 Davis-Bacon prevailing wage requirements apply to the construction, alteration or repair of treatment works carried out, in whole or in part, with assistance made available by the Clean Water State Revolving Fund (CWSRF) or a construction project financed, in whole or in part, from the Drinking Water State Revolving Fund(DWSRF).

25.2 The Davis-Bacon prevailing wage requirements apply to Contractors and Subcontractors performing on federally funded or assisted contracts in excess of $2,000 for the construction, alteration or repair (including painting) of a treatment works project under the CWSRF or a construction project under the DWSRF.

25.3 For prime contracts in excess of $100,000, Contractors and Subcontractors must also, under the provisions of the Contract Work Hours and Safety Standards Act, as amended, pay laborers and mechanics, including guards and watchmen, at least one and one-half times their regular rate of pay for all hours worked over 40 in a workweek.

The Fair Labor Standards Act may also apply to Davis-Bacon covered contracts.

25.4 Any contracts in excess of $2,000 must include the provisions of the Davis-Bacon Wage Rate Requirements. If the Owner (sub-recipient) is a governmental entity such as a city or district, it must insert in full the contract clauses found in TWDB Guidance DB-0156, Appendix 1: Section 3, Section 4 if the contract exceeds $100,000, and Section 5. If the Owner (sub-recipient) is a non-governmental entity such as a water supply corporation or a private company, it must insert in full the contract clauses found in TWDB Guidance DB- 0156, Appendix 2: Section 3, Section 4 if the contract exceeds $100,000, and Section 5. The Owner (sub-recipient) must ensure all prime contracts require the same full text in any subcontracts. See TWDB Guidance DB-0156 for the text of the contract language that must be included.

26. American Iron and Steel.

26.1 Any contract(s) awarded under this Invitation to Bids is/are subject to the American Iron and Steel (AIS) requirements of 33 U.S.C. § 1388 for Clean Water State Revolving Fund projects. The Contractor must complete the statement of understanding regarding this requirement, found in the TWDB Supplemental Contract Conditions, Item No. 9.

27. Disadvantaged Business Enterprise Goals.

27.1 The Texas Water Development Board's (TWDB) Clean Water and Drinking Water State Revolving Fund programs receive federal funds from the U. S. Environmental Protection Agency (EPA). As a condition of federal grant awards, EPA regulations require that loan recipients make a "**good faith effort**" to award a fair share of work to Disadvantaged Business Enterprises (DBE) who are Minority Business Enterprises (MBE's), and Women-owned Business Enterprises (WBE's) whenever procuring construction, supplies, services and equipment. More information on DBE requirements is available in the TWDB Supplemental Contract Conditions section of this guidance No. ***14***. ***Disadvantaged Business Enterprises***.

27.2 The current fair share goals for the State of Texas are as follows:

CATEGORY	MBE	WBE
Construction	19.44%	9.17%
Equipment	16.28%	11.45%
Services	20.41%	13.66%
Supplies	25.34%	8.82%

28. Equal Employment Opportunity and Affirmitive Action.

28.1 All qualified applicants will receive consideration for employment without regard to race, color, religion, sex (including pregnancy), sexual orientation, gender identity, national origin, age (40 or older), disability, or genetic information. Bidders on this work will be required to comply with the Department of Labor regulations at 41 CFR Part 60-4, relating to Construction Contractors--Affirmative Action Requirements, which include the President's Executive Order No. 11246, as amended by Executive Order No. 11375 and Executive Order No. 13672, in the award and administration of contracts awarded under TWDB financial assistance agreements. Failure by the Contractor to carry out these requirements is a material breach, which may result in the termination of the awarded financial assistance.

29. Debarment and Suspension.

29.1 This contract is subject to the federal requirements of Subpart C of 2 CFR Part 180 and Part 1532 regarding Debarment and Suspension. The Contractor will comply with the assurances provided with the bid that leads to a contract.

30. Liquidated Damages.

30.1 Provisions for liquidated damages are set forth in specification section 00 52 00 - Standard Form of Agreement between Owner and Contractor and Specification Section 00 72 15 - General Conditions of the Contract.

31. Contract Security and Insurance.

31.1 Article 5 of General Conditions sets forth Owner's requirements as to insurance(s) and Performance and Payment Bonds. When Successful Offeror delivers executed Agreement to Owner, it must be accompanied by required insurances, Performance and Payment Bonds. Insurances shall include all required certificates and/or endorsements.

32. Conflict of Interest.

32.1 Chapter 176 of Texas Local Government Code mandates public disclosure of certain information concerning persons doing business or seeking to do business with Owner, including affiliations and business and financial relationships such persons may have with Owner. An explanation of requirements of Chapter 176, applicable forms and a complete text of this law are available at: http://www.ethics.state.tx.us/forms/CIQ.pdf. BY DOING BUSINESS OR SEEKING TO DO BUSINESS WITH OWNER, YOU ACKNOWLEDGE THAT YOU HAVE BEEN NOTIFIED OF REQUIREMENTS OF CHAPTER 176 OF TEXAS LOCAL GOVERNMENT CODE AND THAT YOU ARE SOLELY RESPONSIBLE FOR COMPLYING WITH THEM.

33. Taxes.

33.1 Owner is exempt from payment of sales and compensating use taxes of State of Texas and of cities and counties thereof on all materials to be incorporated into Work. Owner will furnish required certificates of tax exemption to Contractor for use in purchase of supplies and materials to be incorporated into Work.

33.2. Owner’s exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into Work.

33.3. Sales and Use Tax: Owner is exempt from Texas state sales and use taxes on materials and equipment to be incorporated into Work. Said taxes shall not be included in Proposal.

34. Signing of Agreement.

34.1 Owner will transmit to Successful Offeror required number of unsigned counterparts of Agreement with all other written Contract Documents attached. Contractor shall sign and deliver required number of counterparts of Agreement and written Contract Documents to Owner thirty (30) days of receipt.

END OF SECTION

SECTION 00 21 14

STATEMENT OF QUALIFICATIONS

TABLE 1 – GENERAL INFORMATION				
A. COMPANY DATA				
Organization Doing Business:	Matous Construction, Ltd.			
Business Address:	8602 State Highway 317			
	Belton, TX 76513			
Telephone Number:	254-780-1400			
Fax Number:	254-780-2599			
Form of Business:	Corporation	(Partnership)	Individual	Joint Venture
IF A CORPORATION				
Date of Incorporation:				
State Incorporated:				
President's Name:				
Vice President's Name:				
IF A PARTNERSHIP				
Date of Organization:	July 14, 1998			
Type	General	(Limited)		
IF AN INDIVIDUAL				
Name:				
Business Address:				
IF A JOINT VENTURE				
Name of Manager:				
Name of Firm:				
Name of Individual Companies:				
B. BUSINESS INFORMATION				
Current Number of Full Time Employees:	63	Past Year's Revenues:	$43,332,645	
Average Number of Projects Annually:	12	Average Construction Cost of Project:	$20M	
C. DIVISION OF WORK BETWEEN CONTRACTOR AND SUBCONTRACTORS				
1. List work that will be provided by Offeror (Prime Contractor) using its own resources.				
All other work not listed below.				
2. List work that will be provided by Subcontractors on this project.				
Electrical, instrumentation, photography/videography, roofing, installation of all doors/ overhead doors, HVAC, and other miscellaneous architectural finishes.				

TABLE 2 – CONSTRUCTION EXPERIENCE			
1. Years of experience on wastewater treatment facility projects:			
As a General Contractor:	30	Number of Total Projects:	181
2. Number of linear waterline projects completed in Coryell County in the past five (5) years?			No
3. Has this or a predecessor company ever defaulted on a project or failed to complete work award to it?			No
4. Has this or a predecessor company ever been released from a bid or proposal in the past ten (10) years?			No
5. Has this or a predecessor company ever been disqualified as a bidder or offeror on any project within the last five (5) years?			No
6. Is offering company currently involved in any litigation or contemplating any litigation?			No
7. Has this or a predecessor company ever refused to construct of refused to provide materials defined in Contract Documents on a project?			No
8. Are there any liens currently filed against the offeror by either subcontractor or material suppliers on previous projects?			No

TABLE 3 – PROPOSED KEY PERSONNEL	
PROJECT MANAGER	
Name of Project Manager	Mike L. Psencik
Years of Experience as PM	20
Number of Similar Projects as PM with this company	10
Number of Similar Projects with other companies (PM)	N/A
Current Assignments	6
% of time dedicated to this project	100
Reference Project	
Project Name: Avenue G Pump Station Improvements	Reference Name: Rick Kasberg
Title: President	Organization: KPA Engineers
Telephone Number: 254-773-3731	Email: RKasberg@kpaengineers.com
PROJECT SUPERINTENDENT #1	
Name of Superintendent	William Beach
Years of Experience as Superintendent	40
Number of Similar Projects as Super with this company	22
Number of Similar Project with other companies (Super)	N/A
Current Assignments	1
% of time dedicated to this project	100
Reference Project	
Project Name: Davis Water Treatment Plant Treated Water Disharge System	Reference Name: James King P.E
Title: Project Manager	Organization: City of Austin
Telephone Number: 512-972-0185	Email: james.king@austintexas.gov

TABLE 3 – PROPOSED KEY PERSONNEL	

PROJECT SUPERINTENDENT #2	
Name of Superintendent	Cory Jackson
Years of Experience as Superintendent	12
Number of Similar Projects as Super with this company	8
Number of Similar Project with other companies (Super)	N/A
Current Assignments	3
% of time dedicated to this project	100
Reference Project	
Project Name: Davis & Handcox WTP Polymer Feed System	Reference Name: Matt Hendrix
Title: Project Manager	Organization: City of Austin
Telephone Number: 512-968-2793	Email: matt.hendrix@austintexas.gov

TABLE 4 – SIMILAR PROJECTS COMPLETED WITHIN LAST 5 YEARS

REFERENCE PROJECT 1

Project Description

Construction and installation of (3) new Andritz Centrifuges, demolition of existing gravity belt thickeners, excavation, odor control, piping, valves, electrical and instrumentation while maintaining operations of existing facilities. Design, installation, and maintenance of (4) temporary gravity belt thickeners and associated bypass system components.

Owner	Project Name	Contract Amount	Date Completed	% Change Orders
City of Austin Public Works	Hornsby Bend BMP - Thickener Complex Rehab	$16,279,752	4/23/21	8.84

Owner's Reference Information

Name	Title	Organization	Telephone	E-Mail
Jules Parrish	Project Manager	City of Austin Public Works	512-974-9385	jules.parrish@austintexas.gov

Engineer's Reference Information

Name	Title	Company	Telephone	E-Mail
Jesse Penn	Engineer of Record	CP&Y Inc.	512-492-6852	

REFERENCE PROJECT 2

Project Description

Rehab the plant's existing filter system and convert to cloth media filters. Extensive concrete work including modifying existing filters, basins, and mudwells. Installation of large diameter ductile iron piping, both exposed and buried. Major modifications of filter electrical / instrumentation. Furnished bypass pumping and temporary filter units to keep plant in service.

Owner	Project Name	Contract Amount	Date Completed	% Change Orders
City of Austin - Public Works	SAR WWTP Filter Improvements	$25,952,594	10/23/2018	4.75

Owner's Reference Information

Name	Title	Organization	Telephone	E-Mail
Steve Parks, P.E.	Project Manager	City of Austin Public Works	512-974-3576	steve.parks@austintexas.gov

Engineer's Reference Information

Name	Title	Company	Telephone	E-Mail
John Buser	Engineer of Record	AECOM	512-457-7701	

REFERENCE PROJECT 3

Project Description

Rehab of plant's existing blower building and replacement of plant's existing blowers. Included furnishing and installing large diameter stainless steel air piping and air diffusers at aeration basins. Extensive electrical and instrumentation work for new blowers. This project was completed while maintaining operations of the existing plant. Extensive coordination was required between Contractor and Plant Operations to maintain plant operations while accommodating the various work activities that were required to complete the project.

Owner	Project Name	Contract Amount	Date Completed	% Change Orders
City of Austin Public Works	SAR WWTP Trains A&B Blower Replacement	$23,536,370	12/31/2018	4.20

Owner's Reference Information

Name	Title	Organization	Telephone	E-Mail
Steve Parks, P.E.	Project Manager	City of Austin Public Works	512-974-3576	steve.parks@austintexas.gov

Engineer's Reference Information

Name	Title	Company	Telephone	E-Mail
Jason Anderson	Engineer of Record	Carollo Engineering	512-453-5358	

TABLE 4 – SIMILAR PROJECTS COMPLETED WITHIN LAST 5 YEARS

REFERENCE PROJECT 1

Project Description

Construction and rehabilitation of the Side Stream WWTP located at the Hornsby Bend BMF. Work included concrete, excavation, piping, valves, pumps, blowers, process equipment, electrical, and instrumentation. Start up and commissioning of the facility.

Owner	Project Name	Contract Amount	Date Completed	% Change Orders
City of Austin Public Works	Hornsby Bend BMP - Side Stream Plant Relief	$13,219,090	5/25/2021	4.65

Owner's Reference Information

Name	Title	Organization	Telephone	E-Mail
Jules Parrish	Project Manager	City of Austin Public Works	512-974-9385	jules.parrish@austintexas.gov

Engineer's Reference Information

Name	Title	Company	Telephone	E-Mail
Hani Michel	Engineer of Record	Carollo Engineering	512-453-5383	

REFERENCE PROJECT 2

Project Description

Furnished all labor and materials, equipment, and incidentals required for installation, start-up, warranty, and testing of two complete, bioscrubber systems. Each system included: 50' diameter gravity thickener equipment, two fiberglass reinforced plastic (FRP) bioscrubber vessels, submersible chopper pumps, exhaust stacks, media, electrical components, and supplemental nutrient supply equipment. This project was completed while maintaining operations of the existing plant. Extensive coordination was required between Contractor and Plant operations to maintain plant operations while accommodating the various work activities required to complete the project.

Owner	Project Name	Contract Amount	Date Completed	% Change Orders
City of Austin Public Works	SAR WWTP Thickener Improvements	7,610,682.65	7/09/2019	5.48

Owner's Reference Information

Name	Title	Organization	Telephone	E-Mail
John Wepryck	Project Manager	City of Austin Public Works	512-974-7010	john.wepryck@austintexas.gov

Engineer's Reference Information

Name	Title	Company	Telephone	E-Mail
Danny Hurtado	Engineer of Record	CDM Smith	512-318-3093	

REFERENCE PROJECT 3

Project Description

Owner	Project Name	Contract Amount	Date Completed	% Change Orders

Owner's Reference Information

Name	Title	Organization	Telephone	E-Mail

Engineer's Reference Information

Name	Title	Company	Telephone	E-Mail

TABLE 5 – SUBCONTRACTORS AND SUPPLIERS		
PROJECT SPECIFIC SUBCONTRACTORS (greater than 10% of work)		
Name	Work to be Provided	% of Contract
T Morales Company	Electrical	15%

Provide a list of major equipment or material suppliers for use on project.

Supplier Name	Material or Equipment Supplied
HRM Environmental	Clarifier Equipment Replacement
Hartwell Environmental	Perforated Plate Screen, Screenings Washer/Compactor, Gas Feed Equipment, Submersible Mixers, Disk Fine Bubble Diffusers, PD Rotary Lobe Blower, Fabricated Stainless Steel Slide Gates
Ferguson Waterworks	Piping & Valves
Pump Solutions	Submersible Centrifugal Pumps
AmeriTex Pipe	Box Culverts
Locke	Precast Trench Drains
Red Dot	Pre-Eng Metal Bldg

AFFIDAVIT

State Texas

County of Bell

Bruce A. Matous, being duly sworn deposes and attests that he/she is
(name)

CEO of General Partner and is a duly authorized representative of the Offeror
(title)

submitting the foregoing Section 00 21 14 – Statement of Qualifications and related information, that he/she has read such documents, that he/she is authorized to submit such information on behalf of the Offeror, and that such documents are true and correct and contain no factual errors or material misrepresentations.

Signature

Signed and sworn to me before this 20th day of June, 20 23 .

Notary Public

NOTARY PUBLIC STATE OF TEXAS
MARY KATHERINE RICHTER
MY COMMISSION EXPIRES
11/23/2026
NOTARY ID: 134078022

My Commission expires: 11/23/2026

DOCUMENT 00 31 00

AVAILABLE PROJECT INFORMATION

1. SUMMARY

A. Document Includes:
   1. Subsurface investigation report.

B. Related Documents:
   1. Document 00 21 13 - Instructions to Offerers: Site examination.

2. SUBSURFACE INVESTIGATION REPORT

A. A geotechnical report titled "Subsurface Investigation and Foundation Recommendations for Gatesville Stillhouse Wastewater Treatment Facility", dated October 13, 2022, and prepared by Holt Engineering, Inc., was prepared for the design of the Owner.

B. A complete copy of the report shall be furnished *during the bidding*. The report was not prepared for purposes of bid development and its information and accuracy may be limited for that purpose. *Engineer recommends that Offerers confer with the geotechnical engineer who prepared the report for interpretation of data contained therein and to conduct any additional studies required to obtain specific types of information required for bid development*.

C. Report(s) to Offerer for informational purposes only and not for purposes of Offerer using or relying on this information in preparing its costs for performing Work. By submitting a Proposal, Offerer agrees and affirms that Offerer is solely responsible for determining all site conditions that may affect Work on Project.

D. Offerer agrees and expressly understands that Report(s) may not represent all conditions that Offerer may encounter during performance of Work on Project and that Report(s) is/are indicative of only those locations where tests were performed or observations were made and conditions may vary greatly at other locations on the Project and Offerer is responsible for determining such actual conditions;

E. Offerers are urged to conduct an independent examination of available soils investigation data and conduct further investigations, as needed, of Site prior to submitting a Proposal. Owner and Engineer disclaim any responsibility for accuracy, true location, and extent of soils investigation prepared by others. Owner and Engineer further disclaims any responsibility for interpretation of that data by Offerers, as in projecting soil bearing values; types of materials encountered; soil stability; and the presence, level and extent of any underground water.

F. By submission of a Proposal Offerer expressly also agrees that Report(s) shall not be utilized for purposes of asserting a claim for additional costs in performance of Work due to a changed condition on Project.

G. Soil investigation data is not a part of Contract Documents.

END OF DOCUMENT

SECTION 00 41 00

PROPOSAL FORM

To: City of Gatesville
803 E. Main Street
Gatesville, TX 76528

Project: Project Name City of Gatesville – Stillhouse Branch Wastewater Treatment Facility Improvements

RFP No.: 2-01590

Offerer: Matous Construction, Ltd.
(Print or type full name of proprietorship, partnership, corporation, or joint venture)

1.0 OFFER

A. Total Proposal Price: Undersigned Offerer proposes and agrees, if this Proposal is accepted, to enter into an Agreement with Owner on form included in Contract Documents to perform all Work as specified or indicated in Contract Documents for Contract Price indicated in this Proposal or as modified by written Amendment.

B. Proposal Security: Included with the Proposal is a Proposal Security in amount of 5% of Total Proposal Price subject to terms described in Document 00 21 13 – Instructions to Offerers.

C. Period for Proposal Acceptance: Offerer accepts all of terms and conditions of Request for Proposals and Instructions to Offerers, including without limitation those dealing with disposition of required Bonds. This offer shall remain open to acceptance and is irrevocable for 90 days from Proposal Date (opening). That period may be extended by mutual written agreement of Owner and Offerer.

D. Liquidated Damages: Offerer accepts the provisions of Agreement as to liquidated damages in the event of its failure to complete Work in accordance with schedule as set forth in Agreement.

E. Addenda: Offerer hereby acknowledges it has received, examined and carefully studied all Addenda and modifications to Proposal Documents have been considered and all related costs are included in Total Proposal Price.

F. Proposal Supplements: The following documents shall be provided with proposal:

☐ Offerer's Statement of Qualifications (SOQ).

☐ Completed Certification of Proposal

☐ Proposal Security

☐ Non-Collusion Affidavit

2.0 CONTRACT TIME

A. If offer is accepted, Contractor shall achieve Date of Substantial Completion and Date of Final Completion within Contract Times prescribed in Article 3 of Section 00 52 00 - Agreement Between Owner and Contractor, subject to adjustments of Contract Time as provided in Contract.

3.0 OFFERER REPRESENTATIONS

A. Offerer is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and furnishing of Goods and Special Services.

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

C. Offerer has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to Site (except Underground Facilities) and (2) Hazardous Environmental Conditions identified in reports and drawings provided to Offerer or available for Offerer review. Offerer understands that neither Owner nor Engineer is responsible for the accuracy of these documents and that they are not part of Contract Documents.

D. Offerer has obtained and carefully studied all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions including surface, subsurface and Underground Facilities at or contiguous to Site which may affect cost, progress, or performance of Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Offerer, including applying specific means, methods, techniques, sequences, and procedures of construction expressly required by Contract Documents to be employed by Offerer, and safety precautions and programs incident thereto and accepts all consequences for not doing so.

E. Offerer does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Proposal for performance of Work at the Contract Price proposed, within Contract Times proposed and in accordance with terms and conditions of Contract Documents.

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

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

H. Offerer has given Owner written notice of all conflicts, errors, ambiguities, or discrepancies that Offerer has discovered in Contract Documents, and written resolution thereof by Owner or Engineer is acceptable to Offerer.

I. Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of Work for which this Proposal is submitted.

J. Laws to be Observed: In execution of Contract, Contractor must comply with all applicable Federal, State, and Local laws, including, but not limited to laws concerned with labor, safety, minimum wages, and environment. Contractor will make himself familiar with and shall at all times observe and comply with all Federal, State, and Local laws, ordinances and regulations which in any manner affect the conduct of the work, and shall indemnify and save harmless the Owner and its representatives against any claim arising from violation of any such law, ordinance or regulation by himself or by his subcontractor or by his employees.

K. Review by Owner: Owner and authorized representatives and agents of owner shall at all times have access to and be permitted to observe and review all work, materials, equipment, payrolls, personnel records, employment conditions, material invoices, and other relevant data and records pertaining to this Contract.

L. Offerer will submit written evidence of its authority to do business in State of Texas.

M. Offerer further represents that this Proposal is genuine and not made in 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; Offerer has not directly or indirectly induced or solicited any other Offerer to submit a false or sham Proposal; Offerer has not solicited or induced any

individual or entity to refrain from making an offer; and Offerer has not sought by collusion to obtain for itself any advantage over any other Offerer or over Owner.

4.0 DEFINED TERMS:

A. Defined terms used in this Proposal, if any, shall be for purposes of this Proposal and shall not change any meanings indicated in General Conditions. Significance of terms with initial capital letters is defined in General Conditions.

5.0 TOTAL PROPOSAL PRICE HAS BEEN CALCULATED BY OFFERER, USING THE FOLLOWING COMPONENT PRICES AND PROCESS (PRINT OR TYPE NUMERICAL AMOUNTS):

CITY OF GATESVILLE
STILLHOUSE BRANCH WWTF IMPROVEMENTS
PROPOSAL TABULATION

Item	Description	Qty	Unit	Unit Price	Total Amount
1.00	**GENERAL CONDITIONS**				
1.01	Mobilization and Incidentals	1	LS	$500,000	$500,000
1.02	Trench Safety	2,000	LF	$5.00	$10,000
	SUBTOTAL GENERAL CONDITIONS				$510,000

Item	Description	Qty	Unit	Unit Price	Total Amount
2.00	**WWTF IMPROVEMENTS**				
2.01	WWTF Improvements	1	LS	$13,433,000	$13,433,000
2.02	SCADA Allowance	1	LS	$500,000.00	$500,000.00
	SUBTOTAL WWTF IMPROVEMENTS				$13,933,000
	SUBTOTAL BASE PROPOSAL				$14,443,000

Item	Description	Qty	Unit	Unit Price	Total Amount
2.00	**DEDUCTIVE ALTERNATES**				
2.01	Perforated Plate Screen	1	LS	($150,000)	
2.02	Blower #3	1	LS	($55,000)	
	SUBTOTAL DEDUCTIVE ALTERNATES				($205,000)
	TOTAL PROPOSAL AMOUNT WITH DEDUCTIVE ALTERNATES				$14,238,000

Work Included in Item 2.00 "WWTF Improvements"

- Replacement of gates and perforated plate screen in Bar Screen Structure.
- Replacement of pumps, piping and valves in Influent Lift Station
- Installation of fine bubble aeration and mixers in the Aeration Basins
- Furnish and install blowers, instrumentation and controls for the aeration system
- Installation of new Yard Piping
- Replace feedwells and scum blades on Clarifiers
- Replace gates on Splitter Box #2
- Replace chemical feed for Chlorine and sulfur dioxide gas
- Replace injection of chlorine and sulfur dioxide aquaeous solutions into the Process stream
- Construct additional Chlorine Contact Basin
- Remove old Effluent Pumps, install new Effluent pumps, piping and valves
- Add diffused membrane aeration to re-aeration structure.
- Replace RAS pumps, piping and valves
- Revise WAS feed to Thickener
- Construct Biosolids Storage Area
- Construct 3 Motor Control Centers
- All electrical motor control, instrumentation, conduit and feeders necessary for new equipment
- Install Transfer Switch
- Install all instrumentation, PLC's and programming for new SCADA system
- Refinish interior of Control Building for additional space
- All other work as described in the Plans and Specifications to ensure a complete and functional system.

6.0 ADDENDA

Following Addenda have been received by Offerer. Modifications to Proposal Documents noted below have been considered and all costs are included in Proposal Price.

Addendum # 1 ..... Dated 5/24/2023

Addendum # 2 ..... Dated 6/01/2023

Addendum # 3 ..... Dated 6/13/2023

Addendum # 4 ..... Dated 6/15/2023

Addendum # ..... Dated .....

Addendum # ..... Dated .....

7.0 PROPOSAL FORM SIGNATURES*

This Proposal is submitted by:

Matous Construction, Ltd.

(Offerer - print the full name of firm submitting Proposal)**

was hereunto affixed in the presence of:

Name and Title (printed or typed): Bruce A. Matous, CEO

By: _____ 6/20/23

(Authorized signing officer signature)

(Seal)

Person with Offerer authorized to discuss contents of Proposal and Qualifications:

Blake Pltts

Phone Number: 254-534-1638

* If Proposal is a joint venture, add additional Proposal Form signature sheets for each member of joint venture.

** Offerer certifies that only person or parties interested in this offer as principals are those named above. Offerer has not directly or indirectly entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive Proposing.

Note: This document constitutes a government record, as defined by § 37.01 of Texas Penal Code. Submission of a false government record is punishable as provided in § 37.10 of Texas Penal Code.

END OF SECTION

SECTION 00 43 13

OFFERER'S BOND

THAT WE, Matous Construction, Ltd., 8602 N. Hwy 317, Belton, TX 76513 , as Principal, ("Offerer"), and the other subscriber hereto, Travelers Casualty and Surety Company of America , as Surety, do hereby acknowledge ourselves to be held and firmly bound to City of Gatesville, ("Owner") a political sub-division of the State of Texas, in the sum of Five Percent of the Greatest Amount Bid by Principal Dollars ($ 5% of GABP) an amount equal to five (5) percent of the Total Bid Price, including Cash Allowances and Alternates, if any, for payment of which sum, well and truly to be made to Owner and its successors, Offerer and Surety do bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally.

CONDITIONS OF THIS OBLIGATION ARE SUCH THAT: WHEREAS, Offerer has submitted on or about this day a proposal offering to perform the following:

2-01650 - City of Gatesville – Stillhouse Branch Wastewater Treatment Facility Improvements in accordance with Drawings, Specifications, and terms and conditions related thereto to which reference is hereby made.

NOW, THEREFORE, if Offerer's offer as stated in Document 00 41 00 – Proposal Form is accepted by Owner, and Offerer executes and returns to Owner executed Section 00 52 00 – Agreement on forms provided in Proposal Documents, for Work and also executes and returns same number of Performance, Payment, and Maintenance Bonds (such bonds to be executed by a Corporate Surety authorized by State Board of Insurance to conduct insurance business in the State of Texas, and having an underwriting limitation in at least the amount of bond) and other submittals as required, in connection with Work, within allotted Contract Time, then this obligation shall become null and void; otherwise it is to remain in full force and effect.

If Offerer is unable to or fails to perform its obligations undertaken herein, the undersigned Offerer and Surety shall be liable to Owner for full amount of this obligation which is hereby acknowledged as amount of damages which will be suffered by Owner on account of failure of such Offerer to perform such obligations, the actual amount of such damages being difficult to ascertain. Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to respective other Party at address prescribed in Contract Documents, or at such other address as receiving Party may hereafter prescribe by written notice to sending Party.

IN WITNESS THEREOF, both Offerer and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)

OFFERER

Matous Construction, Ltd. (Seal)

Bidder's Name and Corporate Seal

By: BAM

Signature and Title Bruce A. Matous, CEO of General Partner

Attest: Jessica Bozon

Signature and Title Jessica Bozon, CFO

SURETY

Travelers Casualty and Surety Company Of America (Seal)

Surety's Name and Corporate Seal

By: Emily Mikeska

Signature and Title Emily Mikeska, Attorney-In-Fact

(Attach Power of Attorney)

Attest: Connie Williamson

Signature and Title Connie Williamson, Witness

END OF SECTION

TRAVELERS

Travelers Casualty and Surety Company of America
Travelers Casualty and Surety Company
St. Paul Fire and Marine Insurance Company

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That Travelers Casualty and Surety Company of America, Travelers Casualty and Surety Company, and St. Paul Fire and Marine Insurance Company are corporations duly organized under the laws of the State of Connecticut (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint **Emily Mikeska** of **TEMPLE** , **Texas** , their true and lawful Attorney(s)-in-Fact to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed, and their corporate seals to be hereto affixed, this **21st** day of **April**, **2021**.

State of Connecticut

City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the **21st** day of **April**, **2021**, before me personally appeared **Robert L. Raney**, who acknowledged himself to be the Senior Vice President of each of the Companies, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of said Companies by himself as a duly authorized officer.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

My Commission expires the **30th** day of **June**, **2026**

_____
Anna P. Nowik, Notary Public

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of each of the Companies, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, **Kevin E. Hughes**, the undersigned, Assistant Secretary of each of the Companies, do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which remains in full force and effect.

Dated this **20th** day of **June** , **2023** .

_____
Kevin E. Hughes, Assistant Secretary

To verify the authenticity of this Power of Attorney, please call us at 1-800-421-3880.
Please refer to the above-named Attorney(s)-in-Fact and the details of the bond to which this Power of Attorney is attached.

IMPORTANT NOTICE

To obtain information or make a complaint:

You may call Travelers Casualty and Surety Company of America and its affiliates' toll-free telephone number for information or to make a complaint at:

1-800-328-2189

You may contact the Texas Department of Insurance to obtain information on companies, coverages, rights or complaints at:

1-800-252-3439

You may write the Texas Department of Insurance:

P. O. Box 149104
Austin, TX 78714-9104
Fax: (512) 475-1771
Web: http://www.tdi.state.tx.us
E-mail: ConsumerProtection@tdi.state.tx.us

PREMIUM OR CLAIM DISPUTES:
Should you have a dispute concerning your premium or about a claim you should contact your Agent or Travelers first. If the dispute is not resolved, you may contact the Texas Department of Insurance.

ATTACH THIS NOTICE TO YOUR BOND:
This notice is for information only and does not become a part or condition of the attached document and is given to comply with Texas legal and regulatory requirements.

Notice of Award

Dated _____

Project:	Owner:	Owner's Contract No.:
Contract:		Engineer's Project No.:

Bidder:

Bidder's Address: (send Certified Mail, Return Receipt Requested)

You are notified that your Bid dated _ for the above Contract has been considered. You are the Successful Bidder and are awarded a Contract for _____

_____

(Indicate total Work, alternates or sections or Work awarded.)

The Contract Price of your Contract is _____Dollars ($_____).

_____ copies of each of the proposed Contract Documents (except Drawings) accompany this Notice of Award.

_____ 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 Owner [_____] fully executed counterparts of the Contract Documents.
2. Deliver with the executed Contract Documents the Contract security [Bonds] as specified in the Instructions to Offerers (Article 27), [and] General Conditions (Paragraph 5.01).
3. Other conditions precedent:

_____

_____

_____

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award and 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.

_____
Owner

By:_____
Authorized Signature

_____
Title

Copy to Engineer

Notice to Proceed

Dated _____

Project:	Owner:	Owner's Contract No.:
Contract:		Engineer's Project No.:
Contractor:		
Contractor's Address: [send Certified Mail, Return Receipt Requested]		

You are notified that the Contract Times under the above contract will commence to run on_____. On or before that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 4 of the Agreement, the number of days to achieve Substantial Completion is 550, and the number of days to achieve readiness for final payment is 580.

Before you may start any Work at the Site, Paragraph 2.01.B 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:

1.0 The contractor shall call the Texas One-Call System @ 1-800-344-8377 at least 48 hours prior to digging.

2.0 Prepare and submit Trench Safety Plan.

3.0 Prepare a Stormwater Pollution Prevention Plan. Prepare and submit a Notice of Intent (NOI) to TCEQ as prescribed in the Technical Specifications.

Contractor	Owner
Received by:	Given by:
Authorized Signature	Authorized Signature
Title	Title
Date	Date

Copy to Engineer

SECTION 00 52 00
AGREEMENT

THIS AGREEMENT is dated as of by and between City of Gatesville (hereinafter called "OWNER") and Matous Construction, Ltd. (hereinafter called "CONTRACTOR"). OWNER and CONTRACTOR, in consideration of covenants hereinafter set forth, agree as follows:

ARTICLE 1. WORK. CONTRACTOR shall complete all Work as specified or indicated in Contract Documents. Work is generally described as follows:

2-01590 City of Gatesville – Stillhouse Branch Wastewater Treatment Facility Improvements in accordance with Drawings, Specifications, and terms and conditions related thereto to which reference is hereby made.

ARTICLE 2. ENGINEER AND OWNER'S REPRESENTATIVE. Project has been designed by Walker Partners, 6504 Las Cimas Parkway, Suite 200, Austin, TX, 78730 who is hereinafter called "ENGINEER" and who assumes all duties and responsibilities and has rights and authority assigned to ENGINEER in Contract Documents in connection with completion of Work in accordance with Contract Documents. Owner's Representative for Project shall be Walker Partners, LLC.

ARTICLE 3. CONTRACT TIMES. Work will be Substantially Completed within 550 calendar days and CONTRACTOR shall achieve Final Completion within 580 calendar days after date when Contract Time Requirements commence to run as provided in Article 2.03 of General Conditions. OWNER and CONTRACTOR recognize that time is of essence of this Agreement and that OWNER will suffer financial loss including, but not limited to, loss of revenue, additional professional fees, fines, labor costs, insurance premiums, etc. if the Work is not completed within times specified in above paragraph, plus any extensions thereof allowed in accordance with Article 12 of General Conditions. They also recognize delays, expense and difficulties involved in proving 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) and, as a reasonable estimate of such damages, CONTRACTOR shall pay OWNER ONE THOUSAND Dollars ($1000) for each and every day of delay in CONTRACTOR achieving Substantial Completion of Work and readiness for final payment beyond times specified in above paragraph. OWNER shall have option of deducting the amount of any liquidated damages from any monies that may be owed to CONTRACTOR or to recover such amount from CONTRACTOR or its sureties, at CONTRACTOR'S expense.

ARTICLE 4. CONTRACT AMOUNT. OWNER shall pay CONTRACTOR for completion of Work in accordance with Contract Documents an amount in current funds equal to sum of amounts determined pursuant to Proposal and any subsequent Change Orders and Change Directives thereto in the amount of Seven million, Two hundred three thousand and no/100 dollars ($7,203,000.00).

ARTICLE 5. PAYMENT PROCEDURES. CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of General Conditions. Applications for Payment will be processed by ENGINEER and as provided in General Conditions and Supplemental Conditions. OWNER shall make progress payments on account of Contract Amount on the basis of CONTRACTOR'S Applications for Payment as recommended by ENGINEER and in conformance with the

procedures described in General Conditions. All such payments will be measured by schedule of values established in Article 2.05 of General Conditions (and on number of units of each Unit Price item completed, if unit price contract). Upon final completion and acceptance of Work in accordance with Article 14 of General Conditions, OWNER shall pay the remainder of Contract Amount as recommended by Owner's Representative as provided in said Article 14. In accordance with Texas Water Code Section 49.276 – PAYMENT FOR CONSTRUCTION WORK, Subsection (d), in making progress payments, 5% of estimated amount shall be retained until final completion and acceptance of contract work.

ARTICLE 6. CONTRACTOR'S REPRESENTATIONS. In order to induce OWNER to enter into this Agreement CONTRACTOR makes the following representations:

- CONTRACTOR has examined and carefully studied Contract Documents (including Addenda listed in Article 7) and other related data identified in Proposal Documents.
- CONTRACTOR has visited site and become familiar with and is satisfied as to general, local, and site conditions that may affect cost, progress, performance, or furnishing of Work.
- CONTRACTOR is familiar with and is satisfied as to all federal, state, and local Legal Requirements that may affect cost, progress, performance, and furnishing of Work.
- CONTRACTOR has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to Site.
- CONTRACTOR acknowledges that such reports and drawings are not Contract Documents, are not warranted or represented in any manner by Owner to accurately show the conditions at Site, and may not be complete for CONTRACTOR'S purposes.
- CONTRACTOR acknowledges that OWNER and ENGINEER do not assume responsibility for accuracy or completeness of information and data shown or indicated in Contract Documents with respect to subsurface conditions or Underground Facilities at or contiguous to Site or CONTRACTOR'S interpretation of such information and data.
- CONTRACTOR has obtained and carefully studied (or assumes responsibility for having done so) all such additional supplementary research, examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site or otherwise which may affect cost, progress, performance, or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto.
- CONTRACTOR does not consider that any additional examinations, investigations, explorations, tests, studies, or data are necessary for the performance and furnishing of Work at Contract Amount, within Contract Time Requirements and in accordance with other terms and conditions of Contract Documents.
- CONTRACTOR is aware of the general nature of work to be performed by OWNER and others at Site that relates to Work as indicated in Contract Documents.
- CONTRACTOR has correlated information known to CONTRACTOR, information and observations obtained from visits to Site, reports, and Drawings identified in Contract Documents and all additional examinations, investigations, explorations, tests, studies, and data with Contract Documents.

- CONTRACTOR has provided ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that CONTRACTOR has discovered in Contract Documents and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR, and Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of Work.

ARTICLE 7. CONTRACT DOCUMENTS. Contract Documents are comprised of the following:

1. This Agreement.
2. Exhibits to this Agreement:
   a. Document Title Date Page(s)
3. Performance and Payment Bonds.
4. General Conditions of Contract.
5. Supplemental Conditions, if any.
6. Specifications, prepared by Walker Partners, dated May 2023.
7. Drawings.
8. Addenda: Addendum No. 01 through Addendum No. 04
9. CONTRACTOR'S Proposal Form pursuant to Request for Proposal.
10. CONTRACTOR's revised Proposal dated August 15, 2023 with a reduced Scope of Work and Fee.
11. Prevailing Wage Rates.
12. Following which may be delivered or issued after Effective Date of Agreement and are not attached thereto: All written Change Orders or Work Orders pursuant to Article 3.04 of General Conditions. There are no Contract Documents other than those listed in this Article. Contract Documents may only be amended, modified, or supplemented as provided in Article 3.04 of General Conditions.

ARTICLE 8. INDEMNITY PROVISIONS. GENERAL, SPECIAL, AND SUPPLEMENTAL CONDITIONS, IF ANY, INCORPORATED INTO THIS AGREEMENT CONTAIN PROVISIONS THAT MAY RELIEVE ONE PARTY FOR RESPONSIBILITY IT WOULD OTHERWISE HAVE UNDER LAW FOR DAMAGES OR OTHER LIABILITY ARISING OUT OF WORK. EACH OF THE PARTIES HERETO SPECIFICALLY AGREES THAT IT HAS A DUTY TO READ THIS AGREEMENT, GENERAL, SPECIAL, AND SUPPLEMENTAL CONDITIONS, IF ANY, AND ALL OTHER CONTRACT DOCUMENTS AND AGREES THAT IT IS CHARGED WITH NOTICE AND KNOWLEDGE OF TERMS OF THIS AGREEMENT AND ALL CONTRACT DOCUMENTS; THAT IT HAS IN FACT READ THIS AGREEMENT AND ALL CONTRACT DOCUMENTS AND IS FULLY INFORMED AND HAS FULL NOTICE AND KNOWLEDGE OF TERMS, CONDITIONS AND EFFECTS OF THIS AGREEMENT; THAT IT HAS HAD OPPORTUNITY TO BE REPRESENTED BY INDEPENDENT LEGAL COUNSEL OF ITS CHOICE PRECEDING ITS EXECUTION OF THIS AGREEMENT AND HAS RECEIVED OR VOLUNTARILY CHOSEN NOT TO RECEIVE ADVICE OF ITS ATTORNEY IN ENTERING INTO THIS AGREEMENT; AND THAT IT RECOGNIZES THAT CERTAIN TERMS OF THIS AGREEMENT AND CONTRACT DOCUMENTS RESULT IN ONE PARTY ASSUMING THE LIABILITY INHERENT IN SOME ASPECTS OF TRANSACTION AND RELIEVING OTHER PARTY OF ITS RESPONSIBILITY FOR SUCH LIABILITY. EACH PARTY HERETO AGREES AND COVENANTS THAT IT WILL NOT CONTEST VALIDITY OR ENFORCEMENT OF ANY EXCULPATORY PROVISION OF THIS AGREEMENT ON BASIS THAT THE PARTY HAD NO NOTICE OR KNOWLEDGE OF SUCH PROVISION OR THAT THE PROVISION IS NOT "CONSPICUOUS".

ARTICLE 9. MISCELLANEOUS. Terms used in this Agreement which are defined in Article 1 of General Conditions will have the meanings indicated in General Conditions. CONTRACTOR certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing Contract. For purposes of this Article 9:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in proposal process or in Contract execution;
2. "fraudulent practice" means an intentional misrepresentation of facts made
   (a) to influence proposal process or execution of Contract to detriment of OWNER,
   (b) to establish Proposal or Contract prices at artificial noncompetitive levels, or
   (c) to deprive OWNER of benefits of free and open competition;
3. "collusive practice" means a scheme or arrangement between two or more Proposers, with or without knowledge of OWNER, a purpose of which is to establish Proposal prices at artificial, non-competitive levels; and
4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the proposal process or affect execution of Contract.

ARTICLE 10. AMERICAN IRON AND STEEL. The Contractor acknowledges to and for the benefit of the Owner ("Purchaser") and the Texas Water Development Board (TWDB) that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking 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 Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and the TWDB 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 Owner or the TWDB. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner to enforce this Agreement and recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Owner resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the TWDB or any damages owed to the TWDB by the Owner). While the Contractor has no direct contractual privity with the TWDB, as a lender to the Owner for the funding of its project, the Owner and the Contractor agree that the TWDB 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 TWDB.

No assignment by a party hereto of any rights or interests in Contract will be binding on another party hereto without written consent of 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 effect of this restriction may be limited by law), and unless specifically stated to contrary in any written consent to an assignment no assignment will release or discharge assignor from any duty or responsibility under Contract.

OWNER and CONTRACTOR each binds itself, its officers, directors, shareholders, partners, members, successors, assigns, and legal representatives to other party hereto, its officers, directors, shareholders, partners, members, successors, assigns and legal representatives in respect to all covenants, agreements, and obligations contained in Contract Documents. Any provision or part thereof of Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions or parts thereof shall continue to be valid and binding upon OWNER and CONTRACTOR, who agree that 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 intention of the stricken provision or part thereof.

IN WITNESS WHEREOF, OWNER, and CONTRACTOR have signed this Agreement in duplicate. One counterpart has been delivered to OWNER, one counterpart has been delivered to CONTRACTOR and one counterpart has been delivered to ENGINEER. All portions of Contract Documents have been signed, initialed, or otherwise clearly identified by OWNER and CONTRACTOR or identified by ENGINEER on their behalf.

This Agreement will be effective on 10-24-23, (which is effective date of Agreement).

OWNER: Scott L. Albert

By: Scott L. Albert

Attest: Wendy Cole

Address for giving notices:

803 E. Main Street

Gatesville, Tx 76528

CONTRACTOR: Matous Construction, Ltd.

By: Bruce Matous

Attest: Mary K. Richter

(CORPORATE SEAL)

Address for giving notices:

8602 State Highway 317

Belton, TX 76513

END OF SECTION

Walker Partners
engineers | surveyors

6504 Bridge Point Parkway, Suite 200
Austin, Texas 78730

October12, 2023

City of Gatesville
803 E. Main Street
Gatesville, TX 76528

Attn: Scott L. Albert, City Manager

Re: Gatesville Stillhouse WWTF Expansion Construction Bid –
Negotiation of Final Price
Project No.: 02-01590

Dear Mr. Albert:

On June 20, 2023, Walker Partners assisted the City of Gatesville in opening competitive sealed proposals for the above referenced project. Three responsive, competitive sealed proposals were submitted by JM Pipeline, LLC of Horseshoe Bay, TX, Matous Construction, Ltd. of Belton TX and Gracon Construction, Inc. of Mesquite, TX. All the proposals were complete and none of the proposals included any deviations from the contract documents. See the Bid Tabulation attached to this letter.

The lowest bid and second-lowest bids were for $13,906,690.00 and $14,443,000.00. Our recommendation was to award the bid to the second-lowest bidder, Matous Construction, Inc., for reasons outlined in the "recommendation of Award" letter submitted to you on August 21, 2023.

The proposed contract amount is much greater than available funding left in the TWDB contract, estimated to be $7,900,000. Since Gatesville cannot provide the additional funding needed, Walker Partners (WP) recommended that Gatesville negotiate a construction Scope of Work with Matous that will (1) construct only those items necessary for the continued operation of the WWTF and (2) postpone any construction items that were required for the increased capacity of the WWTF.

Meanwhile WP reviewed the operation of the WWTF since the last permit renewal. Daily flow actually decreased over the last 5 years, resulting from pushes to increase water use efficiency in the prisons (which supply 75% of the water entering the WWTF), and Gatesville's rehabilitation of several manholes. WP met with TCEQ regarding the renewal of the permit. TCEQ agreed that the WWTF expansion that was included in the last permit renewal (to be completed while the permit was in-place), can still be postponed and included in the new permit. This will allow for the WWTF improvements to be completed as Phase 1 and the WWTF expansion as Phase 2, when flows require the expansion, and the City of Gatesville has secured the funding.

WP and Matous Construction have worked together to design a construction program that will improve operation of the WWTF and bring several items into compliance with TCEQ requirements. A summary of the revised Scope is:

- Replace Influent Pumps and piping
- Replace clarifier skim mechanisms
- Replace chemical feed systems
- Replace RAS pumps and piping
- Provide a concrete pad and drainage system for sludge storage.

This revised scope will update a lot of the equipment in the WWTF, some of which has been operating for 30 years, and provide greater flexibility for the Operators.

The revised Contract Price for Phase 1 – Stillhouse Branch WWTF Improvements is $7,203,000. This price addresses the pressing needs for the WWTF, and there is room for Change Orders. If there are a low number of Change Orders, possibly other items can be added to the Scope of Work, to be determined during construction. The letter from Matous is attached to this letter.

Walker Partners approves the revised Scope of Work and project cost, and requests that Gatesville conditionally approve the Contract so that the documents can be submitted to the TWDB for their approval.

Once that approval is granted, Walker Partners will prepare the Notice of Intent to Award Letter and other contract documents for transmittal to Matous Construction, Ltd.

Sincerely,

Michael Clough, PE 10/12/2023
Project Manager

Electronic Delivery

Cc: Project File

MATOUS CONSTRUCTION

GENERAL CONTRACTORS

8602 N. Hwy 317 • Belton, Texas 76513 • Office: 254.780.1400 • Fax: 254.780.2599

August 15, 2023

Mr. Mike Clough, P.E.
Senior Project Manager
Walker Partners
6504 Bridge Point Parkway, Suite 200
Austin, Texas 78730

RE: City of Gatesville
Stillhouse Branch WWTF Improvements

Dear Mike:

Matous Construction is pleased to offer the following to reduce costs for the construction of the above-referenced project. Our revised scope of work includes the following:

Bar Screening Structure

- Existing Bar Screen to stay in service.
- Remove and replace compactor.

Influent Lift Station

- Furnish and install all new pumps, rails, etc as per original drawings.
- New piping, valves, valve vault
- Electrical Starters and Controls will be in local panels under steel canopy.
- Influent Lift Station Electrical Building is deleted in its entirety.

Drum Screening and Splitter Box #1

- Demolition will be completed per drawings.
- New piping and valves will be furnished and installed per drawings.

Aeration Basin

- All work associated with Aeration Basin is deleted. This includes air piping, bridge, air drops, and diffusers.

Splitter Box #2

- Installation of Two (2) New Slide Gates

Modifications to Clarifiers (2)

- Work includes removing and replacing influent wells, skimmer, etc as per original drawings.

Chlorine and SO2 Equipment

- All chlorine and SO2 equipment will be replaced as per the original drawings and specifications.

Chlorine Contact Chamber

- All work associated with the Chlorine Contact Chamber is deleted in its entirety.
- All ductile iron yard piping to and from the CCC is deleted per drawing.

Effluent Pump Station

- All work is deleted.

Post Aeration

- All work is deleted.

Sludge Box A

- All work will be done per original drawings.

RAS Pump Station

- Furnish and Install New Pumps, Rails, etc as per original drawings.
- New piping will be included and installed.
- Electrical, Starters, Control Panels will be installed locally under steel canopy.

Sludge Drying Beds / Blower Room / Metal Building

- All work is deleted in its entirety.

Biosolids Storage Area

- Four Beds will be constructed at this time.
- Box Culvert will be constructed as per original drawings in front of the four beds.

Biosolids Drain Pump Station

- Pumps, piping, valves, and structure will be constructed as per original drawings.
- Electrical starters, controls, etc will be local on adjacent pad.

Control Building Modifications

- Delete all work.

Yard Piping

- Installed as per attached drawings.

Access Roads

- Installed as designed.

For the lump sum of $7,203,000.00

Should you have any questions, please feel free to call.

Sincerely,

Bruce A. Matous

CITY OF GATESVILLE, TEXAS		
STILLHOUSE WASTEWATER TREATMENT PLANT UPGRADE AND EXPANSION		
SCHEDULE OF VALUES		
DESCRIPTION	**AMOUNT**	
MOBILIZATION		
Bonds and Insurance	$ 75,000.00	
Mobilization	$ 275,000.00	
EROSION CONTROL		
Construction Entrances	$ 5,000.00	
Silt Fence	$ 9,000.00	
Rock Berm	$ 7,000.00	
Concrete Washout Area	$ 1,500.00	
SITEWORK		
Surveying	$ 5,000.00	
Gravel Drive	$ 40,000.00	
Concrete Paving	$ 40,000.00	
Remove and Replace Sidewalks Damaged by Yard Piping	$ 30,000.00	
Final Site Grading	$ 15,000.00	
Seeding	$ 6,000.00	
YARD PIPING		
Trench Protection	$ 10,000.00	
Line A - 20" SRS DI Piping	$ 107,500.00	
Line B - 4" RS DI Piping	$ 80,000.00	
Line C - 16" RAS DI Piping	$ 108,000.00	
Line D - 16" Sludge DI Piping	$ 108,000.00	
2" Plant Water PVC to Existing Hose Valves	$ 55,000.00	
1 1/2" CL2 from CL2 Bldg to CL2 Manhole	$ 20,000.00	
1 1/2" SO2 from Ejector to Yard	$ 14,000.00	
1 1/2" SO2 from SO2 Bldg to SO2 Manhole	$ 24,000.00	
Rem and Replace 6" PV at Vault #2	$ 11,000.00	
BAR SCREEN		
Demolition - Compactor	$ 5,000.00	
Demolition - Slide Gates	$ 5,000.00	
Machine Excavation	$ 3,000.00	
Excavation-Other	$ 3,000.00	
Concrete	$ 10,000.00	
Compactor - Material	$ 110,000.00	
Compactor - Installation	$ 4,000.00	
Slide Gates - Material	$ 60,000.00	
Slide Gates - Install	$ 4,000.00	
INFLUENT LIFT STATION		
Demolition	$ 35,000.00	
Machine Excavation	$ 3,000.00	
Excavation-Other	$ 3,000.00	
Concrete	$ 25,000.00	
Canopy @ Electrical Panels	$ 35,000.00	

Guide Rails	$	6,000.00	
Submersible Pumps - Materials	$	275,000.00	
Submersible Pumps -Installation	$	90,000.00	
Piping- 8" PVC Stilling Well	$	5,000.00	
Piping - 4" Valve Vault Drain	$	5,000.00	
Piping - 8"-10"-12"-20" Discharge Piping	$	330,000.00	
Piping - Pressure Gauge Assemblies	$	8,000.00	
Piping - Air/Vacuum Valves	$	9,000.00	
Painting	$	40,000.00	
DRUM SCREENS & SPLITTER BOX			
Demolition	$	35,000.00	
Piping - 16"-20"SRS DI Pipe	$	305,000.00	
Piping - 2" SRS Air/Vacuum Valve	$	17,000.00	
Painting	$	40,000.00	
SPLITTER BOX NO. 2			
Demolition	$	5,000.00	
Slide Gate - Materials	$	60,000.00	
Slide Gate - Installation	$	4,000.00	
CLARIFIERS			
Demolition	$	20,000.00	
Replace Feedwell / Scum Box	$	270,000.00	
Level Clarifier Weirs	$	20,000.00	
Painting	$	50,000.00	
CHLORINE MODIFICATIONS			
Demolition	$	15,000.00	
Chlorination Equipment	$	175,000.00	
Piping	$	20,000.00	
Insulation / Heat Trace	$	20,000.00	
SO2 MODIFICATIONS			
Demolition	$	15,000.00	
SO2 Equipment	$	175,000.00	
Piping	$	15,000.00	
Insulation / Heat Trace	$	20,000.00	
CHLORINE MANHOLE			
Machine Excavation	$	7,000.00	
Excavation Other	$	4,000.00	
Concrete	$	40,000.00	
Slide Gates - Material	$	120,000.00	
Slide Gates - Installation	$	8,000.00	
SLUDGE BOX "A"			
Demo	$	5,000.00	
Concrete	$	17,000.00	

RAS PUMP STATION		
Demolition	$ 35,000.00	
Machine Excavation	$ 5,000.00	
Excav Other	$ 5,000.00	
Concrete	$ 17,000.00	
Canopy @ Electrical Panels	$ 35,000.00	
RAS Pumps - Material	$ 165,000.00	
RAS Pumps - Installation	$ 40,000.00	
Piping - Pump Discharge Piping	$ 270,000.00	
8" Stilling Well	$ 5,000.00	
4" Vault Drain	$ 5,000.00	
Piping - Pressure Gauges	$ 8,000.00	
RAS Pump Air / Vacuum Valves	$ 9,000.00	
Painting	$ 20,000.00	
BIOSOLIDS STORAGE AREA		
Machine Excavation	$ 75,000.00	
Excav Other	$ 70,000.00	
Pre-Cast Box Culverts	$ 130,000.00	
Pre-Cast Trench Drains	$ 190,000.00	
Concrete	$ 420,000.00	
Discharge Piping	$ 25,000.00	
BIOSOLIDS DRAIN PUMP STATION		
Machine Excavation	$ 25,000.00	
Excav Other	$ 10,000.00	
FRP Wetwell	$ 35,000.00	
Biosolids Drain Pumps - Material	$ 35,000.00	
Biosolids Drain Pumps - Installation	$ 8,000.00	
Drain Pump Station - Piping	$ 140,000.00	
Painting	$ 20,000.00	
Electrical - Phase 1		
Mobilization - Elec	$ 85,000.00	
Electrical Switchgear, Disc, Testing	$ 685,000.00	
Light Fixtures	$ 13,000.00	
Grounding	$ 42,000.00	
Manholes and Handholes	$ 98,000.00	
Electrical Ductbankds	$ 240,000.00	
Site Conduit	$ 87,000.00	
Site Wiring	$ 117,000.00	
Influent LS Electrical	$ 147,000.00	
Chlorine Modifications Electrical	$ 55,000.00	
SO2 Modifications Electrical	$ 37,000.00	
RAS Pump Station Electrical	$ 150,000.00	
Biosolids Electrical	$ 44,000.00	
Total for Above	**$ 7,203,000.00**	

Build 4 drying beds

1 2 3 4

DOG POUND

PHASE 1

STORAGE BUILDING

BELT PRESS BLDG

ELEC BLDG

CONTROL BUILDING

THICKENER

WAS

CL2 BLDG

SO2 BLDG

CLARIFIER #1

PH 1

LINE C

LINE C

LINE I

LINE J

RAS PUMP

SPLITTER BOX #2

SLUDGE BOX

LINE L

SO2

PHASE 1

SPLITTER BOX #1

AERATION BASINS

LINE M

PH 1

CLARIFIER #2

LINE D

LINE A

LINE B

LINE K

CL2

INFLUENT PUMP

LIMITS OF 100 YR FLOODPLAIN

BAR SCREEN

PHASE 1

Delete Perf Bar Screen

Furnish and Install Compactor

Furnish and Install Slide Gates (2)

PLAN

1" = 30'

REV.	DESCRIPTION	DATE

Walker Partners engineers | surveyors

T.B.P.E. Registration No. 9053

CITY OF GATESVILLE

CITY OF GATESVILLE - STILLHOUSE WWTF UPGRADE AND EXPANSION

YARD PIPING PLAN

5-8-23

DATE

MICHAEL CLOUGH

PM	J. JENKINS
DESIGNED	M. CLOUGH
DRAFTED	TFG, PA
CHECKED	J. JENKINS
PROJECT NO.	2-01590

STATE OF TEXAS MICHAEL CLOUGH 105725 LICENSED PROFESSIONAL ENGINEER

DRAWING NO.

C-06

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EFFLUENT PUMP STATION

EXISTING SIDEWALK (TO BE REPLACED)

LINE L

AERATOR

CHLORINE CONTACT BASIN #1

SO2 MH

LINE H

CL2 MH

LINE I

LINE E

LINE G

LINE F

EXISTING SIDEWALK

EXISTING SIDEWALK (TO BE REPLACED)

CHLORINE CONTACT BASIN #2

EFFLUENT METERING STATION

LINE K

PLAN
1" = 5'

N

E

S

REV.	DESCRIPTION	DATE

Walker Partners engineers | surveyors
T.B.P.E. Registration No. 6053

CITY OF GATESVILLE

CITY OF GATESVILLE - STILLHOUSE WWTF UPGRADE AND EXPANSION

EAST YARD PIPING PLAN

5-8-23
DATE

MICHAEL CLOUGH

STATE OF TEXAS
MICHAEL CLOUGH
105725
LICENSED PROFESSIONAL ENGINEER

PM	J. JENKINS
DESIGNED	M. CLOUGH
DRAFTED	TFG, PA
CHECKED	J. JENKINS
PROJECT NO.	2-01590

DRAWING NO.
C-07

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Bond #107491594

SECTION 00 61 13

PAYMENT BOND

STATE OF TEXAS

COUNTY OF Coryell

KNOW ALL MEN BY THESE PRESENTS: That Matous Construction, Ltd. (Contractor) of City of Belton, County of Bell, and State of Texas, as Principal, and Travelers Casualty and Surety Company of America authorized under the Laws of the State of Texas to act as surety on bonds for principals, are held and firmly bound unto City of Gatesville (Owner), in the penal sum of Seven Million Two Hundred Three Thousand and No/100 Dollars ($7,203,000.00) (no less than 100% of Contract Price) for payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, by these presents:

WHEREAS, Principal has entered into a certain written contract with Owner, dated the 24th day of October, 2023 for construction of 2-01590 – City of Gatesville – Stillhouse Branch Wastewater Treatment Facility Improvements in accordance with Drawings, Specifications, and terms and conditions related thereto to which Contract is hereby referred to and make a part hereof as fully and to the same extent as if copied at length herein. The work done under the Contract will be completed and performed according to the approved plans and specifications and in accordance with sound construction principles and practices.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION IS SUCH, that if said Principal shall pay all claimants supplying labor and material to him or a Sub-Contractor in prosecution of work provided for in said contract, then, this obligation shall be void; otherwise to remain in full force and effect until one year beyond the date of approval by the Engineer of the political subdivision;

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 2253 of Texas Government Code as amended and all liabilities on this bond shall be determined in accordance with the provisions of said Statute to the same extent as if it were copied at length herein. Surety, for value received, stipulates and agrees that no change, extension of time, alteration or addition to the terms of contract, or to work performed thereunder, or Specifications, or Drawings, accompanying the same, shall in anyway affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to terms of contract, or work to be performed thereunder.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument on the 24th day of October, 2023

Contractor: Matous Construction, Ltd.

By: _____

Name: Bruce A. Matous

Title: CEO of General Partner

Date: October 24, 2023

Surety: Travelers Casualty and Surety Company of America

By: _____

Name: Emily Allison Mikeska

Title: Attorney-In-Fact

Date: October 24, 2023

ATTEST/SURETY WITNESS:

Full Name of Surety: Travelers Casualty and Surety Company of America

(SEAL)

Address of Surety for Notice

One Tower Square

Hartford, CT 06183

Telephone Number of Surety: 1-860-277-0111

By: _____

Name: Connie Williamson

Title: Witness

Date: October 24, 2023

By: _____

Name: Emily Allison Mikeska

Title: Attorney-in-Fact

Date: October 24, 2023

END OF SECTION

Bond #107491594

SECTION 00 61 14

PERFORMANCE BOND

STATE OF TEXAS

COUNTY OF Coryell

KNOW ALL MEN BY THESE PRESENTS: That Matous Construction, Ltd. (Contractor) of City of Belton, County of Bell, and State of Texas, as Principal, and Travelers Casualty and Surety Company of America authorized under Laws of State of Texas to act as surety on bonds for principals, are held and firmly bound unto City of Gatesville (Owner), in the penal sum of Seven Million Two Hundred Three Thousand and No/100 Dollars ($ 7,203,000.00) (no less than 100% of Contract Price) for the payment whereof, said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, by these presents:

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NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if said Principal shall faithfully perform said Contract and shall in all respects duly and faithfully observe and perform all and singular the covenants, conditions an agreements in and by said contract agreed and covenanted by Principal to be observed and performed, and according to the true intent and meaning of said Contract and Drawings and Specifications hereto annexed, then this obligation shall be void; otherwise to remain in full force and effect until one year beyond the date of approval by the Engineer of the political subdivision;

PROVIDED, HOWEVER, that this bond is executed pursuant to provisions of Chapter 2253 of Texas Government Code as amended and all liabilities on this bond shall be determined in accordance with the provisions of said Statute to same extent as if it were copied at length herein. Surety, for value received, stipulates and agrees that no change, extension of time, alteration or addition to the terms of contract, or to work performed thereunder, or drawings, Specifications, or Drawings, accompanying same, shall in anyway affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to terms of contract, or work to be performed thereunder.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument on 24th day of October, 20 23

Contractor: Matous Construction, Ltd.

By: _____

Name: Bruce A. Matous

Title: CEO of General Partner

Date: October 24, 2023

Surety: Travelers Casualty and Surety Company of America

By: _____

Name: Emily Allison Mikeska

Title: Attorney-In-Fact

Date: October 24, 2023

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One Tower Square

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Telephone Number of Surety: 1-860-277-0111

By: _____

Name: Connie Williamson

Title: Witness

Date: October 24, 2023

By: _____

Name: Emily Allison Mikeska

Title: Attorney-in-Fact

Date: October 24, 2023

END OF SECTION

TRAVELERS

Travelers Casualty and Surety Company of America
Travelers Casualty and Surety Company
St. Paul Fire and Marine Insurance Company

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That Travelers Casualty and Surety Company of America, Travelers Casualty and Surety Company, and St. Paul Fire and Marine Insurance Company are corporations duly organized under the laws of the State of Connecticut (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint **Emily Mikeska** of **TEMPLE** , **Texas** , their true and lawful Attorney(s)-in-Fact to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed, and their corporate seals to be hereto affixed, this **21st** day of **April**, **2021**.

State of Connecticut

City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the **21st** day of **April**, **2021**, before me personally appeared **Robert L. Raney**, who acknowledged himself to be the Senior Vice President of each of the Companies, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of said Companies by himself as a duly authorized officer.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

My Commission expires the **30th** day of **June**, **2026**

_____
Anna P. Nowik, Notary Public

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of each of the Companies, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, **Kevin E. Hughes**, the undersigned, Assistant Secretary of each of the Companies, do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which remains in full force and effect.

Dated this **24th** day of **October** , **2023** .

_____
Kevin E. Hughes, Assistant Secretary

To verify the authenticity of this Power of Attorney, please call us at 1-800-421-3880.
Please refer to the above-named Attorney(s)-in-Fact and the details of the bond to which this Power of Attorney is attached.

IMPORTANT NOTICE

To obtain information or make a complaint:

You may call Travelers Casualty and Surety Company of America and its affiliates' toll-free telephone number for information or to make a complaint at:

1-800-328-2189

You may contact the Texas Department of Insurance to obtain information on companies, coverages, rights or complaints at:

1-800-252-3439

You may write the Texas Department of Insurance:

P. O. Box 149104
Austin, TX 78714-9104
Fax: (512) 475-1771
Web: http://www.tdi.state.tx.us
E-mail: ConsumerProtection@tdi.state.tx.us

PREMIUM OR CLAIM DISPUTES:
Should you have a dispute concerning your premium or about a claim you should contact your Agent or Travelers first. If the dispute is not resolved, you may contact the Texas Department of Insurance.

ATTACH THIS NOTICE TO YOUR BOND:
This notice is for information only and does not become a part or condition of the attached document and is given to comply with Texas legal and regulatory requirements.

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 10/18/2023

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

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

PRODUCER
Ward & Moore Insurance Services
1023 Canyon Creek Drive, Suite 110
Temple TX 76502

CONTACT NAME: Marlo Reinhardt
PHONE (A/C, No, Ext): 254-865-8411 **FAX (A/C, No):**
E-MAIL ADDRESS: mreinhardt@acrisure.com

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Cincinnati Insurance Company	10677
INSURER B : Travelers Property Casualty Company of America	25674
INSURER C : Texas Mutual Insurance Company	22945
INSURER D : Indian Harbor Insurance Company	36940
INSURER E :	
INSURER F :	

INSURED MATOCON-03
Matous Construction, Ltd.
8602 North Highway 317
Belton TX 76513

COVERAGES **CERTIFICATE NUMBER:** 1493182191 **REVISION NUMBER:**

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

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY			EPP 0471570	1/12/2021	1/12/2024	EACH OCCURRENCE	$ 1,000,000
	CLAIMS-MADE X OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 500,000
							MED EXP (Any one person)	$ 10,000
							PERSONAL & ADV INJURY	$ 1,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$ 2,000,000
	POLICY X PRO-JECT LOC						PRODUCTS - COMP/OP AGG	$ 2,000,000
	OTHER:						Electronic Data Liab	$ 1,000,000
A	AUTOMOBILE LIABILITY			EBA 0471570	1/12/2023	1/12/2024	COMBINED SINGLE LIMIT (Ea accident)	$ 1,000,000
	X ANY AUTO						BODILY INJURY (Per person)	$
	OWNED AUTOS ONLY / SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	X HIRED AUTOS ONLY / X NON-OWNED AUTOS ONLY						PROPERTY DAMAGE (Per accident)	$
								$
B	X UMBRELLA LIAB X OCCUR			CUP8S57576A	1/12/2023	1/12/2024	EACH OCCURRENCE	$ 15,000,000
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$ 15,000,000
	DED X RETENTION $ 10,000							$
C	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y/N	N/A		0002008328	1/12/2023	1/12/2024	X PER STATUTE OTH-ER	
	ANYPROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) N						E.L. EACH ACCIDENT	$ 1,000,000
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$ 1,000,000
							E.L. DISEASE - POLICY LIMIT	$ 1,000,000
D	Pollution/Professional Liability			PEC2000359	1/12/2023	1/12/2024	Each Occu / Aggregate	2,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
Additional Insured endorsement for General Liability, Auto Liability & Umbrella Liability attached.
Waiver of Subrogation endorsement for General Liability, Auto Liability, Umbrella Liability & Workers Compensation attached.
30 Day Notice of Cancellation endorsement for General Liability, Auto Liability, & Umbrella Liability attached.
Primary & Non-Contributory endorsement for General Liability, Auto Liability, & Umbrella Liability attached.

Project: 2-01590 City of Gatesville – Stillhouse Branch Wastewater Treatment Facility Improvements.

CERTIFICATE HOLDER

City of Gatesville
803 Main Street
Gatesville, TX 76528

CANCELLATION

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

AUTHORIZED REPRESENTATIVE

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

CANCELLATION OR NONRENEWAL BY US NOTIFICATION TO A DESIGNATED ENTITY

This endorsement modifies insurance provided under the following:

BUSINESSOWNERS PACKAGE POLICY
CLAIMS-MADE EXCESS LIABILITY COVERAGE PART
COMMERCIAL AUTO COVERAGE PART
COMMERCIAL GENERAL LIABILITY COVERAGE PART
COMMERCIAL UMBRELLA LIABILITY COVERAGE PART
DENTIST'S PACKAGE POLICY
ELECTRONIC DATA LIABILITY COVERAGE PART
EXCESS LIABILITY COVERAGE PART
LIQUOR LIABILITY COVERAGE PART
OWNERS AND CONTRACTORS PROTECTIVE LIABILITY COVERAGE PART
POLLUTION LIABILITY COVERAGE PART
PRODUCTS/COMPLETED OPERATIONS COVERAGE PART
PRODUCT WITHDRAWAL COVERAGE PART
PROFESSIONAL LIABILITY COVERAGE PART
PROFESSIONAL UMBRELLA LIABILITY COVERAGE PART
PROFESSIONAL UMBRELLA LIABILITY COVERAGE PART - CLAIMS-MADE
RAILROAD PROTECTIVE LIABILITY COVERAGE PART
UNDERGROUND STORAGE TANK POLICY

SCHEDULE

Name and mailing address of person(s) or organization(s):
1. FOR WHOM YOU ARE REQUIRED IN A WRITTEN CONTRACT THAT WAS EXECUTED ON OR AFTER THE EARLIER OF THE FOLLOWING DATES: A. THE EFFECTIVE DATE OF THIS POLICY, OR B. THE EFFECTIVE DATE OF THE ORIGINAL POLICY OF WHICH THIS POLICY IS A RENEWAL OR REPLACEMENT, AND 2. FOR WHOM YOU ARE REQUIRED IN THAT SAME WRITTEN CONTRACT AS REFERRED TO IN 1. ABOVE TO PROVIDE CANCELLATION NOTICE.

Number of days notice (other than nonpayment of premium): 30

A. If we cancel or nonrenew this policy for any statutorily permitted reason other than nonpayment of premium we will mail notice to the person or organization shown in the Schedule. We will mail such notice at least the number of days shown in the Schedule before the effective date of cancellation or nonrenewal.

B. If we cancel this policy for nonpayment of premium, we will mail notice to the person or organization shown in the Schedule. We will mail such notice at least 10 days before the effective date of cancellation.

C. If notice is mailed, proof of mailing to the mailing address shown in the Schedule will be sufficient proof of notice.

D. In no event will coverage extend beyond the actual expiration, termination or cancellation of the policy.

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

CinciPlus®
BUSINESS AUTO XC+®
(EXPANDED COVERAGE PLUS)
ENDORSEMENT

This endorsement modifies insurance provided by the following:

BUSINESS AUTO COVERAGE FORM

With respect to the coverage provided by this endorsement, the provisions of the Coverage Form apply unless modified by this endorsement.

A. Blanket Waiver of Subrogation

SECTION IV - BUSINESS AUTO CONDITIONS, A. Loss Conditions, 5. Transfer of Rights of Recovery Against Others to Us is amended by the addition of the following:

We waive any right of recovery we may have against any person or organization because of payments we make for "bodily injury" or "property damage" arising out of the operation of a covered "auto" when you have assumed liability for such "bodily injury" or "property damage" under an "insured contract", provided the "bodily injury" or "property damage" occurs subsequent to the execution or the "insured contract".

B. Noncontributory Insurance

SECTION IV - BUSINESS AUTO CONDITIONS, B. General Conditions, 5. Other Insurance c. is deleted in its entirety and replaced by the following:

c. Regardless of the provisions of Paragraph **a.** above, this Coverage Form's Liability Coverage is primary and we will not seek contribution from any other insurance for any liability assumed under an "insured contract" that requires liability to be assumed on a primary noncontributory basis.

C. Additional Insured by Contract

SECTION II - LIABILITY COVERAGE, A. Coverage, 1. Who is an Insured is amended to include as an insured any person or organization for whom you have agreed in a valid written contract to provide insurance as afforded by this policy.

This provision is limited to the scope of the valid written contract.

This provision does not apply unless the valid written contract has been:

1. Executed prior to the accident causing "bodily injury" or "property damage"; and
2. Is still in force at the time of the "accident" causing "bodily injury" or "property damage".

D. Employee Hired Auto

1. Changes in Liability Coverage

The following is added to the **SECTION II - LIABILITY COVERAGE, A. Coverage, 1. Who is an Insured**:

An "employee" of yours is an "insured" while operating an "auto" hired or rented under a contract or agreement in that "employee's" name, with your permission, while performing duties related to the conduct of your business.

2. Changes in General Conditions

SECTION IV - BUSINESS AUTO CONDITIONS, B. General Conditions, 5. Other Insurance is deleted in its entirety and replaced by the following:

b. For Hired Auto Physical Damage Coverage the following are deemed to be covered "autos" you own:

(1) Any covered "auto" you lease, hire, rent or borrow; and

(2) Any covered "auto" hired or rented by your "employee" under a contract in that individual "employee's" name, with your permission, while performing duties related to the conduct of your business.

However, any "auto" that is leased, hired, rented or borrowed with a driver is not a covered "auto".

E. Audio, Visual and Data Electronic Equipment

SECTION III - PHYSICAL DAMAGE COVERAGE, C. Limit of Insurance is amended by adding the following:

4. The most we will pay for all "loss" to audio, visual or data electronic equipment and any accessories used with this equipment as a result of any one "accident" is the lesser of:

   a. The actual cash value of the damaged or stolen property as of the time of the "accident";

   b. The cost of repairing or replacing the damaged or stolen property with other property of like kind and quality; or

   c. $2,500.

   Provided the equipment, at the time of the "loss" is:

   a. Permanently installed in or upon the covered "auto" in a housing, opening or other location that is not normally used by the "auto" manufacturer for the installation of such equipment;

   b. Removable from a permanently installed housing unit as described in Paragraph **2.a.** above; or

   c. An integral part of such equipment.

F. Who is an Insured - Amended

SECTION II - LIABILITY COVERAGE, A. Coverage, 1. Who is an Insured is amended by adding the following:

The following are "insureds":

1. Any subsidiary which is a legally incorporated entity of which you own a financial interest of more than 50% of the voting stock on the effective date of this coverage form.

   However, the insurance afforded by this provision does not apply to any subsidiary that is an "insured" under any other automobile liability policy or would be an "insured" under such policy but for termination of such policy or the exhaustion of such policy's limits of insurance.

2. Any organization that is newly acquired or formed by you and over which you maintain majority ownership. The insurance provided by this provision:

   a. Is effective on the date of acquisition or formation, and is afforded for 180 days after such date;

   b. Does not apply to "bodily injury" or "property damage" resulting from an "accident" that occurred before you acquired or formed the organization;

   c. Does not apply to any newly acquired or formed organization that is a joint venture or partnership; and

   d. Does not apply to an insured under any other automobile liability policy or would be an insured under such a policy but for the termination of such policy or the exhaustion of such policy's limits of insurance.

3. Any of your "employees" while using a covered "auto" in your business or your personal affairs, provided you do not own, hire or borrow that "auto".

G. Liability Coverage Extensions - Supplementary Payments - Higher Limits

SECTION II - LIABILITY COVERAGE, A. Coverage, 2. Coverage Extensions, a. Supplementary Payments is amended by:

1. Replacing the $2,000 Limit of Insurance for bail bonds with $4,000 in **(2)**; and

2. Replacing the $250 Limit of Insurance for reasonable expenses with $500 in **(4)**.

H. Amended Fellow Employee Exclusion

SECTION II - LIABILITY COVERAGE, B. Exclusions, 5. Fellow Employee is modified as follows:

Exclusion **5. Fellow Employee** is deleted.

I. Hired Auto - Physical Damage

If hired "autos" are covered "autos" for Liability Coverage, then Comprehensive and Collision Physical Damage Coverages as provided under **SECTION III - PHYSICAL DAMAGE COVERAGE** of this Coverage Part are extended to "autos" you hire, subject to the following:

1. The most we will pay for "loss" to any hired "auto" is $50,000 or the actual cash value or cost to repair or replace, whichever is the least, minus a deductible.

2. The deductible will be equal to the largest deductible applicable to any owned "auto" for that coverage, or $1,000, whichever is less.

3. Hired Auto - Physical Damage coverage is excess over any other collectible insurance.

4. Subject to the above limit, deductible, and excess provisions we will provide coverage equal to the broadest coverage applicable to any covered "auto" you own insured under this policy.

Coverage includes loss of use of that hired auto, provided it results from an "accident" for which you are legally liable and as a result of which a monetary loss is sustained by the leasing or rental concern. The most we will pay for any one "accident" is $3,000.

If a limit for Hired Auto - Physical Damage is shown in the Schedule, then that limit replaces, and is not added to, the $50,000 limit indicated above and the deductibles shown in the Schedule are applicable.

J. Rental Reimbursement

SECTION III - PHYSICAL DAMAGE COVERAGE is amended by adding the following:

1. We will pay for rental reimbursement expenses incurred by you for the rental of an "auto" because of a "loss" to a covered "auto". Payment applies in addition to the otherwise applicable amount of each coverage you have on a covered "auto". No deductible applies to this coverage.

2. We will pay only for those expenses incurred during the policy period beginning 24 hours after the "loss" and ending, regardless of the policy's expiration, with the lesser of the following number of days:

   a. The number of days reasonably required to repair the covered "auto". If "loss" is caused by theft, this number of days is added to the number of days it takes to locate the covered "auto" and return it to you; or

   b. 30 days.

3. Our payment is limited to the lesser of the following amounts:

   a. Necessary and actual expenses incurred; or

   b. $50 per day.

4. This coverage does not apply while there are spare or reserve "autos" available to you for your operations.

5. We will pay under this coverage only that amount of your rental reimbursement expenses which is not already provided for under **SECTION III - PHYSICAL DAMAGE COVERAGE, A. Coverage, 4. Coverage Extensions**.

K. Transportation Expense - Higher Limits

SECTION III - PHYSICAL DAMAGE COVERAGE, A. Coverage, 4. Coverage Extensions is amended by replacing $20 per day with $50 per day, and $600 maximum with $1,500 maximum in **Extension a. Transportation Expenses**.

L. Airbag Coverage

SECTION III - PHYSICAL DAMAGE COVERAGE, B. Exclusions, 3.a. is amended by adding the following:

However, the mechanical and electrical breakdown portion of this exclusion does not apply to the accidental discharge of an airbag. This coverage for airbags is excess over any other collectible insurance or warranty.

M. Loan or Lease Gap Coverage

1. **SECTION III - PHYSICAL DAMAGE COVERAGE, C. Limit of Insurance** is deleted in its entirety and replaced by the following, but only for private passenger type "autos" with an original loan or lease, and only in the event of a "total loss" to such a private passenger type "auto":

   a. The most we will pay for "loss" in any one "accident" is the greater of:

      (1) The amount due under the terms of the lease or loan to which your covered private passenger type "auto" is subject, but will not include:

         (a) Overdue lease or loan payments;

         (b) Financial penalties imposed under the lease due to high mileage, excessive use or abnormal wear and tear;

         (c) Security deposits not refunded by the lessor;

         (d) Costs for extended warranties, Credit Life Insurance, Health, Accident or Disability Insurance purchased with the loan or lease; and

         (e) Carry-over balances from previous loans or leases, or

      (2) Actual cash value of the stolen or damaged property.

   b. An adjustment for depreciation and physical condition will be made in determining actual cash value at the time of "loss".

2. **SECTION V - DEFINITIONS** is amended by adding the following, but only for the purposes of this **Loan or Lease Gap Coverage**:

   "Total loss" means a "loss" in which the cost of repairs plus the salvage value exceeds the actual cash value.

N. Glass Repair - Waiver of Deductible

SECTION III - PHYSICAL DAMAGE COVERAGE, D. Deductible is amended by adding the following:

No deductible applies to glass damage if the glass is repaired in a manner acceptable to us rather than replaced.

O. Duties in the Event of an Accident, Claim, Suit or Loss - Amended

SECTION IV - BUSINESS AUTO CONDITIONS, A. Loss Conditions, 2. Duties in the Event of Accident, Claim, Suit or Loss, a. is amended by adding the following:

This condition applies only when the "accident" or "loss" is known to:

1. You, if you are an individual;
2. A partner, if you are a partnership;
3. An executive officer or insurance manager, if you are a corporation; or
4. A member or manager, if you are a limited liability company.

P. Unintentional Failure to Disclose Hazards

SECTION IV - BUSINESS AUTO CONDITIONS, B. General Conditions, 2. Concealment, Misrepresentation or Fraud is amended by adding the following:

However, if you unintentionally fail to disclose any hazards existing on the effective date of this Coverage Form, we will not deny coverage under this Coverage Form because of such failure.

Q. Mental Anguish Resulting from Bodily Injury

SECTION V - DEFINITIONS, C. "Bodily injury" is deleted in its entirety and replaced by the following:

"Bodily injury" means bodily injury, sickness or disease sustained by a person, including mental anguish and death sustained by the same person that results from such bodily injury, sickness or disease. "Bodily injury" does not include mental anguish or death that does not result from bodily injury, sickness or disease.

R. Coverage for Certain Operations in Connection with Railroads

With respect to the use of a covered "auto" in operations for or affecting a railroad:

1. **SECTION V - DEFINITIONS, H.** "Insured contract", **1.c.** is deleted in its entirety and replaced by the following:

   c. An easement or license agreement;

2. **SECTION V - DEFINITIONS, H.** "Insured contract", **2.a.** is deleted.

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

CONTRACTORS ADDITIONAL INSURED - AUTOMATIC STATUS AND AUTOMATIC WAIVER OF SUBROGATION WHEN REQUIRED IN WRITTEN CONTRACT, AGREEMENT, PERMIT OR AUTHORIZATION

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

A. Additional Insured - Owners, Lessees Or Contractors - Automatic Status For Other Parties When Required In Written Contract Or Agreement With You

1. **Section II - Who Is An Insured** is amended to include as an additional insured any person or organization you have agreed in writing in a contract or agreement to add as an additional insured on this Coverage Part. Such person(s) or organization(s) is an additional insured only with respect to liability for:

   a. "Bodily injury", "property damage" or "personal and advertising injury" *caused, in whole or in part, by* the performance of your ongoing operations by you or on your behalf, under that written contract or written agreement. Ongoing operations does not apply to "bodily injury" or "property damage" occurring after:

      (1) All work, including materials, parts or equipment furnished in connection with such work, on the project (other than service, maintenance or repairs) to be performed by or on behalf of the additional insured(s) at the location of the covered operations has been completed; or

      (2) That portion of "your work" out of which the injury or damage arises has been put to its intended use by any person or organization other than another contractor or subcontractor engaged in performing operations for a principal as a part of the same project; and

   b. "Bodily injury" or "property damage" *caused, in whole or in part, by* "your work" performed under that written contract or written agreement and included in the "products-completed operations hazard", but only if:

      (1) The Coverage Part to which this endorsement is attached provides coverage for "bodily injury" or "property damage" included within the "products-completed operations hazard"; and

      (2) The written contract or written agreement requires you to provide additional insured coverage included within the "products-completed operations hazard" for that person or organization.

      If the written contract or written agreement requires you to provide additional insured coverage included within the "products-completed operations hazard" for a specified length of time for that person or organization, the "bodily injury" or "property damage" must occur prior to the expiration of that period of time in order for this insurance to apply.

      If the written contract or written agreement requires you to provide additional insured coverage for a person or organization per only ISO additional insured endorsement form number **CG 20 10**, without specifying an edition date, and without specifically requiring additional insured coverage included within the "products-completed operations hazard", this Paragraph **b.** does not apply to that person or organization.

2. If the written contract or written agreement described in Paragraph **1.** above specifically requires you to provide additional insured coverage to that person or organization:

   a. *Arising out of* your ongoing operations or *arising out of* "your work"; or

b. By way of an edition of an ISO additional insured endorsement that includes *arising out of* your ongoing operations or *arising out of* "your work";

then the phrase *caused, in whole or in part, by* in Paragraph **A.1.a.** and/or Paragraph **A.1.b.** above, whichever applies, is replaced by the phrase *arising out of*.

3. With respect to the insurance afforded to the additional insureds described in Paragraph **A.1.**, the following additional exclusion applies:

This insurance does not apply to "bodily injury", "property damage" or "personal and advertising injury" arising out of the rendering of, or the failure to render, any professional architectural, engineering or surveying services, including:

a. The preparing, approving or failing to prepare or approve, maps, shop drawings, opinions, reports, surveys, field orders, change orders or drawings and specifications; or

b. Supervisory, inspection, architectural or engineering activities.

This exclusion applies even if the claims against any insured allege negligence or other wrongdoing in the supervision, hiring, employment, training or monitoring of others by that insured, if the "occurrence" which caused the "bodily injury" or "property damage", or the offense which caused the "personal and advertising injury", involved the rendering of, or the failure to render, any professional architectural, engineering or surveying services.

4. This Paragraph **A.** does not apply to additional insureds described in Paragraph **B.**

B. Additional Insured - State Or Governmental Agency Or Subdivision Or Political Subdivision - Automatic Status When Required In Written Permits Or Authorizations

1. Section II - Who Is An Insured is amended to include as an additional insured any state or governmental agency or subdivision or political subdivision you have agreed in writing in a contract, agreement, permit or authorization to add as an additional insured on this Coverage Part. Such state or governmental agency or subdivision or political subdivision is an additional insured only with respect to operations performed by you or on your behalf for which the state or governmental agency or subdivision or political subdivision issued, in writing, a contract, agreement, permit or authorization.

2. With respect to the insurance afforded to the additional insureds described in Paragraph **B.1.**, the following additional exclusions apply:

This insurance does not apply to:

a. "Bodily injury", "property damage" or "personal and advertising injury" arising out of operations performed for the federal government, state or municipality; or

b. "Bodily injury" or "property damage" included within the "products-completed operations hazard."

C. The insurance afforded to additional insureds described in Paragraphs **A.** and **B.**:

1. Only applies to the extent permitted by law; and

2. Will not be broader than that which you are required by the written contract, written agreement, written permit or written authorization to provide for such additional insured; and

3. Does not apply to any person, organization, state, governmental agency or subdivision or political subdivision specifically named as an additional insured for the same project in the schedule of an endorsement added to this Coverage Part.

D. With respect to the insurance afforded to the additional insureds described in Paragraphs **A.** and **B.**, the following is added to **Section III - Limits Of Insurance**:

The most we will pay on behalf of the additional insured is the amount of insurance:

1. Required by the written contract, written agreement, written permit or written authorization described in Paragraphs **A.** and **B.**; or

2. Available under the applicable Limits of Insurance shown in the Declarations;

whichever is less.

This endorsement shall not increase the applicable Limits of Insurance shown in the Declarations.

E. Section IV - Commercial General Liability Conditions is amended to add the following:

Automatic Additional Insured Provision

This insurance applies only if the "bodily injury" or "property damage" occurs, or the "personal and advertising injury" offense is committed:

1. During the policy period; and

2. Subsequent to your execution of the written contract or written agreement, or the issuance of a written permit or written authorization, described in Paragraphs **A.** and **B.**

F. Except when **G.** below applies, the following is added to **Section IV - Commercial General Liability Conditions, 5. Other Insurance,** and supersedes any provision to the contrary:

When Other Additional Insured Coverage Applies On An Excess Basis

This insurance is primary to other insurance available to the additional insured described in Paragraphs **A.** and **B.** except:

1. As otherwise provided in **Section IV - Commercial General Liability Conditions, 5. Other Insurance, b. Excess Insurance**; or

2. For any other valid and collectible insurance available to the additional insured as an additional insured by attachment of an endorsement to another insurance policy that is written on an excess basis. In such case, this insurance is also excess.

G. The following is added to **Section IV - Commercial General Liability Conditions, 5. Other Insurance,** and supersedes any provision to the contrary:

Primary Insurance When Required By Written Contract, Agreement, Permit Or Authorization

Except when wrap-up insurance applies to the claim or "suit" on behalf of the additional insured, this insurance is primary to any other insurance available to the additional insured described in Paragraphs **A.** and **B.** provided that:

1. The additional insured is a Named Insured under such other insurance; and

2. You have agreed in writing in a contract, agreement, permit or authorization described in Paragraph **A.** or **B.** that this insurance would be primary to any other insurance available to the additional insured.

As used in this endorsement, wrap-up insurance means any insurance provided by a consolidated (wrap-up) insurance program.

Primary And Noncontributory Insurance When Required By Written Contract, Agreement, Permit Or Authorization

Except when wrap-up insurance applies to the claim or "suit" on behalf of the additional insured, this insurance is primary to and will not seek contribution from any other insurance available to the additional insured described in Paragraphs **A.** and **B.** provided that:

1. The additional insured is a Named Insured under such other insurance; and

2. You have agreed in writing in a contract, agreement, permit or authorization described in Paragraph **A.** or **B.** that this insurance would be primary and would not seek contribution from any other insurance available to the additional insured.

As used in this endorsement, wrap-up insurance means any insurance provided by a consolidated (wrap-up) insurance program.

H. Section IV - Commercial General Liability Conditions, 9. Transfer Of Rights Of Recovery Against Others To Us is amended by the addition of the following:

We waive any right of recovery we may have against any additional insured under this endorsement against whom you have agreed to waive such right of recovery in a written contract, written agreement, written permit or written authorization because of payments we make for injury or damage arising out of your ongoing operations or "your work" done under a written contract, written agreement, written permit or written authorization. However, our rights may only be waived prior to the "occurrence" giving rise to the injury or damage for which we make payment under this Coverage Part. The insured must do nothing after a loss to impair our rights. At our request, the insured will bring "suit" or transfer those rights to us and help us enforce those rights.

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

TEXAS - CONTRACTORS' COMMERCIAL GENERAL LIABILITY BROADENED ENDORSEMENT

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

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B. Limits of Insurance:

The Commercial General Liability Limits of Insurance apply to the insurance provided by this endorsement, except as provided below:

1. Employee Benefit Liability Coverage

Each Employee Limit: $1,000,000
Aggregate Limit: $3,000,000
Deductible Amount: $ 1,000

3. Damage to Premises Rented to You

The lesser of:

a. The Each Occurrence Limit shown in the Declarations; or

b. $500,000 unless otherwise stated $ _____

4. Supplementary Payments

a. Bail Bonds: $2,500

b. Loss of Earnings: $ 500

5. Medical Payments

Medical Expense Limit: $ 10,000

9. Property Damage to Borrowed Equipment

Each Occurrence Limit: $10,000
Deductible Amount: $ 250

16. Voluntary Property Damage Coverage (Coverage **a.**) **And Care, Custody or Control Liability Coverage** (Coverage **b.**)

Limits of Insurance
Coverage **a.**
$1,000 Each Occurrence
$5,000 Aggregate
Coverage **b.** $5,000 Each Occurrence unless otherwise stated $ _____

Deductible Amount (Each Occurrence)
Coverage **a.** $250
Coverage **b.** $250 unless otherwise stated $ _____

COVERAGE	PREMIUM BASIS **(a)** Area **(b)** Payroll **(c)** Gross Sales **(d)** Units **(e)** Other	RATE (For Limits in Excess of $5,000)	ADVANCE PREMIUM (For Limits in Excess of $5,000)
b. Care, Custody or Control			**$**
		TOTAL ANNUAL PREMIUM	**$**

a. Insurance under this provision is afforded only until the 180th day after you acquire or form the organization or the end of the policy period, whichever is earlier;

7. Waiver of Subrogation

Section IV - Commercial General Liability Conditions, 9. Transfer of Rights of Recovery Against Others to us is amended by the addition of the following:

We waive any right of recovery we may have against any person or organization against whom you have agreed to waive such right of recovery in a written contract or agreement because of payments we make for injury or damage arising out of your ongoing operations or "your work" done under a written contract or agreement with that person or organization and included in the "products-completed operations hazard". However, our rights may only be waived prior to the "occurrence" giving rise to the injury or damage for which we make payment under this Coverage Part. The insured must do nothing after a loss to impair our rights. At our request, the insured will bring "suit" or transfer those rights to us and help us enforce those rights.

8. Automatic Additional Insured - Specified Relationships

a. The following is added to **Section II - Who is an Insured**:

(1) Any person(s) or organization(s) described in Paragraph **8.a.(2)** of this endorsement (hereinafter referred to as additional insured) whom you are required to add as an additional insured under this Coverage Part by reason of a written contract, written agreement, written permit or written authorization.

(2) Only the following persons or organizations are additional insureds under this endorsement, and insurance coverage provided to such additional insureds is limited as provided herein:

(a) Managers or Lessors of Premises

The manager or lessor of a premises leased to you with whom you have agreed per Paragraph **8.a.(1)** of this endorsement to provide insurance, but only with respect to liability arising out of the ownership, maintenance or use of that part of the premises leased to you, subject to the following additional exclusions:

This insurance does not apply to:

(i) Any "occurrence" which takes place after you cease to be a tenant in that premises;

(ii) Structural alterations, new construction or demolition operations performed by or on behalf of such additional insured.

(b) Lessor of Leased Equipment

Any person or organization from whom you lease equipment when you and such person(s) or organization(s) have agreed per Paragraph **8.a.(1)** of this endorsement to provide insurance. Such person(s) or organization(s) are insureds only with respect to liability for "bodily injury", "property damage" or "personal and advertising injury" caused, in whole or in part, by your maintenance, operation or use of equipment leased to you by such person(s) or organization(s). A person's or organization's status as an additional insured under this endorsement ends when their contract or agreement with you for such leased equipment ends. However, this insurance does not apply to any "occurrence" which takes place after the equipment lease expires.

(c) Vendors

Any person or organization (referred to below as vendor) with whom you have agreed per Paragraph **8.a.(1)** of this endorsement to provide insurance, but only with respect to "bodily injury" or "property damage"

arising out of "your products" which are distributed or sold in the regular course of the vendor's business, subject to the following additional exclusions:

(i) The insurance afforded the vendor does not apply to:

1) "Bodily injury" or "property damage" for which the vendor is obligated to pay damages by reason of the assumption of liability in a contract or agreement. This exclusion does not apply to liability for damages that the vendor would have in the absence of the contract or agreement;

2) Any express warranty unauthorized by you;

3) Any physical or chemical change in the product made intentionally by the vendor;

4) Repackaging, except when unpacked solely for the purpose of inspection, demonstration, testing, or the substitution of parts under instructions from the manufacturer, and then repackaged in the original container;

5) Any failure to make such inspections, adjustments, tests or servicing as the vendor has agreed to make or normally undertakes to make in the usual course of business, in connection with the distribution or sale of the products;

6) Demonstration, installation, servicing or repair operations, except such operations performed at the vendor's premises in connection with the sale of the product;

7) Products which, after distribution or sale by you, have been labeled or relabeled or used as a container, part or ingredient of any other thing or substance by or for the vendor; or

8) "Bodily injury" or "property damage" arising out of the sole negligence of the vendor for its own acts or omissions or those of its employees or anyone else acting on its behalf. However, this exclusion does not apply to:

a) The exceptions contained in Paragraphs **(c) (i) 4)** or **6)** of this endorsement; or

b) Such inspections, adjustments, tests or servicing as the vendor has agreed to make or normally undertakes to make in the usual course of business, in connection with the distribution or sale of the products.

(ii) This insurance does not apply to any insured person or organization:

1) From whom you have acquired such products, or any ingredient, part or container, entering into, accompanying or containing such products; or

2) When liability included within the "products-completed operations hazard" has been excluded under this Coverage Part with respect to such products.

(d) State or Governmental Agency or Subdivision or Political Subdivision - Permits or Authorizations Relating to Premises

Any state or governmental agency or subdivision or political subdivision with which you have agreed per Paragraph **8.a.(1)** of this endorsement to provide insurance, subject to the following additional provision:

This insurance applies only with respect to the following hazards for which the state or governmental agency or subdivision or political subdivision has issued a permit or authorization in connection with premises you own, rent or control and to which this insurance applies:

(i) The existence, maintenance, repair, construction, erection or removal of advertising signs, awnings, canopies, cellar entrances, coal holes, driveways, manholes, marquees, hoist away openings, sidewalk vaults, street banners or decorations and similar exposures; or

(ii) The construction, erection or removal of elevators; or

(iii) The ownership, maintenance or use of any elevators covered by this insurance.

(e) Mortgagee, Assignee or Receiver

Any person or organization with whom you have agreed per Paragraph **8.a.(1)** of this endorsement to provide insurance, but only with respect to their liability as mortgagee, assignee, or receiver and arising out of the ownership, maintenance, or use of the premises by you. However, this insurance does not apply to structural alterations, new construction and demolition operations performed by or for that person or organization.

(3) The insurance afforded to additional insureds described in Paragraph **8.a.(1)** of this endorsement:

(a) Only applies to the extent permitted by law; and

(b) Will not be broader than that which you are required by the written contract, written agreement, written permit or written authorization to provide for such additional insured; and

(c) Does not apply to any person, organization, vendor, state, governmental agency or subdivision or political subdivision, specifically named as an additional insured under any other provision of, or endorsement added to, this Coverage Part, provided such other provision or endorsement covers the injury or damage for which this insurance applies.

b. With respect to the insurance afforded to the additional insureds described in Paragraph **8.a.(1)** of this endorsement, the following is added to **Section III - Limits of Insurance**:

The most we will pay on behalf of the additional insured is the amount of insurance:

(1) Required by the written contract, written agreement, written permit or written authorization described in Paragraph **8.a.(1)** of this endorsement; or

(2) Available under the applicable Limits of Insurance shown in the Declarations;

whichever is less.

This endorsement shall not increase the applicable Limits of Insurance shown in the Declarations.

c. **Section IV - Commercial General Liability Conditions** is amended to include the following:

Automatic Additional Insured Provision

This insurance applies only if the "bodily injury" or "property damage" occurs, or the "personal and advertising injury" offense is committed:

(1) During the policy period; and

(2) Subsequent to your execution of the written contract or written agreement, or the issuance of a written permit or written authorization, described in Paragraph **8.a.(1)**.

d. **Section IV - Commercial General Liability Conditions** is amended as follows:

Condition **5. Other Insurance** is amended to include:

Primary and Noncontributory Insurance

This insurance is primary to and will not seek contribution from any other insurance available to an additional insured per Paragraph **8.a.(1)** of this endorsement provided that:

(1) The additional insured is a Named Insured under such other insurance; and

(2) You have agreed in writing in a contract, agreement, permit or authorization described in **8.a.(2)** of this endorsement that this insurance would be primary and would not seek contribution from any other insurance available to the additional insured.

9. **Property Damage to Borrowed Equipment**

a. The following is added to **Exclusion 2.j. Damage to Property** under **Section I - Coverage A - Bodily Injury and Property Damage Liability:**

Paragraphs **(3)** and **(4)** of this exclusion do not apply to tools or equipment loaned to you, provided they are not being used to perform operations at the time of loss.

b. With respect to the insurance provided by this section of the endorsement, the following additional provisions apply:

(1) The Limits of Insurance shown in the Declarations are replaced by the limits designated in Section **B. Limits of Insurance, 9. Property Damage to Borrowed Equipment** of this endorsement with respect to coverage provided by this endorsement. These limits are inclusive of and not in addition to the limits being replaced. The Limits of Insurance shown in Section **B. Limits of Insurance, 9. Property Damage to Borrowed Equipment** of this endorsement fix the most we will pay in any one "occurrence" regardless of the number of:

(a) Insureds;

(b) Claims made or "suits" brought; or

(c) Persons or organizations making claims or bringing "suits".

(2) **Deductible Clause**

(a) Our obligation to pay damages on your behalf applies only to the amount of damages for each "occurrence" which are in excess of the Deductible Amount stated in Section **B. Limits of Insurance, 9. Property Damage to Borrowed Equipment** of this endorsement. The limits of insurance will not be reduced by the application of such deductible amount.

(b) **Section IV - Commercial General Liability Conditions, 2. Duties in the Event of Occurrence, of-**

EXCESS FOLLOW-FORM AND UMBRELLA LIABILITY INSURANCE

THIS POLICY, IN PART, PROVIDES FOLLOW-FORM LIABILITY COVERAGE.

COVERAGE WILL APPLY ON A CLAIMS-MADE BASIS WHEN FOLLOWING CLAIMS-MADE UNDERLYING INSURANCE.

COVERAGE WILL APPLY ON A DEFENSE-WITHIN-LIMITS BASIS WHEN FOLLOWING UNDERLYING INSURANCE UNDER WHICH DEFENSE EXPENSES ARE PAYABLE WITHIN, AND NOT IN ADDITION TO, THE LIMITS OF INSURANCE. WHEN FOLLOWING SUCH UNDERLYING INSURANCE, PAYMENT OF DEFENSE EXPENSES UNDER THIS POLICY WILL REDUCE, AND MAY EXHAUST, THE LIMITS OF INSURANCE OF THIS POLICY.

PLEASE READ THE ENTIRE POLICY CAREFULLY.

Various provisions in this policy restrict coverage. Read the entire policy carefully to determine rights, duties and what is and is not covered.

Throughout this policy, the words "you" and "your" refer to the Named Insured shown in the Declarations and any other person or organization qualifying as a Named Insured under this policy. The words "we", "us" and "our" refer to the company providing this insurance.

The word "insured" means any person or organization qualifying as such under **SECTION II – WHO IS AN INSURED**.

Other words and phrases that appear in quotation marks have special meaning. Refer to **SECTION VI – DEFINITIONS**.

SECTION I – COVERAGES

A. COVERAGE A – EXCESS FOLLOW-FORM LIABILITY

1. We will pay on behalf of the insured those sums, in excess of the "applicable underlying limit", that the insured becomes legally obligated to pay as damages to which Coverage **A** of this insurance applies, provided that the "underlying insurance" would apply to such damages but for the exhaustion of its applicable limits of insurance. If a sublimit is specified in any "underlying insurance", Coverage **A** of this insurance applies to damages that are in excess of that sublimit only if such sublimit is shown for that "underlying insurance" in the Schedule Of Underlying Insurance.

2. Coverage **A** of this insurance is subject to the same terms, conditions, agreements, exclusions and definitions as the "underlying insurance", except with respect to any provisions to the contrary contained in this insurance.

3. The amount we will pay for damages is limited as described in **SECTION III – LIMITS OF INSURANCE**.

4. For the purposes of Paragraph **1.** above:

   a. The applicable limit of insurance stated for the policies of "underlying insurance" in the Schedule Of Underlying Insurance will be considered to be reduced or exhausted only by the following payments:

      (1) Payments of judgments or settlements for damages that are covered by that "underlying insurance". However, if such "underlying insurance" has a policy period which differs from the policy period of this Excess Follow-Form And Umbrella Liability Insurance, any such payments for damages that would not be covered by this Excess

2. We have no duty to defend any insured against any "suit":
   a. Seeking damages to which this insurance does not apply; or
   b. If any other insurer has a duty to defend.
3. When we have the duty to defend, we may, at our discretion, investigate and settle any claim or "suit". In all other cases, we may, at our discretion, participate in the investigation, defense and settlement of any claim or "suit" for damages to which this insurance may apply. If we exercise such right to participate, all expenses we incur in doing so will not reduce the applicable limits of insurance.
4. Our duty to defend ends when we have used up the applicable limit of insurance in the payment of judgments or settlements, or defense expenses if such expenses are within the limits of insurance of this policy.
5. We will pay, with respect to a claim we investigate or settle, or "suit" against an insured we defend:
   a. All expenses we incur.
   b. The cost of:
      (1) Bail bonds required because of accidents or traffic law violations arising out of the use of any vehicle to which this insurance applies; or
      (2) Appeal bonds and bonds to release attachments;

      but only for bond amounts within the applicable limit of insurance. We do not have to furnish these bonds.
   c. All reasonable expenses incurred by the insured at our request to assist us in the investigation or defense of such claim or "suit", including actual loss of earnings up to $1,000 a day because of time off from work.
   d. All court costs taxed against the insured in the "suit". However, these payments do not include attorneys' fees or attorneys' expenses taxed against the insured.
   e. Prejudgment interest awarded against the insured on that part of the judgment we pay. If we make an offer to pay the applicable limit of insurance, we will not pay any prejudgment interest based on that period of time after the offer.
   f. All interest that accrues on the full amount of any judgment after entry of the judgment and before we have paid, offered to pay or deposited in court the part of the judgment that is within the applicable limit of insurance. If we do not pay part of the judgment for any reason other than it is more than the applicable limit of insurance, we will not pay any interest that accrues on that portion of the judgment.

With respect to a claim we investigate or settle, or "suit" against an insured we defend under **COVERAGE A – EXCESS FOLLOW-FORM LIABILITY**, these payments will not reduce the applicable limits of insurance, but only if the applicable "underlying insurance" provides for such payments in addition to its limits of insurance. With respect to a claim we investigate or settle, or "suit" against an insured we defend under **COVERAGE B – UMBRELLA LIABILITY**, these payments will not reduce the applicable limits of insurance.

SECTION II – WHO IS AN INSURED

A. COVERAGE A – EXCESS FOLLOW-FORM LIABILITY

With respect to Coverage **A**, the following persons and organizations qualify as insureds:

1. The Named Insured shown in the Declarations; and
2. Any other person or organization qualifying as an insured in the "underlying insurance". If you have agreed to provide insurance for that person or organization in a written contract or agreement:
   a. The limits of insurance afforded to such person or organization will be:
      (1) The amount by which the minimum limits of insurance you agreed to provide such person or organization in that written contract or agreement exceed the total limits of insurance of all applicable "underlying insurance"; or
      (2) The limits of insurance of this policy;

      whichever is less; and
   b. Coverage under this policy does not apply to such person or organization if the minimum limits of insurance you agreed to provide such person or organization in that written contract or agreement are wholly within the total limits of insurance of all available applicable "underlying insurance".

B. COVERAGE B – UMBRELLA LIABILITY

With respect to Coverage **B**:

1. The Named Insured shown in the Declarations is an insured.
2. If you are:

a. An individual, your spouse is also an insured, but only with respect to the conduct of a business of which you are the sole owner.

b. A partnership or joint venture, your members, your partners and their spouses are also insureds, but only with respect to the conduct of your business.

c. A limited liability company, your members are also insureds, but only with respect to the conduct of your business. Your managers are also insureds, but only with respect to their duties as your managers.

d. An organization other than a partnership, joint venture or limited liability company, your "officers" and directors are also insureds, but only with respect to their duties as your "officers" or directors. Your stockholders are also insureds, but only with respect to their liability as stockholders.

e. A trust, your trustees are also insureds, but only with respect to their duties as trustees.

3. Each of the following is also an insured:

a. Your "volunteer workers" only while performing duties related to the conduct of your business, or your "employees", other than either your "officers" (if you are an organization other than a partnership, joint venture or limited liability company) or your managers (if you are a limited liability company), but only for acts within the scope of their employment by you or while performing duties related to the conduct of your business. However, none of these "employees" or "volunteer workers" are insureds for:

(1) "Bodily injury" or "personal injury":

(a) To you, to your partners or members (if you are a partnership or joint venture), to your members (if you are a limited liability company), to a co-"employee" while in the course of his or her employment or performing duties related to the conduct of your business, or to your other "volunteer workers" while performing duties related to the conduct of your business;

(b) To the spouse, child, parent, brother or sister of that co-"employee" or "volunteer worker" as a consequence of Paragraph **(1)(a)** above;

(c) For which there is any obligation to share damages with or repay someone else who must pay damages because of the injury described in Paragraph **(1)(a)** or **(b)** above; or

(d) Arising out of his or her providing or failing to provide professional health care services.

Unless you are in the business or occupation of providing professional health care services, Paragraphs **(1)(a)**, **(b)**, **(c)** and **(d)** above do not apply to "bodily injury" arising out of providing or failing to provide first aid or "Good Samaritan services" by any of your "employees" or "volunteer workers" other than an employed or volunteer doctor. Any such "employees" or "volunteer workers" providing or failing to provide first aid or "Good Samaritan services" during their work hours for you will be deemed to be acting within the scope of their employment by you or performing duties related to the conduct of your business.

(2) "Property damage" to property:

(a) Owned, occupied or used by; or

(b) Rented to, in the care, custody or control of, or over which physical control is being exercised for any purpose by;

you, any of your "employees" or "volunteer workers", any of your partners or members (if you are a partnership or joint venture), or any of your members (if you are a limited liability company).

b. Any person (other than your "employee" or "volunteer worker"), or any organization, while acting as your real estate manager.

c. Any person or organization having proper temporary custody of your property if you die, but only:

(1) With respect to liability arising out of the maintenance or use of that property; and

(2) Until your legal representative has been appointed.

d. Your legal representative if you die, but only with respect to duties as such. That

representative will have all your rights and duties under this insurance.

4. Any organization, other than a partnership, joint venture or limited liability company, of which you are the sole owner, or in which you maintain an ownership interest of more than 50%, on the first day of the policy period is an insured and will qualify as a Named Insured. No such organization is an insured or will qualify as a Named Insured for "bodily injury" or "property damage" that occurred, or "personal injury" or "advertising injury" caused by an offense committed after the date, if any, during the policy period, that you no longer maintain an ownership interest of more than 50% in such organization.

5. Any organization you newly acquire or form, other than a partnership, joint venture or limited liability company, and of which you are the sole owner, or in which you maintain an ownership interest of more than 50%, is an insured and will qualify as a Named Insured if there is no other similar insurance available to that organization. However:

   a. Coverage under this provision is afforded only until the 180th day after you acquire or form the organization or the end of the policy period, whichever is earlier; and

   b. Coverage for such organization does not apply to:

      (1) "Bodily injury" or "property damage" that occurred; or

      (2) "Personal injury" or "advertising injury" arising out of an offense committed;

      before you acquired or formed the organization.

No person or organization is an insured or will qualify as a Named Insured with respect to the conduct of any current or past partnership, joint venture or limited liability company that is not shown as a Named Insured in the Declarations. This paragraph does not apply to any such partnership, joint venture or limited liability company that otherwise qualifies as an insured under Paragraph **B.** of **SECTION II – WHO IS AN INSURED**.

C. COVERAGE C – CRISIS MANAGEMENT SERVICE EXPENSES

With respect to Coverage **C**, the following persons and organizations are insureds and will qualify as Named Insureds:

1. The Named Insured shown in the Declarations.

2. Any organization, other than a partnership, joint venture or limited liability company, of which you are the sole owner, or in which you maintain an ownership interest of more than 50%, on the first day of the policy period. No such organization is an insured or will qualify as a Named Insured for "crisis management service expenses" arising out of a "crisis management event" that first commences after the date, if any, during the policy period, that you no longer maintain an ownership interest of more than 50% in such organization.

3. Any organization you newly acquire or form, other than a partnership, joint venture or limited liability company, and of which you are the sole owner, or in which you maintain an ownership interest of more than 50%, if there is no other similar insurance available to that organization. However:

   a. Coverage under this provision is afforded only until the 180th day after you acquire or form the organization or the end of the policy period, whichever is earlier; and

   b. Coverage for such organization does not apply to "crisis management service expenses" arising out of a "crisis management event" that occurred before you acquired or formed the organization, even if an "executive officer" only first becomes aware of an "event" or "occurrence" that leads to such "crisis management event" after the date you acquired or formed the organization.

No person or organization is an insured or will qualify as a Named Insured with respect to the conduct of any current or past partnership, joint venture or limited liability company that is not shown as a Named Insured in the Declarations.

SECTION III – LIMITS OF INSURANCE

A. The Limits of Insurance shown in the Declarations and the rules below fix the most we will pay for the amounts described below to which this insurance applies regardless of the number of:

1. Insureds;
2. Claims made or "suits" brought;
3. Number of vehicles involved;
4. Persons or organizations making claims or bringing "suits"; or
5. Coverages provided under this insurance.

As indicated in Paragraph **D.1.** of **SECTION I – COVERAGES**, for any "suit" for which we have the right and duty to defend the insured under Coverage **A**, defense expenses will be within the

b. You have paid all premiums due for this policy at the time you make such request;

c. You promptly pay the additional premium we charge for the Extended Reporting Period endorsement for this insurance when due. We will determine that additional premium after we have received your request for the Extended Reporting Period endorsement for this insurance. That additional premium is not subject to any limitation stated in the "underlying insurance" on the amount or percentage of additional premium that may be charged for the "extended reporting period" in such "underlying insurance"; and

d. That Extended Reporting Period endorsement is issued by us and made a part of this policy.

3. Any Extended Reporting Period endorsement for this insurance will not reinstate or increase the Limits of Insurance or extend the policy period.

4. Except with respect to any provisions to the contrary contained in Paragraphs **1.**, **2.** or **3.** above, all provisions of any option to purchase an "extended reporting period" granted to you in the "underlying insurance" apply to this insurance.

J. INSPECTIONS AND SURVEYS

1. We have the right but are not obligated to:

a. Make inspections and surveys at any time;

b. Give you reports on the conditions we find; and

c. Recommend changes.

2. Any inspections, surveys, reports or recommendations relate only to insurability and the premiums to be charged. We do not make safety inspections. We do not undertake to perform the duty of any person or organization to provide for the health or safety of workers or the public. We do not warrant that conditions:

a. Are safe or healthful; or

b. Comply with laws, regulations, codes or standards.

K. LEGAL ACTION AGAINST US

1. No person or organization has a right under this insurance:

a. To join us as a party or otherwise bring us into a "suit" asking for damages from an insured; or

b. To sue us on this insurance unless all of its terms have been fully complied with.

2. A person or organization may sue us to recover on an agreed settlement or on a final judgment against an insured. We will not be liable for damages that:

a. Are not payable under the terms of this insurance; or

b. Are in excess of the applicable limit of insurance.

An agreed settlement means a settlement and release of liability signed by us, the insured and the claimant or the claimant's legal representative.

L. MAINTENANCE OF UNDERLYING INSURANCE

1. The insurance afforded by each policy of "underlying insurance" will be maintained for the full policy period of this Excess Follow-Form And Umbrella Liability Insurance. This provision does not apply to the reduction or exhaustion of the aggregate limit or limits of such "underlying insurance" solely by payments as permitted in Paragraphs **4.a.(1)**, **(2)** and **(3)** of **COVERAGE A – EXCESS FOLLOW-FORM LIABILITY** of **SECTION I – COVERAGES**. As such policies expire, you will renew them at limits and with coverage at least equal to the expiring limits of insurance. If you fail to comply with the above requirements, Coverage **A** is not invalidated. However, in the event of a loss, we will pay only to the extent that we would have paid had you complied with the above requirements.

2. The first Named Insured shown in the Declarations must give us written notice of any change in the "underlying insurance" as respects:

a. Coverage;

b. Limits of insurance;

c. Termination of any coverage; or

d. Exhaustion of aggregate limits.

3. If you are unable to recover from any "underlying insurer" because you fail to comply with any term or condition of the "underlying insurance", Coverage **A** is not invalidated. However, we will pay for any loss only to the extent that we would have paid had you complied with that term or condition in that "underlying insurance".

M. OTHER INSURANCE

This insurance is excess over any valid and collectible "other insurance" whether such "other insurance" is stated to be primary, contributing,

excess, contingent or otherwise. This provision does not apply to a policy bought specifically to apply as excess of this insurance.

However, if you specifically agree in a written contract or agreement that the insurance provided to any person or organization that qualifies as an insured under this insurance must apply on a primary basis, or a primary and non-contributory basis, then insurance provided under Coverage **A** is subject to the following provisions:

1. This insurance will apply before any "other insurance" that is available to such additional insured which covers that person or organization as a named insured, and we will not share with that "other insurance", provided that the injury or damage for which coverage is sought is caused by an "event" that takes place or is committed subsequent to the signing of that contract or agreement by you.
2. This insurance is still excess over any valid and collectible "other insurance", whether primary, excess, contingent or otherwise, which covers that person or organization as an additional insured or as any other insured that does not qualify as a named insured.

N. PREMIUM

1. The first Named Insured shown in the Declarations is responsible for the payment of all premiums and will be the payee for any return premiums.
2. If the premium is a flat charge, it is not subject to adjustment except as provided in Paragraph **4.** below.
3. If the premium is other than a flat charge, it is an advance premium only. The earned premium will be computed at the end of the policy period, or at the end of each year of the policy period if the policy period is two years or longer, at the rate shown in the Declarations, subject to the Minimum Premium.
4. Additional premium may become payable when coverage is provided for additional insureds under the provisions of **SECTION II – WHO IS AN INSURED**.

O. PREMIUM AUDIT

The premium for this policy is the amount stated in Item **5.** of the Declarations. The premium is a flat charge unless it is specified in the Declarations as adjustable.

P. PROHIBITED COVERAGE – UNLICENSED INSURANCE

1. With respect to loss sustained by any insured in a country or jurisdiction in which we are not licensed to provide this insurance, this insurance does not apply to the extent that insuring such loss would violate the laws or regulations of such country or jurisdiction.
2. We do not assume responsibility for:
   a. The payment of any fine, fee, penalty or other charge that may be imposed on any person or organization in any country or jurisdiction because we are not licensed to provide insurance in such country or jurisdiction; or
   b. The furnishing of certificates or other evidence of insurance in any country or jurisdiction in which we are not licensed to provide insurance.

Q. PROHIBITED COVERAGE – TRADE OR ECONOMIC SANCTIONS

We will provide coverage for any loss, or otherwise will provide any benefit, only to the extent that providing such coverage or benefit does not expose us or any of our affiliated or parent companies to:

1. Any trade or economic sanction under any law or regulation of the United States of America; or
2. Any other applicable trade or economic sanction, prohibition or restriction.

R. REPRESENTATIONS

By accepting this insurance, you agree:

1. The statements in the Declarations and any subsequent notice relating to "underlying insurance" are accurate and complete;
2. Those statements are based upon representations you made to us; and
3. We have issued this insurance in reliance upon your representations.

S. SEPARATION OF INSUREDS

Except with respect to the Limits of Insurance, and any rights or duties specifically assigned in this policy to the first Named Insured shown in the Declarations, this insurance applies:

1. As if each Named Insured were the only Named Insured; and
2. Separately to each insured against whom claim is made or "suit" is brought.

T. WAIVER OR TRANSFER OF RIGHTS OF RECOVERY AGAINST OTHERS TO US

1. If the insured has rights to recover all or part of any payment we have made under this insurance, those rights are transferred to us and the insured must do nothing after loss to impair them. At our request, the insured will bring suit or transfer those rights to us and help us, and with respect to Coverage **A**, the "underlying insurer", enforce them.

   If the insured has agreed in a contract or agreement to waive that insured's right of recovery against any person or organization, we waive our right of recovery against that person or organization, but only for payments we make because of an "event" that takes place or is committed subsequent to the execution of that contract or agreement by such insured.

2. Reimbursement of any amount recovered will be made in the following order:

   a. First, to any person or organization (including us or the insured) who has paid any amount in excess of the applicable limit of insurance;

   b. Next, to us; and

   c. Then, to any person or organization (including the insured and with respect to Coverage **A**, the "underlying insurer") that is entitled to claim the remainder, if any.

3. Expenses incurred in the process of recovery will be divided among all persons or organizations receiving amounts recovered according to the ratio of their respective recoveries.

U. TRANSFER OF YOUR RIGHTS AND DUTIES UNDER THIS INSURANCE

1. Your rights and duties under this insurance may not be transferred without our written consent except in the case of death of an individual Named Insured.

2. If you die, your rights and duties will be transferred to your legal representative but only while acting within the scope of duties as your legal representative. Until your legal representative is appointed, anyone having proper temporary custody of your property will have your rights and duties but only with respect to that property.

V. UNINTENTIONAL OMISSION OR ERROR

The unintentional omission of, or unintentional error in, any information provided by you which we relied upon in issuing this policy will not prejudice your rights under this insurance. However, this provision does not affect our right to collect additional premium or to exercise our rights of cancellation or nonrenewal in accordance with applicable insurance laws or regulations.

W. WHEN LOSS IS PAYABLE

If we are liable under this insurance, we will pay for injury, damage or loss after:

1. The insured's liability is established by:

   a. A court decision; or

   b. A written agreement between the claimant, the insured, any "underlying insurer" and us; and

2. The amount of the "applicable underlying limit" or "self-insured retention" is paid by or on behalf of the insured.

SECTION VI – DEFINITIONS

A. With respect to all coverages of this insurance:

1. "Applicable underlying limit" means the sum of:

   a. The applicable limit of insurance stated for the policies of "underlying insurance" in the Schedule Of Underlying Insurance subject to the provisions in Paragraphs **4.a.(1)**, **(2)** and **(3)** of **COVERAGE A – EXCESS FOLLOW-FORM LIABILITY** of **SECTION I – COVERAGES**; and

   b. The applicable limit of insurance of any "other insurance" that applies.

   The limits of insurance in any policy of "underlying insurance" will apply even if:

   a. The "underlying insurer" claims the insured failed to comply with any term or condition of the policy; or

   b. The "underlying insurer" becomes bankrupt or insolvent.

2. "Auto hazard" means all "bodily injury" and "property damage" to which liability insurance afforded under an auto policy of "underlying insurance" would apply but for the exhaustion of its applicable limits of insurance.

3. "Electronic data" means information, facts or programs stored as or on, created or used on, or transmitted to or from computer software (including systems and applications software), hard or floppy disks, CD-ROMs, tapes, drives, cells, data processing devices or any other media which are used with electronically controlled equipment.

4. "Event" means an "occurrence", offense, accident, act, error, omission, wrongful act or loss.

HIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

DESIGNATED PERSON OR ORGANIZATION – NOTICE OF CANCELLATION PROVIDED BY US

This endorsement modifies insurance provided under the following:

ALL COVERAGE PARTS INCLUDED IN THE POLICY

SCHEDULE

Cancellation: **Number of Days Notice:** 30

Person or organization:

ANY PERSON OR ORGANIZATION WITH WHOM YOU HAVE AGREED IN A WRITTEN CONTRACT OR AGREEMENT TO WAIVE YOUR RIGHT OF RECOVERY, BUT ONLY FOR PAYMENTS WE MAKE BECAUSE OF DAMAGES TO WHICH THIS INSURANCE APPLIES, AFTER YOU HAVE EXECUTED THAT CONTRACT OR AGREEMENT.

Address:

ANY LOCATION TO WHICH SUCH WRITTEN CONTRACT DESCRIBED IN THE NAME OF PERSON(S) OR ORGANIZATION(S) SECTION OF THIS SCHEDULE APPLIES

PROVISIONS

If we cancel this policy for any legally permitted reason other than nonpayment of premium, and a number of days is shown for Cancellation in the Schedule above, we will mail notice of cancellation to the person or organization shown in such Schedule. We will mail such notice to the address shown in the Schedule above at least the number of days shown for Cancellation in such Schedule before the effective date of cancellation.

TexasMutual®
WORKERS' COMPENSATION INSURANCE

WORKERS' COMPENSATION AND EMPLOYERS LIABILITY POLICY

WC 42 03 04 B
Insured copy

TEXAS WAIVER OF OUR RIGHT TO RECOVER FROM OTHERS ENDORSEMENT

This endorsement applies only to the insurance provided by the policy because Texas is shown in item 3.A. of the Information Page.

We have the right to recover our payments from anyone liable for an injury covered by this policy. We will not enforce our right against the person or organization named in the Schedule, but this waiver applies only with respect to bodily injury arising out of the operations described in the schedule where you are required by a written contract to obtain this waiver from us.

This endorsement shall not operate directly or indirectly to benefit anyone not named in the Schedule.

The premium for this endorsement is shown in the Schedule.

Schedule

1. ( ) Specific Waiver
   Name of person or organization
   (X) Blanket Waiver
   Any person or organization for whom the Named Insured has agreed by written contract to furnish this waiver.

2. Operations: All Texas operations
3. Premium:
   The premium charge for this endorsement shall be **2.00** percent of the premium developed on payroll in connection with work performed for the above person(s) or organization(s) arising out of the operations described.
4. Advance Premium: Included, see Information Page

This endorsement changes the policy to which it is attached effective on the inception date of the policy unless a different date is indicated below.
(The following "attaching clause" need be completed only when this endorsement is issued subsequent to preparation of the policy.)
This endorsement, effective on 1/12/23 **at 12:01 a.m.** standard time, forms a part of:

Policy no. 0002008328 of Texas Mutual Insurance Company effective on 1/12/23

Issued to: Matous Construction, Ltd.

This is not a bill

Authorized representative

NCCI Carrier Code: 29939

PO Box 12058, Austin, TX 78711-2058
texasmutual.com | (800) 859-5995 | Fax (800) 359-0650

TexasMutual®
WORKERS' COMPENSATION INSURANCE

WORKERS' COMPENSATION AND EMPLOYERS LIABILITY POLICY

WC 42 06 01
Insured copy

TEXAS NOTICE OF MATERIAL CHANGE ENDORSEMENT

This endorsement applies only to the insurance provided by the policy because Texas is shown in Item 3.A. of the Information Page.

In the event of cancellation or other material change of the policy, we will mail advance notice to the person or organization named in the Schedule. The number of days advance notice is shown in the Schedule.

This endorsement shall not operate directly or indirectly to benefit anyone not named in the Schedule.

Schedule

1. Number of days advance notice: 30
2. Notice will be mailed to: PER LIST ON FILE

This endorsement changes the policy to which it is attached effective on the inception date of the policy unless a different date is indicated below.
(The following "attaching clause" need be completed only when this endorsement is issued subsequent to preparation of the policy.)
This endorsement, effective on 1/12/23 **at 12:01 a.m.** standard time, forms a part of:

Policy no. 0002008328 of Texas Mutual Insurance Company effective on 1/12/23

Issued to: Matous Construction, Ltd.

This is not a bill

Authorized representative

NCCI Carrier Code: 29939

PO Box 12058, Austin, TX 78711-2058
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GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

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

2. *Agreement*--The written instrument 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. *Bidder*--The individual or entity who submits a Bid directly to Owner.

7. *Bidding Documents*--The Bidding Requirements and the proposed Contract Documents (including all Addenda).

8. *Bidding Requirements*--The Advertisement or Invitation to Bid, Instructions to Bidders, bid security of acceptable form, if any, and the Bid Form with any supplements.

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*-- Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor's submittals, and the reports and drawings of subsurface and physical conditions 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 Milestones, if any, (ii) achieve Substantial Completion; and (iii) 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. *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.

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

22. *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.

23. *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.

24. *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.

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

26. *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.

27. *Notice of Award*--The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.

28. *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.

29. *Owner*--The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

30. *PCBs*--Polychlorinated biphenyls.

31. *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.

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

33. *Project*--The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

34. *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.

35. *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.

36. *Related Entity* -- An officer, director, partner, employee, agent, consultant, or subcontractor.

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. *Schedule of Submittals*--A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

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

41. *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.

42. *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.

43. *Specifications*--That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain

administrative requirements and procedural matters applicable thereto.

44. *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.

45. *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.

46. *Successful Bidder*--The Bidder submitting a responsive Bid to whom Owner makes an award.

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

48. *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.

49. *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.

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

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

52. *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.

1.02 *Terminology*

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

B. *Intent of Certain Terms or Adjectives*

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered", "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action or determination will be solely to evaluate, in general, the Work for compliance with the 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 is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day*

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

D. *Defective*

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

a. does not conform to the Contract Documents, or

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

c. has been damaged prior to Engineer's - recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide*

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

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

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

4. 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.

F. 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 and Evidence of Insurance*

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

B. *Evidence of 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.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. 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. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review**:**

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

2. a preliminary Schedule of Submittals; and

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

2.06 *Preconstruction Conference*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.07 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

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

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

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

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

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

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. 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. No such provision or instruction shall be effective to assign to Owner, or Engineer, or any of, their Related Entities, 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. *Contractor's Review of Contract Documents Before Starting Work*: 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.

2. *Contractor's Review of Contract Documents During Performance of Work*: 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 promptly report it to Engineer in writing. 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.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor 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 by either a Change Order or 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:

1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample; (Subject to the provisions of Paragraph 6.17.D.3); or

3. 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 all of the Work under a direct or indirect contract with Contractor, shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or Engineer's consultants, including electronic media editions; or

2. 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.

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

3.06 *Electronic Data*

A. Copies of data furnished by Owner or Engineer to Contractor or Contractor to Owner or Engineer that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party..

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL 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 or a part thereof, 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 Engineer 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 or Engineer, or any of their Related Entities 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 9.07 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 with respect to 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 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 and Engineer, and any of their Related Entities 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 or 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 or Engineer, or any of their Related Entities 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.A); 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, and Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (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. G 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 and Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H 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 do not 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 of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified

in Paragraph 13.07, whichever is later, 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 the 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 promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the 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 coverages 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.

B. 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:

   a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

   b. 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 required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insured (subject to any customary exclusion regarding professional liability) Owner and Engineer, 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, 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 coverages 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 6.11 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 30 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.

a. 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, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, 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 insured or 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, (other than caused by flood) 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, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, 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 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. 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, and Engineer, 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, 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, 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, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insured or additional insured (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.

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

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

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial 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, or Engineer, and the officers, directors, partners, employees, agents, 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 .

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 2.01.B. 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. 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.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances. 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 and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a 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 Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

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

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

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. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

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:

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

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

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

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

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

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

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. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

c. The requirements 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 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:

1) shall certify that the proposed substitute item will:

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

b) be similar in substance to that specified, and

c) be suited to the same use as that specified;

2) will state:

a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time;

b) 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 other work on the Project) to adapt the design to the proposed substitute item; and

c) 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;

3) will identify:

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

b) available engineering, sales, maintenance, repair, and replacement services;

4) and shall 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,

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is 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 requirements for review by Engineer will be similar to those provided in Paragraph 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 may require Contractor to furnish additional data about the proposed substitute item. 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 Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B Whether or not Engineer approves a substitute item so proposed or submitted by Contractor, Contractor shall reimburse Owner for the charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

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 . 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:

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

2. shall anything in the Contract Documents 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, and Engineer,, 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, 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.

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

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. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

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

B. If Contractor performs any Work 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 shall 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 and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any 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 the Work 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, 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.

C. 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 Draw

ings or Specifications or to the acts or omissions of Owner or Engineer or , 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).

D. 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 and Samples to Engineer for review and approval in accordance with the acceptable Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. Shop Drawings

a. Submit number of copies specified in the General Requirements.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples:* Contractor shall also submit Samples to Engineer for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals.

a. Submit number of Samples specified in the Specifications.

b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

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

C. Submittal Procedures

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

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

b. the suitability of 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 Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto; and

d. 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 certification that Contractor has satisfied Contractor's obligations under the Contract Documents

with respect to Contractor's review and approval of that submittal.

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

D. *Engineer's Review*

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

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (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 shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures*

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

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 that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its Related Entities shall be entitled to rely on representation of Contractor's warranty and guarantee.

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

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

2. normal wear and tear under normal usage.

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

1. observations by Engineer;

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

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

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

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

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

7. 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 and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or

arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .

B. In any and all claims against Owner or Engineer or any of their 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 officers, directors, partners, employees, agents, consultants and subcontractors arising out of:

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

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

6.21 *Delegation of Professional Design Services*

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

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

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

D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 - OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or via 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, each utility owner and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, 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. 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.

7.03 *Legal Relationships*

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's actions or inactions.

C. Contractor shall be liable to Owner and any other contractor for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's action or inactions.

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 When Due*

A. Owner shall make payments to Contractor 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 9.09. 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 authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. 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 *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 or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties 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.

9.05 *Rejecting Defective Work*

A. Engineer will have authority to 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.

9.06 *Shop Drawings, Change Orders and Payments*

A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

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

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

9.07 *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.

9.08 *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. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believe that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

D. When functioning as interpreter and judge under this Paragraph 9.08, 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.

9.09 *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 9.09 shall also apply to, the Resident Project Representative, if any, and assistants, if any.

ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by 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 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*

A. *Engineer's Decision Required*: All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

B. *Notice:* Written notice stating the general nature of each Claim, 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. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, 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). 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).

C. *Engineer's Action*: Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part,

2. approve the Claim, or

3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 - COST OF THE WORK; 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, except those excluded in Paragraph 11.01.B, 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, expresses, and similar petty cash items in connection with the Work.

i. 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, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 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 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*

1. Contractor agrees that:

a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

b. Contractor's costs for unloading and handling on the Site, labor, installation , overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. Contingency Allowance

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

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.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. 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 9.07.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. 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 significantly 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. 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. 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 may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times 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 covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times 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.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times , or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

C If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

D. Owner, Engineer and the Related Entities of each of them 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.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for 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.

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, their consultants and 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.C; 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.

C. If it is found that the uncovered 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.

D. If, the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, 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. Promptly after receipt of notice, 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).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

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 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:

1. repair such defective land or areas; or

2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. 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.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications .

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 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.

E. 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 or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, 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 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 in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

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 9.07, 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:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

b. 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:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 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 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 will 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.

B. Promptly after Contractor's notification, , Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a 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.

D. 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.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions.

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when 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.

2. 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.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 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.

4. No use or 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:

a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.7;

b. consent of the surety, if any, to final payment;

c. a list of all Claims against Owner that Contractor believes are unsettled; and

d. 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. *Engineer's Review of Application and Acceptance*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations

under the Contract 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, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and , 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 (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, 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 accordance with the requirements herein and expressly acknowledged by Owner in writing as 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 granted 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 surety) seven days written notice of its intent to terminate the services of Contractor:

1. 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),

2. 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

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds 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.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

E. 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.

F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B, and 15.02.C.

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, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. 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. 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, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) 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.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 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. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be

governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions, or

2. agrees with the other party to submit the Claim to another dispute resolution process, or

3. gives written notice to the other party of their intent to submit the Claim to a court of competent jurisdiction.

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:

1. 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

2. 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. 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 Contract or termination of the services of Contractor.

17.05 *Controlling Law*

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

17.06 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (No. C-700) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect:

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

D. Texas Water Development Board (TWDB) Construction Contract Supplemental Conditions in Section III of the attached document TWDB-0550 shall also supplement the Standard General Conditions.

SC-4.02 Delete Paragraphs 4.02.A and 4.02.B in their entirety and insert the following:

A. A Geotechnical Report entitled "Subsurface Investigation and Foundation Recommendations for Gatesville Stillhouse Wastewater Treatment Facility Stillhouse Road Gatesville Texas" was prepared by Holt Engineering, Inc. (Oct. 13, 2022), a bound copy of which is available from the Owner upon request.

SC-4.06 Delete Paragraphs 4.06.A and 4.06.B in their entirety and insert the following:

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

B. Left Blank Intentionally.

SC-5.04 Add the following new paragraph immediately after Paragraph 5.04.B:

CONTRACTOR'S Insurance. Before commencing the work, and as a condition of payment, the CONTRACTOR shall purchase and maintain insurance that will protect it from the claims arising out of its operations under this Agreement, whether the operations are by the CONTRACTOR, or any of its consultants or subcontractors or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.

C. Minimum Limits of Liability. The CONTRACTOR shall maintain insurance with limits of liability equal to the limits of liability as set forth below.

1. Workers Compensation

   A. Statutory Workers Compensation Benefits
   B. Employer Liability:
      Bodily Injury by Accident - $1,000,000 Each Accident
      Bodily Injury by Disease - $1,000,000 Policy Limit
      Bodily Injury by Disease - $1,000,000 Each Employee

2. Commercial General Liability

   $1,000,000 Combined Single Limit of Bodily Injury

Liability and Property Damage Liability Per Occurrence

$2,000,000 General Aggregate Limit
$2,000,000 Products & Completed Operations Aggregate Limit
$1,000,000 Personal and Advertising Injury Limit

Products and Completed Operations Coverage must be maintained for not less than two full years after final payment.

3. Business Auto Liability

A. $1,000,000 Combined Single Limit of Bodily Injury Liability and Property Damage Liability

4. Excess Liability

A. $2,000,000 Each Occurrence Limit
$2,000,000 Aggregate Limit

D. Number of Policies. Commercial General Liability Insurance and other liability insurance may be arranged under a single policy for the full limits required or by a combination of underlying policies with the balance provided by an Excess or Umbrella Liability Policy.

E. Additional Insured. The CONTRACTOR shall endorse all policies identified in Subparagraph 5.04(C) (with the exception of Workers Compensation) to name Owner as an Additional Insured. On the Commercial General Liability Policy, the Owner shall be given Additional Insured status for BOTH the ongoing operations of the CONTRACTOR and the completed operations of the CONTRACTOR. Also, the coverage provided to the Owner as an Additional Insured shall be written on a Primary Basis.

F. Waiver of Subrogation Endorsements. The CONTRACTOR shall endorse all policies identified in Subparagraph 5.04(C) with a Waiver of Subrogation in favor of the Owner. The CONTRACTOR shall also require similar waivers from its subcontractors in favor of the CONTRACTOR and Owner.

G. Acceptable Insurance Companies. The CONTRACTOR shall maintain in effect all insurance coverages under this Agreement at the CONTRACTOR'S sole expense and with insurance companies acceptable to the Owner and which have an A. M. Best Company rating of A- VII or better.

H. Notice of Cancellation or Non-Renewal. The CONTRACTOR'S insurance policies identified in Subparagraph 5.04(C) shall contain a provision that coverage will not be cancelled or non-renewed until at least thirty (30) days' prior written notice has been given to the Owner.

I. Certificates of Insurance. Certificates of insurance showing required coverage to be in force pursuant to Subparagraph 5.04(C) shall be filed with the Owner prior to commencement of the CONTRACTOR'S work. In the event the CONTRACTOR fails to obtain or maintain any insurance coverage required under this Agreement, the Owner may purchase such

coverage as desired for Owner's benefit and charge the expense to the CONTRACTOR, or terminate this Agreement.

J. Continuation of Coverage. The CONTRACTOR shall continue to carry Completed Operations Liability Insurance for at least two years after either ninety (90) days following substantial completion of the work or final payment to the CONTRACTOR, whichever is earlier. The CONTRACTOR shall furnish the Owner evidence of such insurance at final payment and one year from final payment.

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

A. Contractor shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof.

1. This insurance shall:

a. include the interests of Owner, Contractor, Subcontractors, Engineer and any other individuals or entities identified herein, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;

b. 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 and damage to the Work, temporary buildings, falsework, and materials and equipment in transit and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;

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

d. 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;

e. allow for partial utilization of the Work by Owner;

f. include testing and startup; and

g. 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.

2. Contractor shall be responsible for any deductible or self-insured retention.

3. The policies of insurance required to be purchased and maintained by Contractor in accordance with this Paragraph SC-5.06.A shall comply with the requirements of paragraph 5.06.C of the General Conditions.

SC-5.06.E. Delete Paragraph GC-5.06.E in its entirety.

SC-6.10 Add a new paragraph immediately after Paragraph 6.10.A:

B. Owner is exempt from payment of sales and compensating use taxes of the [State] and of cities and counties thereof on all materials to be incorporated into the public streets, drainage, and sanitary sewer portions of the Work.

1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.

2. Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

SC-6.19 Add new paragraphs immediately after Paragraph 6.19.C.7:

8. the issuance of a notice of acceptability by the Engineer.

9. the failure of the Owner, Engineer, the Project Representative or any other person or entity acting on behalf of the Owner or Engineer to observe, detect or discover any defect in the Work or any non-conformance of the Work with any requirements of the Contract Documents.

Contractor hereby waives any claim or defense to any claim by the Owner that any failure by the Owner, Engineer, Resident Project Representative or any other person or entity acting on behalf of the Owner to observe, detect or discover any defect in the Work relieves or releases, in whole or in part, Contractor from any obligations or responsibility for the correction of such defects or any other obligation of Contractor under the Contract Documents.

SC-6.19 Add new paragraphs immediately after Paragraph 6.19.C.:

D. The Contractor warrants to the Owner that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will be performed in a good and workmanlike manner, will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements shall be considered defective. If required by the

Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

E. In addition to Contractor's warranty obligations set forth elsewhere in the Contract Documents, including but not limited to Paragraph 6.19 C above and subject to the provisions of Paragraph 6.19 F below, the Contractor warrants and guarantees the Work for one (1) year from Final Completion ("Correction Period"), or for a longer period if expressly stated in the Contract Documents. This includes a warranty and guarantee against any and all defects. The Contractor must correct any and all defects in material and/or workmanship which may appear during such Correction Period, or any defects that occur during the Correction Period even if discovered more than one (1) year after Final Completion, by repairing (or replacing with new items or new materials, if necessary) any such defect at no cost to the Owner, within a reasonable period of time, and to the Owner's satisfaction.

F. Prior to the expiration of the Correction Period, the Owner reserves the right to require a re-inspection of the Work. Such inspection shall be made by duly authorized representatives of the Owner, Engineer, and Contractor, in order to determine if any defects or deficiencies exist which are due to be corrected by the Contractor.

G. Manufacturer's Warranties on installed machinery and equipment as well as subcontractor and supplier warranties and guarantees, express or implied, respecting any part of the work and any materials used therein shall be deemed obtained – and shall be enforced – by the Contractor as the agent and for the benefit of the Owner.

H. If within one year after the date of Final Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is in need of repair, adjustment, modification, correction, or found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;
2. correct such defective Work;
3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective;
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom, and
5. Perform such work specified by Owner that will allow Owner to accept defective Work.

I. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired, may have the rejected Work removed and replaced, or may have work performed to allow Owner to accept defective Work. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs)

arising out of or relating to such correction or repair, removal and replacement or other work performed to allow Owner to accept defective Work (including but not limited to all costs of repair or replacement of work of others).

J. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the Correction Period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

K. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

SC-7.04 Add the following new paragraph immediately after Paragraph 7.03:

Claims Between Contractors

A. Should Contractor cause damage to the work or property of any other contractor at the Site, or should any claim arising out of Contractor's performance of the Work at the Site be made by any other contractor against Contractor, Owner, Engineer, or the construction coordinator, Contractor shall promptly attempt to settle with such other contractor by agreement, or to otherwise resolve the dispute by arbitration or at law.

B. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner, Engineer, the construction coordinator 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, fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any other contractor against Owner, Engineer, Engineer's Consultants, or the construction coordinator to the extent said claim is based on or arises out of Contractor's performance of the Work. Should another contractor cause damage to the Work or property of Contractor or should the performance of work by any other contractor at the Site give rise to any other Claim, Contractor shall not institute any action, legal or equitable, against Owner, Engineer, or the construction coordinator or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from Owner, Engineer, or the construction coordinator on account of any such damage or Claim.

C. If Contractor is delayed at any time in performing or furnishing Work by any act or neglect of another contractor, and Owner and Contractor are unable to agree as to the extent of any adjustment in Contract Times attributable thereto, Contractor may make a Claim for an extension of times in accordance with Article 12. An extension of the Contract Times shall be Contractor's exclusive remedy with respect to Owner, Engineer, and construction coordinator for any delay, disruption, interference, or hindrance caused by any other contractor. This paragraph does not prevent recovery from Owner, Engineer, or construction coordinator for activities that are their respective responsibilities.

SECTION 00 83 00

WAGE RATES & PAYROLL REPORTING

1. PAYMENT

A. Classification Definitions, Building and Highway-Heavy

Definitions for Building Construction and Highway-Heavy classifications shall conform to the current "Dictionary of Occupational Titles" as published by the U.S. Department of Labor.

B. Minimum Wages

Workers on Project shall be paid not less than wage rates, including fringe benefits, as published by the Department of Labor (DOL) for Building Construction and Highway Heavy Trades. Such wage rates shall be used throughout the Contract. If a classification is to be used, which is not listed in the attached wage rates, Contractor shall submit to Owner rates and classification proposed for use, for approval, prior to performance of Work.

NOTE: The terms journeyman and apprentice apply to both union and independent workers, and are not intended to imply that these positions are union workers only.

All laborers and mechanics working upon the Work for this Project shall be paid unconditionally and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by Secretary of Labor under the Copeland Act, Title 29 CFR, Part 3) full wages accrued and when due, computed at rates not less than wage rates bound herein pertaining to type of Work being performed. When Work is of such a nature that both Building and Highway-Heavy wage scales are incorporated into contract, Contractor shall pay wage rates to mechanics or laborers performing Work in more than one classification at the rate indicated for each classification for time actually worked as determined by area practice applicable to type (Site Construction Crafts or Building Construction Crafts) of Work being performed without regards to skill. Salaried specialists (project superintendent and administrative personnel only) in the permanent employment of Contractor do not fall under any Wage Classification. Wage rates shall be posted by Contractor at site(s) of Work in prominent, easily accessible places where they can be seen by all workers.

C. Overtime Requirements

No Contractor, Subcontractor, or Sub-subcontractor contracting for any part of contract Work which may require or involve the employment of laborers or mechanics shall require or permit any laborer or mechanic in any workweek in which he 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 time his basic rate of pay for all hours in excess of forty hours in such workweek.

2. APPRENTICES

A. Locally and Federally Funded Projects

Apprentices and Trainees will be permitted to work as such only when they are registered, individually, under a bonafide Apprenticeship or Trainee program registered with the Bureau of Apprenticeship and Training, United States Department of Labor. The allowable ration of Apprentices or Trainees to journeyman in any craft classification shall not be greater than the ration permitted to Contractor as stated in the registered apprenticeship program standards. Any employee listed on a payroll at an Apprentice or Trainee wage rate, who is not registered as above, shall be paid the wage rate provided in Contract for Work employee actually performed. Contractor, Subcontractor, or Sub-subcontractor shall furnish to Owner written evidence of registration of his program for Apprentices and Trainees as well as of the appropriate ratios and wage rates, for the area of construction prior to using any Apprentices or Trainees on this Contract.

3. WITHHOLDING OF PAYMENTS

Owner may withhold or cause to be withheld from Contractor as much of the accrued payments as necessary to pay laborers and mechanics employed by Contractor, Subcontractors, or Sub-subcontractors the amount of wages required to comply with the Contract. In the event of nonpayment of wages to laborers or mechanics working on the site of the Work of this Contract, Owner may, after Written Notice to Contractor, take such action as may be necessary to cause suspension of any further payments or advance of funds to Contractor until such violations have ceased and until restitution has been made. Payments may also be withheld if Contractor fails to maintain weekly payroll reports or fails to provide copies in a timely manner upon request of Owner.

4. PAYROLLS

A. Contractor shall keep records showing:
   1. the name and occupation of each worker employed by the Contractor or subcontractor(s) in the construction of public work; and
   2. the actual per diem wages paid to each worker and
   3. Employee Certification. Contractor, Subcontractor, and Sub-subcontractor shall identify in writing, the classification agreed to by all laborers and mechanics employed by them in the execution of the Contract, and pay not less than rates specified in the attached Building Construction and Highway Heavy Wage Rate Schedule(s). Contractor shall prepare a completed form for the signature of Employee and a witness shall sign the form in the presence of Employee. If work performed by worker is different than the trade classification agreed upon, the worker shall be paid for that work no less than the minimum prevailing for that specified trade.

B. The record shall be open at all reasonable hours to inspection by the officers and agents of the Owner as requested. Contractor will be responsible to provide copies of record as requested by the Owner within two (2) working days. Payrolls relating to this Work shall be maintained during term of Contract and preserved for a period of three (3) years thereafter by Contractor for all laborers and mechanics working on the Work.

C. A Statement of Compliance, a letter signed and dated by party responsible for supervising the payment of persons employed by Contractor or subcontractor shall accompanying payrolls required by Owner. The Statement of Compliance letter shall identify but is not limited to:
   1. name of signatory party and title,
   2. name of project, payroll period and
   3. name of Contractor or Subcontractor.

   The signed letter attests that the payroll complies with 29CFR issued by the Secretary of Labor.

5. COMPLAINTS AND PENALTIES

A public body awarding a contract, and an agent or officer of the public body, shall, take cognizance of complaints of all violations of Chapter 2258 Texas Government Code Title 10 or applicable Federal Statutes committed in the execution of the contract; and withhold money forfeited or required to be withheld under this chapter from the payments to the Contractor under the contract. A Contractor or subcontractor(s) who violates this section shall pay to the political subdivision on whose behalf the contract is made, $60 for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the contract. A public body shall use any money collected under this section to offset the costs incurred in the administration of this chapter.

Confirmed Disciplinary action taken by Contractor against employees who provide information during an interview or investigation by the Owner on wages received, may result in suspension or debarment from consideration of award of City contracts.

6. AREA PRACTICE

A. Highway Heavy Construction Rates shall be used on this Project, unless the Project consists primarily of Building Construction and Building Construction Rates are to be used.

1. Building Construction consists generally of all aspects of construction of buildings, which are sheltered enclosures with walk-in access for the purpose of housing persons, machinery, equipment or supplies, including without limitation the installation of utilities and equipment, both above and below grade level, as well as incidental demolition, grading, utilities, paving and other site work. Buildings need not be "habitable" to be classified as Building Construction and the installation of heavy machinery and/or equipment will not generally change a Building Construction project's classification.
2. The determination of Building Construction Wage Rates includes all construction trades and work necessary to complete a building, regardless of the number of contracts involved, so long as all such contracts are closely related in purpose, time and place.

B. For projects that involve both Building Construction and Highway Heavy trades, the following classifications shall be used:

1. A multiple classification shall be used if Building Construction items are more than 20% of Highway Heavy project cost.
2. A multiple classification shall be used if Highway Heavy Construction items are more than 20% of the Building Construction project cost.
3. When multiple classifications are used, the Highway Heavy Construction Rates are to be paid to workers engaged in site work determined to be five (5) feet beyond the building, extending to the property boundary or construction limits.

7. TEXAS OPEN RECORDS ACT

Unless covered by an exception to mandatory disclosure under the Texas Open Records Act, any and all documents submitted to the Owner become Public Records and are, therefore, subject to public disclosure.

Refer to General Decisions TX20230023 for Prevailing Wage Rate Determination for governing rates on this Project.

1. Additional Trade Information:

Unlisted classifications needed for work not included within the scope of the classifications listed may be added upon the advance approval of the Engineer. Contractor shall submit to the Engineer the following: classification, a bona fide definition of work to be performed and a proposed wage with sample payrolls conforming to area practice prior to the start of the job for that type of work. Proposed trade may not be performed by any trade already listed.

2. Wages:

For overtime, the basic hourly rate listed in the contract wage determination must be used in computing pay obligations.

3. Proper Designation of Trade:

A work classification from the Prevailing Wage Poster for each worker must be made based on the actually type of work he/she performed on the job. In summary the work performed, not the "title" determines the correct worker classification and wage. Each worker must be paid no less that the wage rate on the wage decision for that classification regardless of his/her level of skill (exclusive of a bona fide apprentice currently registered in a DOL approved apprentice program – proof of individual registration must be supplied in advance to the Engineer).

4. Split Classification:

If a firm has employees that perform work in more than one classification, in can pay the wage rates specified for each classification only if it maintains accurate time records showing the amount of time spent in each classification. If accurate time records are not maintained, these

employees must be paid the highest wage rate of all the classifications of work performed by each worker. Accurate time records tracking how many hours a worker performed the work of one trade and the switched to another trade must be accounted for on a daily basis and reflected on Employer Certified Payroll accordingly.

END OF SECTION

ADDENDUM NO. 4

CITY OF GATESVILLE

CID 01-STILLHOUSE BRANCH WASTEWATER TREATMENT FACILITY IMPROVEMENTS

PROJECT NO.: 2-01590 | TWDB CWSRF NO. 73776

DATE OF ADDENDUM: JUNE 15, 2023

BID OPENING DATE: JUNE 20, 2023

REVISED ADDENDUM PER TWDB COMMENTS: OCTOBER 30, 2023

This Addendum forms a part of Contract and clarifies, corrects or modifies original Proposal Documents, dated May 8, 2023. Acknowledge receipt of this addendum in space provided on Proposal Form. Failure to do so may subject bidder to disqualification.

MODIFICATIONS TO PROPOSAL DOCUMENTS

1) Project Manual
   a. Section 13 34 19 – Metal Building Systems

      Specification "Section 13 34 19 – Metal Building Systems" has been REVISED to include statement that all steel components of the Pre-Engineering Metal Building shall be galvanized.

   b. Section 01 30 00 – Administration Requirements

      Specification "Section 01 30 00 – Administration Requirements" has been REVISED to include information regarding construction photographs and videos.

   c. Section 46 51 36 – Fine Bubble Membrane Disc Aeration System

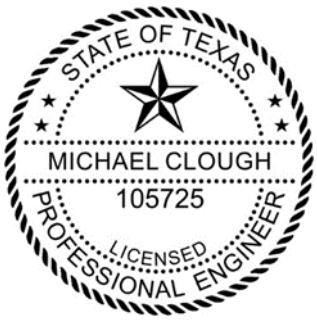
      Paragraph 2.5.C.2.g has been REVISED to exclude 10 days of history statement. Paragraph 2.5.C.2.h has been REVISED to remove the entire statement.

2) Drawings
   a. Sheet MD-03

      REVISED to include additional information regarding the pipe supports.

CLARIFICATIONS

1) Manufacturer Substitutions
   a. "All manufacturers meeting the equipment specifications are approved whether they are mentioned in the individual specification sections as an approved equal, subject to provisions of American Iron and Steel rules and other project requirements. See General Conditions, Article 6.05."



Approved by:

Engineer

ADDENDUM NO. 3

CITY OF GATESVILLE

CID 01-STILLHOUSE BRANCH WASTEWATER TREATMENT FACILITY IMPROVEMENTS

PROJECT NO.: 2-01590 | TWDB CWSRF NO. 73776

DATE OF ADDENDUM: JUNE 13, 2023

BID OPENING DATE: JUNE 20, 2023

REVISED ADDENDUM PER TWDB COMMENTS: OCTOBER 30, 2023

This Addendum forms a part of Contract and clarifies, corrects or modifies original Proposal Documents, dated May 8, 2023. Acknowledge receipt of this addendum in space provided on Proposal Form. Failure to do so may subject bidder to disqualification.

MODIFICATIONS TO PROPOSAL DOCUMENTS

1) Pre-Bid Meeting Sign-in
   REISSUE the Pre-Bid Meeting Sign-in to remove "Mandatory" from the sheet. The original Pre-bid Meeting Sign-in sheet will be deleted from CivCast.

2) Project Manual
   a. Section 40 05 23 – Stainless Steel Process Pipe and Tubing

      INCLUDE the attached Specification "Section 40 05 23 - Stainless Steel Process Pipe and Tubing" to provide information regarding the approved stainless steel details for the low air pressure piping.

   b. Section 43 25 13.23 – Overhung Close-Coupled Submersible Volute Centrifugal Pumps

      Specification "Section 43 25 13.23 – Overhung Close-Coupled Submersible Volute Centrifugal Pumps" has been REVISED to include information on submersible pumps at Biosolids Drain Pump Station.

   c. Section 00 52 00 – Agreement

      Specification "Section 00 52 00 - Agreement" has been REVISED to include amount for liquidated damages.

3) Drawings
   a. Sheet AJ-01

      REVISED grit storage building floor plan to include dimensions of the two stairways.

   b. Sheet G-01

      REVISED drawing index sheet to match all drawings and their respective titles.

c. Sheets M-03 through M-05

REVISE to include mud valves to valve schedule, include unlined stainless-steel piping for the low air pressure piping in the piping schedule, and update plug valve PV-911 size to 6 inches.

d. Sheet MA-02

REVISED to include image of existing perforated screen in channel.

e. Sheet MD-02

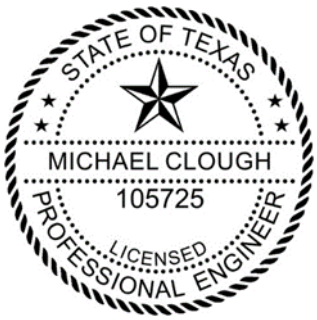
REVISED to include aeration grid information.

f. Sheet MK-02

REVISED to include trench drain information.

g. Sheet P-03

REVISED to include mud valves.



Approved by:

Engineer

ADDENDUM NO. 2

CITY OF GATESVILLE

CID 01-STILLHOUSE BRANCH WASTEWATER TREATMENT FACILITY IMPROVEMENTS

PROJECT NO.: 2-01590 | TWDB CWSRF NO. 73776

DATE OF ADDENDUM: JUNE 1, 2023

BID OPENING DATE: JUNE 20, 2023

REVISED ADDENDUM PER TWDB COMMENTS: OCTOBER 30, 2023

This Addendum forms a part of Contract and clarifies, corrects or modifies original Proposal Documents, dated May 24, 2023. Acknowledge receipt of this addendum in space provided on Proposal Form. Failure to do so may subject bidder to disqualification.

MODIFICATIONS TO PROPOSAL DOCUMENTS

1) Drawings
   a. Sheet C-04

      REVISE to include existing line size.

   b. Sheet C-08

      DELETE blank revision notation.

   c. Sheets M-04 and M-05

      REVISE valve schedule to include specification references.

Approved by:

Engineer

ADDENDUM NO. 1

CITY OF GATESVILLE

CID 01-STILLHOUSE BRANCH WASTEWATER TREATMENT FACILITY IMPROVEMENTS

PROJECT NO.: 2-01590 | TWDB CWSRF NO. 73776

DATE OF ADDENDUM: MAY 24, 2023

BID OPENING DATE: JUNE 20, 2023

REVISED ADDENDUM PER TWDB COMMENTS: OCTOBER 30, 2023

This Addendum forms a part of Contract and clarifies, corrects or modifies original Proposal Documents, dated May 8, 2023. Acknowledge receipt of this addendum in space provided on Proposal Form. Failure to do so may subject bidder to disqualification.

MODIFICATIONS TO PROPOSAL DOCUMENTS

1) Project Manual
   REISSUE the Project Manual dated May 8, 2023, and will be replaced with the Project Manual dated May 24, 2023. The original Project Manual dated May 8, 2023 will be deleted from CivCast. All proposers and plan holders must re-download the latest Project Manual. Changes to the Project Manual are outlined below:

   a. Section 00 41 00 – Proposal Form

      REVISE Section 00 41 00 – Proposal Form, Item 1.0.F to add the required TWDB documents as part of the submittal documents for the Offerer to include in the bid.

   b. Section 01 50 00 – Temporary Facilities and Controls

      REVISE Specification 01 50 00-Temporary Facilities, Article 1.7 (A)to clarify the requirements for temporary facilities to be provided by the Contractor.

   c. Non-Collusion Affidavit

      INCLUDE the attached "Non Collusion Affidavit", required to be submitted by the Offerer with their bid, was not included in the Project Documents.

   d. Section 00 31 00 – Available Project Information

      REVISE Section 00 31 00, Article 2.B - Available Project Information as follows: The Geotechnical Report will be made available via CivCast and will not be part of the bidding documents.

   e. Section 43 11 33 – Positive Displacement Rotary Lobe Blower

REVISE Specification Section 43 11 33 to clarify that the cost estimate for the third blower should be separated for use for the deductive alternate in the Bid. The blowers will run on VFD, so speed can vary to achieve the performance requirements. Moisture Detection Switches are not Required.

2) Drawings
   a. Sheets C-08 through C-17

      REVISE yard piping to reflect the pipe labels on Sheet M-01 and Sheet M-02.

   b. Sheet G-01

      REVISE drawing index sheet to show name of yard piping.

      DELETE drawings CZ-4 and CZ-5.

   c. Sheets P-01 through P-05

      REVISE to match the yard pipe labels.

   d. Sheet M-02

      REVISE to match the yard pipe labels.

   e. Sheet MJ-03

      REVISE Sheet MJ-03 Note to state “Sheet C-16” instead of “Sheet C-20”.

Approved by:

Engineer

NON-COLLUSION AFFIDAVIT

STATE OF TEXAS §
§
COUNTY OF Bell §

By the signature below, the signatory for the bidder certifies that neither he nor the firm, corporation, partnership or institution represented by the signatory or anyone acting for the firm bidding this project has violated the antitrust laws of this State, codified at Section 15.01, *et seq.*, Texas Business and Commerce Code, or the Federal antitrust laws, nor communicated directly or indirectly the bid made to any competitor or any other person engaged in the same line of business, nor has the signatory or anyone acting for the firm, corporation or institution submitting a bid committed any other act of collusion related to the development and submission of this bid proposal.

Signature: BAM

Printed Name: Bruce A. Matous

Title: CEO of General Partner

Company: Matous Construction, Ltd

Date: June 20, 2023

SUBSCRIBED and sworn to before me the undersigned authority by June the 20th of, 2023 on behalf of said bidder.

MARY KATHERINE RICHTER
MY COMMISSION EXPIRES
11/23/2026
NOTARY ID: 134078022

Notary Public in and for the
State of Texas

My commission expires: 11/23/2026

Revised May 2007

SAMPLE FORMS

Work Change Directive

No. _____

Date of Issuance: _____ Effective Date: _____

Project:	Owner:	Owner's Contract No.:
Contract:		Date of Contract:
Contractor:		Engineer's Project No.:

You are directed to proceed promptly with the following change(s):

Item No.	Description

Attachments (list documents supporting change):

Purpose for Work Change Directive:

☐ Authorization for Work described herein to proceed on the basis of Cost of the Work due to:

☐ Nonagreement on pricing of proposed change.

☐ Necessity to expedite Work described herein prior to agreeing to changes on Contract Price and Contract Time.

Estimated change in Contract Price and Contract Times:

Contract Price $ _____ (increase/decrease) Contract Time _____ (increase/decrease)
days

If the change involves an increase, the estimated amounts are not to be exceeded without further authorization.

Recommended for Approval by Engineer:	Date
Authorized for Owner by:	Date
Accepted for Contractor by:	Date
Approved by Funding Agency (if applicable):	Date:

Field Order

No. _____

Date of Issuance: _____ Effective Date: _____

Project:	Owner:	Owner's Contract No.:
Contract:		Date of Contract:
Contractor:		Engineer's Project No.:

Attention:
You are hereby directed to promptly execute this Field Order issued in accordance with General Conditions Paragraph 9.05A., for minor changes in the Work without changes in Contract Price or Contract Times. If you consider that a change in Contract Price or Contract Times is required, please notify the Engineer immediately and before proceeding with this Work.

Reference: _____ _____
(Specification Section(s)) (Drawing(s) / Detail(s))

Description:

Attachments:

Engineer:

Receipt Acknowledged by (Contractor):	Date:

Copy to Owner

Change Order

No. _____

Date of Issuance: _____ Effective Date: _____

Project:	Owner:	Owner's Contract No.:
Contract:		Date of Contract:
Contractor:		Engineer's Project No.:

The Contract Documents are modified as follows upon execution of this Change Order:

Description:

Attachments: (List documents supporting change):

CHANGE IN CONTRACT PRICE:

Original Contract Price:

$_____

[Increase] [Decrease] from previously approved Change Orders No._____ to No._____:

$_____

Contract Price prior to this Change Order:

$_____

[Increase] [Decrease] of this Change Order:

$_____

Contract Price incorporating this Change Order:

$_____

CHANGE IN CONTRACT TIMES:

Original Contract Times: ☐ Working days ☐ Calendar days

Substantial completion (days or date): _____

Ready for final payment (days or date): _____

[Increase] [Decrease] from previously approved Change Orders No._____ to No._____:

Substantial completion (days): _____

Ready for final payment (days): _____

Contract Times prior to this Change Order:

Substantial completion (days or date): _____

Ready for final payment (days or date): _____

[Increase] [Decrease] of this Change Order:

Substantial completion (days or date): _____

Ready for final payment (days or date): _____

Contract Times with all approved Change Orders:

Substantial completion (days or date): _____

Ready for final payment (days or date): _____

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____	By: _____	By: _____
Engineer (Authorized Signature)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Date: _____	Date: _____	Date: _____

Approved by Funding Agency (if applicable): _____ Date: _____

A. GENERAL INFORMATION

This document was developed to provide a uniform format for handling contract changes that affect Contract Price or Contract Times. Changes that have been initiated by a Work Change Directive must be incorporated into a subsequent Change Order if they affect Price or Times.

Changes that affect Contract Price or Contract Times should be promptly covered by a Change Order. The practice of accumulating Change Orders to reduce the administrative burden may lead to unnecessary disputes.

If Milestones have been listed in the Agreement, any effect of a Change Order thereon should be addressed.

For supplemental instructions and minor changes not involving a change in the Contract Price or Contract Times, a Field Order should be used.

B. COMPLETING THE CHANGE ORDER FORM

Engineer normally initiates the form, including a description of the changes involved and attachments based upon documents and proposals submitted by Contractor, or requests from Owner, or both.

Once Engineer has completed and signed the form, all copies should be sent to Owner or Contractor for approval, depending on whether the Change Order is a true order to the Contractor or the formalization of a negotiated agreement for a previously performed change. After approval by one contracting party, all copies should be sent to the other party for approval. Engineer should make distribution of executed copies after approval by both parties.

If a change only applies to price or to times, cross out the part of the tabulation that does not apply.

Contractor's Application For Payment No. _____

	Application Period:	Application Date:
To (Owner):	From (Contractor):	Via (Engineer)
Project:	Contract:	
Owner's Contract No.:	Contractor's Project No.:	Engineer's Project No.:

APPLICATION FOR PAYMENT

Change Order Summary

Approved Change Orders		
Number	Additions	Deductions
TOTALS		
NET CHANGE BY CHANGE ORDERS		

1.	**ORIGINAL CONTRACT PRICE**	$
2.	**Net change by Change Orders**	$
3.	**CURRENT CONTRACT PRICE (Line 1 ± 2)**	$
4.	**TOTAL COMPLETED AND STORED TO DATE (Column F on Progress Estimate)**	$
5.	**RETAINAGE:**	
	a. _____ % x $_____ Work Completed	$
	b. _____ % x $_____ Stored Material	$
	c. Total Retainage (Line 5a + Line 5b)	$
6.	**AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5c)**	$
7.	**LESS PREVIOUS PAYMENTS (Line 6 from prior Application)**	$
8.	**AMOUNT DUE THIS APPLICATION**	$
9.	**BALANCE TO FINISH, PLUS RETAINAGE (Column G on Progress Estimate + Line 5 above)**	$

CONTRACTOR'S CERTIFICATION

The undersigned Contractor certifies that: (1) all previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with Work covered by prior Applications for Payment; (2) title of all Work, materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to Owner at time of payment free and clear of all Liens, security interests and encumbrances (except such as are covered by a Bond acceptable to Owner indemnifying Owner against any such Liens, security interest or encumbrances); and (3) all Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

By:	Date:

Payment of: $_____
(Line 8 or other - attach explanation of other amount)

is recommended by: _____ _____
(Engineer) (Date)

Payment of: $_____
(Line 8 or other - attach explanation of other amount)

is approved by: _____ _____
(Owner) (Date)

Approved by: _____
Funding Agency (if applicable) (Date)

Progress Estimate

Contractor's Application

For (contract):	Application Number:
Application Period:	Application Date:

A		B	Work Completed		E	F		G
Item			C	D		Total Completed and Stored to Date (C + D + E)	% (F) B	Balance to Finish (B - F)
Specification Section No.	Description	Scheduled Value	From Previous Application (C + D)	This Period	Materials Presently Stored (not in C or D)			
	Totals							

Progress Estimate

Contractor's Application

For (contract):	Application Number:
Application Period:	Application Date:

A				B	C	D	E	F		G
Item		Bid Quantity	Unit Price	Bid Value	Estimated Quantity Installed	Value	Materials Presently Stored (not in C)	Total Completed and Stored to Date (D + E)	% (F) B	Balance to Finish (B - F)
Bid Item No.	Description									
	Totals									

Stored Material Summary

Contractor's Application

For (contract):					Application Number:				
Application Period:					Application Date:				
A	B	C	D		E		F		G
Invoice No.	Shop Drawing Transmittal No.	Materials Description	Stored Previously		Stored this Month		Incorporated in Work		Materials Remaining in Storage ($) (D + E - F)
			Date (Month/Year)	Amount ($)	Amount ($)	Subtotal	Date (Month/Year)	Amount ($)	
		Totals							

Certificate of Substantial Completion

Project:	Owner:	Owner's Contract No.:
Contract:		Date of Contract:
Contractor:		Engineer's Project No.:

This [tentative] [definitive] Certificate of Substantial Completion applies to:

☐ All Work under the Contract Documents: ☐ The following specified portions:

_____

_____

_____

_____

_____
Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby declared and is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below.

A [tentative] [revised tentative] [definitive] list of items to be completed or corrected, is attached hereto. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance, and warranties shall be as provided in the Contract Documents except as amended as follows:

☐ Amended Responsibilities ☐ Not Amended

Owner's Amended Responsibilities:

_____

_____

_____

Contractor's Amended Responsibilities:

_____

_____

_____

The following documents are attached to and made part of this Certificate:

_____

_____

_____

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

_____ _____
Executed by Engineer Date

_____ _____
Accepted by Contractor Date

_____ _____
Accepted by Owner Date

TWDB-0550
Rev 07/2021

Texas Water Development Board Supplemental Contract Conditions for Clean Water State Revolving Fund (Equivalency) and Drinking Water State Revolving Fund

For Construction Services for Projects Funded through the CWSRF Equivalency and DWSRF Programs

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Forms and Guidance:

The Texas Water Development Board (TWDB) forms and guidance documents noted in this instruction document may be accessed through the TWDB Financial Assistance website at:

http://www.twdb.texas.gov/financial/instructions/index.asp

Search by either the document number or name.

I. INSTRUCTIONS FOR APPLICANTS

1. Applicability

These Supplemental Contract Conditions contain provisions that are worded to comply with certain statutes and regulations which specifically relate to all Drinking Water State Revolving Fund (DWSRF) projects and Clean Water State Revolving Fund (CWSRF) Equivalency Program projects. Provisions which are applicable to the project's funding source or dollar value of the contract are so noted within these provisions.

2. Use of Conditions

The conditions and forms listed under ***Section II: Instructions to Bidders*** are to be included in the instructions to bidders for construction services. The provisions listed under ***Section III: Construction Contract Supplemental Conditions*** shall be included, in their entirety, with the other general and special conditions that are typically included in the construction contract documents by the design engineer.

3. Modifications to Provisions

These provisions shall be included as a stand-alone section in the contract documents. The Applicant may need to modify parts of these provisions to better fit the other provisions of the construction contract. The Applicant and the consulting engineer should carefully study these provisions before incorporating them into the construction contract documents. In particular, Water Districts and other types of Districts should be aware of statutes relating to their creation and operation which may affect the application of these conditions. The TWDB Project Engineer/Reviewer should be consulted if the Applicant thinks there is a need to modify parts of these provisions.

The Applicant is to determine and incorporate the affirmative action goals for the project into Supplemental Contract Condition No. 12. Supplemental Condition No. 15, Archeological Discoveries and Cultural Resources, and Condition No. 16, Endangered Species, may be superseded or modified by project specific conditions established during the environmental review process.

These documents may confer certain duties and responsibilities on the consulting engineer that are beyond, or short of, what the Applicant intends to delegate. The Applicant should ensure that the contractual agreement with the Engineer provides for the appropriate services. Otherwise the Applicant should revise the wording in these special conditions to agree with actually delegated functions.

4. Good Business Practices

There are other contract provisions that the Applicant and Engineer need to include as a matter of good business practice. It is recommended that provisions addressing the following matters be included in the construction contract.

(a) Specifying the time frame for accomplishing the construction of the project, and the consequences of not completing on time, including liquidation damages.
(b) Specifying the type and dollar value of and documentation of insurance the Contractor is to carry. At a minimum, the Contractor should carry worker's compensation, liability and builder's risk insurance.
(c) Identifying the responsibility of the Contractor - responsibility and warranty of work.
(d) Price reduction for defective pricing of negotiated costs.
(e) Differing site conditions - notice and claims regarding site conditions differing from indicated conditions.
(f) Covenants against contingent fees - prohibit contingent fees for securing business.
(g) Gratuities - prohibitions against offering and accepting gratuities.
(h) Audit and access records.
(i) Suspension of work - conditions under which the Applicant may suspend work.
(j) Termination - conditions under which the Applicant may terminate.
(k) Remedies - how disputes will be remedied.

5. Other Requirements

There may be other local government requirements and applicable Federal and State statutes and regulations which are not included by these conditions. It is the Loan/Principal Forgiveness Applicant's responsibility to ensure that the project and all contract provisions are consistent with the relevant statutes and regulations.

6. Advertisements for Bids

State procurement statutes require advertising a contract for bid for at least two (2) consecutive weeks. By not following this requirement, the project may need to be re-advertised. The official advertisement for bids that is published in newspapers should include certain information such as, but not limited to, the following:

(a) A clear description of what is being procured.
(b) How to obtain plans and specifications (P&S), necessary forms and information.
(c) The date and time by which bids are to be submitted (deadline).
(d) The address where bids are to be provided.
(e) This contract is contingent upon release of funds from the Texas Water Development Board (TWDB).
(f) Any contract or contracts awarded under this Invitation for Bid (IFB), Request for Proposals (RFP), or Request for Qualifications (RFQ) are expected to be funded in part by financial assistance from the TWDB. Neither the U.S. Environmental Protection Agency (EPA) or the State of Texas, nor any of its departments, agencies, or employees, are or will be a party to this IFB, RFP, RFQ, or any resulting contract.
(g) For CWSRF, include – Any contract(s) awarded under this Invitation for Bids is/are subject to the American Iron and Steel (AIS) requirements of Section 608 of the Federal Water Pollution Control Act.
For DWSRF, include – Any contract(s) awarded under this Invitation for Bids is/are subject to the American Iron and Steel (AIS) requirements of federal law, including federal appropriation acts.

(h) This contract is subject to the Environmental Protection Agency's (EPA) Disadvantaged Business Enterprise (DBE) Program, which includes EPA-approved fair share goals toward procurement of Minority and Women-owned Business Enterprise (M/WBE) businesses. EPA rules require that applicants and prime contractors make a good faith effort to award a fair share of contracts, subcontracts, and procurements to M/WBEs through demonstration of the six affirmative steps. For more details of the DBE Program and the current, applicable fair share goals, please visit http://www.twdb.texas.gov/dbe.

(i) Equal Opportunity in Employment - All qualified Applicants will receive consideration for employment without regard to race, color, religion, sex (including pregnancy), sexual orientation, gender identity, national origin, age (40 or older), disability, or genetic information. Bidders on this work will be required to comply with the Department of Labor regulations at 41 CFR Part 60-4, relating to Construction Contractors--Affirmative Action Requirements, which include the President's Executive Order No. 11246, as amended by Executive Order No. 11375 and Executive Order No. 13672, in the award and administration of contracts awarded under TWDB financial assistance agreements. Failure by the Contractor to carry out these requirements is a material breach, which may result in the termination of the awarded financial assistance.

(j) Acknowledgement of any special requirements such as mandatory pre-bid conference.

(k) Right to reject any and all bids.

(l) Davis-Bacon prevailing wage requirements apply to the construction, alteration or repair of treatment works carried out, in whole or in part, with assistance made available by the Clean Water State Revolving Fund (CWSRF) or a construction project financed, in whole or in part, from the Drinking Water State Revolving Fund (DWSRF).

(m) The Davis-Bacon prevailing wage requirements apply to Contractors and Subcontractors performing on federally funded or assisted contracts in excess of $2,000 for the construction, alteration or repair (including painting) of a treatment works project under the CWSRF or a construction project under the DWSRF.

(n) For prime contracts in excess of $100,000, Contractors and Subcontractors must also, under the provisions of the Contract Work Hours and Safety Standards Act, as amended, pay laborers and mechanics, including guards and watchmen, at least one and one-half times their regular rate of pay for all hours worked over 40 in a workweek. The Fair Labor Standards Act may also apply to Davis-Bacon covered contracts.

(o) Any contracts or subcontracts in excess of $2,000 must include the provisions of the Davis-Bacon Wage Rate Requirements found in TWDB Guidance No. DB-0156.

(p) Wage Determinations - U.S. Department of Labor (DOL) wage determination must be included in the bidding and contract documents. DOL wage determinations may be obtained online at http://www.wdol.gov/.
Once it is determined that Davis-Bacon wage rates will apply to a construction contract, the Applicant must state in the solicitation that Davis-Bacon prevailing wage rates are applicable and bid packages must include the current Davis-Bacon general wage determination for the area where construction will occur. While the solicitation remains open, the Applicant must monitor www.wdol.gov on a weekly basis to ensure that the wage determination contained in the solicitation remains current.

The Applicant must amend the solicitation if the 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 Applicant may request a finding from TWDB that there is not reasonable time to notify interested Contractors of the modification of the wage determination.

(q) For additional information on Davis-Bacon Wage Rate Requirements and its applicability to this contract, please consult TWDB Guidance No. DB-0156.

7. Bid Proposal

The Bid proposal form should account for the following:

(a) If a lump sum bid, include a list of the materials used and associated costs.
(b) Distinguish Eligible and Ineligible items.
(c) Accommodate Trench Safety requirements with separate per unit pay item for trench excavation safety protection, Health and Safety Code Chapter 756, Subchapter C.
(d) Include space for the Contractor to acknowledge receipt of each Addendum issued during the bidding process.

8. Bidding Process

The Plans and Specifications, P&S, should include an explanation of how the bids will be processed and should include the following components:

(a) Whether a Pre-bid Conference will be held, whether it is optional or mandatory, where and when it will be held.
(b) Specify the criteria and process for determining responsiveness and responsibility of the bidder.
(c) Specify the method of determining the successful bidder and award (e.g., award to the lowest responsive, responsible bidder, accounting for any multiple parts to bids).
(d) Allow for withdrawal of a bid due to a material mistake.
(e) Identify the time frame that the bids may be held by the Applicant before awarding a contract (i.e., typically for 60 or 90 days).
(f) Acknowledge right of the Applicant to reject any and all bids.

9. Debarment and Suspension Certification

Financial assistant recipients must fully comply with the requirements of Subpart C of 2 CFR Part 180 – "*Responsibilities of Participants Regarding Transactions Doing Business with Other Persons"* - as implemented and supplemented by 2 CFR Part 1532. The recipient is responsible for ensuring that any lower tier covered transaction, as described in Subpart B of 2 CFR Part 180 – *"Covered Transactions"* – includes a term or condition requiring compliance with Subpart C.

The recipient is fully responsible for requiring the inclusion of a similar term or condition in any subsequent lower tier covered transactions.

Recipient acknowledges that failing to disclose the information required under 2 CFR 180.355 may result in the delay or negation of the financial assistance, or pursuance of legal remedies including debarment and suspension.

The recipient must complete and submit certification No. ***SRF-404: Debarment / Suspension Certification***, certifying that it has checked the federal System for Award Management website (http://www.sam.gov) and determined that the Contractor is not an "excluded party" that is debarred, suspended or otherwise excluded from participation in federal assistance programs under Executive Order 12549, as required by 2 CFR Part 180 and 2 CFR Part 1532.

10. Release of Funds

Prior to the TWDB approval to issue a notice to proceed (NTP), and subsequent release of funds for construction (according to program specific requirements), the Applicant and its consultant shall provide the following bid documents:

(a) Submittal of Bid Documents to TWDB Project Engineer/Reviewer to allow contingent award of contract:

Advertisement and Affidavit of advertisement,
Bid tabulation,
All Addenda submitted and approved for the contract,
Bid proposal of apparent low bidder (or chosen bidder with explanation) with bid bond,
Entity's Disadvantaged Business Enterprise forms TWDB 0216 and TWDB 373,
Contractor's Disadvantaged Business Enterprise forms TWDB 0216, 0217, and 0373
Site Certificate (ED-101),
Consulting engineer's recommendation to award letter,
A description of any bidding irregularities,
Construction inspection proposal,
Bidder's Certifications Form (WRD-255).

(b) Following contingent award of the contract, TWDB Project Engineer/Reviewer should receive a bound copy of the executed contract documents (including specifications). This document should include:

Executed agreement,
Contractor's Act of Assurance (TWDB Form ED -103),
Contractor's Act of Assurance Resolution (TWDB Form ED-104),
Payment and Performance Bonds (must be executed on or after the date of the contract),
Contractor's Certificate of Insurance,
Sufficiency of Funds letter.

After reviewing and approving the executed bid documents, the TWDB will issue an authorization for the Applicant to issue a notice to proceed. At this time, TWDB staff can begin releasing construction funds in accordance with program requirements.

Once construction begins, the Applicant must submit monthly, with each Outlay Request, the following documents:

- DB-0154 – Monthly Davis Bacon Wage Rate Certificate of Compliance.
- TWDB-1106-A – Monthly American Iron and Steel Certificate.

Failure to provide these certificates will result in denial of release of funds.

For any questions or proposed modifications to these conditions, please contact your TWDB Project Engineer/Reviewer.

II. INSTRUCTIONS TO BIDDERS

The language and conditions listed in this Section shall be included in the "Instructions to Bidders" section of the construction contract documents.

1. Contingent Award of Contract

This contract is contingent upon release of funds from the Texas Water Development Board. Any contract(s) awarded under this Invitation for Bids is/are expected to be funded in part by a loan or loan with principal forgiveness from the Texas Water Development Board and a grant from the United States Environmental Protection Agency, U.S. EPA. Neither the State of Texas, the U.S. EPA, nor any of its departments, agencies, or employees, are or will be a party to this Invitation for Bids or any resulting contract.

2. Disadvantaged Business Enterprise Goals

The Texas Water Development Board's (TWDB) Clean Water and Drinking Water State Revolving Fund programs receive federal funds from the U. S. Environmental Protection Agency (EPA). As a condition of federal grant awards, EPA regulations require that loan recipients make a "**good faith effort**" to award a fair share of work to Disadvantaged Business Enterprises (DBE) who are Minority Business Enterprises (MBE's), and Women-owned Business Enterprises (WBE's) whenever procuring construction, supplies, services and equipment. More information on DBE requirements is available in the Supplemental Contract Conditions section of this guidance No. ***14***. ***Disadvantaged Business Enterprises***.

The current fair share goals for the State of Texas are as follows:

CATEGORY	MBE	WBE
Construction	19.44%	9.17%
Equipment	16.28%	11.45%
Services	20.41%	13.66%
Supplies	25.34%	8.82%

3. Davis-Bacon Wage Rate Requirements

(a) Davis-Bacon prevailing wage requirements apply to the construction, alteration or repair of treatment works carried out, in whole or in part, with assistance made available by the Clean Water State Revolving Fund (CWSRF) or a construction project financed, in whole or in part, from the Drinking Water State Revolving Fund (DWSRF).

(b) The Davis-Bacon prevailing wage requirements apply to Contractors and Subcontractors performing on federally funded or assisted contracts in excess of $2,000 for the construction, alteration or repair (including painting) of a treatment works project under the CWSRF or a construction project under the DWSRF.

(c) For prime contracts in excess of $100,000, Contractors and Subcontractors must also, under the provisions of the Contract Work Hours and Safety Standards Act, as amended, pay laborers and mechanics, including guards and watchmen, at least one and one-half times their regular rate of pay for all hours worked over 40 in a workweek.
The Fair Labor Standards Act may also apply to Davis-Bacon covered contracts.

(d) Any contracts in excess of $2,000 must include the provisions of the Davis-Bacon Wage Rate Requirements. If the Owner (sub-recipient) is a governmental entity such as a city or district, it must insert in full the contract clauses found in TWDB Guidance DB-0156, Appendix 1: Section 3, Section 4 if the contract exceeds $100,000, and Section 5. If the Owner (sub-recipient) is a non-governmental entity such as a water supply corporation or a private company, it must insert in full the contract clauses found in TWDB Guidance DB-0156, Appendix 2: Section 3, Section 4 if the contract exceeds $100,000, and Section 5. The Owner (sub-recipient) must ensure all prime contracts require the same full text in any subcontracts. See TWDB Guidance DB-0156 for the text of the contract language that must be included.

Additional information on Davis-Bacon Wage Rate Requirements and its applicability to this contract can be found in TWDB Guidance DB-0156.

4. American Iron and Steel

Any contract(s) awarded under this Invitation for Bids is/are subject to the American Iron and Steel (AIS) requirements of 33 U.S.C §1388 for Clean Water State Revolving Fund projects or Public Law 114-113, Consolidated Appropriations Act, 2016, or subsequent appropriations acts, for Drinking Water State Revolving Fund projects. The Contractor must complete the statement of understanding regarding this requirement, found in Supplemental Contract Conditions, Item No. 9.

5. Equal Employment Opportunity and Affirmative Action

All qualified applicants will receive consideration for employment without regard to race, color, religion, sex (including pregnancy), sexual orientation, gender identity, national origin, age (40 or older), disability, or genetic information. Bidders on this work will be required to comply with the Department of Labor regulations at 41 CFR Part 60-4, relating to Construction Contractors--Affirmative Action Requirements, which include the President's Executive Order No. 11246, as amended by Executive Order No. 11375 and Executive Order No. 13672, in the award and administration of contracts awarded under TWDB financial assistance agreements. Failure by the Contractor to carry out these requirements is a material breach, which may result in the termination of the awarded financial assistance.

6. Debarment and Suspension Certification

This contract is subject to the federal requirements of Subpart C of 2 CFR Part 180 and Part 1532 regarding Debarment and Suspension. The Contractor will comply with the assurances provided with the bid that leads to a contract.

7. Bid Guarantee

Each bidder shall furnish a bid guarantee equivalent to five percent of the bid price (Water Code 17.183). If a bid bond is provided, the Contractor shall utilize a surety company which is authorized to do business in Texas in accordance with Surety Bonds and Related Instruments, Chapter 3503 of the Insurance Code.

Forms to be submitted with Bid:

- WRD-255, Bidder's Certifications regarding Equal Employment Opportunity and Non-Segregated Facilities.
- SRF-404, Certification Regarding Debarment, Suspension and Other Responsibility Matters, (to be completed and submitted by the sub-recipient).
- Disadvantaged Business Enterprise (DBE) Construction Contract Phase Forms

Form	Prime Contractor	Submit Form To
TWDB-0216	Required	TWDB
TWDB-0217	Required	TWDB
TWDB-0373	Required	TWDB

III. SUPPLEMENTAL CONTRACT CONDITIONS

1. Supersession

The Owner and the Contractor agree that the TWDB Supplemental Conditions apply to that work eligible for Texas Water Development Board assistance to be performed under this contract and these clauses supersede any conflicting provisions of this contract.

2. Privity of Contract

Funding for this project is expected to be provided in part by the Texas Water Development Board. Neither the State of Texas, nor any of its departments, agencies or employees is, or will be, a party to this contract or any lower tier contract. This contract is subject to applicable provisions 31 TAC Chapter 371 (DWSRF) or 375 (CWSRF) in effect on the date of the assistance award for this project.

3. Definitions

(a) The term "Owner" means the local entity contracting for the construction services.

(b) The term "TWDB" means the Executive Administrator of the Texas Water Development Board, or other person who may be at the time acting in the capacity or authorized to perform the functions of such Executive Administrator, or the authorized representative thereof.

(c) The term "Engineer" means the engineer the Owner has authorized to work on the project.

4. Laws to be Observed

In the execution of the Contract, the Contractor must comply with all applicable Local, State and Federal laws, including but not limited to laws concerned with labor, safety, minimum wages, and the environment. The Contractor shall make himself familiar with and at all times shall observe and comply with all Federal, State, and Local laws, ordinances and regulations which in any manner affect the conduct of the work, and shall indemnify and save harmless the Owner, Texas Water Development Board, and their representatives against any claim arising from violation of any such law, ordinance or regulation by the Contractor, their Subcontractor or their employees.

5. Review by Owner and TWDB

(a) The Owner, authorized representatives and agents of the Owner, and TWDB shall, at all times have access to and be permitted to observe and review all work, materials, equipment, payrolls, personnel records, employment conditions, material invoices, and other relevant data and records pertaining to this Contract, provided, however that all instructions and approval with respect to the work will be given to the Contractor only by the Owner through authorized representatives or agents.

(b) Any such inspection or review by the TWDB shall not subject the State of Texas, or its representatives, to any action for damages.

6. Performance and Payment Bonds

Each Contractor awarded a construction contract must furnish performance and payment bonds:

(a) The performance bond shall include without limitation guarantees that work done under the contract will be completed and performed according to approved plans and specifications and in accordance with sound construction principles and practices;

(b) The performance and payment bonds shall be in a penal sum of not less than 100 percent of the contract price and remain in effect for one year beyond the date of approval by the Engineer of the political subdivision; and

(c) The Contractor shall utilize a surety company which is authorized to do business in Texas in accordance with Surety Bonds and Related Instruments, Chapter 3503 of the Insurance Code.

7. Payment Schedule and Cost Breakdown

(a) The Contractor shall submit for approval immediately after execution of the Agreement, a carefully prepared Progress Schedule, showing the proposed dates of starting and completing each of the various sections of the work, the anticipated monthly payments to become due to the Contractor, and the accumulated percent of progress each month.

(b) The following paragraph applies only to contracts awarded on a lump sum contract price:

COST BREAKDOWN - The Contractor shall submit to the Owner a detailed breakdown of the estimated cost of all work to be accomplished under the contract, arranged and itemized as to meet the approval of the Owner or funding agencies. This breakdown shall be submitted promptly after execution of the agreement and before any payment is made to the Contractor for the work performed under the contract. After approval by the Owner the unit prices established in the breakdown shall be used in estimating the amount of partial payments to be made to the Contractor.

8. Workman's Compensation Insurance Coverage (as applicable, consistent with Texas Labor Code § 406.096)

(a) The Contractor shall certify in writing that the Contractor provides workers' compensation insurance coverage for each employee of the Contractor employed on the public project.
(b) Each Subcontractor on the public project shall provide such a certificate relating to coverage of the Subcontractor's employees to the general Contractor, who shall provide the Subcontractor's certificate to the governmental entity.
(c) A Contractor who has a contract that requires workers' compensation insurance coverage may provide the coverage through a group plan or other method satisfactory to the governing body of the governmental entity.
(d) The employment of a maintenance employee by an employer who is not engaging in building or construction as the employer's primary business does not constitute engaging in building or construction.
(e) In this section:

i. "Building or construction" includes:
   - erecting or preparing to erect a structure, including a building, bridge, roadway, public utility facility, or related appurtenance;
   - remodeling, extending, repairing, or demolishing a structure; or
   - otherwise improving real property or an appurtenance to real property through similar activities.

ii. "Governmental entity" means this state or a political subdivision of this state. The term includes a municipality.

9. American Iron & Steel

The following statement must be completed by the Contractor and made a part of the agreement between the Owner and the Contractor:

The Contractor acknowledges to and for the benefit of the Owner ("Purchaser") and the Texas Water Development Board (TWDB) that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking 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 Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and the TWDB 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 Owner or the TWDB. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner to enforce this Agreement and recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Owner resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the TWDB or any damages owed to the TWDB by the Owner). While the Contractor has no direct contractual privity with the TWDB, as a lender to the Owner for the funding of its project, the Owner and the Contractor agree that the TWDB 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 TWDB.

Additional information on the American Iron and Steel (AIS) and its applicability to this contract can be found in the TWDB-1106 guidance.

It is recommended the Owner receive and maintain files documenting the Contractor's use of AIS. Monthly compliance with AIS will be verified by the Owner through the submittal of the TWDB form TWDB-1106-A.

10. Davis-Bacon Wage Rate Requirements

(a) Compliance Procedures

In order to be held in compliance and satisfy this federal requirement, the following must be fulfilled:

i. **Wage Determinations** - U.S. Department of Labor (DOL) wage determination must be included in the bidding and contract documents. DOL wage determinations may be obtained online at http://www.wdol.gov/. Once it is determined that Davis-Bacon wage rates will apply to a construction contract, the Owner must state in the solicitation that Davis-Bacon prevailing wage rates are applicable and bid packages must include the current Davis-Bacon general wage determination for the area where construction will occur. While the solicitation remains open, the Owner must monitor www.wdol.gov on a weekly basis to ensure that the wage determination contained in the solicitation remains current. The Owner must amend the solicitation if the 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 Owner may request a finding from the TWDB that there is not a reasonable time to notify interested Contractors of the modification of the wage determination.

ii. **Insert wage rate requirements in full for all contracts and subcontracts in excess of $2,000** - If the Owner is a governmental entity such as a city or district, it must insert in full the contract clauses shown below as Option 1: Section 3, Section 4 if the contract exceeds $100,000, and Section 5. If the Owner is a non-governmental entity such as a water supply corporation or a private company, it must insert in full the contract clauses shown below as Option 2: Section 3, Section 4 if the contract exceeds $100,000, and Section 5. The Owner must ensure all prime contracts require the same full text in any subcontracts.

iii. **Monthly Certification** – The Owner must complete and submit monthly a Davis Bacon Wage Rate Certificate of Compliance once construction has begun. **(Use Monthly Davis Bacon Wage Rate Certificate of Compliance Submittal by Owner (Subrecipient) DB-0154).**

iv. **Contractor Payroll Requirements** - The Contractor is required to pay the prevailing wage rates on a weekly basis to laborers and mechanics in accordance with the requirements of 29 CFR 5.5, which are incorporated into the actual construction contract. Contractors/ Subcontractors must furnish weekly a statement with respect to the wages paid to each employee during the preceding week. They may use the Department of Labor (DOL) Payroll Form WH-347 and weekly Statement of Compliance on the reverse, or their own payroll form with all of the same data elements as the DOL Payroll Form WH-347, and the TWDB's form, Statement of Compliance Certification by Contractor for SRF, DB-0155. The DOL Payroll Form WH-347 can be found under the forms section of this document or at the following link: http://www.dol.gov/whd/programs/dbra/wh347.htm.

v. **Interviews -** The Owner must periodically interview a sufficient number of employees entitled to the Davis-Bacon prevailing wages to verify that Contractors or Subcontractors are paying the appropriate wage rates. All interviews must be conducted in confidence. The Owner must use Standard Form 1445 (SF 1445) found in the forms section of TWDB guidance document TWDB-0156 or equivalent documentation to memorialize the interviews. The Owner must establish and follow an interview schedule based on its assessment of the risks of noncompliance with Davis-Bacon posed by Contractors or Subcontractors and the duration of the contract or subcontract. The Owner must conduct more frequent interviews if the initial interviews or other information indicated that there is a risk that the Contractor or Subcontractor is not complying with Davis-Bacon. The Owner must immediately conduct interviews in response to an alleged violation of the prevailing wage requirements.

vi. **Payroll Records** - Certified payroll records are required to be retained by the Owner and Contractor for three years after completion of the construction project. The Owner must periodically conduct spot checks of a representative sample of weekly payroll data to verify that Contractors or Subcontractors are paying the appropriate wage rates.

vii. **Wage Rate Poster** – The Contractor must post the required Poster (WH-1321) and applicable wage rates at the construction site. The wage rate poster may be found at under the forms section of TWDB Guidance DB-0156 or at http://www.dol.gov/whd/programs/dbra/wh1321.htm.

viii. **Report Violations** – The Owner must immediately report violations of the Davis-Bacon prevailing wage requirements to the EPA Davis-Bacon Coordinator listed in the assistance agreement and to the appropriate DOL WHD Office listed at http://www.dol.gov/dol/contact/index.htm.

(b) Subcontracts

The Contractor will insert in full the required wage rate requirement in any subcontract in excess of $2,000 as specified in (a)(ii) of this section.

(c) Davis-Bacon General Wage Determinations

A "wage determination" is the listing of wage and fringe benefit for each classification of laborers and mechanics which the Administrator of the Wage and Hour Division of the U.S. DOL has determined to be prevailing in a given area for a construction. The Davis-Bacon Wage Determinations are classified by the nature of the construction projects performed, specifically listed as "schedules": residential, building, highway, and heavy construction. A brief outline of the definitions for each schedule is listed below.

- Construction Type: Heavy determination

  This determination includes those projects that are not properly classified as either "building," "highway," or "residential." Unlike these classifications, heavy construction is not a homogenous classification. Because of this catch-all nature, projects within the heavy classification may sometimes be distinguished on the basis of their particular project characteristics, and separate schedules may be issued for dredging projects, water and sewer line projects, dams, major bridges, and flood control projects.

- Construction Type: Highway determination
  This determination includes construction, alteration or repair of roads, streets, highways, runways, taxiways, alleys, trails, paths, parking areas, and other similar projects not incidental to building or heavy construction.

- Construction Type: Building determination
  This determination includes construction of sheltered enclosures with walk-in access for the purpose of housing persons, machinery, equipment or supplies; all construction of such structures; the installation of utilities and of equipment, both above and below grade levels; as well as incidental grading, utilities and paving. Such structures need not be "habitable" to be building construction. Also, the installation of heavy machinery and/or equipment does not generally change the project's character as a building.

- Construction Type: Residential
  This determination includes the construction, alteration or repair of single-family houses, apartment buildings of no more than four stories in height. This includes all incidental items such as site work, parking areas, utilities, streets, and sidewalks.

The Owner should review their Contractor's wage decisions and confirm they provide an adequate classification of the labor required for the specific construction contract. Most CWSRF and DWSRF projects will fall under the "Heavy" construction type, but Owners should ask their consulting Engineers if unsure. Some contracts or projects may require more than one general schedule to be included depending on the nature and extent of the work (i.e. a building is constructed in a water treatment facility). This is described in more detail in DOL's All Agency Memorandum 130 with Addendum 131. See the DOL's website http://www.dol.gov/whd/programs/dbra/memorand.htm. In such cases, the TWDB would designate the work to which each wage determination or part thereof applies per Federal Acquisition Regulations (FAR) 22.404-2 thru 404-3 https://www.acquisition.gov/browse/far/22?&searchTerms=Regulations+%28FAR%29+22.404-2+thru+404-3 Should overlaps occur in the wage classification schedules for the contract(s), the Owner may consider adopting the higher rate classification.

In all cases, the Owner is responsible to insure an adequate classification is provided to insure compliance with the law. Where a Contractor alerts the Owner that the classification is inadequate, the Owner should work with the Contractor and the DOL to address any valid concerns.

All questions regarding Davis-Bacon guidance can be directed to: U.S. Department of Labor Wage and Hour Division1-866-4USWAGE (1-866-487-9243), TTY: 1-877-889-5627, Monday-Friday 8 a.m. to 8 p.m. Eastern Time.

If you require further information about Davis-Bacon and how to apply it to your project, please contact the Texas Water Development Board Project Team Manager for your region or Clay Schultz, Director, Regional Water Project Development, (512) 463-6277.

The Owner and Contractor may obtain additional information on the Davis-Bacon Wage Rates requirements in the TWDB's Guidance DB-0156 – *"Guidance on Davis-Bacon Wage Rate Requirements".*

11. Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment

Effective August 13, 2020, all recipients of CWSRF and DWSRF Equivalency funding, regardless of the date of the TWDB commitment, closing date, or Intended Use Plan, must comply with regulations at 2 CFR 200.216, ***Prohibition on certain telecommunication and video surveillance services or equipment***, implementing section 889 of Public Law 115-232.

The condition below must be included in all project construction contracts associated with equivalency assistance agreements. It must also be in any sub-contract that involves the purchase of telecommunications or video surveillance services or equipment.

Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment

This term and condition implements 2 CFR 200.216 and is effective for obligations and expenditures of EPA financial assistance funding on or after 8/13/2020.

As required by 2 CFR 200.216, EPA recipients and subrecipients, including borrowers under EPA funded revolving loan fund programs, are prohibited from obligating or expending loan or grant funds to procure or obtain; extend or renew a contract to procure or obtain; or enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that use covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

Recipients, subrecipients, and borrowers also may not use EPA funds to purchase:
a. For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).
b. Telecommunications or video surveillance services provided by such entities or using such equipment.
c. Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

Consistent with 2 CFR 200.471, costs incurred for telecommunications and video surveillance services or equipment such as phones, internet, video surveillance, and cloud servers are allowable except for the following circumstances:
a. Obligating or expending EPA funds for covered telecommunications and video surveillance services or equipment or services as described in 2 CFR 200.216 to:
(1) Procure or obtain, extend or renew a contract to procure or obtain;
(2) Enter into a contract (or extend or renew a contract) to procure; or
(3) Obtain the equipment, services, or systems.

Certain prohibited equipment, systems, or services, including equipment, systems, or services produced or provided by entities identified in section 889, are recorded in the System for Award Management (https://sam.gov/content/home) exclusion list.

Additional details:

Neither TWDB nor EPA have an exhaustive list of components and services that fall under the prohibition. EPA recommends recipients be mindful of automatic meter reading (AMR) technology and advanced metering infrastructure (AMI), instrumentation control systems (e.g., process control systems, distributed control systems and programmable logic controls), and security cameras and other electronic security measures to ensure that those items are procured from a non-excluded entity. Items included in the prohibition are not eligible SRF costs and the TWDB SRF programs cannot reimburse recipients for these costs.

Option 1 – Applies to Governmental Entities (such as Cities and Districts)

1. Applicability of the Davis-Bacon (DB) prevailing wage requirements.

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 the Clean Water State Revolving Fund and to any construction project carried out in whole or in part by assistance made available by the Drinking Water State Revolving Fund. If an Owner encounters a unique situation at a site that presents uncertainties regarding DB applicability, the Owner must discuss the situation with the TWDB before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Owners 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 Owner shall monitor www.wdol.gov weekly to ensure that the wage determination contained in the solicitation remains current. The recipients 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 Owners may request a finding from the TWDB that there is not a reasonable time to notify interested Contractors of the modification of the wage determination. The TWDB will provide a report of its findings to the Owner.

(ii) If the Owner 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 TWDB, at the request of the Owner, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The Owner 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 Owner 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 Owner shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument.

(c) Owners 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 an Owner's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the Owner 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 Owner 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 Owner's Contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

(a) The Owner(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 29 CFR 5.1, the Water Resources Reform and Development Act of 2014 for a CWSRF-funded project or the Consolidated Appropriations Act, 2016 (or subsequent federal law) for a DWSRF-funded project, 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 29 CFR 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.

Owners may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

(ii)(A) The Owner(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 TWDB 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 Owner(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 Owner (s) to the TWDB.
The TWDB 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 TWDB or will notify the TWDB 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 Owner(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the TWDB shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the TWDB, 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 Owner(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 EPA 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 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 Owner, that is, the entity that receives the funds from the TWDB. Such documentation shall be available on request of the TWDB or EPA. As to each payroll copy received, the Owner shall provide written confirmation in a form satisfactory to the TWDB indicating whether 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 http://www.dol.gov/whd/forms/wh347instr.htm 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 Owner(s) for transmission to the TWDB or EPA if requested by EPA, the TWDB, 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 Owner(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 TWDB, 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 EPA or TWDB 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 as 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 Owner(s), TWDB, 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 Owner 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 Owner**,** 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 (a)(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 Owner 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 Owner shall insert in any such contract a clause providing that

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 EPA, TWDB, 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 Owner 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 Owner must use Standard Form 1445 (SF 1445) found in the forms section of TWDB guidance document TWDB-0156 or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are also available from EPA on request.

(b) The Owner 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. Owners must conduct more frequent interviews if the initial interviews or other information indicated that there is a risk that the Contractor or Subcontractor is not complying with DB.
Owners shall immediately conduct interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence."

(c) The Owner 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 Owner 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 Owner 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. Owners 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 Owner shall verify evidence of fringe benefit plans and payments there under by Contractors and Subcontractors who claim credit for fringe benefit contributions.

(d) The Owner shall periodically review Contractors and Subcontractor's 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) Owners must immediately report potential violations of the DB prevailing wage requirements to the EPA Region 6 DB Coordinator, TWDB, and to the appropriate DOL Wage and Hour District Office listed at http://www.dol.gov/whd/america2.htm.

Option 2 – Applies to Non-Governmental Entities (such as Water Supply Corporations and Private Companies)

1. Applicability of the Davis-Bacon (DB) prevailing wage requirements.

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 the CWSRF and to any construction project carried out in whole or in part by assistance made available by the DWSRF. If an Owner encounters a unique situation at a site that presents uncertainties regarding DB applicability, the Owner must discuss the situation with the TWDB before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Owners must obtain proposed wage determinations for specific localities at www.wdol.gov. After the Owner obtains its proposed wage determination, it must submit the wage determination to the TWDB for approval prior to inserting the wage determination into a solicitation, contract or issuing task orders, work assignments or similar instruments to existing Contractors (ordering instruments unless subsequently directed otherwise by the TWDB.)

(b) Owners 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 Owner shall monitor www.wdol.gov on a weekly basis to ensure that the wage determination contained in the solicitation remains current. The recipients 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 Owners may request a finding from the TWDB that there is not a reasonable time to notify interested Contractors of the modification of the wage determination. The TWDB will provide a report of its findings to the Owner.

(ii) If the Owner 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 TWDB, at the request of the Owner, obtains an extension of the 90-day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The Owner 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.

(c) If the Owner 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 Owner shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument.

(d) Owners 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.

(e) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to an Owner's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the Owner 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 Owner 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 Owner's Contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

(a) The Owner(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 29 CFR 5.1, the Water Resources Reform and Development Act of 2014 for a CWSRF-funded project or the Consolidated Appropriations Act, 2016 (or subsequent federal law) for a DWSRF-funded project, 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 29 CFR 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.

Owners may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

(ii)(A) The Owner(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 TWDB 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 Owner(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 Owner(s) to the TWDB. The TWDB 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 TWDB or will notify the TWDB 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 Owner(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the TWDB shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the TWDB, 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 Owner(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 EPA 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 Owner, that is, the entity that receives the funds from the TWDB. Such documentation shall be available on request of the TWDB or EPA. As to each payroll copy received, the Owner shall provide written confirmation in a form satisfactory to the TWDB 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 http://www.dol.gov/whd/forms/wh347instr.htm 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 Owner(s) for transmission to the TWDB or EPA if requested by EPA, the TWDB, 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 Owner(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 TWDB, 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 EPA or TWDB 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 Owner(s), TWDB, 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 Owner 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 Owner shall upon the request of the EPA Award Official or an authorized representative of the Department of Labor, 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 (a)(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 Owner 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 Owner shall insert in any such contract a clause providing that 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 EPA, TWDB, 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 Owner 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 Owner must use Standard Form 1445 (SF 1445) found in the forms section of TWDB guidance document TWDB-0156 or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are also available from EPA on request.

(b) The Owner 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. Owners must conduct more frequent interviews if the initial interviews or other information indicated that there is a risk that the Contractor or Subcontractor is not complying with DB. Owners shall immediately conduct interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence."

(c) The Owner 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 Owner 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 Owner 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. Owners 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 Owner shall verify evidence of fringe benefit plans and payments there under by Contractors and Subcontractors who claim credit for fringe benefit contributions.

(d) The Owner shall periodically review Contractors and Subcontractor's 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) Owners must immediately report potential violations of the DB prevailing wage requirements to the EPA Region 6 DB Coordinator, TWDB, and to the appropriate DOL Wage and Hour District Office listed at http://www.dol.gov/whd/america2.htm.

11. Payments

(a) Progress Payments:

i. The Contractor shall prepare their requisition for progress payment as of the last day of the payment month and submit it, with the required number of copies, to the Engineer for review. Except as provided in paragraph (iii) of this subsection, the amount of the payment due to the Contractor shall be determined by adding to the total value of work completed to date, the value of materials properly stored on the site and deducting (1) five percent (5%) minimum of the total amount, as a retainage and (2) the amount of all previous payments. The total value of work completed to date shall be based on the actual or estimated quantities of work completed and on the

unit prices contained in the agreement (or cost breakdown approved pursuant to section 7.b relating to lump sum bids) and adjusted by approved change orders. The value of materials properly stored on the site shall be based upon the estimated quantities of such materials and the invoices prices.
Copies of all invoices shall be available for inspection by the Engineer.

ii. The Contractor shall be responsible for the care and protection of all materials and work upon which payments have been made until final acceptance of such work and materials by the Owner. Such payments shall not constitute a waiver of the right of the Owner to require the fulfillment of all terms of the contract and the delivery of all improvements embraced in the contract complete and satisfactory to the Owner in all details.

iii. This clause applies to contracts when the Owner is a District or Authority. The retainage shall be ten (10%) percent minimum of the amount otherwise due until at least fifty (50%) of the work has been completed. After the project is fifty (50%) percent completed, and if the District or Authority's Board finds that satisfactory progress is being made, then the District may authorize any of the remaining progress payments to be made in full. The District is not obligated to pay interest earned on the first 50% of work completed (Texas Water Code Sec. 49.276(d)).

iv. The five (5%) percent retainage of the progress payments due to the Contractor may not be reduced until the building of the project is substantially complete and a reduction in the retainage has been authorized by the TWDB.

(b) Withholding Payments. The Owner may withhold from any payment otherwise due to the Contractor so much as may be necessary to protect the Owner and if so elects may also withhold any amounts due from the Contractor to any Subcontractors or material dealers for work performed or material furnished by them. The foregoing provisions shall be construed solely for the benefit of the Owner and will not require the Owner to determine or adjust any claims or disputes between the Contractor and his Subcontractors or material dealers, or to withhold any monies for their protection unless the Owner elects to do so.

The failure or refusal of the Owner to withhold any monies from the Contractor shall in no way impair the obligations of any surety or sureties under any bond or bonds furnished under this contract.

(c) Payments Subject to Submission of Certificates. Each payment to the Contractor by the Owner shall be made subject to submission by the Contractor of all written certifications required of him and his Subcontractors by general and special conditions pertaining to this contract.

(d) Final Payment.

i. Upon satisfactory completion of the work performed under this contract,

as a condition before final payment under this contract or as a termination settlement under this contract the Contractor shall execute and deliver to the Owner a release of all claims against the Owner arising under, or by virtue of, this contract, except claims which are specifically exempted by the Contractor to be set forth therein. Unless otherwise provided in this contract, by State law or otherwise expressly agreed to by the parties to this contract, final payment under this contract or settlement upon termination of this contract shall not constitute a waiver of the Owner's claims against the Contractor or his sureties under this contract or applicable performance and payment bonds.

ii. After final inspection and acceptance by the Owner of all work under the contract, the Contractor shall prepare their requisition for final payment which shall be based upon the carefully measured or computed quantity of each item of work at the applicable unit prices stipulated in the Agreement or cost breakdown (if lump sum), as adjusted by approved change orders. The total amount of the final payment due the Contractor under this contract shall be the amount computed as described above less all previous payments.

iii. The retainage and its interest earnings, if any, shall not be paid to the Contractor until the TWDB has authorized a reduction in, or release of, retainage on the contract work.

iv. Withholding of any amount due to the Owner, under general and/or special conditions regarding "Liquidated Damages," shall be deducted from the final payment due the Contractor.

12. Equal employment opportunity and affirmative action

This provision applies to Clean Water State Revolving Fund Program and Drinking Water State Revolving Fund projects where the contract agreement is for more than $10,000.

During the performance of this contract, the Contractor agrees as follows:

(1) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex (including pregnancy), sexual orientation, gender identity, national origin, age (40 or older), disability, or genetic information. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for

training, including apprenticeship.

The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

(2) The Contractor will, in all solicitations or advancements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.

(3) The Contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the Contractor's legal duty to furnish information.

(4) The Contractor will send to each labor union or representative of workers with which the Contractor has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the Contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(5) The Contractor will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(6) The Contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(7) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of Sept. 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(8) The Contractor will include the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each Subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a Subcontractor or vendor as a result of such direction, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the notice which contains the applicable goals set for minority and female participation and which is set forth in the solicitations from which this contract resulted.

13. Debarment and Suspension

This provision applies only to Clean Water State Revolving Fund Equivalency Program projects and Drinking Water State Revolving Fund projects. This contract is subject to the Title 40 Code of Federal Regulations Part 32 concerning Debarment and Suspension. The Contractor will comply with the assurances provided with the bid that led to this contract.

Instructions for Certification

(a) By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.

(b) The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

(c) The prospective lower tier participant shall provide immediate written notice to the person to whom this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or had become erroneous by reason of changed circumstances.

(d) The terms covered transaction, debarred, suspended, ineligible, lower tier covered transaction, participant, person, primary covered transaction, principal, proposal, and voluntarily excluded, as used in this clause, have the meaning set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.

(e) The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is proposed for debarment under 48

CFR part 9, subpart 9.4, debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

(f) The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

(g) A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not proposed for debarment under 48 CFR part 9, subpart 9.4, debarred, suspended, ineligible, or voluntarily excluded from covered transactions, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the List of Parties Excluded from Federal Procurement and Non-procurement Programs.

(h) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(i) Except for transactions authorized under paragraph (e) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is proposed for debarment under 48 CFR part 9, subpart 9.4, suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Covered Transactions.

(1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

14. Disadvantaged Business Enterprises

The Texas Water Development Board's (TWDB) Clean Water and Drinking Water State Revolving Fund programs receive federal funds from the U. S. Environmental Protection Agency (EPA). As a condition of federal grant awards, EPA regulations require that loan recipients make a "good faith effort" to award a fair share of work to DBE's who are Minority Business Enterprises (MBE's), and Women-owned Business Enterprises (WBE's) whenever procuring construction, supplies, services and equipment.

The current fair share goals for the State of Texas are as follows:

Category	MBE	WBE
Construction	19.44%	9.17%
Equipment	16.28%	11.45%
Services	20.41%	13.66%
Supplies	25.34%	8.82%

After loan commitment, but prior to closing, Owners (Applicants) must provide forms TWDB-0216 and TWDB-0373. The project's Prime Engineer, Financial Advisor, and Bond Counsel must complete a TWDB-0217 form and indicate if any subcontracting opportunities will be available or if the Contractor will be self-performing the contract. Regardless of the procurement's outcome, all entities must submit a TWDB-0373 and list the Contractors selected by the Owner for the project. Failure to include a Contractor and contract amount will result in denial of payment until the proper documentation has been reviewed and approved.

For each construction contract, Owners are required to submit a TWDB-0216 and TWDB-0373 for the procurement of the project's Prime Contractor. If the Prime Contractor is utilizing Subcontractors for the project, then additional TWDB-0216 and TWDB-0373 forms will be required for submittal prior to request for payment.

The following forms are required for each contract:

Form	Prime Contractor	Submit Form To
TWDB-0216	Required	TWDB
TWDB-0217	Required	TWDB
TWDB-0373	Required	TWDB

(a) The Contractor shall, if awarding sub-agreements, to the extent appropriate for the goals listed in the instructions to bidders make a good faith effort to award a fair share of work to DBE's who are Minority Business Enterprises (MBE's) and Women-owned Business Enterprises (WBE's) as sources of supplies, construction, equipment and services by taking the following steps:

i. Ensure DBEs are made aware of contracting opportunities by including qualified small, minority, and women's businesses on solicitation lists;

ii. Assuring that small, minority, and women's businesses are solicited whenever they are potential sources;

iii. Dividing total requirements, when economically feasible, into small tasks or quantities to permit maximum participation of small, minority, and women's businesses;

iv. Establishing delivery schedules, where the requirements of the work permit, which will encourage participation by small, minority, and women's businesses; and

v. Using the services and assistance of the Small Business Administration, Minority Business Development Agency of the U.S. Department of Commerce, and Texas Marketplace, as appropriate.

15. Archeological Discoveries and Cultural Resources

No activity which may affect properties listed or properties eligible for listing in the National Register of Historic Places or eligible for designation as a State Archeological Landmark is authorized until the Owner has complied with the provisions of the National Historic Preservation Act and the Antiquities Code of Texas.

The Owner has previously coordinated with the appropriate agencies and impacts to known cultural or archeological deposits have been avoided or mitigated. However, the Contractor may encounter unanticipated cultural or archeological deposits during construction.

If archeological sites or historic structures which may qualify for designation as a State Archeological Landmark according to the criteria in 13 TAC Chapter 26, or that may be eligible for listing on the National Register of Historic Places in accordance with 36 CFR Part 800, are discovered after construction operations are begun, the Contractor shall immediately cease operations in that particular area and notify the Owner, the TWDB, and the Texas Historical Commission, 1511 N. Colorado St., P.O. Box 12276, Capitol Station, Austin, Texas 78711-2276. The Contractor shall take reasonable steps to protect and preserve the discoveries until they have been inspected by the Owner's representative and the TWDB. The Owner will promptly coordinate with the State Historic Preservation Officer and any other appropriate agencies to obtain any necessary approvals or permits to enable the work to continue. The Contractor shall not resume work in the discovery until authorized to do so by the Owner.

16. Endangered Species

No activity is authorized that is likely to jeopardize the continued existence of a threatened or endangered species as listed or proposed for listing under the Federal Endangered Species Act (ESA), and/or the State of Texas Parks and Wildlife Code on Endangered Species, or to destroy or adversely modify the habitat of such species.

If a threatened or endangered species is encountered during construction, the Contractor shall immediately cease work in the area of the encounter and notify the Owner, who will immediately implement actions in accordance with the ESA and applicable State statutes. These actions shall include reporting the encounter to the TWDB, the U. S. Fish and Wildlife Service, and the Texas Parks and Wildlife Department, obtaining any necessary approvals or permits to enable the work to continue, or implement other mitigation actions. The Contractor shall not resume construction in the area of the encounter until authorized to do so by the Owner.

17. Hazardous Materials

Materials utilized in the project shall be free of any hazardous materials, except as may be specifically provided for in the specifications.

If the Contractor encounters existing material on sites owned or controlled by the Owner or in material sources that are suspected by visual observation or smell to contain hazardous materials, the Contractor shall immediately notify the Engineer and the Owner.
The Owner will be responsible for the testing and removal or disposal of hazardous materials on sites owned or controlled by the Owner. The Owner may suspend the work, wholly or in part during the testing, removal or disposal of hazardous materials on sites owned or controlled by the Owner.

18. Project Signage

The Owner must implement one of the signage options below as described in TWDB Guidance TWDB-1109:

- Online signage placed on community website or social media outlet;
- Press release;
- Posters or wall signage in a public building or location;
- Newspaper or periodical advertisement for project construction, groundbreaking ceremony, or operation of the new or improved facility; or
- Standard on-site signage erected in a prominent location at the construction project site or along a major thoroughfare within the community as directed by the Owner.

If a recipient decides on a public or media event to publicize the accomplishment of significant events related to construction of the project, the U.S Environmental Protection Administration, Region 6, must be provided with at least a ten working day notice of the event and provided the opportunity to attend and participate. Please contact Associate Director Claudia Hosch, who can be reached at (214) 665-6464 or Hosch.Claudia@epa.gov.

19. Changes

*Provisions identified with an asterisk below are consistent with Local Government Code 271.060. Counties and Municipalities may modify the identified provisions, when applicable, to conform to Local Government Code 262.031 (Counties) or 252.048 (Municipalities).

(a) The Owner may at any time, without notice to any surety, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including but not limited to changes:
   i. In the specifications (including drawings and designs);
   ii. In the time, method or manner of performance of the work;
   iii. To decrease or increase the quantity of work to be performed or materials, equipment or supplies to be furnished;

(b) *The total price of a contract may not be increased by a change order unless provision has been made for the payment of the added cost by the appropriation of current funds or bond funds for that purpose, by the authorization of the issuance of certificates, or by a combination of those procedures.

(c) *A contract with an original contract price of $1 million or more may not be increased by more than 25 percent. If a change order for a contract with an original contract price of less than $1 million increases the contract amount to $1 million or more, subsequent change orders may not increase the revised contract amount by more than 25 percent.

(d) *A governing body may grant authority to an official or employee responsible for purchasing or for administering a contract to approve a change order that involves an increase or decrease of $50,000 or less.

(e) Changes that involve an increase in price will be supported by documentation of the cost components. For projects funded through the EDAP program, or with grant proceeds, TWDB staff may request this information to be provided in a format equivalent to the Cost and Pricing Information form (No. WRD-277).

(f) Any change orders involving a change in the project requiring a relocation of project components, sizing, or process may require additional environmental approval. A map and description of the proposed changes should be sent to the TWDB Environmental Reviewer for coordination and approval as soon as possible to avoid any delay.

20. Operation and Maintenance Manuals and Training

(a) The Contractor shall obtain installation, operation, and maintenance manuals from manufacturers and suppliers for equipment furnished under the contract. The Contractor shall submit three copies of each complete manual to the Engineer within 90 days after approval of shop drawings, product data, and samples, and not later than the date of shipment of each item of equipment to the project site or storage location.

(b) The Owner shall require the Engineer to promptly review each manual submitted, noting necessary corrections and revisions. If the Engineer rejects the manual, the Contractor shall correct and resubmit the manual until it is acceptable to the Engineer as being in conformance with the design concept of the project and for compliance with information given in the Contract Documents. Owner may assess the Contractor a charge for reviews of the same items in excess of three (3) times. Such procedure shall not be considered cause for delay.

(c) Acceptance of manuals by Engineer does not relieve the Contractor of any requirements of terms of Contract.

(d) The Contractor shall provide the services of trained, qualified technicians to check final equipment installation, to assist as required in placing same in operation, and to instruct operating personnel in the proper manner of performing routine operation and maintenance of the equipment.

(e) Operations and maintenance manuals specified hereinafter are in addition to any operation, maintenance, or installation instructions required by the Contractor to install, test, and start-up the equipment. Each manual is to be bound in a folder and labeled to identify the contents and project to which it applies. The manual shall contain the following applicable items:

i. A listing of the manufacturer's identification, including order number, model, serial number, and location of parts and service centers.
ii. A list of recommended stock of parts, including part number and quantity.
iii. Complete replacement parts list.
iv. Performance data and rating tables.
v. Specific instructions for installation, operation, adjustment, and maintenance.
vi. Exploded view drawings for major equipment items.

vii. Lubrication requirements.
viii. Complete equipment wiring diagrams and control schematics with terminal identification.

21. As-Built Dimensions and Drawings

(a) Contractor shall make appropriate daily measurements of facilities constructed and keep accurate records of location (horizontal and vertical) of all facilities.

(b) Upon completion of each facility, the Contractor shall furnish the Owner with one set of direct prints, marked with red pencil, to show as-built dimensions and locations of all work constructed. As a minimum, the final drawings shall include the following:

i. Horizontal and vertical locations of work.
ii. Changes in equipment and dimensions due to substitutions.
iii. "Nameplate" data on all installed equipment.
iv. Deletions, additions, and changes to scope of work.
v. Any other changes made.

22. Close-Out Procedures

To close-out the contract and release final retainage, the following steps must be completed:

(a) TWDB Staff must conduct a construction contract final inspection (CCFI);
(b) The following submittals must be received, reviewed, and accepted by the TWDB:
i. The final change order, adjustment of quantities, or a statement that all change orders have previously been submitted and there will be no more change orders;
ii. The final pay request from the Contractor;
iii. An affidavit by the Contractor that all bills have been paid;
iv. Certification by the consulting Engineer that the work has been completed and was constructed in accordance with the approved plans and specifications and sound engineering principals and construction practices;
v. Acceptance of the project by the Owner in the form of a written resolution or other formal action;
vi. Notification of the beginning date of the warranty period for the contract; and
vii. Confirmation that the Owner has received the as-built drawings from the Contractor.
(c) TWDB will issue a Certificate of Approval allowing the release of retainage.

23. Additional Forms and Information

The following forms and guidance documents, mentioned throughout this Guidance, are available on the TWDB site at: http://www.twdb.texas.gov/financial/instructions/index.asp

Forms:

Contractor's Act of Assurance (ED-103)
Contractor's Resolution on Authorized Representative (ED-104)
Debarment / Suspension Certification (SRF-404)
Bidder's Certifications- EEO (WRD – 255)

DBE Affirmative Steps solicitation Report (TWDB 0216)
DBE Prime Contractor Affirmative Steps Certification & Goals (TWDB 0217)
DBE Loan/Grant Participation Summary (TWDB 0373)
Monthly American Iron and Steel Certificate (TWDB-1106-A)
American Iron and Steel (AIS) De Minimis Log (TWDB-1106-B)

Monthly Davis Bacon Wage Rate Certificate of Compliance Submittal by Owner (Sub-Recipient) (DB-0154)

Guidance Documents:

TWDB-0210 Disadvantaged Business Enterprise Guidance
Requirements for American Iron and Steel (AIS) Guidance (TWDB-1106)
Guidance on Davis-Bacon Wage Rate Requirements for State Revolving Fund Projects (DB-0156)

Monthly Davis-Bacon Wage Rate Certificate of Compliance Submittal by Owner (Subrecipient)

TWDB Project No. _____

Loan No. _____

This executed certificate must be submitted with each Outlay report for labor included within construction contracts. This Certificate applies only for Financial Assistance CLOSED AFTER 10/30/2009.

I , _____, _____ of
(Name) **(Title)**
_____ hereby certify that periodic reviews of a
(Name of entity)
representative sample of the weekly payroll data, and contractor weekly payroll certifications, such as OMB No. 1235-0008, have been performed to verify that contractors and subcontractors are paying the appropriate wage rate for compliance with section 513 of the Federal Water Pollution Control Act (33 U.S.C. §1372) for the Clean Water State Revolving Fund or with section 1452(a)(5) of the Safe Drinking Water Act (42 U.S.C. §300j-12(a)(5)) for the Drinking Water State Revolving Fund. These laws require payment of prevailing wages in accordance with 40 U.S.C. §§ 3141–3144, 3146, and 3147 (contained within the Davis-Bacon Act, as amended).

I understand that a false statement herein may subject me to penalties under federal and state laws relating to filing false statements and other relevant statutes.

_____ _____
Signature **Date**

ED-103
Reviewed 09/26/2016

CONTRACTOR'S ACT OF ASSURANCE

STATE OF TEXAS §
§
COUNTY OF Bell §

BEFORE ME Mary K. Richter, a Notary Public duly commissioned and qualified in and for the County of Bell in the State of Texas came and appeared Bruce A. Matous, as represented by Matous Construction, Ltd., the ~~Corporation's~~ Partnership's Corporate General Partner's CEO, who declares he/she is authorized to represent Bruce A. Matous pursuant to provisions of a resolution adopted by said Corporation on the 19th day of June, 2023 (a duly certified copy of such resolution is attached to and is hereby made a part of this document).

Matous Construction, Ltd., as the representative of, Bruce A. Matous declares that Bruce A. Matous assures the Texas Water Development Board that it will construct Stillhouse Branch Wastewater Treatment Facility Improvements project at City of Gatesville, Texas, in accordance with sound construction practice, all laws of the State of Texas, and the rules of the Texas Water Development Board.

GIVEN UNDER MY HAND and seal of office this 19th day of June, 2023.

Mary K Richter (Notary Public in and for the State of Texas)

Mary K. Richter (Print Name)

NOTARY PUBLIC STATE OF TEXAS
MARY KATHERINE RICHTER
MY COMMISSION EXPIRES
11/23/2026
NOTARY ID: 134078022

[SEAL]

ED-104
10/06/2016

CONTRACTOR'S ACT OF ASSURANCE RESOLUTION

I hereby certify that it was RESOLVED by a quorum of the directors of the Matous Construction Co. Inc. (Name of Corporation), meeting on the 19th day of June 2023, that:

Authorized Representative(s):

Bruce A. Matous

be, and hereby is/are authorized to act on behalf of Matous Construction Co. Inc. (Name of Corporation), as its representative in all business transactions conducted in the State of Texas, and;

That all above resolution was unanimously ratified by the Board of Directors at said meeting and that the resolution has not been rescinded or amended and is now in full forces and effect; and;

In authentication of the adoption of this resolution, I subscribe my name and affix the seal of the Corporation this 19th day of June, 2023.

Jessica Bezon (Secretary)

[SEAL]

SRF-404
4/16/2015

Debarment / Suspension Certification

I, Bruce A. Matous, hereby certify that I have checked on the federal
(Authorized Representative of Recipient)

System for Award Management (www.sam.gov) website and determined that
Matous Construction, Ltd. is not shown as an "excluded party" that is debarred,
(Name of entity)

suspended or otherwise excluded from or ineligible for participation in federal assistance programs under Executive Order 12549. (See 2 CFR Part 180 and 2 CFR Part 1532 for additional information on the federal governmentwide debarment and suspension system for nonprocurement programs and activities.)

I understand that a false statement herein may subject me to penalties under federal and state laws relating to filing false statements and other relevant statutes.

BAM

Signature

6/20/23

Date

CEO of General Partner

Title

City of Gatesville Public Works Dept

Name of Recipient

Verifying prime contractors and subcontractors for construction, equipment, supplies and services: Using the www.sam.gov website, the recipient must verify prior to awarding the contract that the prime contractor is not listed as an "excluded party" that is debarred, suspended or otherwise excluded from or ineligible. Once any subcontractors are known, they also must be verified as not listed as an "excluded party" prior to award of a subcontract. The recipient must print a dated record of the verification from the www.sam.gov website and retain a copy that is available for review by TWDB. The prime contractors and subcontractors must be verified prior to the contract award or the costs may be disallowed.

FOR OFFICE USE ONLY
Commitment #_____

TWDB-0216
TEXAS WATER DEVELOPMENT BOARD
AFFIRMATIVE STEPS SOLICITATION REPORT

I. PROJECT INFORMATION

TWDB Project Number	Applicant/Entity Name	Total TWDB Funding Request	Program Type (insert "X" for all that apply)
73776	City of Gatesville		☐ Drinking Water SRF (DWSRF) ☑ Clean Water SRF (CWSRF)

Project Name: Stillhouse Branch Wastewater Treatment Facility Improvements

Solicitation By: ☐ Applicant/Entity OR ☑ Prime Contracted Business: Matous Construction, Ltd.

Project Phase: ☐ Prior to Closing ☐ Release of funding for PADs ☐ Construction Contract #_____

II. SOLICITATION METHOD(S) UTILIZED

At least two methods of solicitation are required. Select the method(s) utilized for the solicitation. Copies of the actual postings, direct contact email/phone log, etc. must be attached to this form as support documentation for each method used. Failure to adequately follow these steps will result in the requirement to complete additional steps in order to become compliant.

☑ Newspaper Advertisements ☐ Meetings or Conferences ☐ Trade Association Publications

☑ Minority Media ☑ Internet & Web Postings ☐ Other Government Publications

☑ Direct Contact by Phone, Fax, USPS Mail, or Email*

If using direct contact, entities must solicit to a **minimum of 3 businesses/firms (at least one being a DBE) for each category of contract sought (i.e., construction, supplies, equipment, or services) to demonstrate a Good Faith Effort.*

III. PROJECT BIDDERS LIST:

List on the following table, or provide on a separate list, each business entity directly solicited for procurement or that submitted a bid for consideration.

Instructions for Columns 1 - 4	1 - Full business name (line one) & point of contact (line two) 2 - Business address 3 - Telephone number 4 - Email address for the business
Instructions for Column 5	Enter one of the following procurement or contract categories: **CONSTRUCTION – SUPPLIES – EQUIPMENT – SERVICES** *For detailed definitions, review guidance document, TWDB-0210.*
Instructions for Column 6	Enter the type of business: **MBE** - Minority Business Enterprise, **WBE** - Women-owned Business Enterprise, or **OTHER** - Company or firm is Non-MBE or WBE

Notice: Entities receiving State Revolving Fund financial assistance must create and maintain a Bidders List if the entity is subject to, or chooses to follow, competitive bidding. The Bidders List must include all firms that bid or quoted on contracts under EPA assisted projects, including both MBE/WBEs and non-MBE/WBEs. Entities must keep all Bidders Lists until project completion or the recipient is no longer receiving EPA funding under the loan, whichever is later. Entities with loans totaling less than $250,000 during a state fiscal year are exempt from the Bidders List requirement, but must still meet DBE program requirements. The Bidders List requirement also applies to all Prime Contracted Businesses/Firms that make subcontracting.

TWDB-0216
Revised 11/13/2017

	Column 1 Business Name & Point of Contact	Column 2 Business Address	Column 3 Telephone Number	Column 4 E-Mail Address	Column 5 Procurement Category	Column 6 MBE/WBE Status
1.	T. Morales Company Tina Eldridge	401 TX-130 Georgetown, TX 78626	254-793-4344	teldridge@moralescompany.com	Services	Other
2.	Stephanie Braun Clayton LLC Stephanie Braun Clayton	812 West Gibson St Austin, TX 78704		stephaniebraunclayton@gmail.com	Services	WBE
3.	Alpha Painting Cliff Rosenbaum	904 Tradesmens Park Loop Hutto, TX 78634	512-759-2456	crosenbaum@alphapaintingtx.com	Services	Other
4.	Penhall Doc Barron	4201 Felter Ln Austin, TX 78744	512-385-8500	dbarron@penhall.com	Services	Other
5.	Zye Industrial Zachary Eldridge	401 SH 130 Georgetown, TX 78626		zeldridge@zyeindustrial.com	Services	MBE
6.	Hartwell Environmental Kent Guilbeau	22115 Hufsmith Kohrville Rd Tomball, TX 77375	281-351-8501	kguilbeau@hartwellenv.com	Supplies	Other
7.	HRM Environmental Miguel Vera	3118 Media Dr Cedar Park, TX 78641	512-565-1681	mvera@hrmenv.com	Supplies	Other
8.	Ferguson Waterworks Tom Ellis	200 Park Central Blvd Georgetown, TX 78626	512-930-2262	tom.ellis@ferguson.com	Supplies	Other
9.	KLP Nathali Parker	18013 Vorwerk Rd Manor, TX 78653	866-629-3627	np@klpsupply.com	Supplies	WBE

Use additional sheets if necessary

Signature – Authorized Representative	Title (print legibly)	Date
	LED OF GENERAL PARTNER	6/20/2?

IV. TWDB APPROVAL SIGNATURE

Signature indicates the form meets DBE requirements.

DBE Coordinator	Approval Date

TWDB-0216
Revised 11/13/2017

	Column 1 Business Name & Point of Contact	Column 2 Business Address	Column 3 Telephone Number	Column 4 E-Mail Address	Column 5 Procurement Category	Column 6 MBE/WBE Status
1.	Pump Solutions Cole Green	806 Tradesmens Park Loop Hutto, TX 78634	512-846-2600	cole@pumpsolutions.com	Supplies	Other
2.	D+G Quality Roofing Mike Kowalski	4305 E FM 1187, #100 Burleson, TX 76028	713-724-2480	mike@dgqroofing.com	Services	WBE
3.						
4.						
5.						
6.						
7.						
8.						
9.						

Use additional sheets if necessary

Signature – Authorized Representative	Title (print legibly)	Date
	CEO OF GENERAL PARTNER	6/20/23

IV. TWDB APPROVAL SIGNATURE

Signature indicates the form meets DBE requirements.

DBE Coordinator	Approval Date

FOR OFFICE USE ONLY: Commitment #	TWDB-0217 Revised 08/14/2018

TWDB-0217
TEXAS WATER DEVELOPMENT BOARD (TWDB)
PRIME CONSULTANT/CONTRACTOR CERTIFICATION

I. PROJECT INFORMATION

TWDB Project Number	Applicant/Entity Name	Total of TWDB Funding	Program Type (insert "X" for all that apply)	
73776	City of Gatesville		☐	Drinking Water SRF (DWSRF)
			☑	Clean Water SRF (CWSRF)

Prime Consultant/Contractor: Matous Construction, Ltd.

Contract Number: _____ **Contract Amount:** _____

II. GOOD FAITH EFFORT (Applicable to all subcontracts awarded by the prime contractor/consultant)

I understand that it is my responsibility to comply with all state and federal regulations and guidance in the utilization of Minority and Women-owned Businesses in procurement. I certify that I will make a "good faith effort" to afford opportunities for Minority Business Enterprise (MBE), and Women-owned Business Enterprise (WBE) by:

1.	Including qualified MBEs and WBEs on procurement solicitation lists
2.	Soliciting potential MBEs and WBEs
3.	Reducing contract size/quantities when economically feasible to permit maximum participation by MBEs and WBEs
4.	Establishing delivery schedules to encourage participation by MBEs and WBEs
5.	Using the services and assistance of the Small Business Administration, Minority Business Development Agency, U.S. Department of Commerce, and Texas Marketplace
6.	Submitting documentation to the Applicant/Entity to verify good faith effort, steps 1-5.
☐	**EXCEPTION**: As the Prime Consultant/Contractor, I certify that I have reviewed the contract requirements and found no available subcontracting opportunities. I also certify that I will fulfill 100 percent of the contract requirements with my own employees and resources. (Check if applicable)

Signature – Prime Consultant/Contractor	Title (print legibly)	Certification Date
BMV	CEO OF GENERAL PARTNER	6/20/23

III. PROJECT PARTICIPATION ESTIMATES

The Cost Categories mentioned below are goals. These goals are neither standards nor quotas. Recipients of financial assistance are not required to meet the fair share objectives. They must, however, acknowledge that they are aware of and are actively pursuing the fair share objectives with their procurements.

	Potential **MBE** Participation	Potential **WBE** Participation
Cost Category	**Goal**	**Goal**
Construction	19.44%	9.17%
Supplies	25.34%	8.82%
Equipment	16.28%	11.45%
Services	20.41%	13.66%

The fair share goals listed above are required by 40 CFR Part 33 Subpart D and are directly negotiated with EPA Region 6. Entities receiving federal financial assistance are subject to the TWDB's goals and may not be substituted with other agency or program goals.

IV. TWDB APPROVAL SIGNATURE

Signature indicates the form meets DBE Requirements.

DBE Coordinator	Approval Date

FOR OFFICE USE ONLY
Commitment #_____

TWDB-0373
TEXAS WATER DEVELOPMENT BOARD
PARTICIPATION SUMMARY

I. PROJECT INFORMATION

TWDB Project Number	Applicant/Entity Name	Total TWDB Funding Request	Program Type (insert "X" for all that apply)	
73776	City of Gatesville		☐	Drinking Water SRF (DWSRF)
			☑	Clean Water SRF (CWSRF)

Project Name: Stillhouse Branch Wastewater Treatment Facility Improvements

Solicitation By: ☐ Applicant/Entity OR ☑ Prime Contracted Business: Matous Construction, Ltd.

Project Phase: ☐ Prior to Closing ☐ Release of funding for PADs ☐ Construction Contract # _____

Instructions	
Column 1	Enter the full name, street address, city/state/zip for each firm awarded a contract for the project.
Column 2	Enter one of the following procurement or contract categories: **CONSTRUCTION – SUPPLIES – EQUIPMENT – SERVICES**
Column 3	Enter the type of business: **MBE (Minority Business Enterprise), WBE (Women-owned Business Enterprise), or OTHER (NOTE: OTHER = Company or firm is Non-MBE or WBE)**
Column 4	Enter the exact amount of the awarded contract.
Column 5	Enter the exact date the contract was executed or the proposed date of contract execution.

If valid MBE/WBE firms are awarded contracts, a copy of their certification is required to be attached with this form for each MBE/WBE business listed.

Notice: Brokers may not be listed below as an MBE or WBE. A broker is a firm that does not perform, manage, or supervise the work of its sub/contract in a manner consistent with the normal business practices for sub/contractors in its line of business. For more specifics, review guidance document, TWDB-0210.

II. LIST OF ACTUAL CONTRACTS/PROCUREMENTS

	Column 1	Column 2	Column 3	Column 4	Column 5
	Name & Address of Contracted Firm/Vendor	Procurement Category	MBE/WBE Status	Contract Amount ($)	Contract Execution Date
1.	T Morales Company 401 SH 130, Georgetown, TX 78626	Services	Other	$3,050,000	9/1/2023
2.	Alpha Painting 904 Tradesmens Park Loop, Hutto, TX 78634	Services	Other	$201,000	9/1/2023
3.	Penhall 4201 Felter Ln, Austin, TX 78744	Services	Other	$25,000	9/1/2023
4.	Zye Industrial 401 SH 130, Georgetown, TX 78626	Services	MBE	$700,000	9/1/2023
5.	Hartwell Environmental 22115 Hufsmith Korhville Rd, Tomball, TX 77375	Supplies	Other	$1,700,000	9/1/2023
6.	HRM Environmental 3118 Media Dr, Cedar Park, TX 78641	Supplies	Other	$191,000	9/1/2023

(Table continues on the next page)

	Column 1 Name & Address of Contracted Firm/Vendor	Column 2 Procurement Category	Column 3 MBE/WBE Status	Column 4 Contract Amount ($)	Column 5 Contract Execution Date
7.	Ferguson Waterworks 200 Park Central Blvd, Georgetown, TX 78626	Supplies	Other	$1,900,000	9/1/2023
8.	KLP 18013 Vorwerk Rd, Manor, TX 78653	Supplies	WBE	$63,000	9/1/2023
9.	Pump Solutions 806 Tradesmens Park Loop, Hutto, TX 78634	Supplies	Other	$390,000	9/1/2023
10.	D+G Quality Roofing 4305 E FM 1187, #100, Burleson, TX 76028	Services	WBE	$18,000	9/1/2023
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					

Use additional sheets if necessary

Signature – Authorized Representative	Title (print legibly)	Date
[signature]	CEO of General Partner	6/20/23

III. TWDB APPROVAL SIGNATURE

Signature indicates the form meets DBE requirements.

DBE Coordinator	Approval Date

Monthly American Iron and Steel Certificate

Compliance Submittal by Owner (Sub-Recipient)

TWDB Project No. _____
Loan No. _____

This executed certificate must be submitted with each Outlay report requesting funds associated with construction contracts for all iron and steel products and/or materials included within the project's construction contracts.

I, _____, _____ of
(Name) (Title)
_____ hereby certify that all iron and steel products and/or materials incorporated into the construction, alteration, maintenance, or repair of the subject project are in full compliance with the American Iron and Steel requirements of Section 608 of the Federal Water Pollution Control Act (33 U.S.C. §1388) for the Clean Water State Revolving Fund or federal law, including federal appropriation acts and Section 1452(a)(4) of the Safe Drinking Water Act (42 U.S.C. §300j-12(a)(4)), as applicable, for the Drinking Water State Revolving Fund, or comply with waivers granted by the U.S. Environmental Protection Agency.

I understand that a false statement herein may subject me to penalties under federal and state laws relating to filing false statements and other relevant statutes.

_____ _____
Signature **Date**

De Minimis Log

The following information is provided as a sample De Minimis log for AIS compliance. The TWDB makes no claims regarding the legality of the De Minimis log with respect to AIS compliance.

Figure 1 - Information contained in the log example: Owner Name, Project Name, TWDB SRF Number, Contractor Name, Total Project Cost, Total Material Cost followed by data entered for each of the following categories: Item Number, Iron or Steel Product, Unit Cost, Quantity, Total Cost, Percent of Total Material Cost Less Than One Percent, Cumulative Cost, Percent of Total Material Cost Less Than Five Percent.

American Iron and Steel
de minimis log

Owner Name:	City	Total Project Cost:	$130,000.00
Project Name:	CID 01 - Project	Total Material Cost:	$100,000.00
TWDB SRF No.:	####		
Contractor Name:	Contractor		

Item No.	Iron or Steel Product	Unit Cost	Quantity	Total Cost	% Mat Cost (< 1%)	Cum Cost	% Mat Cost (< 5%)
1	Steel Door	$400.00	1	$ 400.00	0.40%	$ 400.00	0.40%
2	Bolts	$100.00	1	$ 100.00	0.10%	$ 500.00	0.50%
3	Welding rods	$30.00	1	$ 30.00	0.03%	$ 530.00	0.53%
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							

BIDDER'S CERTIFICATIONS

Project Name: Stillhouse Branch Wastewater Treatment Facility Improvements

Project Number: 2-01590

Contract For: City of Gatesville

The following certifications must be completed by the bidder for each contract.

A. EQUAL EMPLOYMENT OPPORTUNITY:

☑ I have developed and have on file at each establishment affirmative action programs pursuant to 41 CFR Part 60-1.7.

I have:

(■) participated in previous contract(s) or subcontract(s) subject to the equal opportunity clause under Executive Orders 11246 and 11375. I have filed all notices, contract specifications, and compliance reports due under the requirements contained in 41 CFR Part 60-4.

( ) **not** participated in previous contracts(s) subject to the equal opportunity clause under Executive Orders 11246 and 11375 and 41 CFR Chapter 60.

B. NONSEGREGATED FACILITIES

☑ I certify that I do not and will not maintain any facilities provided for my employees in a segregated manner, or permit my employees to perform their services at any location under my control where segregated facilities are maintained; and that I will obtain a similar certification prior to the award of any federally assisted subcontract exceeding $10,000 which is not exempt from the equal opportunity clause as required by 41 CFR Part 60-1.8.

I will obtain a similar certification from any proposed subcontractor(s), when appropriate.

I understand that a false statement on this certification may be grounds for rejection of this bid proposal or termination of the contract award.

Bruce A. Matous, CEO of General Partner

Typed Name and Title of Bidder's Authorized Representative

BAM

6/20/2023

Signature of Bidder's Authorized Representative — Date

Matous Construction, Ltd. 8602 St Hwy 317, Belton, TX 76513

Name and Address of Bidder

TECHNICAL SPECIFICATIONS

SECTION 01 10 00 - SUMMARY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Contract description.
2. Work by Owner or other Work at the Site.
3. Owner-furnished products.
4. Contractor's use of Site and premises.
5. Future Work
6. Work sequence.
7. Owner occupancy.
8. Permits
9. Specification conventions.
10. Reference specifications and standards.

1.2 CONTRACT DESCRIPTION

A. Work of the Project includes construction of capacity expansion and treatment system improvements for the Gatesville Stillhouse WWTF.

B. Construct the Work in accordance with the Drawings, Technical Specifications, and Bid Items listed on the Bid Form.

C. The Stillhouse WWTF must remain operational and in compliance with the TCEQ Discharge permit during construction. Refer to the Table “Permit Compliance During Construction” after the “End of Section” that describes some of the measures that must be undertaken during construction to keep the Facility in compliance. The Table is not meant to be complete and the Contractor must take all measures necessary to ensure that the construction does not overly impact the operation of the Facility.

1.3 WORK BY OWNER OR OTHERS

A. Coordinate Work with utilities of Owner and public or private agencies.

B. If Owner-awarded contracts interfere with each other due to work being performed at the same time or at the same Site, Owner will determine the sequence of work under all contracts according to "Work Sequence" and "Contractor's Use of Site and Premises" Articles in this Section.

1.4 OWNER-FURNISHED PRODUCTS

A. Items furnished by Owner for installation by Contractor:
1. Heaters from Control Building Garage
2. 30” Butterfly Valve

1.5 CONTRACTOR'S USE OF SITE AND PREMISES

A. Limit use of Site and premises to allow:
   1. Owner occupancy.
   2. Noisy and Disruptive Operations (such as Use of Jack Hammers and Other Noisy Equipment): Not allowed in close proximity to existing building during regular hours of operation. Coordinate and schedule such operations with Owner to minimize disruptions.
   3. The public has no access to the Project site.

B. Time Restrictions for Performing Work: None.

C. Construction Plan: Before start of construction, submit a construction plan regarding access to Work and use of Site for acceptance by Owner. After acceptance of plan, construction operations shall comply with accepted plan unless deviations are accepted by Owner in writing.

1.6 FUTURE WORK: N/A

1.7 WORK SEQUENCE

A. Sequencing of Construction Plan: Before start of construction, submit one copy of construction plan regarding phasing of construction and new Work for acceptance by Owner. After acceptance of plan, construction sequencing shall comply with accepted plan unless deviations are accepted by Owner in writing.

B. Refer to Table “Permit Compliance During Construction” at the end of this specification. The Stillhouse WWTF must remain in compliance with it’s operating permit during construction. To accomplish that, only portions of the Facility can be offline for certain periods of time. As well, some treatment processes cannot be stopped or bypassed. This shall be considered in the Sequencing of Construction Plan.

1.8 OWNER OCCUPANCY

A. Owner will occupy Site during entire period of construction.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.9 PERMITS: N/A

1.10 SPECIFICATION CONVENTIONS

A. These Specifications are written in imperative mood and streamlined form. This imperative language is directed to Contractor unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

1.11 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI or AWWA specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are considered minimum acceptable quality for all equipment, material and work. In instances where capacities, size or other feature of equipment, devices or materials exceed these minimums, meet listed or shown capacities.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are part of this Specification.
1. Table: Permit Compliance During Construction.

END OF SECTION

Gatesville Stillhouse WWTF
Permit Compliance During Construction

Preliminary Treatment	
Mechanical Perforated Plate Screen + Parallel Manual Bar Screen	
Proposed Upgrades	New Screen, new gates, new compactor
Mitigation Plan	A back-up pump will be provided to bypass the screen structure
Influent Lift Station	
Proposed Upgrades	Replace 3 submersible pumps; upsize discharge piping, valves, and fittings. Rework wet well bays. Construct new electrical building to house new electrical equipment. Install flow meter.
Mitigation Plan	A back-up, emergency pump will be provided to bypass the influent pump station
Fine Screens	
Proposed upgrades	No upgrades, demolish equip
Mitigation Plan	Can do while operational
Flow Splitter Box No. 1	
Proposed upgrades	Re-work RAS and influent piping to improve mixing.
Mitigation Plan	Do work while bypassing Influent Pump Station

Secondary Treatment	
Aeration Basins	
Proposed Upgrades	Add 2 supplemental aeration systems; add 3 blowers. Repair outlet gates
Mitigation Plan	Contractor to install supplemental systems one at a time while basin is out of service, operate other basin as sole treatment during work. Operate new aeration system in completed basin while working in second basin.
Flow Splitter Box No. 2	
Proposed upgrades	Replace gates that distribute flow to clarifiers
Mitigation Plan	Provide storage in aeration basin to cutoff flow for sufficient time to do work. Possible while refilling basin after aeration system installation.
Final Clarifiers	
Proposed Upgrades	Replace feedwells, scum arms and scum system
Mitigation Plan	Plug piping and pump down clarifier, operate other clarifier as sole treatment. Work will need to be completed after gates in Flow Splitter Box No. 2 are replaced.
Return Activated Sludge Pumps (RAS)	
Proposed Upgrades	Replace 3 submersible pumps; upsize discharge piping, valves, and fittings; upsize piping to Flow Splitter Box # 1. Retrofit electrical building to house new electrical equipment. Install flow meter.
Mitigation Plan	A back-up pump will be provided to bypass the RAS Pumps
Tertiary Treatment	
Chlorine Injection Equipment	
Proposed Upgrades	Remove old equipment and install new chemical injection system.
Mitigation Plan	Install new equipment while existing is operational, tie in after new diffuser is installed.
Chlorine Manhole	
Proposed Upgrades	Revise Manhole to allow flow to new Chlorine Contact Basin.
Mitigation Plan	A back-up pump will be provided to bypass the Chlorine Manhole During Construction, move chlorine injection point during construction

Chlorine Contact	
Proposed Upgrades	Construct rectangular, serpentine-type concrete contact basin
Mitigation Plan	Construct new basin isolated from inlet and outlet piping, tie in inlet and outlet with plugs on Chlorine Manhole after that work is completed.
Dechlorination Equipment	
Proposed Upgrades	Remove old equipment and install new chemical injection system.
Mitigation Plan	Install new equipment while existing operational, tie in after new diffuser is installed.
SO2 Manhole	
Proposed Upgrades	Revise Manhole to allow flow from new Chlorine Contact Basin.
Mitigation Plan	A back-up pump will be provided to bypass the SO2 Manhole During Construction, move SO2 injection point during construction
Effluent Pump Station	
Proposed Upgrades	Replace pumps. Retrofit wet well.
Mitigation Plan	Open butterfly valve at SO2 Manhole to bypass the Effluent Pump Station during construction
Post Aeration	
Proposed Upgrades	Equip with a fine bubble aeration system connected to blower piping from oxidation ditches; construct new weir
Mitigation Plan	A back-up pump will be provided to bypass the Post Aeration Vault during construction
Biosolids Treatment	
Sludge Box	
Proposed Upgrades	Install overflow to divert excess flows from RAS pumps
Mitigation Plan	Can do while operational
Sludge Thickener	
Proposed Upgrades	No upgrades needed.
Mitigation Plan	-

Waste Activated Sludge (WAS)	
Proposed Upgrades	Install flow meter and new discharge on RAS pump station.
Mitigation Plan	Tie-in during down time (6 days/week)
Biosolids Dewatering	
Proposed Upgrades	No upgrades needed.
Mitigation Plan	-
Biosolids Storage	
Proposed Upgrades	New Biosolids Pad
Mitigation Plan	Construct while operating existing biosolids storage area.

SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Contingency allowances.
B. Testing and inspection allowances.
C. Allowances.
D. Schedule of Values.
E. Application for Payment.
F. Change procedures.
G. Defect assessment.
H. Unit prices.
I. Alternates.

1.2 CONTINGENCY ALLOWANCES: N/A

1.3 TESTING AND INSPECTION ALLOWANCES: N/A

1.4 ALLOWANCES

A. Include in Contract a stipulated sum/price as described in Section 01 20 23 - Allowances for use upon Owner's instruction as a SCADA System allowance.

B. The cost of providing the Work of this allowance will be paid, up to the amount specified, based on documentation of actual costs. The actual amount shall be approved by the Owner prior to authorization by means of a Field Order. Costs above the allowance amount, if any, will be paid by means of a Change Order.

1.5 SCHEDULE OF VALUES

A. Submit schedule of Values on Contractor’s standard form to be approved by the Engineer.

B. Submit Schedule of Values within 15 days after date established in Notice to Proceed.

C. Identify each line item with number and title of major Specification Section.

D. Include within each line item, direct proportional amount of Contractor's overhead and profit.

E. Revise schedule to list approved Change Orders with each Application for Payment.

1.6 APPLICATION FOR PAYMENT

A. Submit three copies of each Application for Payment on EJCDC C-620 - Contractor's Application for Payment or a Contractor’s electronic media driven form as approved by the Engineer.

B. Content and Format: Use items listed in Schedule of Values for listing items in Application for Payment.

C. Submit updated construction schedule with each Application for Payment, when required.

D. Payment Period: Submit at intervals stipulated in the Agreement.

1.7 CHANGE PROCEDURES

A. Carefully study and compare Contract Documents before proceeding with fabrication and installation of Work. Promptly advise Engineer of any error, inconsistency, omission, or apparent discrepancy.

B. Engineer will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions on EJCDC C-942 – Field Order.

C. Contractor may propose changes by submitting a request for change to Engineer, describing proposed change and its full effect on the Work. Include a statement describing reason for the change and the effect on Contract Price and Contract Time with full documentation and a statement describing effect on the Work by separate or other Contractors.

D. Stipulated Price Change Order: Based on Engineer’s request and Contractor's fixed price quotation or Contractor's request for Change Order as recommended by Engineer and approved by Owner.

E. Unit Price Change Order: For Contract unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of that which are not predetermined, execute Work under Work Directive Change. Changes in Contract Price or Contract Time will be computed as specified in Change Order.

F. Work Directive Change: Engineer may issue directive, on EJCDC C-940 - Work Change Directive signed by Owner, instructing Contractor to proceed with change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work and designate method of determining any change in Contract Price or Contract Time. Promptly execute change.

G. Change Order Forms: EJCDC C-941 - Change Order or as approved by Engineer.

H. Execution of Change Orders: Engineer will issue Change Orders for signatures of parties as provided in the General Conditions of the Contract.

1.8 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of Engineer, it is not practical to remove and replace the Work, Engineer will direct appropriate remedy or adjust payment.
   1. When the defective Work is deemed to remain the unit price will be adjusted to new price at discretion of Engineer and Owner.

C. Authority of Engineer and Owner to assess defects and identify payment adjustments is final.

D. Nonpayment for Rejected Products: Payment will not be made for rejected products for any of the following reasons:
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products not completely unloaded from transporting vehicle.
   4. Products placed beyond lines and levels of the required Work.
   5. Products remaining on hand after completion of the Work.
   6. Loading, hauling, and disposing of rejected products.

1.9 UNIT PRICES

A. Authority: Measurement methods are described in individual Specification Sections.

B. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application, or installation of item of the Work; overhead and profit.

C. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities accepted by Engineer multiplied by unit price for Work incorporated in or made necessary by the Work. A final Change Order will be executed to adjust the contract amount accordingly.

1.10 ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 21 00 – MOBILIZATION, TRAFFIC HANDLING, AND INCIDENTALS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Project Mobilization and Demobilization.
   2. Traffic Handling.
   3. All project costs (incidentals) not included in the contract bid items.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Basis of Measurement: By the Lump Sum as the work progresses.

B. Basis of Payment: This item will be paid for at the contract unit price bid for "Mobilization, Traffic Handling, and Project Incidentals," which price shall be full compensation for mobilization and demobilization of all contractor personnel, facilities, equipment, and supplies, for all equipment, labor, and material associated with traffic handling, and all other project costs not specifically covered in the contract bid items.

C. Partial payments for this item will be administered as follows. The adjusted contract amount for construction items as used below is defined as the total contract amount less the lump sum bid for mobilization.
   1. When 1% of the adjusted contract amount for construction items is earned, 50% of the mobilization lump sum bid will be paid.
   2. When 5% of the adjusted contract amount for construction items is earned, 75% of the mobilization lump sum bid will be paid.
   3. When 10% of the adjusted contract amount for construction items is earned, 90% of the mobilization lump sum bid will be paid.
   4. Upon completion of all work items, payment for the remainder of the mobilization lump sum bid will be made.

D. The lump sum bid for mobilization shall not exceed 10% of the total contract.

1.3 REFERENCES – Not used.

1.4 QUALITY ASSURANCE – Not used.

PART 2 PRODUCTS – Not used.

PART 3 EXECUTION – Not used.

END OF SECTION

SECTION 01 23 00 - ALLOWANCES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Include in the contract sum, the allowances stated in this Section.

B. Should the net cost be more than the specified amount of the allowance, the contract sum will be adjusted by Change Order on Contract in accordance with the General Conditions. No Work in excess of the allowance will be permitted except by Change Order on Contract. Should the net cost be less than the specified amount of the allowance, the balance will be deducted from the final payment.

1.2 TOTALS FOR ALLOWANCES

A. The total sum of allowances required in Item 1.02 of the Base Bid of this Contract is $500,000.

1.3 ALLOWANCES FOR CONTINGENCIES: N/A

1.4 ALLOWANCE FOR SCADA SYSTEM

A. The System Integrator work shall be provided by Dedicated Controls of Evant, TX. The Scope of Work is provided in Section 40 61 00 – Plant SCADA System. Include in Item 1.02 of the Base Bid the amount of $500,000 to cover the cost of providing instrumentation, constructing and installing Control Panels and programming the Control SCADA for this Project as described in Section 40 61 00 – Plant SCADA System.

B. The cost of providing the Work of this allowance will be paid, up to the amount specified, based on the lump sum amount. Costs above the allowance amount, if any, will be paid by means of a Change Order.

C. Include overhead and profit for administering this allowance separately in the contract sum, not in the allowance.

D. Cause the products covered by this allowance to be furnished by such persons or firm and for such amount as designated by the Engineer.

E. The amount of the allowance includes delivery to the Site, installation, programming, and start-up.

F. Include storage and protection costs and other expenses related to this work separately in the contract sum, not in the allowance.

G. Purchase and Delivery:
   1. On notification, execute purchase agreement with designated supplier.
   2. Arrange for and process Samples, Shop Drawings, and Product Data as required.

3. Make arrangements for delivery.
4. Upon delivery, promptly inspect products for damage or defects.
5. Submit claims for transportation damage.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 FIELD ORDER

A. Work performed under the "Allowance" shall only be initiated only after execution of a Work Change Directive based on agreed costs determined by one of the following methods:

1. By accepting an amount agreed upon by both the Owner and Contractor with the Engineer's recommendation, which amount is to be calculated based on time, materials, equipment, overhead, and profit.

2. By applying the applicable price or prices as set forth in the Contract Documents or in the detailed schedule of values or by applying a unit price agreed to by both the Owner and Contractor with the Engineer's recommendation.

END OF SECTION

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality assurance.
B. Product options.
C. Product substitution procedures.
D. Installer substitution procedures.

1.2 QUALITY ASSURANCE

A. Contract is based on products and standards established in Contract Documents without consideration of proposed substitutions.

B. Products specified define standard of quality, type, function, dimension, appearance, and performance required.

C. Substitution Proposals: Permitted for specified products except where specified otherwise. Do not substitute products unless substitution has been accepted and approved in writing by Owner.

1.3 PRODUCT OPTIONS

A. See Section 01 60 00 - Product Requirements

1.4 PRODUCT SUBSTITUTION PROCEDURES

A. Engineer will consider requests for substitutions only within 15 days after date of Owner-Contractor Agreement.

B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.

C. Document each request with complete data, substantiating compliance of proposed substitution with Contract Documents, including:
   1. Manufacturer's name and address, product, trade name, model, or catalog number, performance and test data, and reference standards.
   2. Itemized point-by-point comparison of proposed substitution with specified product, listing variations in quality, performance, and other pertinent characteristics.
   3. Reference to Article and Paragraph numbers in Specification Section.
   4. Cost data comparing proposed substitution with specified product and amount of net change to Contract Sum.
   5. Changes required in other Work.
   6. Availability of maintenance service and source of replacement parts as applicable.
   7. Certified test data to show compliance with performance characteristics specified.
   8. Samples when applicable or requested.
   9. Other information as necessary to assist Architect/Engineer's evaluation.

D. A request constitutes a representation that Contractor:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of specified product.
   2. Will provide same warranty for substitution as for specified product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Will coordinate installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.
   6. Will reimburse Owner [and Engineer] for review or redesign services associated with reapproval by authorities having jurisdiction.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals without separate written request or when acceptance will require revision to Contract Documents.

F. Substitution Submittal Procedure:

   1. Submit requests for substitutions in writing.
   2. Submit electronic files of Request for Substitution for consideration. Limit each request to one proposed substitution.
   3. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. The burden of proof is on Contractor.
   4. Architect/Engineer will notify Contractor in writing of decision to accept or reject request.

1.5 INSTALLER SUBSTITUTION PROCEDURES

A. Engineer will consider requests for substitutions only within 15 days after date of Owner-Contractor Agreement.

B. Document each request with:
   1. Installer's qualifications.
   2. Installer's experience in work similar to that specified.
   3. Other information as necessary to assist Architect/Engineer's evaluation.

C. Substitution Submittal Procedure:
   1. Submit electronic files of Request for Substitution for consideration. Limit each request to one proposed substitution.
   2. Engineer will notify Contractor in writing of decision to accept or reject request.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination and Project conditions.
B. Preconstruction meeting.
C. Site mobilization meeting.
D. Progress meetings.
E. Preinstallation meetings.
F. Closeout meeting.
G. Construction Photographs
H. Audio-Video Recordings
I. Alteration procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of various Sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify that utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate Work of various Sections having interdependent responsibilities for installing, connecting to, and placing operating equipment in service.

C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit as closely as practical; place runs parallel with lines of building. Use spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. Coordinate interruptions of all utilities and services. All work shall be in accordance with the requirements of the applicable utility company or agency involved.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of Work of separate Sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.

G. After Owner's occupancy of premises, coordinate access to Site for correction of defective Work and Work not complying with Contract Documents, to minimize disruption of Owner's activities.

1.3 PRECONSTRUCTION MEETING

A. Engineer will schedule and preside over meeting after the Agreement has been executed and all bonds and insurance are in affect for the project.

B. Attendance Required: Engineer, Owner, Inspector, and Contractor.

1.4 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at monthly intervals.

B. Engineer will make arrangements for meetings, prepare agenda with copies for participants, and preside over meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, and Engineer, as appropriate to agenda topics for each meeting.

1.5 PRE-INSTALLATION MEETINGS

A. When required in individual Specification Sections, convene preinstallation meetings at Project Site before starting Work of specific Section.

B. Require attendance of parties directly affecting, or affected by, Work of specific Section.

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

1.6 CLOSEOUT MEETING

A. Schedule Project closeout meeting with sufficient time to prepare for requesting Substantial Completion. Preside over meeting and be responsible for minutes.

B. Attendance Required: Contractor, Engineer, Owner, and others appropriate to agenda.

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

1.7 Construction Photographs

4

A. General:

1. Photographically document all phases of the Project including preconstruction, construction progress, and post-construction.

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

3. Digital Images: No post-session electronic editing of images is allowed. Stored image shall be actual image as captured without cropping or other edits

4. Images shall be submitted digitally or on flash drive with each Application for Payment.

B. Preconstruction and Post-Construction:

1. After Effective Date of the Agreement and before Work at Site is started, and again upon issuance of Substantial Completion, take a minimum of 48 photographs of Site and property adjacent to perimeter of Site.

2. Particular emphasis shall be directed to structures both inside and outside the Site.

3. Format: Digital, minimum resolution of 2176 by 3264

C. Construction Progress Photos:

1. Photographically demonstrate progress of construction, showing every aspect of Site and adjacent properties as well as interior and exterior of new or impacted structures.

2. Weekly: Take 24 photographs using digital, minimum resolution of 2176 by 3264 pixels and 24-bit, millions of colors.

D. Documentation:

1. Digital Images:

a. Electronic image shall have date taken embedded into image.

b. Archive using a commercially available photo management system that provides listing of photographs including date, keyword description, and direction of photograph.

c. Label file folders or database records with Project and Owner's name, and month and year images were produced.

1.8 Audio Video Recordings

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

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

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

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

E. Audio Video Recordings shall be submitted digitally or on a flash drive.

F. Video Format and Quality:

1. Digital format, with sound.

2. Video:

a. Produce bright, sharp, and clear images with accurate colors, free of distortion and other forms of picture imperfections.

3. Audio:

a. Audio documentation shall be done clearly, precisely, and at a moderate pace.

b. Indicate date, project name, and a brief description of the location of recording, including:

1) Facility name.

2) Street names or easements.

3) Addresses of private property.

4) Direction of coverage, including engineering stationing, if applicable.

G. Documentation:

1. Digital File Label:

a. Project name.

b. Applicable location by structure.

c. Date and time of coverage.

2. Project Video Log: Maintain an ongoing log that incorporates above noted label information for video recordings on Project.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 ALTERATION PROCEDURES

A. Entire facility will be occupied for normal operations during progress of construction. Cooperate with Owner in scheduling operations to minimize conflict and to permit continuous usage.

1. Perform Work not to interfere with operations of occupied areas.
2. Keep utility and service outages to a minimum and perform only after written approval of Owner.
3. Clean Owner-occupied areas daily. Clean spillage, overspray, and heavy collection of dust in Owner-occupied areas immediately.

B. Materials: As specified in product Sections; match existing products with new products for patching and extending Work.

C. Employ original and/or skilled and experienced installer to perform alteration and renovation Work.

D. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion. Comply with Section 01 70 00 - Execution and Closeout Requirements

E. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

F. Remove debris and abandoned items from area and from concealed spaces.

G. Prepare surface and remove surface finishes to permit installation of new Work and finishes.

H. Close openings in exterior surfaces to protect existing Work from weather and extremes of temperature and humidity.

I. Remove, cut, and patch Work to minimize damage and to permit restoring products and finishes to original or specified condition.

J. Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with neat transition to adjacent finishes.

K. Where new Work abuts or aligns with existing Work, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

L. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and submit recommendation to Engineer for review.

M. Where change of plane of 1/4 inch or more occurs, submit recommendation for providing smooth transition to Engineer for review.

N. Patch or replace portions of existing surfaces that are damaged, lifted, discolored, or showing other imperfections.

O. Finish surfaces as specified in individual product Sections.

END OF SECTION

SECTION 01 32 16 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittals.
B. Network analysis schedules.
C. Review and evaluation.
D. Updating schedules.
E. Distribution.

1.2 SUBMITTALS

A. Within 10 days after date of Owner-Contractor Agreement, submit proposed preliminary network diagram defining planned operations for first 60 days of Work, with general outline for remainder of Work.

B. Participate in review of preliminary and complete network diagrams jointly with Engineer.

C. Within 20 days after joint review of proposed preliminary network diagram, submit draft of proposed complete network diagram for review. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete network analysis consisting of network diagrams and mathematical analyses.

E. Submit updated network schedules with each Application for Payment.

F. Schedule Updates:
   1. Overall percent complete, projected and actual.
   2. Completion progress by listed activity and subactivity, to within five working days prior to submittal.
   3. Changes in Work scope and activities modified since submittal.
   4. Delays in submittals or resubmittals, deliveries, or Work.
   5. Adjusted or modified sequences of Work.
   6. Other identifiable changes.
   7. Revised projections of progress and completion.

G. Narrative Progress Report:
   1. Submit with each monthly submission of Progress Schedule.
   2. Summary of Work completed during the past period between reports.
   3. Work planned during the next period.
   4. Explanation of differences between summary of Work completed and Work planned in previously submitted report.
   5. Current and anticipated delaying factors and estimated impact on other activities and completion milestones.
   6. Corrective action taken or proposed.

1.3 NETWORK ANALYSIS SCHEDULES

A. Prepare network analysis diagrams and supporting mathematical analyses using critical path method.

B. Illustrate order and interdependence of activities and sequence of Work; how start of given activity depends on completion of preceding activities, and how completion of activity may restrain start of subsequent activities.

C. Illustrate complete sequence of construction by activity, identifying Work of separate stages. Indicate dates for submittals, including dates for Owner-furnished items, and return of submittals; dates for procurement and delivery of critical products; and dates for installation and provision for testing. Include legend for symbols and abbreviations used.

D. Mathematical Analysis: Tabulate each activity of detailed network diagrams using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 30-day intervals. Status of critical activities.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; accrue float time to Owner and to Owner's benefit.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Percentage of activity completed.
   13. Responsibility.

E. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, of accepting revised completion dates, and of recomputing of scheduled dates and float.

F. Required Sorts: List activities in sorts or groups:
   1. By preceding Work item or event number from lowest to highest.
   2. By longest float, then in order of early start.
   3. By responsibility in order of earliest possible start date.
   4. In order of latest allowable start dates.
   5. In order of latest allowable finish dates.
   6. Contractor's periodic payment request sorted by Schedule of Values list.
   7. List of basic input data-generating report.
   8. List of activities on critical path.

1.4 REVIEW AND EVALUATION

A. Participate in joint review and evaluation of schedules with Engineer at each submittal.

B. Evaluate Project status to determine Work behind schedule and Work ahead of schedule.

C. After review, revise schedules incorporating results of review, and resubmit within 10 days.

1.5 UPDATING SCHEDULES

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity. Update schedules to depict current status of Work.

C. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

D. Upon approval of a Change Order, include the change in the next schedule submittal.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit sorts as required to support recommended changes.

G. Prepare narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken or proposed and its effect including effects of changes on schedules of separate Contractors.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittal procedures.
B. Construction progress schedules.
C. Product data.
D. Use of electronic CAD files of Project Drawings.
E. Shop Drawings.
F. Samples.
G. Design data.
H. Test reports.
I. Certificates.
J. Manufacturer's instructions.
K. Manufacturer's field reports.
L. Erection Drawings.
M. Contractor review.
N. Engineer review.

1.2 SUBMITTAL PROCEDURES

A. Submittals shall be directly from the Contractor. Submittals from others (i.e., suppliers or subcontractors) shall not be accepted.

B. Transmit each submittal on an Engineer accepted form.

C. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.

D. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.

E. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.

F. Schedule submittals to expedite Project, and deliver to Engineer at business address. Coordinate submission of related items.

G. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.

H. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.

I. Allow space on submittals for Contractor and Engineer review stamps.

J. When revised for resubmission, identify changes made since previous submission.

K. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

L. Submittals not requested will not be recognized or processed.

M. Incomplete Submittals: Engineer will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of Engineer.

1.3 CONSTRUCTION PROGRESS SCHEDULES

A. Comply with Section 01 32 16 - Construction Progress Schedule

1.4 PRODUCT DATA

A. Product Data: Action Submittal: Submit to Engineer for review for assessing conformance with information given and design concept expressed in Contract Documents.

B. Submit electronic submittals to Engineer via email as PDF electronic files.

C. Identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. After review, distribute according to "Submittal Procedures" Article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.5 ELECTRONIC CAD FILES OF PROJECT DRAWINGS

A. Electronic CAD Files of Project Drawings: May only be used to expedite production of Shop Drawings for the Project. Use for other Projects or purposes is not allowed.

B. Electronic CAD Files of Project Drawings: Distributed only under the following conditions:
   1. Use of files is solely at receiver's risk. Engineer does not warrant accuracy of files. Receiving files in electronic form does not relieve receiver of responsibilities for measurements, dimensions, and quantities set forth in Contract Documents. In the event of ambiguity, discrepancy, or conflict between information on electronic media and that in Contract Documents, notify Engineer of discrepancy and use information in hard-copy Drawings and Specifications.
   2. CAD files do not necessarily represent the latest Contract Documents, existing conditions, and as-built conditions. Receiver is responsible for determining and complying with these conditions and for incorporating addenda and modifications.
   3. User is responsible for removing information not normally provided on Shop Drawings and removing references to Contract Documents. Shop Drawings submitted with information associated with other trades or with references to Contract Documents will not be reviewed and will be immediately returned.
   4. Receiver shall not hold Engineer responsible for data or file clean-up required to make files usable, nor for error or malfunction in translation, interpretation, or use of this electronic information.

5. Receiver shall understand that even though Engineer has computer virus scanning software to detect presence of computer viruses, there is no guarantee that computer viruses are not present in files or in electronic media.
6. Receiver shall not hold Engineer responsible for such viruses or their consequences, and shall hold Engineer harmless against costs, losses, or damage caused by presence of computer virus in files or media.

1.6 SHOP DRAWINGS

A. Shop Drawings: Action Submittal: Submit to Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a professional Engineer responsible for designing components shown on Shop Drawings.
1. Include signed and sealed calculations to support design.
2. Submit Shop Drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
3. Make revisions and provide additional information when required by authorities having jurisdiction.
4. Submit electronic shop drawings to Engineer via email as PDF electronic files.
5. After review, distribute according to "Submittal Procedures" Article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.7 SAMPLES

A. Samples: Action Submittal: Submit to Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

B. Samples for Selection as Specified in Product Sections:
1. Submit to Engineer for aesthetic, color, and finish selection.
2. Submit Samples of finishes, textures, and patterns for Engineer selection.

C. Submit Samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate Sample submittals for interfacing work.

D. Include identification on each Sample, with full Project information.

E. Submit number of Samples specified in individual Specification Sections; Engineer will retain one Sample.

F. Reviewed Samples that may be used in the Work are indicated in individual Specification Sections.

G. Samples will not be used for testing purposes unless specifically stated in Specification Section.

H. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.8 DESIGN DATA

A. Submit to Engineer for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.9 TEST REPORTS

A. Submit test reports to Engineer for information for assessing conformance with information given and design concept expressed in Contract Documents.

1.10 CERTIFICATES

A. Informational Submittal: When specified in Technical Specifications, submit certification by manufacturer, installation/application Subcontractor, or Contractor to Engineer, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product but must be acceptable to Engineer.

1.11 MANUFACTURER'S INSTRUCTIONS

A. Informational Submittal: When specified in Technical Specifications, submit manufacturer's installation instructions to Engineer for informational purposes.

B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to Engineer for delivery to Owner in quantities specified for Product Data.

C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.12 MANUFACTURER'S FIELD REPORTS

A. Submit reports for information for limited purposes of assessing conformance with information given and design concept expressed in Contract Documents.

1.13 ERECTION DRAWINGS

A. Submit Drawings to Engineer for information assessing conformance with information given and design concept expressed in Contract Documents.

B. Data indicating inappropriate or unacceptable Work may be subject to action by Engineer or Owner.

1.14 CONTRACTOR REVIEW

A. Review for compliance with Contract Documents and approve submittals before transmitting to Engineer.

B. Contractor: Responsible for:
1. Determination and verification of materials including manufacturer's catalog numbers.
2. Determination and verification of field measurements and field construction criteria.
3. Checking and coordinating information in submittal with requirements of Work and of Contract Documents.
4. Determination of accuracy and completeness of dimensions and quantities.
5. Confirmation and coordination of dimensions and field conditions at Site.
6. Construction means, techniques, sequences, and procedures.
7. Safety precautions.
8. Coordination and performance of Work of all trades.

C. Stamp, sign or initial, and date each submittal to certify compliance with requirements of Contract Documents.

D. Do not fabricate products or begin Work for which submittals are required until approved submittals have been received from Engineer.

1.15 ENGINEER REVIEW

A. Do not make "mass submittals" to Engineer. "Mass submittals" are defined as six or more submittals or items in one day or 15 or more submittals or items in one week. If "mass submittals" are received, Engineer's review time stated above will be extended as necessary to perform proper review. Engineer will review "mass submittals" based on priority determined by Engineer after consultation with Owner.

B. Informational submittals and other similar data are for Engineer's information, do not require Engineer's responsive action, and will not be reviewed or returned with comment.

C. Submittals made by Contractor that are not required by Contract Documents may be returned without action.

D. Submittal approval does not authorize changes to Contract requirements unless accompanied by Change Order, Field Order, or Work Change Directive.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality control.
B. Tolerances.
C. References.
D. Labeling.
E. Testing and inspection services.
F. Manufacturers' field services.

1.2 QUALITY CONTROL

A. Monitor quality control over suppliers, manufacturers, products, services, Site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. When manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Products, materials, and equipment may be subject to inspection by Engineer and Owner at place of manufacture or fabrication. Such inspections shall not relieve Contractor of complying with requirements of Contract Documents.

E. Supervise performance of Work in such manner and by such means to ensure that Work, whether completed or in progress, will not be subjected to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

F. Perform work in accordance with the Plans and Specifications for this Project, current AWWA Standards and TCEQ regulations.

1.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' recommended tolerances and tolerance requirements in reference standards. When such tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current as of date for receiving Bids except where specific date is established by code.

C. Obtain copies of standards and maintain on Site when required by product Specification Sections.

D. When requirements of indicated reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

E. Neither contractual relationships, duties, or responsibilities of parties in Contract nor those of Engineer shall be altered from Contract Documents by mention or inference in reference documents.

1.5 LABELING

A. Attach label from agency approved by authorities having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.

B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label:
   1. Model number.
   2. Serial number.
   3. Performance characteristics.

C. Manufacturer's Nameplates, Trademarks, Logos, and Other Identifying Marks on Products: Not allowed on surfaces exposed to view in public areas, interior or exterior.

1.6 TESTING AND INSPECTION SERVICES

A. Contractor shall employ and pay for services of an independent testing agency or laboratory acceptable to Owner to perform specified testing.
   1. Before starting Work, submit testing laboratory name, address, and telephone number, and names of full-time Professional Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities' inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of deficiencies reported by inspection.

B. Independent testing firm will perform tests, inspections, and other services specified in individual Specification Sections and as required by Engineer. In the event of a conflict in the Contract Documents concerning sampling and testing frequency, the more stringent standard shall be enforced, unless otherwise approved by the Engineer.
   1. Laboratory: Authorized to operate in State of Texas.
   2. Laboratory Staff: Maintain full-time Professional Engineer on staff to review services.
   3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.

C. Testing, inspections, and source quality control may occur on or off Project Site. Perform off-Site testing as required by Engineer or Owner.

D. Reports shall be submitted by independent firm to Engineer, Contractor, and authorities having jurisdiction, in duplicate, indicating observations and results of tests and compliance or non-compliance with Contract Documents.
   1. Submit final report indicating correction of Work previously reported as non-compliant.

E. Cooperate with independent testing firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
   1. Notify Engineer and independent testing firm 48 hours before expected time for operations requiring services.
   2. Make arrangements with independent testing firm and pay for additional Samples and tests required for Contractor's use.

F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work according to requirements of Contract Documents.

G. Retesting or re-inspection required because of nonconformance with specified or indicated requirements shall be performed by same independent testing firm on instructions from Engineer. Payment for retesting or re-inspection will be charged to Contractor by deducting testing charges from Contract Price.

H. Independent Testing Firm Responsibilities:
   1. Test Samples of mixes submitted by Contractor.
   2. Provide qualified personnel at Site. Cooperate with Engineer and Contractor in performance of services.
   3. Perform indicated sampling and testing of products according to specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Engineer and Contractor of observed irregularities or nonconformance of Work or products.
   6. Perform additional tests required by Engineer.
   7. Attend preconstruction meetings and progress meetings.

I. Material Testing Reports: After each test, Independent Testing Firm shall promptly submit testing reports to Engineer, Contractor, and other entities as directed, indicating observations and results of tests and compliance or noncompliance with Contract Documents. At a minimum, include the following information in testing reports:
   1. Date issued.
   2. Project title and number.
   3. Name of inspector/testing technician.
   4. Date and time of sampling or inspection.
   5. Identification of product and Specification Section.
   6. Location in Project.
   7. Type of inspection or test.
   8. Date of test.
   9. Results of tests.
   10. Compliance or noncompliance with Contract Documents.
   11. Special observations, if any.

   Submit final report indicating correction of Work previously reported as noncompliant. Log all test results in an electronic spreadsheet for each test procedure and provide updated versions to Engineer at agreed upon time interval.

J. Limits on Independent Testing Firm Authority:
   1. Independent Testing Firm may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Independent Testing Firm may not approve or accept any portion of the Work.
   3. Independent Testing Firm may not assume duties of Contractor.
   4. Independent Testing Firm has no authority to stop the Work.

1.7 MANUFACTURER'S FIELD SERVICES

A. When specified in individual Specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe Site conditions, conditions of surfaces and installation, quality of workmanship, startup of equipment, testing, adjusting, and balancing of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Engineer 30 days in advance of required observations. Observer is subject to approval of Engineer.

C. Report observations and Site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities
B. Construction Facilities
C. Temporary Controls
D. Removal of utilities, facilities, and controls

1.2 TEMPORARY ELECTRICITY

A. Provide and pay for power service required from utility source as needed for construction operation.

B. Provide temporary electric feeder from electrical service at location as directed by Engineer. Do not disrupt Owner's use of service.

C. Complement existing power service capacity and characteristics as required for construction operations.

D. Provide power outlets with branch wiring and distribution boxes located as required for construction operations. Provide suitable, flexible power cords as required for portable construction tools and equipment.

E. Provide main service disconnect and overcurrent protection at feeder switch at source distribution equipment.

F. Permanent convenience receptacles may be used during construction.

G. Provide distribution equipment, wiring, and outlets for single-phase branch circuits for power and lighting.
   1. Provide 20-ampere duplex outlets, single-phase circuits for power.
   2. Provide 20-ampere, single-phase branch circuits for lighting.

1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain lighting for construction operations.

B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, lamps, and the like, for specified lighting levels.

C. Maintain lighting and provide routine repairs.

D. Permanent lighting may be used during construction.

1.4 TEMPORARY VENTILATION

A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Use existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.

1.5 TEMPORARY WATER SERVICE

A. Owner will pay cost of temporary water. Exercise measures to conserve energy. Use Owner's existing water system, extended and supplemented with temporary devices as needed to maintain specified conditions for construction operations.

1.6 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of Project mobilization.

B. At end of construction, return existing facilities used for construction operations to same or better condition as original condition.

1.7 FIELD OFFICES AND SHEDS

A. Field Office: Weathertight, with lighting, electrical outlets, heating, cooling and ventilating equipment. 1

1. Provide space for Project meetings, with table and chairs to accommodate six persons.
2. Provide space for Contractor Superintendent and personnel.
3. Provide lavatory with sink, toilet and hot and cold running water.
4. Furnish offices with desks, chairs, tables, shelves and drawing display table.
5. Provide separate office for Resident Project Representative (RPR). RPR Office shall be locked separately from Contractor's offices.
6. Furnish with the following items at a minimum:
a. Paper products (paper towels and toilet paper)
b. Bottled water dispenser and paper cups
c. Fire extinguisher
d. Outdoor thermometer
e. Rain gauge
f. Microwave
g. Refrigerator
h. Wall clock
i. Wall-mounted white dry marker board 3 ft x 4 ft minimum
j. Wastepaper baskets

B. Locate field offices and sheds a minimum distance of 30 feet from existing and new structures.

C. Do not use permanent facilities for field offices or for storage.

D. Construction: Portable or mobile buildings, or buildings constructed with floors raised aboveground, securely fixed to foundations with steps and landings at entrance doors.
   1. Construction: Structurally sound, secure, weathertight enclosures for office and storage spaces. Maintain during progress of Work; remove enclosures when no longer needed.
   2. Thermal Resistance of Floors, Walls, and Ceilings: Compatible with occupancy and storage requirements.
   3. Exterior Materials: Weather-resistant, finished in one color acceptable to Engineer.
   4. Interior Materials in Field Offices: Sheet-type materials for walls and ceilings, prefinished or painted; resilient floors and bases.
   5. Interior Materials in Storage Sheds: As required to provide specified conditions for storage of products.

E. Environmental Control:
   1. Heating, Cooling, and Ventilating for Offices: Automatic equipment to maintain comfort conditions.
   2. Storage Spaces: Heating and ventilating as needed to maintain products according to Contract Documents; lighting for maintenance and inspection of products.

F. Storage Areas and Sheds: Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and inspection of products to suit requirements in Section 01 60 00 - Product Requirements.

G. Preparation: Fill and grade Sites for temporary structures sloped for drainage away from buildings.

H. Installation:
   1. Install field office spaces ready for occupancy 15 days after date established by Owner-Contractor Agreement.
   2. Employee Residential Occupancy: Not allowed on Owner's property.

I. Maintenance and Cleaning:
   1. Weekly janitorial services for field offices; periodic cleaning and maintenance for sheds and storage areas.
   2. Maintain walks free of mud, water, snow, and the like.

J. Removal: At completion of Work remove buildings, foundations, utility services, and debris. Restore areas to same or better condition as original condition.

1.8 VEHICULAR ACCESS

A. Construct temporary all-weather access roads from public thoroughfares to serve construction area, of width and load-bearing capacity to accommodate unimpeded traffic for construction purposes.

B. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.

C. Extend and relocate vehicular access as Work progress requires and provide detours as necessary for unimpeded traffic flow.

D. Location as approved by Engineer.

E. Provide unimpeded access for emergency vehicles. Maintain 20 foot-wide driveways with turning space between and around combustible materials.

F. Provide and maintain access to fire hydrants and control valves free of obstructions.

G. Provide means of removing mud from vehicle wheels before entering streets.

H. Use designated existing on-Site roads for construction traffic.

1.9 PARKING

A. Construct temporary gravel surface parking areas to accommodate construction personnel.

B. Location as approved by Engineer.

C. If Site space is not adequate, provide additional off-Site parking.

D. Use of existing on-Site streets and driveways used for construction traffic is permitted. Tracked vehicles are not allowed on paved areas.

E. Use of designated areas of existing parking facilities used by construction personnel is not permitted.

F. Do not allow heavy vehicles or construction equipment in parking areas.

G. Do not allow vehicle parking on existing pavement.

H. Designate one parking space for Engineer and Owner.

I. Permanent Pavements and Parking Facilities:
   1. Before Substantial Completion, bases for permanent roads and parking areas may be used for construction traffic.
   2. Avoid traffic loading beyond paving design capacity. Tracked vehicles are not allowed.
   3. Use of permanent parking structures is not permitted.

J. Maintenance:
   1. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, snow, ice, and the like.
   2. Maintain existing and permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original condition.

K. Removal, Repair:
   1. Remove temporary materials and construction before Substantial Completion.
   2. Remove underground Work and compacted materials to depth of 2 feet; fill and grade Site as indicated.
   3. Repair existing facilities damaged by use, to original condition.

L. Mud from Site vehicles: Provide means of removing mud from vehicle wheels before entering streets.

1.10 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain Site in clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, before enclosing spaces.

C. Broom and vacuum clean interior areas before starting surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from Site periodically and dispose of off-Site.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

F. Comply with all applicable local, state, and federal requirements regarding excess and waste material, including methods of handling and disposal.

1.11 TRAFFIC REGULATION

A. Haul Routes:
   1. Consult with authorities having jurisdiction and establish public thoroughfares to be used for haul routes and Site access.
   2. Confine construction traffic to designated haul routes.
   3. Provide traffic control at critical areas of haul routes to regulate traffic and to minimize interference with public traffic.

B. Traffic Signs and Signals:
   1. Provide signs at approaches to Site and on Site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
   2. Provide, operate, and maintain traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control and areas affected by Contractor's operations.
   3. Relocate signs and signals as Work progresses, to maintain effective traffic control.

C. Removal:
   1. Remove equipment and devices when no longer required.
   2. Repair damage caused by installation.
   3. Remove post settings to depth of 2 feet.

1.12 FIRE-PREVENTION FACILITIES

A. Prohibit smoking within buildings under construction and demolition. Designate area on Site where smoking is permitted. Provide approved ashtrays in designated smoking areas.

B. Establish fire watch for cutting, welding, and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.

C. Portable Fire Extinguishers: NFPA 10; 10-pound capacity, 4A-60B: C UL rating.
   1. Provide one fire extinguisher at each facility.
   2. Provide minimum of one fire extinguisher in every construction trailer and storage shed.
   3. Provide minimum of one fire extinguisher on roof during roofing operations using heat-producing equipment.

1.13 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to allow for Owner's use of Site, and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way.

C. Tree and Plant Protection: Preserve and protect existing trees and plants designated to remain.
   1. Protect areas within drip lines from traffic, parking, storage, dumping, chemically injurious materials and liquids, ponding, and continuous running water.
   2. Provide 4-foot-high barriers around drip line, with access for maintenance.
   3. Replace trees and plants damaged by construction operations.

D. Protect non-owned vehicular traffic, stored materials, Site, and structures from damage.

1.14 ENCLOSURES AND FENCING

A. Construction: Commercial-grade chain-link fence or orange plastic construction netting.

B. Provide 6-foot-high fence around construction Site; equip with vehicular and pedestrian gates with locks.

C. Provide orange plastic construction netting around open excavations.

D. Exterior Enclosures:
   1. Provide temporary weathertight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual Specification Sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.15 WATER CONTROL

A. Grade Site to drain. Maintain excavations free of water. Provide, operate, and maintain necessary pumping equipment.

B. Protect Site from puddles or running water. Provide water barriers as required to protect Site from soil erosion.

1.16 DUST CONTROL

A. Execute Work by methods that minimize raising dust from construction operations.

B. Provide positive means to prevent airborne dust from dispersing into atmosphere.

1.17 EROSION AND SEDIMENT CONTROL

A. Refer to Section 31 25 12 – Storm Water Pollution Prevention

1.18 NOISE CONTROL

A. Provide methods, means, and facilities to minimize noise produced by construction operations.

1.19 PEST AND RODENT CONTROL

A. Provide methods, means, and facilities to prevent pests and insects from damaging the Work.

B. Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

1.20 POLLUTION CONTROL

A. 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.

B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

C. Control dust caused by the work and comply with pollution control regulations of governing authorities. Sprinkling or similar methods will be permitted to control dust. Use of petroleum products or chlorides is prohibited. Sprinkling must be repeated as needed to keep the disturbed area damp. Dust control shall be performed as the work proceeds whenever a potential for dust nuisance or hazard occurs.

D. Burning is not allowed on this project.

E. Blasting is not allowed on this project.

1.21 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials before Final Application for Payment inspection.

B. Remove underground installations to minimum depth of 2 feet. Grade Site as indicated on Drawings.

C. Clean and repair damage caused by installation or use of temporary Work.

D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.
B. Product delivery requirements.
C. Product storage and handling requirements.
D. Product options.
E. Equipment electrical characteristics and components.
F. Product substitutions and procedures.

1.2 PRODUCTS

A. Specified products define standard of quality, type, function, dimension, appearance, and performance required.

B. Furnish products of qualified manufacturers that are suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise. Confirm that manufacturer's production capacity can provide sufficient product, on time, to meet Project requirements.

C. Domestic Products: Except where specified otherwise, domestic products are required and interpreted to mean products mined, manufactured, fabricated, or produced in United States or its territories.

D. Do not use materials and equipment removed from existing premises except as specifically permitted by Contract Documents.

E. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products according to manufacturer's instructions.

B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products according to manufacturer's instructions.

B. Store products with seals and labels intact and legible.

C. Store sensitive products in weathertight, climate-controlled enclosures in an environment suitable to product.

D. For exterior storage of fabricated products, place products on sloped supports aboveground.

E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

F. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

G. Provide equipment and personnel to store products; use methods to prevent soiling, disfigurement, or damage.

H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Products complying with specified reference standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and complying with Specifications; no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit Request for Substitution for any manufacturer not named.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Field engineering.
B. Closeout procedures.
C. Starting of systems.
D. Demonstration and instructions.
E. Minimum start up requirements.
F. Project record documents.
G. Operation and maintenance data.
H. Manual for materials and finishes.
I. Manual for equipment and systems.
J. Spare parts and maintenance products.
K. Product warranties and product bonds.
L. Maintenance service.
M. Examination.
N. Execution.
O. Cutting and patching.
P. Protecting installed construction.
Q. Final cleaning.

1.2 FIELD ENGINEERING

A. Owner will locate and Contractor shall protect survey control and reference points. Promptly notify Engineer of discrepancies discovered.

B. Control datum for survey is established by Owner-provided survey indicated on Drawings.

C. Contractor shall verify setbacks and easements; confirm Drawing dimensions and elevations.

D. Protect survey control points prior to starting Site Work; preserve permanent reference points during construction.

E. Promptly report to Engineer loss or destruction of reference point or relocation required because of changes in grades or other reasons.

F. Contractor shall retain Engineer to replace dislocated survey control points based on original survey control.

1.3 CLOSEOUT PROCEDURES

A. Prerequisites to Substantial Completion: Complete following items before requesting Certification of Substantial Completion, either for entire Work or for portions of Work:
   1. Submit maintenance manuals, Project record documents, digital images of construction photographs, and other similar final record data in compliance with this Section.

2. Complete facility startup, testing, adjusting, balancing of systems and equipment, demonstrations, and instructions to Owner's operating and maintenance personnel as specified in compliance with this Section.
3. Conduct inspection to establish basis for request that Work is substantially complete. Create comprehensive list (initial punch list) indicating items to be completed or corrected, value of incomplete or nonconforming Work, reason for being incomplete, and date of anticipated completion for each item. Include copy of list with request for Certificate of Substantial Completion.
4. Obtain and submit releases enabling Owner's full, unrestricted use of Project and access to services and utilities. Include certificate of occupancy, operating certificates, and similar releases from authorities having jurisdiction and utility companies.
5. Deliver tools, spare parts, extra stocks of material, and similar physical items to Owner.
6. Make final change-over of locks and transmit keys directly to Owner. Advise Owner's personnel of change-over in security provisions.
7. Discontinue or change over and remove temporary facilities and services from Project Site, along with construction tools, mockups, and similar elements.
8. Perform final cleaning according to this Section.

B. Prerequisites for Final Completion: Complete following items before requesting final acceptance and final payment.
1. When Contractor considers Work to be complete, submit written certification that:
   a. Contract Documents have been reviewed.
   b. Work has been examined for compliance with Contract Documents.
   c. Work has been completed according to Contract Documents.
   d. Work is completed and ready for final inspection.
2. Submittals: Submit following:
   a. Final punch list indicating all items have been completed or corrected.
   b. Final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
   c. Specified warranties, workmanship/maintenance bonds, maintenance agreements, and other similar documents.
   d. Accounting statement for final changes to Contract Sum.
   e. Contractor's affidavit of payment of debts and claims on Contractor's Affidavit of Payment of Debts and Claims.
   f. Contractor affidavit of release of liens on Contractor's Affidavit of Release of Liens.
   g. Consent of surety to final payment on Consent of Surety to Final Payment Form.
3. Perform final cleaning for Contractor-soiled areas according to this Section.

1.4 STARTING OF SYSTEMS

A. Coordinate schedule for startup of various equipment and systems.

B. Notify Engineer and Owner seven days prior to startup 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 which may cause damage.

D. Verify that tests, meter readings, and electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute startup under supervision of manufacturer's representative or Contractors' personnel according to manufacturer's instructions.

G. When specified in individual Specification Sections, require manufacturer to provide authorized representative who will be present at Site to inspect, check, and approve equipment or system installation prior to startup and will supervise placing equipment or system in operation.

H. Submit a written report according to Section 01 33 00 - Submittal Procedures that equipment or system has been properly installed and is functioning correctly.

1.5 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate Project equipment and instruct in classroom environment located at the project site and instructed by qualified manufacturer's representative who is knowledgeable about the Project.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Use 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.

E. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. Required instruction time for each item of equipment and system is specified in individual Specification Sections.

H. Required instruction time for each item of equipment and system is specified in individual sections. The manufacturer's instructor shall present at least one "hands-on" demonstration of common corrective maintenance repairs so that all operation and maintenance personnel have the opportunity to witness the demonstration. The manufacturer shall provide the tools and equipment to conduct the demonstrations.

I. In any "hands-on" training situation where Owner's operation or maintenance personnel participate in disassembly or assembly of equipment components, the manufacturer shall be responsible for such disassembly or assembly and shall provide written certification of proper equipment operation to the Engineer.

1.6 MINIMUM START UP REQUIREMENTS

A. Bearings and Shafting.
   1. Inspect for cleanliness, clean and remove run rough or noisy.
   2. Lubricate as necessary, in accordance with manufacturer's recommendations.

B. Drives.
   1. Adjust tension in V-belt drives and adjust varipitch sheaves and drives for proper equipment speed.
   2. Adjust drives for alignment of sheaves and V-belts.
   3. Clean and remove foreign materials before starting operation.

C. Motors.
   1. Check each motor for comparison to amperage nameplate value.
   2. Correct conditions which produce excessive current flow and which exist due to equipment malfunction.

D. Pumps.
   1. Check glands and seals for cleanliness and adjustment before running pumps.
   2. Inspect shaft sleeves for scoring.
   3. Inspect mechanical faces, chambers, and seal rings, and replace if defective.
   4. Verify that piping system is free of dirt, debris and scale before circulating liquid through the pump.

E. Valves.
   1. Inspect hand and automatic control valves, clean bonnets and stems.
   2. Tighten packing glands to assure no leakage but permit valve stems to operate without galling.
   3. Replace packing in valves to retain maximum adjustment after system is judged complete.
   4. Replace packing on any valve which continues to leak.
   5. Remove and repair bonnets which leak.
   6. Coat packing gland threads and valve stems with a surface preparation of "Moly-Cote" or "Mallow-Pro", after cleaning.

F. Verify that control valve seats are free from foreign material and are properly positioned for intended use.

G. Tighten all pipe joints after system has been placed in operation. Replace gaskets which show any sign of leakage after tightening.

H. Inspect all joints for leakage.
   1. Promptly remake each joint which appears to be faulty, do not wait for rust to form.
   2. Clean threads on both parts, apply compound and remake joints.

I. After system has been placed in operation, clean strainers, dirt pockets, orifices, valve seats and headers in fluid system, to assure freedom from foreign materials.

J. Open traps and air vents where used, remove operating elements. Clean thoroughly, replace internal parts, and put back into operation.

K. Remove rust, scale and foreign material from equipment and renew defaced surfaces.

L. Set and calibrate equipment, including all electrical and control systems.

M. Inspect fan wheels for clearance and balance. Provide factory-authorized personnel for adjustment when needed.

N. Check each electrical control and power circuit to assure that operation complies with specifications and requirements to provide desired performance.

O. Inspect each pressure gauge and thermometer for calibration. Replace items which are defaced, broken or, or which read incorrectly.

P. Repair damaged insulation.

Q. Vent gasses trapped in any part of systems. Verify that liquids are drained from all parts of gas or air systems.

R. Reports to Engineer indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents.

1.7 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, not less than weekly.

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 used.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction as follows:
   1. Include Contract modifications such as Addenda, supplementary instructions, change directives, field orders, minor changes in the Work, and change orders.
   2. Include locations of concealed elements of the Work.

3. Identify depth of buried utility lines and provide dimensions showing distances from permanent facility components that are parallel to utilities.
4. Dimension ends, corners, and junctions of buried utilities to permanent facility components using triangulation.
5. Identify and locate existing buried or concealed items encountered during Project.
6. Measured depths of foundations in relation to vertical datum.
7. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
8. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
9. Field changes of dimension and detail.
10. Details not on original Drawings.

G. Submit marked-up paper copy documents to Engineer with claim for final Application for Payment.

H. Submit PDF electronic files of marked-up documents to Engineer with claim for final Application for Payment.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2 x 11-inch text pages, three D side ring binders with durable plastic covers.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," title of Project, and subject matter of binder when multiple binders are required.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

E. Contents: Prepare table of contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by Specification Section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Include the following:
    a. Significant design criteria.
    b. List of equipment.
    c. Parts list for each component.
    d. Operating instructions.
    e. Maintenance instructions for equipment and systems.
    f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
    g. Safety precautions to be taken when operating and maintaining or working near equipment.

3. Part 3: Project documents and certificates, including the following:
   a. Shop Drawings and product data.
   b. Air and water balance reports.
   c. Certificates.
   d. Originals of warranties and bonds.

1.9 MANUAL FOR MATERIALS AND FINISHES

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.

B. For equipment or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes within ten days after final inspection.

E. Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom-manufactured products.

F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.

H. Additional Requirements: As specified in individual product Specification Sections.

I. Include listing in table of contents for design data, with tabbed fly sheet and space for insertion of data.

1.10 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit electronic copy of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes 30 days prior to final inspection. Draft copy will be reviewed and returned after final inspection, with Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit three sets of revised final volumes within ten days after final inspection.

E. Each Item of Equipment and Each System: Include description of unit or system and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

F. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

G. Include color-coded wiring diagrams as installed.

H. Operating Procedures: Include startup, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and special operating instructions.

I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

J. Include servicing and lubrication schedule and list of lubricants required.

K. Include manufacturer's printed operation and maintenance instructions.

L. Include sequence of operation by controls manufacturer.

M. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

N. Include control diagrams by controls manufacturer as installed.

O. Include Contractor's coordination drawings with color-coded piping diagrams as installed.

P. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

Q. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

R. Include test and balancing reports as specified in Section 01 40 00 - Quality Requirements.

S. Additional Requirements: As specified in individual product Specification Sections.

T. Include listing in table of contents for design data with tabbed dividers and space for insertion of data.

1.11 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual Specification Sections.

B. Deliver to Project Site and place in location as directed by Owner; obtain receipt prior to final payment.

1.12 PRODUCT WARRANTIES

A. Obtain warranties executed in duplicate by responsible Subcontractors, suppliers, and manufacturers within ten days after completion of applicable item of Work.

B. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include table of contents and assemble in three D side ring binder with durable plastic cover.

F. Submit prior to final Application for Payment.

G. Time of Submittals:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
   2. Make other submittals within ten days after date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.13 MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in Specification Sections for one year from date of Substantial Completion.

B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.

D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing Site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new 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. Verify that utility services are available with correct characteristics and in correct locations.

3.2 EXECUTION

A. Comply with manufacturer's installation instructions, performing each step in-sequence. Maintain one set of manufacturer's installation instructions at Project Site during installation and until completion of construction.

B. When manufacturer's installation instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Verify that field measurements are as indicated on approved Shop Drawings or as instructed by manufacturer.

D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
   1. Secure Work true to line and level and within specified tolerances, or if not specified, industry-recognized tolerances.
   2. Physically separate products in place, provide electrical insulation, or provide protective coatings to prevent galvanic action or corrosion between dissimilar metals.
   3. Exposed Joints: Provide uniform joint width and arrange to obtain best visual effect. Refer questionable visual-effect choices to Engineer for final decision.

E. Allow for expansion of materials and building and structural movement.

F. Mounting Heights: Where not indicated, mount individual units of Work at industry recognized standard mounting heights for particular application indicated.
   1. Refer questionable mounting heights choices to Engineer for final decision.
   2. Elements Identified as Accessible to Handicapped: Comply with applicable codes and regulations.

G. Clean and perform maintenance on installed Work as frequently as necessary through remainder of construction period. Lubricate operable components as recommended by manufacturer.

3.3 CUTTING AND PATCHING

A. Employ skilled and experienced installers to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements affecting:
   1. Structural integrity of element.
   2. Integrity of weather-exposed or moisture-resistant elements.
   3. Efficiency, maintenance, or safety of element.
   4. Visual qualities of sight-exposed elements.
   5. Work of Owner or separate contractor.

C. Execute cutting, fitting, and patching including excavation and fill to complete Work and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.
   3. Remove and replace defective and nonconforming Work.
   4. Remove samples of installed Work for testing.
   5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute Work by methods to avoid damage to other Work and to provide proper surfaces to receive patching and finishing.

E. Cut masonry and concrete materials using masonry saw or core drill.

F. Restore Work with new products according to requirements of Contract Documents.

G. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.

H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

I. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.

J. Identify hazardous substances or conditions exposed during the Work to Engineer for decision or remedy.

3.4 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual Specification Sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Use durable sheet materials to protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

3.5 FINAL CLEANING

A. Execute final cleaning prior to final Project assessment.

B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; and vacuum carpeted and soft surfaces.

C. Clean debris from roofs, gutters, downspouts, and drainage systems.

D. Clean Site; sweep paved areas, rake clean landscaped surfaces.

E. Remove waste and surplus materials, rubbish, and construction facilities from Site.

F. Clean equipment and fixtures to sanitary condition with appropriate cleaning materials.

G. Install new filters of operating equipment.

END OF SECTION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
4. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

B. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

a. Personal items.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 WARRANTY

A. Notify warrantor on completion of selective demolition and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.

3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling.

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.

1. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Rooftop equipment bases and support curbs.
2. Wood blocking, cants, and nailers.

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

1. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2[for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground].

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat all miscellaneous carpentry unless otherwise indicated.

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
3. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all miscellaneous carpentry unless otherwise indicated.

1. Concealed blocking.
2. Roof framing and blocking.
3. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.

2.4 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Northern species; NLGA.

B. Other Framing: No. 2 grade of any of the following species:

1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.
4. Southern pine or mixed southern pine; SPIB.
5. Spruce-pine-fir; NLGA.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

C. Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:

1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Northern species, No. 2 Common grade; NLGA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.7 METAL FRAMING ANCHORS

A. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

B. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

C. Stainless-Steel Sheet: ASTM A 666, Type 304.

1. Use for exterior locations and where indicated.

2.8 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate[furring,] nailers, blocking, [grounds,]and similar supports to comply with requirements for attaching other construction.

C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

D. Do not splice structural members between supports unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

COMPOSITE FABRICATIONS - SECTION 06 80 00

PART 1 GENERAL

1.1 WORK OF THIS SECTION

A. Work of this Section includes providing products fabricated from fiberglass reinforced plastic (FRP) and bolts, nuts, washers, supports, and accessories.

B. Work also provides quality standards for all fabricated fiberglass reinforced plastic equipment of this Section and any other Section containing FRP equipment.

C. Work also requires that one manufacturer accepts responsibility for Work as indicated but without altering or modifying Contractor's responsibilities under Contract Documents.

D. Work also includes coordination of design, assembly, testing, and installation.

1.2 RELATED SECTIONS

A. Work of the following Sections applies to Work of this Section. Other Sections of Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.
1. Section 33 05 78 Fiberglass Wetwell

1.3 CODES

A. Work of this Section shall comply with the current editions of the following codes:
1. Uniform Building Code
2. Uniform Mechanical Code
3. Uniform Fire Code
4. National Electrical Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, current editions of the following apply to Work of this Section:
1. NBS PS 15 Custom Contact-Molded Reinforced Polyester Chemical-Resistant Process Equipment
2. ASTM A 325 Specification for High-Strength Bolts for Structural Steel Joints
3. ASTM A 490 Specification for Heat-Treated Steel Structural Bolts 150 ksi (1035 MPa) Tensile Strength
4. ASTM C 581 Practice For Determining Chemical Resistance of Thermosetting Resins Used in Glass Fiber Reinforced Structures, Intended for Liquid Service
5. ASTM D 638 Test Method for Tensile Properties of Plastics
6. ASTM D 695 Test Method for Compressive Properties of Rigid Plastics
7. ASTM D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
8. ASTM D 883 Definitions of Terms Relating to Plastics
9. ASTM D 2563 Recommended Practice for Classifying Visual Defects in Glass- Reinforced Plastic Laminate Parts
10. ASTM D 2583 Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
11. ASTM D 2584 Test Method for Ignition Loss of Cured Reinforced Resins
12. ASTM D 3299 Specification for Filament-Wound Glass Fiber Reinforced Thermoset Resin Chemical-Resistant Tanks
13. ASTM D 3467 Test Method for Carbon Tetrachloride Activity of Activated

Carbon

14. AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings
15. NFPA 255 Method of Test for Surface Burning Characteristics of Building Materials
16. ANSI/AWS D1.1 Structural Welding Code -- Steel
17 ANSI/AWWA F101 Contact-Molded, Fiberglass-Reinforced Plastic Wash Water Troughs and Launders
18. ANSI/AWWA F102 Matched-Die-Molded, Fiberglass-Reinforced Plastic Weir Plates, Scum Baffles and Mounting Brackets

1.5 OWNER'S MANUAL

A. Following shall be included in Owner's Manual in compliance with Section 01 33 00 – Submittal Procedures:
   1. Maintenance and repair instructions for fiberglass work.
   2. Name, address and telephone number of fiberglass fabricators and manufacturers.
   3. Certificate of compliance with specifications and requirements of fiberglass items of Work.

PART 2 - PRODUCTS

2.1 GENERAL

A. General: Only products certified as complying with the indicated requirements shall be provided.

B. Products: All items shall be new, of current design, from reputable manufacturers specializing in such products.

C. Manufacturer's Recommendations: Products shall be recommended by manufacturer for application indicated.

2.2 GENERAL REQUIREMENTS

A. Quality: Fiberglass items shall be constructed of new, filament-wound or fiberglass-fabric-reinforced polyester resin laminate material of strength, thickness, and dimensions indicated, using matched die-molded or contact molded method.

B. Finish: Finished surfaces of fiberglass items and fabrications shall be smooth, resin-rich, free of voids, without dry spots and unreinforced areas, corrosion resistant and without exposed glass fibers.

C. Supports and Fasteners: Bolts, anchor bolts, washers and supports shall be fabricated of Type 316 stainless steel, unless otherwise indicated.

2.3 FIBERGLASS GRATING

A. Construction: Fiberglass grating shall be minimum one inch high with one inch by 4" grid, or 1-1/2" high with 1-1/2" by 6" grid and cut edges shall be resealed. Maximum deflection under design load (200 psf) shall not exceed 1/8" at 24" span. Fiberglass grating shall have a permanently slip-resistant surface. Cut edges and openings shall be banded.

2.4 MANUFACTURERS

A. Products of type or model (if any) indicated shall be manufactured by one of the following (or equal):
   1. Fiberglass Grating:
      a. Fibergrate Corp., "Fibergrate"
      b. Chemical Proof Corp., "Chemi-Grate"

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Fiberglass components shall be fabricated and installed with edges level and straight. In no case shall variation in level exceed 1/16” above, nor 1/8” below established grade. All cut edges shall be sealed.

B. Products shall be installed in accordance with manufacturer's installation instructions.

END OF SECTION

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes standing-seam metal roof panels.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
2. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
3. Review structural loading limitations of deck during and after roofing.
4. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
5. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
6. Review temporary protection requirements for metal panel systems during and after installation.
7. Review procedures for repair of metal panels damaged after installation.
8. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 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 each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 or ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft..

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft..

D. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.

B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Petersen, Pac-Clad "Snap-Clad" or comparable product by one of the following:

a. Architectural Metal Systems; a Nucor company.
b. CENTRIA Architectural Systems.
c. Garland Company, Inc. (The)
d. IMETCO.
e. MBCI; a division of NCI Building Systems, L.P.
f. Morin; a Kingspan Group company.

2. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

a. Thickness: 0.032 inch.
b. Surface: Smooth, flat finish.
c. Exterior Finish: Three-coat fluoropolymer.
d. Color: As selected by Architect from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
3. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.

b. Grace Construction Products; W. R. Grace & Co.- Conn.; Grace Ice and Water Shield HT.
c. Henry Company; Blueskin PE200 HT.
d. Kirsch Building Products, LLC; Sharkskin Ultra SA.
e. Metal-Fab Manufacturing, LLC; MetShield.
f. Owens Corning; WeatherLock Metal High Temperature Underlayment.

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match roof fascia and rake trim.

E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.

F. Roof Curbs: Fabricated from same material as roof panels, 0.048-inch nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch-nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.

1. Insulate roof curb with 1-inch- thick, rigid insulation.

G. Panel Fasteners: Self-tapping screws designed to withstand design loads.

H. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. 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.

C. Aluminum Panels and Accessories:

1. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

    a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated [below] [on Drawings], wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.

B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.4 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weather tight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Watertight Installation:

    a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
    b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
    c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

J. Roof Curbs: Install flashing around bases where they meet metal roof panels.

K. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 074213.53 - METAL SOFFIT PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes metal soffit panels.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 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 each type of panel and accessory.

B. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft..

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft..

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METAL SOFFIT PANELS

A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners inside laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: Match profile and material of metal roof panels.

1. Finish: Match finish and color of metal roof panels.
2. Sealant: Factory applied within interlocking joint.

C. Flush-Profile Metal Soffit Panels: Solid panels formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Petersen Pac Clad - "Flush/Reveal Soffit: Flush Solid" or comparable product by one of the following:

    a. CENTRIA Architectural Systems.
    b. Firestone Metal Products, LLC.
    c. MBCI; a division of NCI Building Systems, L.P.
    d. Metal-Fab Manufacturing, LLC.

2. Material: Same material, finish, and color as metal roof panels.
3. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

    a. Thickness: 0.032 inch.
    b. Surface: Smooth, flat finish.
    c. Exterior Finish: Three-coat fluoropolymer.
    d. Color: As selected by Architect from manufacturer's full range.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in 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.

C. Aluminum Panels and Accessories:

1. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.

    a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.

2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.53

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Formed roof-drainage sheet metal fabrications.
2. Formed low-slope roof sheet metal fabrications.

B. Related Requirements:

1. Section 074113.16 Standing Seam Metal Roof Panels for materials and installation of sheet metal flashing and trim integral with roofing.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 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 each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
2. Include identification of material, thickness, weight, and finish for each item and location in Project.
3. Include details for forming, including profiles, shapes, seams, and dimensions.
4. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
5. Include details of termination points and assemblies.
6. Include details of roof-penetration flashing.
7. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish:

a. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range.
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft.minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

E. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

E. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

G. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

H. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

I. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

J. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

K. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.

1. Gutter Profile: Style B according to cited sheet metal standard.
2. Expansion Joints: Lap type.
3. Gutters with Girth up to 15 Inches: Fabricate from the following materials:

    a. Aluminum: 0.032 inch thick.

4. Gutters with Girth 16 to 20 Inches: Fabricate from the following materials:

a. Aluminum: 0.040 inch thick.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.

1. Fabricated Hanger Style: Fig 1-35A according to SMACNA's "Architectural Sheet Metal Manual."
2. Manufactured Hanger Style: Fig 1-34A according to SMACNA's "Architectural Sheet Metal Manual."
3. Fabricate from the following materials:

a. Aluminum: 0.024 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 ROOF-DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
2. Anchor and loosely lock back edge of gutter to continuous cleat.
3. Anchor gutter with gutter brackets spaced not more than 24 inches apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
4. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.

3.5 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

D. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

E. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

F. Field-Adhesion-Test Reports: For each sealant application tested.

G. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.

3. Stain Testing: Use ASTM C 1248 to determine stain potential of sealant when in contact with masonry substrates.
4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.8 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 790.
    b. Pecora Corporation; 301 NS.
    c. Sika Corporation U.S.; Sikasil WS-290.

B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 791.
    b. Pecora Corporation; PCS.
    c. Sika Corporation U.S.; Sikasil WS-295.

C. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 758.
    b. Schnee-Morehead, Inc., an ITW company; SM5731 Poly-Glaze Plus.
    c. Sherwin-Williams Company (The); White Lighning Silicone Ultra All Purpose Sealant.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. BASF Construction Chemicals - Building Systems; Sonalastic TX1.
    b. Pecora Corporation; Dynatrol I-XL.
    c. Sherwin-Williams Company (The); Stampede-1.
    d. Sika Corporation U.S.; Sikaflex Textured Sealant.
    e. Tremco Incorporated; Dymonic.

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 786-M White.
b. Pecora Corporation: 860.
c. Adfast: Adseal KB 4800 Series.
d. Sika Corporation, Construction Products Division; Sikasil-GP.
e. Tremco Incorporated; Tremsil 200.

2.5 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bostik, Inc.; Chem-Calk 300.
b. Pecora Corporation; BC-158.
c. Sika Corporation, Construction Products Division; SikaLastomer - 511

2.6 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

    a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

    a. Whether sealants filled joint cavities and are free of voids.
    b. Whether sealant dimensions and configurations comply with specified requirements.
    c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 09 90 00 – PAINTING AND COATING

PART 1 GENERAL

1.1 RELATED SECTIONS

A. All equipment, pipelines and structure specifications where painting is required.

B. The following Specifications sections take precedence, painting and coating described in this specification shall not apply to painting and coating on materials described in these specifications:

1. Section 09 91 13 - Exterior Painting
2. Section 09 91 23 - Interior Painting
3. Section 09 96 00 – High-Performance Coatings

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Water Works Association (AWWA):
   a. C209, Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
   b. C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
   c. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
   d. C214, Tape Coating Systems for the Exterior of Steel Water Pipelines.
2. American National Standards Institute (ANSI):
   a. Standard Colors for Color Identification and Coding
   b. A13.1, Scheme for Identification of Piping Systems
3. Environmental Protection Agency (EPA).
4. Ductile Iron Pipe Research Association (DIPRA): Surface Preparation Specifications.
5. NACE International (NACE): SP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
6. National Association of Pipe Fabricators (NAPF):
   a. NAPF 500-03-01, Solvent Cleaning
   b. NAPF 500-03-04, Abrasive Blast Cleaning for Ductile Iron Pipe
   c. NAPF 500-03-05, Abrasive Blast Cleaning for Cast Ductile Iron Fittings
7. NSF International (NSF):
   a. 61, Drinking Water System Components - Health Effects.
   b. 600 Health Effects Evaluation and Criteria for Chemicals in Drinking Water
8. Occupational Safety and Health Act (OSHA).
9. The Society for Protective Coatings (SSPC):

a. QP1, Standard Procedure for Evaluating the Qualifications of Painting Contractors (Field Application to Complex Structures)
b. QP2, Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint.
c. SP 1, Solvent Cleaning.
d. SP 2, Hand Tool Cleaning.
e. SP 3, Power Tool Cleaning.
f. SP 5, Joint Surface Preparation Standard White Metal Blast Cleaning.
g. SP 6, Joint Surface Preparation Standard Commercial Blast Cleaning.
h. SP 7, Joint Surface Preparation Standard Brush-Off Blast Cleaning.
i. SP 10, Joint Surface Preparation Standard Near-White Blast Cleaning.
j. SP 11, Power Tool Cleaning to Bare Metal.
k. SP 12, Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultrahigh Pressure - Water Jetting Prior to Recoating.
l. SP 13, Surface Preparation of Concrete.
m. PA 1, Shop, Field, and Maintenance Painting
n. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
o. PA 3, Guide to Safety in Paint Applications.
p. Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates

1.2 DEFINITIONS

A. Terms used in this section:
1. Coverage: Total minimum dry film thickness in mils or square feet per gallon.
2. FRP: Fiberglass Reinforced Plastic.
3. HCl: Hydrochloric Acid.
4. MDFT: Minimum Dry Film Thickness, mils.
5. MDFTPC: Minimum Dry Film Thickness per Coat, mils.
6. Mil: Thousandth of an inch.
7. PDS: Product Data Sheet.
8. PSDS: Paint System Data Sheet.
9. PVC: Polyvinyl Chloride.
10. SFPG: Square Feet per Gallon.
11. SFPGPC: Square Feet per Gallon per Coat.
12. SP: Surface Preparation.

1.3 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
a. Data Sheets:

1) For each product, furnish a Product Data Sheet (PDS), the manufacturer's technical data sheets, and paint colors available (where applicable). The PDS form is appended to the end of this section.
2) For each paint system, furnish a Paint System Data Sheet (PSDS). The PSDS form is appended to the end of this section.
3) Technical and performance information that demonstrates compliance with Specification.
4) Furnish copies of paint system submittals to the coating applicator.
5) Indiscriminate submittal of only manufacturer's literature is not acceptable.

b. Detailed chemical and gradation analysis for each proposed abrasive material.

2. Samples:
   a. Proposed Abrasive Materials: Minimum 5-pound sample for each type.
   b. Reference Panel:
      1) Surface Preparation:
         a) Prior to start of surface preparation, furnish a 4-inch by 4-inch steel panel for each grade of abrasive blast specified herein, prepared to specified requirements.
         b) Provide panel representative of the steel used; prevent deterioration of surface quality.
         c) Panel to be reference source for inspection upon approval by Engineer.

      2) Paint:
         a) Unless otherwise specified, before painting work is started, prepare minimum 8-inch by 10-inch sample with type of paint and application specified on similar substrate to which paint is to be applied.
         b) Furnish additional samples as required until colors, finishes, and textures are approved.
         c) Approved samples to be the quality standard for final finishes.
      3) A 2-feet by 2-feet panel can also be used for both surface preparation and paint test.

B. Required Informational Submittals:

1. Copy of an active SSPC QP 1 Certification.
2. Applicator's Qualification: List of references substantiating experience.
3. Coating manufacturer's Certificate of Compliance, in accordance with Section 01 33 00, Submittal Procedures.

4. Factory Applied Coatings: Manufacturer's certification stating factory applied coating system meets or exceeds requirements specified.
5. Manufacturer's written verification that submitted material is suitable for the intended use.
6. If the manufacturer of finish coating differs from that of shop primer, provide finish coating manufacturer's written confirmation that materials are compatible.
7. Manufacturer's written instructions and special details for applying each type of paint.
8. Manufacturer's written verification that submitted material is suitable for the intended use.
9. Manufacturer's certification that the coating contractor's foreman and workers are experienced in the application of the specified coating systems. The letter shall state that the manufacturer has verified that the Contractor is going to use the proper mixing, application, heating, and environmental control equipment for the specified products.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum 5 years' experience in application of specified products. Certified in accordance with the Society for Protective Coatings' SSPC QP1.

B. Regulatory Requirements:

1. Meet federal, state, and local requirements limiting the emission of volatile organic compounds.
2. Perform surface preparation and painting in accordance with recommendations of the following:
   a. Paint manufacturer's instructions.
   b. SSPC PA 3, Guide to Safety in Paint Applications.
   c. Federal, state, and local agencies having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Shipping:

1. Where precoated items are to be shipped to the Site, protect coating from damage. Batten coated items to prevent abrasion.
2. Protect shop painted surfaces during shipment and handling by suitable provisions including padding, blocking, and use of canvas or nylon slings.

B. Storage:

1. Store products in a protected area that is heated or cooled to maintain temperatures within the range recommended by paint manufacturer.

Primed surfaces shall not be exposed to weather for more than 2 months before being top coated, or less time if recommended by coating manufacturer.

1.6 PROJECT CONDITIONS

A. Environmental Requirements:
No coating work shall be performed under the following conditions:

1. Surface or ambient temperatures exceed the manufacturer's recommended maximum or minimum allowable.
2. Dust or smoke laden atmosphere.
3. Do not apply paint in temperatures or moisture conditions outside of manufacturer's recommended maximum or minimum allowable.
4. Do not perform final abrasive blast cleaning whenever relative humidity exceeds 85%, or whenever surface temperature is less than 5°F above dew point of ambient air within 8 hours after application of coating.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Material Sources: Products shall be standard products produced by recognized manufacturers who are regularly engaged in the production of such materials for essentially identical service conditions. Where requested, the Contractor shall provide the Owner with the names of not less than 5 successful applications of the proposed manufacturer's products demonstrating compliance with this Specification requirement. Proposed substitute materials shall be shown to satisfy the material descriptions and to equal or exceed the properties of the listed materials as required in the paragraph entitled "Substitute or `Or-Equal' Submittals" herein.

B. Substitute or "Or-Equal" Submittals: Coating materials suitable for immersion and non-immersion and recommended by their manufacturer for water and wastewater treatment process solids, liquid, and gases shall be applied. Unless otherwise specified, materials are from the catalogs of the companies listed herein. Materials by other manufacturers are acceptable provided that they are established as being compatible with and of equal quality to the coatings of the companies listed and accepted by the Owner. The Contractor shall provide satisfactory documentation from the firm manufacturing the proposed substitute or "or-equal" material that said material meets the specified requirements and is equivalent to or better than the listed materials in the following properties:
1. Minimum and maximum recoat times with itself and with topcoats
2. Minimum and maximum cure times for immersion
3. Moisture Vapor Transmission Rate per ASTM D1653 Method B or ASTM E96 at 40 mils minimum for 100% solids products
4. Abrasion Resistance per ASTM D4060 using a CS17 Wheel

5. Dry film thickness per coat
6. Compatibility with other coatings
7. Suitability for the intended service
8. Resistance to chemical attack
9. Temperature limitations in service and during application
10. Solids content by volume

C. Minimum of 5 years' verifiable experience in manufacture of specified product.

D. Each of the following manufacturers is capable of supplying most of the products specified herein:

1. Tnemec Coatings, Kansas City, MO.
2. Carboline Coatings.
3. International Paints.
4. Ameron Protective Coatings, Brea, CA.
5. ICI Devoe Coatings, Louisville, KY.
6. DuPont Chemical Co. Wilmington, DE.
7. Industrial Protective Coatings, Houston, TX.
8. Sherwin Williams, Cleveland, OH.
9. Madewell Products Corporation, Alpharetta, GA.
10. Sauereisen, Pittsburgh, PA.

E. The cost of all testing and analysis of the proposed substitute materials that may be required by the Owner shall be paid by the Contractor. If the proposed substitution requires changes in the Contract work, the Contractor shall bear all such costs involved and the costs of allied trades affected by the substitution.

2.2 ABRASIVE MATERIALS

A. Select abrasive type and size to produce surface that meets coating manufacturer's recommendations for specific primer and coating system to be applied.

2.3 PAINT MATERIALS

A. General:

1. Manufacturer's highest quality products suitable for intended service.
2. Compatibility: Only compatible materials from a single manufacturer shall be used in the Work. Particular attention shall be directed to compatibility of primers and finish coats.
3. Thinners, Cleaners, Driers, and Other Additives: As recommended by coating manufacturer.

B. Products:

Product	Definition
Acrylic Latex	Single-component, finish as required
Acrylic Latex (Flat)	Flat latex
Acrylic Sealer	Clear acrylic
Alkyd (Semigloss)	Semigloss alkyd
Alkyd Enamel	Optimum quality, gloss or semigloss finish as required, medium long oil
Alkyd Wood Primer	Flat alkyd
Bituminous Paint	Single-component, coal-tar pitch based
Block Filler	Primer-sealer designed for rough masonry surfaces, 100% acrylic emulsion
DTM Acrylic Primer	Surface tolerant, direct-to-metal water borne acrylic primer
DTM Acrylic Finish	Surface tolerant, direct-to-metal water borne acrylic finish coat
Elastomeric Polyurethane	100% solids, plural component, spray applied, high build, elastomeric polyurethane coating, suitable for the intended service
Epoxy Filler/Surfacer	100% solids epoxy trowel grade filler and surfacer, non-shrinking, suitable for application to concrete and masonry. Approved for potable water contact and conforming to NSF 61, where required
Epoxy Nonskid (Aggregated)	Polyamidoamine or amine converted epoxies aggregated; aggregate may be packaged separately
Epoxy Primer—Ferrous Metal	Anticorrosive, converted epoxy primer containing rust-inhibitive pigments

Product	Definition
Epoxy Primer—Other	Epoxy primer, high-build, as recommended by coating manufacturer for specific galvanized metal, copper, or nonferrous metal alloy to be coated
Fusion Bonded Coating	100% solids, thermosetting, fusion bonded, dry powder epoxy, suitable for the intended service
Fusion Bonded, TFE Lube or Grease Lube	Tetrafluoroethylene, liquid coating, or open gear grease as supplied by McMaster-Carr Supply Corporation., Elmhurst, IL; RL 736 manufactured by Amrep, Inc., Marietta, GA
High Build Epoxy	Polyamidoamine epoxy, minimum 69% volume solids, capability of 4 to 8 MDFT per coat
Inorganic Zinc Primer	Solvent or water based, having 85% metallic zinc content in the dry film; follow manufacturer's recommendation for topcoating
Latex Primer Sealer	Waterborne vinyl acrylic primer/sealer for interior gypsum board and plaster. Capable of providing uniform seal and suitable for use with specified finish coats
NSF Epoxy	Polyamidoamine epoxy, approved for potable water contact and conforming to NSF 61
Epoxy, High Solids	Polyamidoamine epoxy, 80% volume solids, minimum, suitable for immersion service
Organic Zinc Primer	Zinc coating with epoxy binder protective coating for steelworks.
Polysiloxane	Polymer with silicon-oxygen backbone. Inorganic Polysiloxanes: cured by hydrolytic polycondensation. Epoxy-Polysiloxane Hybrids: cured by both hydrolytic polycondensation and conventional epoxy-amine mechanisms. Acrylic-Polysiloxane Hybrids: combination of acrylic and siloxane resins and can be produced as one- or two-component systems.
Polyurethane Enamel	Two-component, aliphatic or acrylic based polyurethane; high gloss finish

Product	Definition
Rust-Inhibitive Primer	Single-package steel primers with anticorrosive pigment loading
Sanding Sealer	Co-polymer oil, clear, dull luster
Silicone/Silicone Acrylic	Elevated temperature silicone or silicone/acrylic based
Stain, Concrete	Acrylic, water repellant, penetrating stain
Stain, Wood	Satin luster, linseed oil, solid or transparent as required
Underlayment (surfacer)	Fast setting, high early strength Portland Cement based resurfacing material; low shrinkage, low permeability, trowelable-grade that is mixed with potable water and contains fiber reinforcements.
Varnish	Nonpigmented vehicle based on a variety of resins (alkyd, phenolic, urethane) in gloss, semigloss, or flat finishes, as required
Water Base Epoxy	Two-component, polyamide epoxy emulsion, finish as required

2.4 MIXING AND THINNING

A. Multiple-Component Coatings:

1. Prepare using each component as packaged by paint manufacturer.
2. No partial batches will be permitted.
3. Do not use multiple-component coatings that have been mixed beyond their pot life.
4. Furnish small quantity kits for touchup painting and for painting other small areas.
5. Mix only components specified and furnished by paint manufacturer.
6. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating. Opening containers of the materials for the addition of tints or color shall not be permitted in the field or at the distributor's store.
7. All protective coating materials shall be used within the manufacturer's recommended shelf life. Materials exceeding the storage life recommended by the manufacturer shall be removed from the jobsite.
8. Thinning of paint shall be in accordance with the manufacturer's written instructions, especially as to the amount and kind of thinner

used. The Contractor shall perform all thinning in the presence of the Engineer.

B. Colors: Formulate paints with colorants free of lead, lead compounds, or other materials that might be affected by presence of hydrogen sulfide or other gas likely to be present at Site.

2.5 SHOP FINISHES

A. Shop Blast Cleaning: Reference Paragraph, Shop Coating Requirements.

B. Surface Preparation: Provide Engineer minimum 7 days' advance notice to start of shop surface preparation work and coating application work.

C. Shop Coating Requirements:

1. When required by equipment Specifications, such equipment shall be primed and finish coated in shop and touched up in field with identical material after installation.
2. Where fabrication shop's or manufacturer's standard coating is not suitable for intended service condition, Engineer may approve use of a tie-coat to be used between manufacturer's standard coating and specified field finish. In such cases, tie-coat shall be surface tolerant epoxy as recommended by manufacturer of specified field finish coat. Coordinate details of equipment manufacturer's standard coating with field coating manufacturer.

D. Field Preparation of Shop Coatings

1. The Field Coating Applicator shall abrasive blast the shop coated surfaces per SSPC SP7. The previously shop-painted surfaces shall be abraded prior to the application of the final coats. Uncoated steel weld joints, coating holdbacks, and bare metal shall be prepared per SSPC SP10.
2. The Field Coating Applicator shall not apply a coating on a bare steel surface for buried or above ground severe service that has not been prepared per SSPC SP6. The Field coating Applicator shall not apply a coating on a bare steel surface for immersion service that has not been prepared per SSPC SP10. Special attention shall be given to uncoated steel weld joints, coating holdbacks, and primers that have rusted.
3. Metal surfaces less than 25 square feet which are to be incorporated in the work shall be prepared in the field by cleaning all surfaces as necessary in accordance with SSPC SP1, SP2, and SP11. Damaged shop coating shall be cleaned in accordance with SSPC SP11 using an MBX Bristleblaster, or equivalent, and recoated with the primer specified.

E. Pipe:

1. Ductile Iron Pipe:

a. DIP exposed to moisture or buried in soil shall be prepared per NAPF 500-03-01, Solvent Cleaning, and 500-03-04, Abrasive Blast Cleaning for Ductile Iron Pipe, with the following exceptions stated in this specification. Any existing asphaltic or zinc coating shall be removed by abrasive blasting without damaging joints or flanges. The Contractor shall use an abrasive media that can achieve a minimum of a 3 mil surface profile efficiently. The surface shall be free of all visible dust, loose annealing oxide, loose mold coating, or other foreign matter. The abrasive shall be tested in accordance with ASTM D7393 and shall not contain any oil or emulsion on the surface. The abrasive shall not be reused if oil is present in the jar test.
b. The surface preparation and application of the primer shall be performed by a qualified shop applicator.
c. For high performance (epoxy) coatings, follow additional recommendations of the Engineer and coating manufacturers.
d. Prior to blast cleaning, grind smooth surface imperfections, including, but not limited to delaminating metal or oxide layers.

PART 3 EXECUTION

3.1 GENERAL

A. Provide Engineer minimum 7 days' advance notice to start of field surface preparation work and coating application work.

B. Perform the Work only in presence of Engineer, unless Engineer grants prior approval to perform the Work in Engineer's absence.

C. Schedule inspection of cleaned surfaces and all coats prior to succeeding coat in advance with Engineer.

3.2 EXAMINATION

A. Factory Finished Items:

1. Schedule inspection with Engineer before repairing damaged factory-finished items delivered to Site.
2. Repair abraded or otherwise damaged areas on factory-finished items as recommended by coating manufacturer. Carefully blend repaired areas into original finish. If required to match colors, provide full finish coat in field.

B. Surface Preparation Verification: Inspect and provide substrate surfaces prepared in accordance with these Specifications and recommendations of paint manufacturer whose product is to be applied. The more stringent requirements shall apply.

3.3 PROTECTION OF ITEMS NOT TO BE PAINTED

A. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not specified elsewhere to be painted.

B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.

C. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.

D. Mask openings in motors to prevent paint and other materials from entering.

E. Protect surfaces adjacent to or downwind of Work area from overspray.

F. All spray application of coatings or blast cleaning at the project site which is performed outside of a totally enclosed booth shall be kept to a minimum. Tenting the work area shall be required, in accordance with SSPC Guide 6 Containment Classification 3A, to minimize potential blast media and overspray damage. The Contractor shall be fully responsible for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

3.4 SURFACE PREPARATION

A. Field Abrasive Blasting:

1. Perform blasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed or coated.
2. Refer to coating systems for degree of abrasive blasting required.
3. Where the specified degree of surface preparation differs from manufacturer’s recommendations, the more stringent shall apply.
4. The dust mitigation methods shall confirm to SSPC Guide 6 Containment Classification 3A. The Contractor shall provide and use a dust containment system that shall consist of a 12,000 cfm, or higher, mobile industrial dust collector. Approved dust collector products include DC12000 as manufactured by Industrial Vacuum Equipment Corporation, or approved equal.
5. The Contractor shall remove and dispose of all spent abrasive and debris from abrasive blasting and other surface preparation prior to coating an area.
6. Protection of Painted Surfaces: Cleaning and coating shall be so programmed that dust and other contaminants from the cleaning process shall not fall on wet, newly-coated surfaces.

B. Metal Surface Preparation:

1. Where indicated, meet requirements of SSPC Specifications summarized below:

a. SP 1, Solvent Cleaning: Removal of visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants by cleaning with solvent.
b. SP 2, Hand Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using nonpower hand tools.
c. SP 3, Power Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using power-assisted hand tools.
d. SP 5/NACE No. 1, White Metal Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter by blast cleaning.
e. SP 6/NACE No. 3, Commercial Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 33 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.
f. SP 7/NACE No. 4, Brush-Off Blast Cleaning: Removal of visible rust, oil, grease, soil, dust, loose mill scale, loose rust, and loose coatings. Tightly adherent mill scale, rust, and coating may remain on surface.
g. SP 10/NACE No. 2, Near-White Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 5 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.
h. SP 11, Power Tool Cleaning to Bare Metal: Removal of visible oil, grease, dirt, dust, mill scale, rust, paint, oxide, corrosion products, and other foreign matter using power-assisted hand tools capable of producing suitable surface profile. Slight residues of rust and paint may be left in lower portion of pits if original surface is pitted. Approved products include MBX Bristle Blaster, or equal.
i. SP 12/NACE No. 5, Surface Preparation and Cleaning of Metals by Water Jetting Prior to Recoating: Surface preparation using high-pressure and ultrahigh-pressure water jetting to achieve specified surface cleanliness condition. Surface cleanliness conditions are defined in SSPC SP 12 and are designated WJ-1 through WJ-4 for visual surface preparation definitions and SC-1 through SC-3 for nonvisual surface preparation definitions.

2. For every 100 square feet, or less, of steel surface blasted, the surface profile shall be tested with the use of Press-o-Film as manufactured by Testex, or other RP0287 approved equal, at locations to be determined by the Engineer. The replica tape thickness shall be measured using a dial micrometer manufactured by Testex, or other ASTM D4417 Type C approved equal. For each test area, one replica tape test shall be performed and shall be recorded and must be within 10% of the coating manufacturer's recommended profile. If the surface profile does not meet the

manufacturer's recommended profile, two additional tests will be performed within a 12-inch diameter of the initial test. If the values are not satisfactory, the Contractor shall reblast the affected areas.

3. The words “solvent cleaning,” “hand tool cleaning,” “wire brushing,” and “blast cleaning,” or similar words of equal intent in these Specifications or in paint manufacturer’s specification refer to the applicable SSPC Specification.
4. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers’ recommendations for wet blast corrosion inhibitor additives and first coat application shall apply.
5. Ductile Iron Pipe Supplied with Asphaltic Varnish Finish: Remove asphaltic varnish finish prior to performing specified surface preparation. See Section 2.5E.
6. Hand tool clean areas that cannot be cleaned by power tool cleaning.
6. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects to a 1/8-inch radius.
7. Welds and Adjacent Areas shall meet NACE SP0178 Weld Profile D:
    a. Prepare such that there is:
        1) No undercutting or reverse ridges on weld bead.
        2) No weld spatter on or adjacent to weld or any area to be painted.
        3) No sharp peaks or ridges along weld bead.
    b. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.
8. Preblast Cleaning Requirements:
    a. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.
    b. Cleaning Methods: Steam, open flame, hot water, or cold water with appropriate biodegradable detergent additives such as TSP followed with clean water rinsing.
    c. Clean small isolated areas as above or solvent clean with suitable solvent and clean cloth.
9. Blast Cleaning Requirements:
    a. Type of Equipment and Speed of Travel: Design to obtain specified degree of cleanliness. Minimum surface preparation is the more stringent requirement of what is specified herein or coating manufacturer’s recommendations.
    b. Select type and size of abrasive to produce surface profile that meets coating manufacturer’s recommendations for particular coating system to be used.
    c. Use only dry blast cleaning methods.
    d. Do not reuse abrasive, except for designed recyclable systems.
    e. Meet applicable federal, state, and local air pollution and environmental control regulations for blast cleaning, confined space entry (if required), and disposition of spent aggregate and debris.
10. Post-Blast Cleaning and Other Cleaning Requirements:

a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem. All traces of dust shall be removed. and tested per ISO 8502-3 by the Engineer if there evidence of insufficient cleaning The surfaces shall be rated 3 or cleaner.
b. Paint surfaces the same day they are blasted. Re-blast surfaces that have started to rust before they are painted.

C. Galvanized Metal, Copper, Aluminum, and Nonferrous Metal Alloy Surface Preparation:

1. Remove soil, cement spatter, and other surface dirt with appropriate hand or power tools.
2. Remove oil and grease by wiping or scrubbing surface with suitable solvent, rag, and brush per SSPC S P1, Solvent Cleaning. Use clean solvent and clean rag for final wiping to avoid contaminating surface.
3. Pretreatment coatings of surfaces shall be in accordance with the printed recommendations of the coating manufacturer. Galvanized metals may be cleaned with suitable organic solvent such as a rust inhibitor or aqueous alkaline solution per ASTM D6386.
4. Aluminum surfaces shall be cleaned per ASTM D1730 Type B Chemical Treatment prior to coating application.
5. Surfaces. of aluminum, copper, or galvanizing greater than 50 sq. ft shall be abrasive blasted per SSPC SP 16 prior to coating. A minimum 1.5 mil profile shall be produced and cleaned prior to the application of a protective coating.
6. Obtain and follow coating manufacturer's recommendations for additional preparation that may be required.

D. Concrete Surface Preparation:

1. Do not begin until 30 days after concrete has been placed.
2. Abrasive blast existing, resurfaced and new concrete surfaces per SSPC SP13 and ASTM 4259 to remove all crumbling, loose, brown, white, carbonated, or deteriorated concrete from the areas to be coated before resurfacing or priming. All laitance, debris, existing coatings, and other contaminants shall also be removed from the surface as well. The abrasive blasting shall be performed to achieve a minimum of an ICRI 310.2 Concrete Surface Profile 5 for existing concrete. A minimum Concrete Surface Profile of 3 shall be required on new and resurfaced concrete.
3. Remove grease, oil, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent, or other suitable cleaning methods.
4. Brush-off blast clean to remove loose concrete and laitance, and provide a ICRI 310.2 Concrete Surface Profile 3 on resurfaced or new concrete.
5. Secure coating manufacturer's recommendations for additional resurfacing, if required, for excessive bug holes exposed after blasting.

6. Unless otherwise required for proper adhesion, ensure surfaces are dry prior to painting. The Contractor or Engineer shall test for capillary moisture in accordance with ASTM D4263. Moisture tests shall be taken every 200 square feet, or less, and at locations determined by the Engineer. If capillary moisture is present, the coating manufacturer shall be consulted to determine primer requirements, dehumidification, and special coating application criteria.

E. Existing Concrete Surfaces to be Repaired and Lined:

1. These surfaces shall be free of dust, loose particles, oils, grease, chemical contaminants, attacked concrete, and previously applied protective coatings, and shall have a minimum pH of 7.
2. Areas to be immersed or areas that are subject to liquid/gas/solid chemical attack shall be cleaned by abrasive blasting to remove all crumbling, loose, brown, white, carbonated, or deteriorated concrete from the areas to be coated. All grease, debris, existing coatings, and other contaminants shall also be removed from the surface as well. The abrasive blasting shall be performed to achieve a minimum of an ICRI 310.2 Concrete Surface Profile 5. Minimum nozzle pressure for abrasive blasting shall be 100 psi. Only non-silica abrasives shall be used for abrasive blasting.
3. Non-immersion, light service areas shall be prepared by hydroblasting using potable water at a minimum of 10,000 psi.
4. Concrete floors to be coated shall be shot blasted with a self-contained, centrifugal blast unit, Blastrac or equivalent, to remove laitance and to roughen the surface equivalent to ICRI No. 310.2 Concrete Surface Profile No. 4.
5. During surface preparation activities, the Contractor shall regularly (approximately every 100 square feet) measure the pH using pH pencils to verify compliance with these Specifications. Surfaces not meeting the requirements shall be marked and re-blasted.
6. Following completion of surface preparation, all active hydrostatic leaks shall be plugged by use of a water-stop mortar material. All structural defects, voids, or cracks in the substrate shall be repaired prior to the application of the underlayment or lining. Repair materials shall be approved by the lining manufacturer.
5. The attacked or rough concrete substrate, including voids, crevices, and holes, shall be resurfaced with the underlayment material to return it to pre-existing levels. Mix and apply underlayment in accordance with the lining manufacturer’s written recommendations.
6. If any reinforcing steel is exposed during the surface preparation operation, the Engineer shall be notified, and a repair procedure developed for review and approval. Exposed rebar shall be abrasive blasted and coated with at least 20 mils of corrosion inhibitor epoxy that is approved by the mortar manufacturer.
7. Mark and protect embedded anchors prior to blasting.

F. Plastic and FRP Surface Preparation:

1. Hand sand plastic surfaces to be coated with medium grit sandpaper.
2. Large areas may be power sanded, or brush-off blasted, provided sufficient controls are employed so surface is roughened without removing excess material.

G. Masonry Surface Preparation:

1. Complete and cure masonry construction for 14 days or more before starting surface preparation work.
2. Remove oil, grease, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent washing, or other suitable cleaning methods.
3. Clean masonry surfaces of mortar and grout spillage and other surface deposits using one of the following:
   a. Nonmetallic fiber brushes and commercial muriatic acid followed by rinsing with clean water.
   b. Water blasting between 2,500 and 4, 000 psi.
4. Do not damage masonry mortar joints or adjacent surfaces.
5. Leave surfaces clean and, unless otherwise required for proper adhesion, dry prior to painting.
6. Masonry Surfaces to be Painted: Uniform texture and free of surface imperfections that would impair intended finished appearance.
7. Masonry Surfaces to be Clear Coated: Free of discolorations and uniform in texture after cleaning.

H. Wood Surface Preparation:

1. Replace damaged wood surfaces or repair in a manner acceptable to Engineer prior to start of surface preparation.
2. Solvent clean (mineral spirits) knots and other resinous areas and coat with shellac or other knot sealer, prior to painting. Remove pitch by scraping and wipe clean with mineral spirits or turpentine prior to applying knot sealer.
3. Round sharp edges by light sanding prior to priming.
4. Filler:
   a. Synthetic-based wood putty approved by paint manufacturer for paint system.
   b. For natural finishes, color of wood putty shall match color of finished wood.
   c. Fill holes, cracks, and other surface irregularities flush with surrounding surface and sand smooth.

d. Apply putty before or after prime coat, depending on compatibility and putty manufacturer's recommendations.
e. Use cellulose type putty for stained wood surfaces.

5. Ensure surfaces are clean and dry prior to painting.

I. Gypsum Board Surface Preparation: Typically, new gypsum board surfaces require sanding preparation of taped and float areas before painting.

1. Surface Finish: Dry, free of dust, dirt, powdery residue, grease, oil, or any other contaminants.

J. Existing Painted Surfaces to be Repainted Surface Preparation:

1. Detergent wash with a biodegradable solution at 3,500 psi using pressure washing and freshwater rinse. If mold and/or lichen, or other microbial life are present, washing agent shall kill microbial life.
2. Clean loose, abraded, or damaged coatings to substrate by hand or power tool, SP 2 or SP 3.
3. Feather abrupt edges of existing coating with surrounding intact coating or bare metal surface.
4. Apply one spot coat of specified primer to bare areas, overlapping prepared existing coating.
5. Apply one full finish coat of specified primer to entire surface.
6. If an aged, plural component material is to be top coated, it shall be sanded with 60 grit sandpaper by 4 inches and the new coating shall be overlapped by 3 inches onto the sanded area.
7. For ductile iron pipe with asphaltic varnish finish not specified to be abrasive blasted, apply coat of a surface tolerant epoxy mastic prior to application of cosmetic finish coat.
8. Application of Cosmetic Coat in dry and non-corrosive environment:
   a. It is assumed that existing coatings have oxidized sufficiently to prevent lifting or peeling when overcoated with paints specified.
   b. Check compatibility by application to a small area prior to starting painting.
   c. If lifting or other problems occur, request disposition from Engineer.
9. Perform blasting as required to restore damaged surfaces. Materials, equipment, procedures shall meet requirements of SSPC.

3.5 SURFACE CLEANING

A. Brush-off Blast Cleaning:

1. Equipment, procedure, and degree of cleaning shall meet requirements of SSPC SP 7.
2. Abrasive: Dry blasting sand, grit, or nutshell.

3. Select various surface preparation parameters, such as size and hardness of abrasive, nozzle size, air pressure, and nozzle distance from surface such that surface is cleaned without pitting, chipping, or other damage.
4. Verify parameter selection by blast cleaning a trial area that will not be exposed to view.
5. Engineer will review acceptable trial blast cleaned area and use area as a representative sample of surface preparation.
6. Repair or replace surface damaged by blast cleaning.

B. Acid Etching:

1. After precleaning, spread the following solution by brush or plastic sprinkling can: One part commercial muriatic acid reduced by two parts water by volume. Adding acid to water in these proportions gives an approximate 10 percent solution of HCl.
2. Application:
   a. Rate: Approximately 2 gallons per 100 square feet.
   b. Work acid solution into surface by hard-bristled brushes or brooms until complete wetting and coverage is obtained.
   c. Acid will react vigorously for a few minutes, during which time brushing shall be continued.
   d. After bubbling subsides (10 minutes), hose down remaining slurry with high pressure clean water.
   e. Rinse immediately to avoid formation on the surface of salts.
   f. Thoroughly rinse to remove any residual acid surface condition that may impair adhesion.
3. Ensure surface is completely dry before application of coating.
4. Apply acid etching to obtain a “120 grit sandpaper” surface profile. If not, repeat treatment.

C. Solvent Cleaning:

1. Consists of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and any other surface contaminants by using solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods that involve a solvent or cleaning action.
2. Meet requirements of SSPC SP 1.

3.6 APPLICATION

A. General:

1. The intention of these Specifications is for new, interior and exterior masonry, concrete, metal, and submerged metal surfaces to be painted, whether specifically mentioned or not, except as specified otherwise. Do not paint exterior concrete surfaces, unless specifically indicated.

2. Extent of Coating (Immersion): Coatings shall be applied to internal vessel and pipe surfaces, nozzle bores, flange gasket sealing surfaces, carbon steel internals, and stainless steel internals, unless otherwise specified.
3. For coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer's written instructions for these requirements. Do not immerse coating until completion of curing cycle.
4. Apply coatings in accordance with these Specifications and paint manufacturers' printed recommendations and special details. The more stringent requirements shall apply. Allow sufficient time between coats to assure thorough drying of previously applied paint.
5. Sand wood lightly between coats to achieve required finish.
6. Vacuum clean surfaces free of loose particles. Use clean new tack cloth just prior to applying next coat.
7. Fusion Bonded Coatings Method Application: Electrostatic, fluidized bed, or flocking.
8. Coat units or surfaces to be bolted together or joined closely to structures or to one another prior to assembly or installation.
9. Water-Resistant Gypsum Board: Use only solvent type paints and coatings.
10. On pipelines, terminate coatings along pipe runs to 1-inch inside pipe penetrations.
11. Keep paint materials sealed when not in use.
12. Where more than one coat is applied within a given system, alternate colors to provide a visual reference showing required number of coats have been applied.
13. A stripe coat shall be applied before or after the prime coat in accordance with SSPC PA Guide 11. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Particular care shall be used to ensure that the specified coverage is secured on the edges and corners of all surfaces.
14. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.
15. The Contractor shall verify the wet film thickness with a notched gauge in conformance with ASTM D4414. Wet film thickness readings shall be recorded a minimum of every 50 square feet.
16. The Contractor shall provide curing conditions using forced ventilation or dehumidification in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the most stringent requirement, prior to placing the completed coating system into service.
17. Plural Component Coatings – Only heated plural component equipment shall be used for the 100% solids coating application. Equipment shall be capable of performing a ratio test. All gauges on plural component pump shall be in working order. If defective, they shall be replaced prior to the start of any application.
18. After each component of the coating system has been thoroughly heated, the Contractor shall perform a paint/pump ratio test before the start of spraying in the presence of the Owner and Engineer. The Contractor shall set up two see-

through containers with preprinted volumetric marks used for the paint/pump ratio test on a flat surface. The hose valve for each component shall be opened simultaneously and each component flow rate shall be allowed to stabilize by pouring the discharging materials into separate disposable containers. After the flow is stabilized, the hoses shall be transferred to the pre-printed volumetric containers and the valves shall be shut off after one of the containers has been filled to 32 or 48 fluid ounces, depending on the mixing ratio recommended by the manufacturer. If the volumetric quantity of coating in the containers does not match the manufacturer's recommendation, the Contractor shall reduce or increase the pressure and temperature until it meets the specified mixing ratio. No spraying shall be performed until the ratio test result has been accepted by Engineer.

19. Before the start of the coating application each day, the Contractor shall set up a 5-foot by 5-foot polyethylene sheet or cardboard on the ground for the purpose of performing a test patch. The Contractor, in the presence of the Engineer, shall spray on the polyethylene sheet or cardboard and shall not have any discoloration, bubbles, or pinholes in the coating and the spray gun shall not clog. The spray gun shall produce an even fan spray and the coating shall be of a consistent color. Once these performance characteristics are achieved, the coating application may proceed.
20. The Contractor shall employ backrolling, troweling, or multiple coats within the recoat window for the freshly applied finish coating to minimize holidays and bubbles in the lining.
21. Finish coats, including touch-up and damage repair coats shall be overlapped 3 inches onto existing coatings and shall be applied in a manner which will present a uniform texture and color matched appearance.

B. Galvanized Metal, Copper, and Nonferrous Metal Alloys:

1. Concealed galvanized, copper, and nonferrous metal alloy surfaces (behind building panels or walls) do not require painting, unless specifically indicated herein.
2. Prepare surface and apply primer in accordance with System No. 10 specification.
3. Apply intermediate and finish coats of the coating system appropriate for the exposure.

C. Porous Surfaces, Such as Concrete and Masonry:

1. Filler/Surfacer: Use coating manufacturer's recommended product to fill air holes, bug holes, and other surface voids or defects.
2. Prime Coat: May be thinned to provide maximum penetration and adhesion.
   a. Type and Amount of Thinning: Determined by paint manufacturer and dependent on surface density and type of coating.
3. Surface Specified to Receive Water Base Coating: Damp, but free of running water, just prior to application of coating.

D. Film Thickness and Coverage:

1. Number of Coats:
   a. Minimum required without regard to coating thickness.
   b. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in coating manufacturers' products, and atmospheric conditions.
2. Application Thickness:
   a. Do not exceed coating manufacturer's recommendations.
   b. Measure using a wet film thickness gauge to ensure proper coating thickness during application.
3. Film Thickness Measurements and Electrical Inspection of Coated Surfaces:
   a. Perform with properly calibrated instruments.
   b. Recoat and repair as necessary for compliance with Specification.
   c. Coats are subject to inspection by Engineer and coating manufacturer's representative.
4. Visually inspect concrete, masonry, nonferrous metal, plastic, and wood surfaces to ensure proper and complete coverage has been attained.
5. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.
6. Apply additional coats as required to achieve complete hiding of underlying coats. Hiding shall be so complete that additional coats would not increase the hiding.

3.7 PROTECTIVE COATINGS SYSTEMS AND APPLICATION SCHEDULE

A. Unless otherwise shown or specified, paint surfaces in accordance with the following application schedule. In the event of discrepancies or omissions in the following, request clarification from Engineer before starting work in question.

B. Additional requirements are included in the Piping Schedule.

C. System No. 1 Submerged Metal – Potable Water:

Surface Prep.	**Paint Material**	**Min. Coats, Cover**
SP 5 , White Metal Blast Cleaning	NSF Epoxy	3 coats, 3 MDFTPC

1. For all steel and metal surfaces below water level including piping, fittings, pump can, pump discharge piping, and pipe support systems in vaults or for the submersible pump intake facility.

D. System No. 4 Exposed Metal—Highly Corrosive:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 5, Near-White Blast Cleaning	Epoxy Primer—Ferrous Metal	1 coat, 2.5 MDFT
	High Build Epoxy	1 coat, 4 MDFT
	Polyurethane Enamel	1 coat, 3 MDFT

1. Use on the following items or areas:
   a. Exposed metal surfaces, located inside or outside of structures and exposed to weather.

E. System No. 7 Concrete Encased Metal:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 6, Commercial Blast Cleaning	Epoxy	2 coats, 16 MDFT

1. Use on the following items or areas:
   a. Use on concrete encased ferrous metals including wall pipes, pipe sleeves, access manholes, gates, and thimbles.

F. System No. 8 Buried Metal – General:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Standard Enamel -OR- Epoxy	AWWA C203 2 coats, 16 MDFT
	For Highly Abrasive Soil, Brackish Water: Tape Coat System	AWWA C214 with Double Outer Wrap

1. For steel pipe and fittings, follow AWWA C209 and AWWA C214 with double outer wrap.
2. Use on the following items or areas:
   a. Buried, below-grade portions of steel items, except buried stainless steel or ductile iron.

G. System No. 10 Galvanized Metal, Copper, and Nonferrous Metal Allow Conditioning:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation	Epoxy Primer—Other	As recommended by coating manufacturer Remaining coats as required for exposure

1. Use on the following items or areas:
   a. Galvanized surfaces requiring painting.
   b. After application of System No. 10, apply finish coats as required for exposure.

H. System No. 25 Exposed FRP, PVC:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Plastic and FRP Surface Preparation	Acrylic Latex Semigloss	2 coats, 320 SFPGPC

1. Use on the following items or areas:
   a. All exposed-to-view PVC and CPVC surfaces, and FRP surfaces without integral UV-resistant gel coat.

I. System No. 27 Aluminum and Dissimilar Metal Insulation:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1)	Prime in accordance with manufacturer's recommendations	
	Bituminous Paint	1 coat, 10 MDFT

1. Use on aluminum surfaces embedded or in contact with concrete.

J. System No. 29A Fusion Bonded, Steel Dowel Coating:

Surface Prep.	Paint Material	Min. Coats, Cover

SP 10, Near-White Blast Cleaning	Fusion Bonded Coating 100% Solids Epoxy	1 or 2 coats, 7 MDFT
TFE Lube, Shop Applied; Grease Lube Alternative, Field Applied Just Prior to Installation	TFE Lube or Grease Lube	1 coat, as required

K. System 113 To fill in for exterior of concrete building

3.8 COLORS

A. Provide as shown in Piping Schedule and selected by Owner.

B. Proprietary identification of colors is for identification only. Selected manufacturer may supply matches.

C. Equipment Colors:

1. Equipment includes the machinery or vessel itself plus the structural supports and fasteners and attached electrical conduits.
2. Paint equipment and piping one color as selected.
3. Paint non-submerged portions of equipment the same color as the piping it serves, except as itemized below:
    a. Dangerous Parts of Equipment and Machinery: OSHA Orange.
    b. Fire Protection Equipment and Apparatus: OSHA Red.
    c. Radiation Hazards: OSHA Purple.
    d. Physical hazards in normal operating area and energy lockout devices, including, but not limited to, electrical disconnects for equipment and equipment isolation valves in air and liquid lines under pressure: OSHA Yellow.

D. Pipe Identification Painting:

1. Color code non-submerged metal piping, except electrical conduit. Paint fittings and valves the same color as pipe, except equipment isolation valves.
2. Pipe Color Coding: In accordance with Piping Schedule.
3. On exposed stainless steel piping, apply color 24 inches in length along pipe axis at connections to equipment, valves, or branch fittings, at wall boundaries, and at intervals along piping not greater than 9 feet on center.
4. Pipe Supports: Painted light gray, as approved by Owner.

5. Fiberglass reinforced plastic (FRP) pipe, and polyvinyl chloride (PVC) pipe located inside of buildings and enclosed structures will not require painting, except as noted or scheduled.

3.11 FIELD QUALITY CONTROL

A. The Contractor shall provide a written record of the quantity of coating material applied and the quantity of surface area covered, a description of the location of the area coated, each coating product batch number, dew point temperature, surface temperature, ambient temperature, relative humidity, and names of applicators on a daily basis. The Engineer shall record an independent record of the same information and shall resolve any discrepancies with the Contractor.

B. Surface Profile Testing – For 100 square feet or less of steel surface blasted, as determined by the Engineer, the surface profile shall be tested with the use of Press-o-Film as manufactured by Testex, or other RP0287 approved equal, at locations to be determined by the Engineer. The replica tape thickness shall be measured using a dial micrometer manufactured by Testex, or other ASTM D4417 Type C approved equal. For each test area, one replica tape test shall be performed within a single test area 12 inches in diameter. For each test area, the replica tape thickness value shall be recorded and must be within 10% of the coating manufacturer's recommended profile. If the surface profile does not meet the manufacturer's recommended profile, two additional tests will be performed within a 12-inch diameter of the initial test. If the values are not satisfactory, the Contractor shall reblast the affected areas or apply additional primer at no additional cost to the Owner.

C. Testing Equipment:

1. Provide eddy current-type dry film thickness gauge to test coating thickness specified in mils, as manufactured by Defelsko Positector 6000, Elcometer 456, or equal on metals.
2. Provide low-voltage wet sponge electrical holiday detector to test completed coating systems, 20 mils dry film thickness or less, except zinc primer, high-build elastomeric coatings, and galvanizing, for pinholes, holidays, and discontinuities, as manufactured by Tinker and Rasor, San Gabriel, CA, Model M-1, Elcometer 270/4, or equal.
3. Provide high-voltage spark tester to test completed coating systems in excess of 20 mils dry film thickness. Unit as recommended by coating manufacturer. Approved products include Elcometer 236 15kV, D.E. Stearns Co. Model 14/20, or Tinker & Rasor AP-W.

D. Testing:

1. Thickness and Continuity Testing:
   a. Measure coating thickness specified in mils with an eddy current type, dry film thickness gauge, in accordance with SSPC PA 2, with a Level 2. Check each coat for correct millage. Do not make measurements before a minimum of 8 hours after application of coating.
   b. On concrete, the dry film coating thickness shall be measured in accordance with ASTM D6132 and SSPC PA2 with a Level 2 thickness restriction using an ultrasonic dry film thickness gage and

also measured on the coating material that is attached to the adhesion pull dollies. A theoretical thickness shall also be calculated from surface area and the quantities of material applied. The instruments shall have the capability of measuring 25% over the specified coating thickness and shall produce an actual reading and shall not be estimated. No measurements shall be made until at least 8 hours after application of the coating.

c. Holiday detect coatings 20 mils thick or less, except zinc primer and galvanizing, with low voltage wet sponge electrical holiday detector in accordance with NACE RP0188.

d. Holiday detect coatings in excess of 20 mils dry with high voltage spark tester as recommended by coating manufacturer and in accordance with NACE RP0188 for metals and ASTM D4787 for concrete.

e. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final tests may also be conducted by Engineer.

2. Adhesion Testing

a. One adhesion test shall be performed for every 400 square feet of concrete surface to be coated per ASTM D7234. The coating adhesion to the concrete substrates shall be tested using a Type II or Type V instrument per ASTM D4541 and shall be witnessed by the Engineer. Elcometer 106, Defelsko PosiTector, or equal, shall be used to perform the test. All dollies shall be submitted to the Owner at the completion of the testing. The procedure is as follows:

b. The new lining material shall be abraded and wiped with solvent per SSPC SP1 prior to applying the adhesive on the dolly.

c. A minimum of one new 20 mm diameter dolly shall be affixed to the coated surface for every 400 square feet of surface area. Each testing location shall be identified and recorded by the Engineer.

d. After the dolly is affixed to the new lining but prior to conducting the pull-off test, the Engineer shall score around the dolly without disturbing the dolly or bond within the test area. The scoring shall penetrate through the newly applied coating, and abrade the substrate.

e. The adhesive used to attach the dollies to the liner shall be rapid setting with a tensile strength in excess of the coating material and permitted to cure in accordance with the manufacturer’s recommendations. Failure of the dolly adhesive shall require re-testing.

f. The Engineer shall record the type of adhesive used, the length of time the adhesive was allowed to cure and the type of failure observed on the dolly.

g. The minimum concrete adhesion pulls shall be 200 psi with failure at the concrete. Adhesion pulls between 150 psi and 200 psi shall be acceptable if the dolly pull surface contains 50% concrete. An additional pull test will be required for results less than 150 psi for concrete as stated below.

h. If the first adhesion test at each test area does not meet the minimum adhesion criteria, an additional test shall be performed within a 12-inch diameter area of the lowest result. If the second adhesion test does not

meet the adhesion requirements, an additional location shall be tested 10 feet away from the original test. The adhesion values of the retests and passing results shall be recorded and shall average a minimum of 200 psi for concrete, or as otherwise approved by the Owner. If all three adhesion tests fail to meet the adhesion requirements, the liner shall be removed and replaced at the Contractor'S expense.

i. The Contractor shall repair the coating or lining at the locations of the adhesion tests per the manufacturer's recommendations. The testing dollies shall be retained by the Engineer at the conclusion of the testing.

E. Inspection: Leave staging and lighting in place until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer. Provide additional staging and lighting as requested by Engineer.

D. Unsatisfactory Application:

1. If item has an improper finish color or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
3. Repair defects in accordance with written recommendations of coating manufacturer.

E. Damaged Coatings, Pinholes, and Holidays:

1. Feather edges and repair in accordance with recommendations of paint manufacturer.
2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.
3. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.
4. If the coating exhibits discoloration, bubbling, or sticky areas, the Contractor shall, in the presence of the Engineer, conduct a Solvent Rub Test in accordance with ASTM D5402 after 7 days of curing. The test area shall be evaluated for appearance, hardness, or any color transfer to the cloth. If there is no change to the coating after the test, it will be considered cured.
5. If the coating exhibits discoloration, bubbling or sticky areas, the Contractor shall, in the presence of the Engineer, conduct Shore D Hardness Testing per ASTM D2240. In order to consider the coating cured and properly mixed, it must meet the manufacturer's recommended Shore D Durometer requirement for the specified product.

3.11 MANUFACTURER'S SERVICES

A. In accordance with Section 01 40 00, Quality Requirements and 01 33 00, Submittal Procedures, coating manufacturer's representative shall be present at Site as follows:

1. On first day of application of any coating system.
2. A minimum of two additional Site inspection visits, each for a minimum of 4 hours, in order to provide Manufacturer's Certificate of Proper Installation.
3. As required to resolve field problems attributable to or associated with manufacturer's product.
4. To verify full cure of coating prior to coated surfaces being placed into immersion service.

3.12 CLEANUP

A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at end of each day.

B. Upon completion of the Work, remove staging, scaffolding, and containers from Site or destroy in a legal manner.

C. Remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

3.13 APPLICATION SCHEDULE

A. As shown in Section 09900, FINISH SCHEDULE. Additional requirements are included in the PIPING SCHEDULE.

B. Surfaces Not Requiring Painting: Unless otherwise stated or shown below or in other sections, the following areas or items will not require painting or coating:

1. Reinforcing steel
2. Nonferrous and corrosion-resistant ferrous alloys such as copper, bronze, Monel, aluminum, chromium plate, atmospherically exposed weathering steel, and stainless steel, except where:
   a. Required for electrical insulation between dissimilar metals.
   b. Aluminum and stainless steel are embedded in concrete or masonry, or aluminum is in contact with concrete or masonry.
   c. Color coding of equipment and piping is required.
3. Nonmetallic materials such as glass, wood, and porcelain, except as required for architectural painting or color coding.
4. Prefinished electrical and architectural items such as motor control centers, switchboards, switchgear, panelboards, transformers, disconnect switches (if prefinished in OSHA yellow), acoustical tile, cabinets, elevators, building louvers, and wall panels; color coding of equipment is required.
5. Non-submerged electrical conduits attached to unpainted concrete surfaces.
6. Cathodic protection anodes.

7. Items specified to be galvanized after fabrication, unless specified elsewhere or subject to immersion.
8. Insulated piping and insulated piping with jacket will require prime coat only, except as required for architectural painting or color coding.
9. Fiberglass reinforced plastic (FRP) surfaces with an integral ultra-violet resistant colored gel coat do not require painting, provided the color is as selected.

C. Unless otherwise shown or specified, paint surfaces in accordance with the following application schedule. In the event of discrepancies or omissions in the following, request clarification from Engineer before starting work in question.

D. System No. 1 Submerged Metal – Potable Water: Use on the following items or areas:

1. New metal surfaces below a plane 1 foot above the maximum liquid surface; metal surfaces above the maximum liquid surface that are part of the immersed equipment; surfaces of metallic items, such as wall pipes, pipes, pipe sleeves, access manholes, gate guides and thimbles, and structural steel that are embedded in concrete; and the following specific surfaces:
   a. Interior surfaces of steel piping noted in the Piping Schedule or Construction Plans.

3.14 ATTACHMENTS

A. The attachments listed below, following “End of Section,” are a part of this Specification:

1. Paint System Data Sheet (PSDS).
2. Product Data Sheet (PDS).
3. Finish Schedule (FS).

END OF SECTION

SECTION 26 01 00- ELECTRICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The work included under this Section consists of furnishing all materials, labor, equipment and supplies; and performing all operations necessary to complete the installation of an electrical system for control, instrumentation, power and lighting as indicated on the Plans and as specified herein.

B. This Section shall apply to all sections covered in Division 26.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00 - Submittals.
B. Section 01 77 00 - Closeout Procedures

1.3 REFERENCE STANDARDS

A. All technical drawings submitted will bear the seal of a registered Professional Engineer. The act of sealing each drawing shall be taken to indicate that the sealing engineer has personally reviewed the plans and specifications, and that it is his professional opinion that the material covered in his submission meets or exceeds the requirements of the Contract Drawings and Specifications.

B. Workmanship shall be of the highest quality and all work shall be done by workmen skilled in the trades involved. Work shall be performed by a Contractor who has a minimum of 5 continuous years on a minimum of 3 projects of the same type, size and magnitude. The Contractor shall be licensed by the State of Texas to work as an electrical contractor.

C. The term "CONTRACTOR" as used herein, is intended to mean the "Electrical Contractor," or his subcontractor.

D. All construction, installation, workmanship, equipment and materials shall conform to all acts, laws, rules and regulations having jurisdiction in the area where this project is to be located, and to the current edition of the following standards or codes:

1. National Electrical Code (NEC) (ANSI/NFPA 70)
2. National Electrical Manufacturers Association (NEMA)
3. National Electrical Safety Code (ANSI/IEEE C2)
4. NECA Standards of Installation
5. American National Standards Institute (ANSI)
6. National Fire Protection Association (NFPA)
7. Illuminating Engineering Society (IES)
8. Insulated Power Cable Engineers Association (IPCA)
9. Institute of Electrical and Electronic Engineers (IEEE)
10. Underwriter's Laboratories (UL)

11. Electrical Testing Laboratory (ETL)
12. Anti-Friction Bearing Manufacturer's Association (AFBMA)

E. Codes and regulations are to be interpreted as minimum requirements and shall in no way restrict the installation.

F. Regulatory Requirements

1. Conform to ANSI/NFPA 70
2. Conform to local buildings codes.
3. Obtain electrical permits, and inspections from authority having jurisdiction.

G. Allowable Tolerances

1. Scaling dimensions from drawings may be used only for approximate locations. All dimensions shall be verified with existing conditions on the job site.
2. Equipment locations and conduit installation shall follow the layouts shown on the drawings. These layouts, however, are diagrammatic and shall be subject to such changes as may be necessary to complete the installation, to coordinate the work with other trades, or to overcome obstacles encountered during construction.

H. The Contractor shall apply for detailed information regarding the position of equipment and outlets that are not dimensioned on the drawings. The final or required locations must be coordinated on the job site with other outlets or other trades.

I. Where a major deviation from the drawings is indicated by practical considerations, the Contractor shall submit shop drawings showing all deviations in such detail so as to clearly indicate the necessity or desirability for the change.

1.4 SUBMITTALS

A. The drawings indicate the extent and general arrangement of the various systems. If any departures from these drawings are deemed necessary by the Contractor, detailed drawings and descriptions of these departures and a statement of the reasons therefore shall be submitted to the Engineer for approval as soon as practicable. No departures from the arrangements shown on the drawings shall be made without prior written approval of the Engineer.

B. Shop drawings and required field drawings shall be submitted to the Engineer for approval as required under Division 1 and any additional requirements specified in these sections.

C. Consistent with Section 01 33 00, all review material shall be identified in order to identify the submittal as follows:

1. Lighting fixtures shall be identified in accordance with the fixture schedule.
2. Sheets or drawings showing more than the particular item under consideration shall have crossed out all but the pertinent description of the item for which review is requested.

3. Schematics and connection diagrams for all electrical equipment shall be submitted for review. A manufacturer's standard connection diagram or schematic showing more than one scheme of connection will NOT be accepted, unless it is clearly marked to show the intended connections.
4. In addition to complete specifications and descriptive literature, a sample of the largest and smallest size of each type of cable shall be submitted for review before installation. Each sample shall have full surface legible printing showing cable type, size and manufacturer.

1.5 OPERATION AND MAINTENANCE MANUALS

A. Furnish final instruction manuals explaining the proper installation, operation and maintenance requirements for each piece of equipment used.

B. Provide each manual with a project name, volume number, date and a complete index for all volumes in the set. The index shall indicate the volume and section for each piece of equipment.

C. Manual to be 8.5 x 11 inches. Drawings may be 11 x 17 folded to 8.5 x 11. The manual shall be a maximum of 4" thick. If 8.5 x 11 or 11 x 17 is not practical, drawings may be inserted into an envelope inserted into the appropriate section.

D. Materials in manuals shall be suitable for photographic reproduction. Where copies of identical material are included, clarity and quality of copies shall be equal the original. Faxed copies will not be accepted.

E. Manuals shall be customized to describe the equipment actually furnished. manufacturers preprinted literature may be accepted provided it has been modified by underlining the specific model used.

F. Divide manuals into sections paralleling the equipment specifications. Provide Electrical and Instrumentation and Control equipment manuals in a separate volume(s) from mechanical equipment.

G. The front of each section shall have a cover sheet indicating the contractor performing the installation, local suppliers' name, address and phone number for each piece of equipment in the section.

H. In addition to drawings supplied in the O&M manuals, legible copies of all vendor supplied drawings for each piece of equipment shall be compiled into a binder and included as a drawing volume in the O&M manual set.

I. Manuals to be three ring, hard cover, heavy duty binders with pertinent information listed above printed on the front cover as well as the binder backing.

J. The O&M manuals shall contain complete information on all electrical equipment used including by not limited to the following.

1. Written description of the sequence of operation.
2. Detailed description of the function of each principal component in the system.

3. Test procedures and factory test results if required.
4. Bill of material detailing the model, rating and size of each specific component used in the installation.
5. Maintenance instructions and manufacturers recommended preventative maintenance frequency.
6. Recommended calibration instructions and frequency.
7. Emergency shutdown and troubleshooting guide.
8. List of protective relays, breaker types, cable and fuse sizes and settings.
9. Documentation of field functional tests and performance tests described in the specifications.
10. Renewal Parts Bulletin.
11. Manufacturers recommended spare parts.

K. The O&M manuals shall contain complete information on all Instrumentation equipment used including but not limited to the following:

1. Written description of the sequence of operation.
2. Detailed description of the function of each principal component in the system.
3. Test procedures and factory test results if required.
4. Bill of material detailing the model, rating and size of each specific component used in the installation.
5. Safety precautions.
6. Maintenance instructions and manufacturers recommended preventative maintenance frequency.
7. Recommended calibration instructions and frequency.
8. Emergency shutdown and troubleshooting guide.
9. Documentation of field functional tests and performance tests described in the specifications.
10. Renewal Parts Bulletin.
11. Manufacturers recommended spare parts.
12. Calibration data sheets including set-points.
13. List name, address and phone numbers of supplier for each piece of equipment.
14. Drawings and Diagrams (inserted into the appropriate section)

    a. One Line Diagram.
    b. P&ID Diagrams.
    c. Site Plan.
    d. Area Classification Drawing.
    e. Equipment Location Plan.
    f. Wiring diagram schematic.
    g. Inter-connect wiring diagram.
    h. Point to point wiring diagram.
    i. Loop Diagrams.
    j. Conduit/Cable Schedules.
    k. Panel Schedules.
    l. Underground Plans and Details.
    m. Grounding Plans.
    n. Fixture and Equipment Schedule.
    o. Above Ground Plans (lighting, receptacles, power, etc.)
    p. Instrument Index.

q. Equipment Lists.
r. Lighting Schedules.
s. I/O Lists.
t. Control Loop Descriptions.
u. Drawing Index.

L. Deliverables

1. Three (3) bound Operation and Maintenance Manuals supplied to Engineer.
2. One (1) blue-line copy of the contract "as built" drawings.
3. Three (3) 11 x 17 inch sets of "as built" drawings.
4. Disk copy of all drawings and diagrams listed above utilizing AUTOCAD Version 18.

1.6 PRODUCT, DELIVERY, STORAGE AND HANDLING

A. All materials and equipment furnished and/or installed under this contract shall be received and adequately protected by the Contractor.

B. Use space heaters or lamps to prevent condensation in electrical equipment.

C. Do not store equipment in direct contact with the ground.

1.7 JOB CONDITIONS

A. It shall be the responsibility of the Contractor to make a physical survey of existing conditions pertaining to this project.

B. The drawings showing the extent and arrangement of the work of the particular trade must be used together with the drawings showing the extent and arrangement of the work of the other trades. The Contractor shall lay out his work with due consideration for the other trades and shall be responsible for calling to the attention of the Engineer any interferences encountered; such interferences shall be investigated and called to the attention of the Engineer before any equipment is installed and before any material is fabricated. Relocation resulting from interferences shall be made at no additional cost to the Owner.

1.8 MEASUREMENT AND PAYMENT

A. No separate or additional payment will be made for the work of this Section.

1.9 MATERIALS AND EQUIPMENT

A. Materials and Equipment: Acceptable to the authority having jurisdiction as suitable for the use intended.

B. Materials and equipment provided under these specifications must be new, standard products of manufacturers regularly engaged in production of such equipment. Provide the manufacturer's latest standard design for the type equipment specified.

C. Equipment shall be of domestic (U.S.A) manufacture and assembly where the same is available.

D. Product must conform to regulations of the National Electrical Code. Where Underwriter's Laboratories have set standards, listed product and issued labels, products used must be listed and labeled by U.L.

E. Factory assembled equipment for electrical work must be delivered with a hard surface, factory-applied finish so that no additional field painting is required.

1.10 IDENTIFICATION

A. Each item of electrical equipment shall be provided with a unit nameplate, laminated plastic, with engraved white letters on black background which identifies the use of that equipment.

B. The nameplate will also show the manufacturer's name and location, the manufacturer's shop order number and outline drawing number, the date of manufacture and other information required by code, such as "HIGH VOLTAGE", warnings, voltage, and amperage ratings.

C. Each panelboard, switchboard, motor control center and other equipment containing 480 Volt wiring and devices shall have an Arc Flash Hazard sign.

D. All unit equipment shall contain individual unit nameplates. Nameplates will also be provided on all individual dry type transformers, individual panelboards, safety switches and combination starters. The nameplate will describe the unit or equipment which is served. Each nameplate will be of suitable height to get at least three lines of 3/16-inch high engraved laminated plastic white-on-black-background letters, indicating the function and name of the equipment, as identified on the drawings.

E. All pilot lights will include laminated plastic nameplates with 3/16-inch engraved, white letters on black background indicating what has operated or in what state the controlled load is in.

F. There shall be no abbreviations on nameplates.

G. Label wiring with heat-shrunk PVC transparent shrunk-on sleeves, Brady Type HSA or Brady Type HSB, applied over Brady Type B-700 vinyl film wrap markers. Tag wires at both ends with the same notation.

PART 2 PRODUCTS

A. Not Used

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. The Contractor shall test the completed system wiring for faults, and remove any defects prior to final inspection.

3.2 3.02 PROTECTION OF COMPLETED WORK

A. The Contractor shall effectively protect his work, materials and equipment from damage during the construction period. All openings into any part of the conduit system, associated fixtures and equipment must be securely covered or otherwise protected. Steel conduit and other ferrous metal supplies shall be stored where they will not be exposed to corrosion.

END OF SECTION

SECTION 26 01 27 - CALIBRATION AND TESTING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all equipment and labor required for calibration, setting and testing as described herein or otherwise required. All tests are to be witnessed by the Engineer. Give written notification of the tests at least seven days prior. Repair or replace all defective material, equipment or workmanship disclosed as a result of these tests at no additional cost to the Owner.

1.2 RECORDS

A. Provide the Engineer with a tabulation of all tests including the piece of equipment tested, the date tested, weather conditions, and test values results.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use meters, meggers and other test devices specifically approved for the test.

B. Test devices to be provided with dated calibration certificate.

C. Comply with NETA ATS-1991 for suitability, standards and calibration requirements.

2.2 TESTING CONCERN

A. Independent member of the National Electrical Testing Association (NETA).

B. Provides all material, equipment, labor and technical supervision to perform all tests and inspections.

C. Selected by Contractor with concurrence of Owner.

PART 3 - EXECUTION

3.1 DRY TYPE TRANSFORMERS

A. Insulation resistance test.
   1. Use a 500 volt megohmmeter.
   2. Test for ten (10) mins.
   3. Record readings at 30 secs., 1 min. and 10 mins.
   4. Calculate dielectric absorption ratio and polarization index.

B. Turns ratio test.
   1. On each winding.
   2. At all tap settings.

C. AC Overpotential Tests on all high and low voltage windings-to-ground.

D. Verify proper voltage after energization and prior to loading.

3.2 600 VOLT CABLES

A. Inspect for physical damage.

B. Insulation resistance tests.
   1. 1000 volts dc for 1 min.
   2. Each conductor with respect to adjacent conductors and ground.

C. Check continuity of each cable.

3.3 LOW VOLTAGE SWITCHES

A. Visually inspect for damage.

B. Perform insulation-resistance tests.
   1. Phase-phase and phase-ground for 1 min.

C. Contact-resistance test.
   1. Each switch blade.
   2. Fuse holders.

3.4 LOW VOLTAGE INSULATED CASE CIRCUIT BREAKERS

A. Check for proper mounting.

B. Contact resistance test.

C. Insulation-resistance tests - 1000 volts dc pole to pole and ground to ground.

D. Short time pick up and delay.

E. Long time delay.

F. Ground fault pick up.

G. Instantaneous pick up.

3.5 LOW VOLTAGE POWER CIRCUIT BREAKERS

A. Inspect for physical damage.

B. Contact resistance test.

C. Insulation resistance.
   1. 1000 volts dc.
   2. Pole to pole.
   3. Pole to ground.

D. Determine pick up time.

E. Determine pick up and delay.
   1. Long time.
   2. Short time.
   3. Ground fault.
   4. Instantaneous.

F. Check charging mechanism.

3.6 PROTECTIVE RELAYS

A. Test relay settings.
   1. Pick up parameters.
   2. Timing test at 3 points on the curve.
   3. Pick up target and seal in units.

3.7 GROUND TESTING

A. Take ground resistance measurements in normally dry weather, not less than 48 hours after rainfall, with the ground under test isolated from other grounds.

B. Measure the resistance of each ground rod and of the entire ground grid. Submit results in writing to Engineer. Include rod location(s), resistance measured and soil condition at the time.

C. Install additional grounding if the resistance to ground measures more than 25 OHM's at any location.

3.8 MOTOR TESTING

A. Megger test motors as follows:
   1. Insulation resistance test - 200 HP and less.
      a. One (1) min. duration.
      b. Tabulate resistances at 30 secs. and 60 secs.
      c. Calculate dielectric absorption ratio.
   2. Check motor space heater circuit for proper operation.
   3. Perform rotation check.
   4. Measure and record running current.

B. Dry out any wet insulation by use of space heaters or other approved methods.

C. Check coupling alignment, shaft end play, lubrication, and other mechanical checks as required. Follow manufacturer’s instructions.

D. Check for proper rotation.

3.9 RECEPTACLES

A. Test all receptacles for proper connections and grounding. Use an approved plug-in tester.

3.10 CONTROL CIRCUITS

A. Check all circuits for continuity, proper connection and proper operations.

B. Set all time delay relays and timers for the desired operation. Record the settings, indicating the relay or timer, its location and the setting used. Verify all settings with a stopwatch.

3.11 LIGHTING

A. Turn on all lights after lamping them with new lamps.

B. Turn on all lights at each panelboard with lights on and submit typewritten results to the Owner. Results to include panelboard number and location, branch circuit number and load served, and amperage reading.

C. Allow outdoor lights to remain on for 72 hours to check ballasts as well as lamps. Replace any defective material.

D. Set all time switches to turn lights on at dusk and off at dawn.

3.12 MOTOR CONTROL CENTERS AND INDIVIDUAL MOTOR STARTERS

E. Set all motor circuit protectors, all feeder circuit breakers and all overload relays.

F. Record the following information and submit the same to the ENGINEER for checking:
1. Motor control center number.
2. Motor control center location.
3. Feeder breaker or starter.
4. Load served and location.
5. Full load amps.
6. Locked rotor amps.
7. Overload heater unit used.
8. Overload relay setting used.

G. Take and record amperage readings on all feeders and motors to ensure proper phase balance.

3.13 TEST RESULTS

H. Submit copies of each test result for review. Include all information in the O&M Manual Testing Section.

END OF SECTION

SECTION 26 05 19 - WIRE AND CABLE

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The work performed under this section consists of providing labor, material, tools, equipment and related items required to furnish, install and place into operation all wire and cable systems.

1.2 PAYMENT

A. No separate payment shall be made for labor or material under this item. All costs shall be included in the lump sum or unit prices shown in the proposal.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00 - Submittals

B. Section 01 78 00 - Contract Closeout

C. Section 26 01 00 - Electrical General Provisions

D. Section 26 05 33 - Conduits

E. Section 26 05 66 - Grounding

1.4 REFERENCE STANDARDS

A. ANSI/UL 83 - Thermoplastic-insulated Wires

B. ICEA S-61-402 (NEMA WC5) - Thermoplastic Wire and Cable for the Transmission and Distribution of Electrical Energy

C. National Electrical Code

1.5 ACCEPTABLE MANUFACTURERS

A. Building Wire - Okonite, Cablec, Rome, Essex or Engineer-approved equal

B. Instrument Wire - Alpha, Belden, Dekoron or Engineer-approved equal

1.6 SUBMITTALS

A. The submittals shall be made in complete conformance with Section 01 33 00 and the following:

B. Furnish technical specifications and factory and field test reports.

1.7 DELIVERY

A. Wire and cable shall be delivered in unbroken packages bearing UL and manufacturers' labels and showing date of manufacture and maximum allowable voltage.

PART 2 PRODUCTS

2.1 600 VOLT INSULATION

A. The power and/or control cable shall be single-conductor, soft drawn, annealed copper, with type XHHW2 insulation, 90 degrees C in dry and wet locations, unless otherwise noted. However, note that the ampacity for 75 degree C wire as tabulated in the National Electrical Code shall be used throughout in determining proper wire size.

2.2 INSTRUMENT WIRE

A. Twisted pair 16 AWG copper conductors (7 strand, Class B); 15 mil 105 deg. C PVC primary insulation rated not less than 300 volts; color coded; 1.25 mil aluminum Mylar tape shield; 16-gauge, 7-strand tinned copper drain wire; 35 mil FR PVC jacket.

PART 3 EXECUTION

3.1 WIRE AND CABLE RATED 600 VOLTS AND BELOW

A. Color-coded wire shall be used on 600 volts and below.

B. An equipment grounding wire run in conduit shall have an identifying green covering. Ground conductor shall be sized per NEC 250-94 and 250-95. Minimum service ground shall be #6 AWG.

C. A green 600 volt conductor used for grounding purposes with single conductor cables of higher voltage requirements will be permitted.

D. Conductor terminations No. 8 AWG and smaller shall be made with pressure-connected lugs, Buchanan "Termend" or equal. Conductor terminations larger than No. 8 AWG shall be made with solderless, compression-type copper terminals equivalent to Burndy type YA-L. Compression shall be made with a die set that will make a circumferential crimp. Wire strands shall be thoroughly cleaned before lug is applied.

E. Bolted connections for electrical conductors without noncorrosive surfaces shall be thoroughly cleaned and tinned or covered with a light film of commercial paste to prevent oxidation.

F. Where mechanical assistance is used for pulling conductors, a wire pulling compound, Polywater J, or equal, having inert qualities that do not harm the wire insulation or covering shall be applied to the conductors before they are pulled into raceways. The interior of all raceways shall be free from grease, filings or foreign matter before conductors are pulled.

G. No wire smaller than No. 12 shall be installed except as furnished with standard

packaged equipment or specified herein for low voltage control systems or fixture wiring. No. 14 may be used for control wiring where adequately protected by properly sized fuses.

H. All wiring shall be run in conduits or raceways except in special cases. No wire shall be installed until the conduit system is completed and the construction work has progressed beyond the stage where the wire may be damaged.

I. Where the capacity of a single feeder is so great as to require parallel conductors in more than one conduit, each conduit must contain the same number and length of conductors in all phases (legs) of the feeder, including any neutral conductors.

J. In circuits of 600 volts and below, control wiring may be pulled in the same conduit with the power wiring if the control wiring is rated for the same voltage as the power wiring and if the conduit size is adequate. However, control wiring shall not be installed in the same conduit as VFD cable. Generally, motors 30 HP and larger shall have separate conduit systems for the motor leads and control wiring. Under no circumstance shall circuits above 600 volts and below 600 volts be pulled in the same conduit or the same cable tray without a metal barrier between.

K. Wiring shall be continuous between outlets. Keep splices to a minimum. Splice only in accessible junction boxes. Make splices to carry full capacity of conductors without perceptible temperature rise. Do not pull splices into conduit.

L. Wiring shall be tagged with heat shrinkable Brady Wire Markers or equal at panel boards, switchboards, motor control centers and control panels with suitable numbers for use in identification. All control wiring shall be tagged likewise.

M. One conductor of each lighting circuit shall be identified. The identified conductor shall be connected to the screw shell of the lamp socket.

N. No more than three lighting circuits shall be installed in any conduit for 4-wire, 3-phase systems, or two circuits for 3-wire single-phase systems. Each of the circuits shall be of a different phase. A separate neutral shall be provided for each hot wire installed.

O. Identify all wires in accordance with Section 26 01 00.

P. Continuity tests shall be performed on all power and control circuit conductors using an ohmmeter and megohmeter. Proper phasing connections shall be verified.

Q. The manufacturer’s recommended pulling tension shall not be exceeded when installing wiring.

3.2 INSTRUMENTATION WIRING

A. Analog signals shall be separated physically from control and power wiring. A separate conduit shall be used for each.

B. Twenty-four and 48 Vdc shall be used in separate conduits from 115 VAC wiring.

C. Wiring shall be arranged neatly with terminations located directly opposite the terminals. Wire loops shall be not less than 6 inches long in each outlet box. Frayed terminals and exposed wire shall be taped.

D. Unless otherwise noted shields shall be grounded at only one end of each cable run. Shields shall be continuous throughout the run. Jumpers shall be provided at terminals blocks to ensure continuity. VFD cable shields shall be connected at both the motor and the VFD.

E. Brady or equal heat shrink wire markers shall be provided to identify each wire at both the terminal block and the device, i.e., at both ends.

F. Color code as follows:

1. Line and load circuits AC or DC power – Black
2. AC control circuits – Red
3. DC control circuits – Blue
4. Interlock control circuits on the panel energized from an external source – Yellow
5. Equipment grounding conductors – Green
6. Neutral conductor – White

END OF SECTION

SECTION 26 05 26 - GROUNDING

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The work performed under this Section consists of providing all labor, material, tools, equipment and related items required to furnish and install an electrical grounding system in conduits.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00 - Submittals

B. Section 26 01 00 - Electrical General Provisions

C. Section 26 01 27 - Calibration and Testing

1.3 REFERENCE STANDARDS

A. NEC

B. IEEE Standard 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

C. ANSI/UL 467 - Safety Standard for Grounding and Bonding Equipment.

PART 2 PRODUCTS

2.1 MATERIAL

A. All wire and fittings shall be 98 percent conductivity copper.

B. Ground Rods shall be Copperweld, or equal, copperclad steel rods, 3/4" X 10'-0" unless otherwise noted.

C. Above ground connections shall be made with ground lugs, terminals, posts, etc., Burndy, Thomas & Betts, or equal.

D. Connections below grade shall be made with Cadweld process, or equal, connections.

PART 3 EXECUTION

3.1 SYSTEM GROUNDING

A. The secondary of all alternating current distribution systems which are to be grounded shall have the common conductor connected directly to the grounding conductor at the point of supply, i.e., on the line side of the main disconnect switch.

B. All grounding shall be tested in accordance with Section 26 01 27.

3.2 SAFETY GROUNDING OF EQUIPMENT

A. Safety grounding of equipment will be accomplished by providing an equipment ground wire, as shown on the drawings which will be no less than the size recommended in Article 250 of the National Electric Code. This ground will extend throughout the system by means of insulated green ground wires connected to ground buses in each switchgear, motor control center, panelboard and terminal on each outlet box, light fixture housing or grounding terminal of the motor. Install bonding jumpers from ground lugs on conduit grounding bushings to ground buses. Do not loop jumpers through grounding bushings. Provide a separate jumper for each bushing.

B. Each ground bus in addition to connecting to its feeder ground will be grounded to the building ground rods where applicable.

C. Connect ground wires entering outlet boxes in a manner which will allow removal of the receptacle without interrupting the continuity of the grounding circuit. A grounding screw attached to the box, and used for no other purpose, will accomplish this.

D. Where the equipment has no facility to attach an equipment ground wire, use a Burndy Quicklug or equal. Clean the metal surface under the lug to bright metal so that good contact can be made.

E. Connect equipment grounds to motors using a grounding stud threaded into the stationary frame of the motor and not the end bell.

F. Make ground connections to equipment by using ground lugs; or, ground bars where they are provided. Do not make connections to equipment anchor bolts.

G. Connect equipment ground wires to grounding lugs in the lighting panel. DO NOT CONNECT EQUIPMENT GROUNDS AND NEUTRALS AT THE PANELBOARD.

H. All underground cable connections and taps shall be made by a thermoweld process similar or equal to the Cadweld process. Coat connections with Koppers Bitumastic No. 505, or equal.

I. Grounding rods shall be used for grounding electrodes. They shall be placed at convenient locations as shown on the drawings. Ground rods shall be Copperweld with machined drive points and chamfered drive ends. The top of the rods shall be driven at least 18-inches below finished grade. Rods shall be a minimum of 3/4-inch in diameter and not less than 10-feet in length.

J. Furnish a separate dedicated insulated ground conductor and ground rod for the instrumentation and telemetry system. Connect ground wire to a dedicated insulated ground bus in the Control Panel(s).

K. General items to be grounded shall consist of enclosures and/or frames for motor starters, circuit breakers, transformers, safety switches, switchgear, panelboards, motors, capacitors and exposed metal parts of similar equipment. These items shall have solidly grounded cable connections to the grounding system.

L. Connect the X_o terminal of the lighting transformer to building steel or underground metallic water piping where available. Otherwise connect to ground loop.

M. Ground cable termination to enclosure and frames shall be similar to Thomas and Betts 71000 Series.

N. Ground wires installed above grade to be insulated and in conduit for protection. Bare ground wires shall be installed in Schedule 40 PVC conduit.

O. In general, resistance to ground shall not exceed 5 Ohms; however, resistance to ground of the instrument ground shall not exceed 1 Ohms.

P. The doors of all panels and the covers of all other enclosures shall be connected to the equipment ground through a flexible, insulated copper ground wire.

Q. The shields of instrument wiring containing 4-20 mAdc shall be grounded at the control panel end.

END OF SECTION

SECTION 26 05 29 - FOUNDATIONS AND SUPPORTS

PART 1 GENERAL

1.1 SCOPE

A. Furnish all foundations and supports required for the proper installation of conduit and equipment.

B. Comply with the requirements of Section 26 01 00 as applicable.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 11 00 - Concrete Formwork

B. Section 03 21 00 - Concrete Reinforcement

C. Section 03 30 53 - Cast-In-Place Concrete

D. Section 26 01 00 - Electrical General Requirements

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

A. Support suspended single conduits by "Caddy" or "Minerallic" hangers and adequately sized rods attached to the building structure. Use one hole nest back conduit clamps to support conduits run on wall or ceiling surfaces. Use Korns clamps to support single conduits from structural steel members.

B. Use Unistrut or equal trapeze supports to support multiple runs of conduits. Secure conduits to support channel with Unistrut "Uni-Clips".

C. Use Unistrut supports also to support multiple runs of conduit routed on the walls or ceilings.

D. Do not use perforated strap iron or wire to support conduits.

E. Supports located outdoors and in corrosive areas indoors shall be 316 stainless steel.

F. Supports in the Chemical Building shall be 316 stainless steel.

2.2 EQUIPMENT SUPPORTS

A. Provide supports for all control stations, disconnect switches, pull boxes, panels, receptacles and other equipment as shown on the Plans and as required otherwise.

B. Supports are to be constructed from structural steel members, or from Unistrut, or equal, as shown on the Plans. Members shall be sized as shown on the Plans. Where details are not shown, use minimum 3 inch by 1-1/2 inch channel structural steel sections 1/4 inch thick. Weld all structural steel members. All supports are to be corrosion resistant, 316 stainless steel unless otherwise noted.

C. Use expansion shields to attach supports to floor slab or pad.

D. All fastenings are to be corrosion-resistant.

2.3 FOUNDATIONS

A. Concrete used for electrical equipment foundations is to be the same as required for mechanical equipment foundations.

PART 3 EXECUTION

3.1 FOUNDATIONS

A. Concrete foundations for the support of equipment such as floor-mounted panels, motor control centers and switchgear, to be not less than 6" high and extend 3" on each end beyond the limits of the mounted equipment unless otherwise noted and is to be poured in forms built of new-dress lumber. All corners and edges to be neatly chamfered by means of sheet metal or triangular wood strips nailed to the form. Place foundations bolts in the forms when the concrete is poured, the bolts being correctly located by means of templates. Set each bolt in a sleeve of size to provide 1/2" for alignment and grouting. After grouting, remove the forms and hand rub the surfaces of the foundations with carborundum.

B. Furnish inverted channels for leveling switchgear, cabinets and control centers. Grout in channels after leveling the same. Use non-shrink grout.

3.2 CONDUIT SUPPORTS, HANGERS, ANCHORS AND GUIDES

A. Provide supports, hangers, anchors and guides as indicated on the Plans and, additionally, as required by the National Electrical Code.

B. Review all drawings, including structural drawings, for details regarding supports, anchors, hangers and guides.

C. All supports are to be of type and arrangement to prevent excessive deflection, to avoid excessive bending stresses between supports, and to eliminate transmission of vibration.

D. All rod sizes indicated in this Specification are minimum sizes only. CONTRACTOR shall be responsible for structural integrity of all supports, anchors, guides, etc. All structural hanging materials are to have a safety factor of 5 built in.

E. Locate anchor points as indicated on drawings or as required and construct to permit the conduit system to take up its expansion and contraction freely in opposite directions away from the anchored points.

F. Locate guide points where required and at expansion joints, joint, to permit free axial movement only.

G. Spacing of hangers to be adequate for the weight and rigidity of the conduits involved, and, in any case, no greater than 5'- 0" centers and within 12” of conduit bends.

3.3 ATTACHMENTS

A. Where conduits are supported under poured-in-place concrete construction, fit each hanger rod with a nut at its upper end, set into an Underwriters' Laboratories, Inc., listed universal concrete insert placed in the form work before concrete is poured. Where inserts are placed in the bottom faces of concrete joists which are too narrow to provide adequate strength of concrete to hold the insert properly, or where a larger insert would require displacement of the bottom joist steel, suspend the hanger rod from the center of a horizontal angle iron, channel iron, I-beam, etc., spanning across two adjacent joists. Bolt the horizontal support to non-adjustable concrete inserts of the "spot" type, of physical size small enough to avoid the bottom joist steel.

B. Where conduits are supported under bar joists, hanger rods may be run through the space between the bottom angles and secured with a washer and two nuts. Where larger lines are supported beneath bar joists, secure hanger rods to angle irons of adequate size; each angle to span across two or more joists as required to distribute the weight properly and to be welded to the joists or otherwise permanently fixed thereto.

C. Where pipes and loads are supported under steel beams, use approved type beam clamps.

3.4 VIBRATION ISOLATION

A. Support vibrating equipment such as dry-type transformers on adequately size Korfund, or equal, vibration pads.

END OF SECTION

SECTION 26 05 33.01 - BOXES AND FITTINGS

PART 1- GENERAL

1.1 SCOPE OF WORK

A. The work performed under this Section consists of providing all labor, material, tools, equipment and related items required to furnish, and install all junction boxes, pull boxes, outlet boxes and ceiling boxes installed outdoors and indoors.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00 – Submittals

B. Section 01 77 00 - Contract Closeout

C. Section 26 01 00 - Electrical General Provisions

D. Section 26 05 33 – Conduits

E. Section 26 05 26 - Grounding

1.3 REFERENCE STANDARDS

A. ANSI/NEMA OS1 - Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports.

B. ANSI/NEMA OS2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. ANSI/UL 514 - Electrical Outlet Boxes and Fittings.

E. ANSI/NEMA FB-1 - Fittings and Supports for Conduit and Cable Assemblies.

F. FS W-C-582 - Conduit, Raceway, Metal and Fitting, Surface.

G. NEMA TC3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

H. ANSI/UL5 - Safety Standards for Surface Metal Raceways and Fittings.

I. National Electrical Code.

1.4 ACCEPTABLE MANUFACTURERS

A. Galvanized Boxes and Gutters

1. Circle AW
2. Universal
3. AMF

4. Hoffman
5. Engineer Approved Equal

B. Cast Iron Boxes and Fittings

1. O-Z/Gedney Company
2. Appleton Electric
3. Crouse-Hinds
4. Engineer Approved Equal

C. PVC Boxes and Fittings

1. Carlon
2. Engineer Approved Equal

PART 2- PRODUCTS

2.1 MATERIALS

A. Pull and junction boxes installed outdoors shall be Nema 4X 316 SS except those boxes in Class 1, Division 1 hazardous areas shall be Nema 7. Boxes shall be sided as required by the NEC. Provide a Crouse Hinds ECD drain and breather in all boxes where condensation may be a problem.

B. The Contractor shall size all pull and junction boxes in accordance with the requirements of the National Electrical Code.

C. Use standard threaded type couplings and connectors, galvanized outside and inside by hot dipping. Do not use set screw type connectors.

D. For rigid bushings 1.25 inch and larger, use the insulating type. Use double locknuts and bushings on smaller conduits. Use O.Z. Type BLG grounding bushings at panel boards, motor control centers and control panel entries for conduits 1.25 inch and larger.

E. Use galvanized malleable iron conduit clamps and supports appropriately sized for each application. Use conduit clampbacks to provide air space between the conduit and the surface to which it is mounted.

F. Use threaded copper free cast aluminum conduit fittings with gasketed cover for rigid steel. Crouse Hinds Obround Series, or equal.

G. Device or utility boxes shall be of unit construction of a size required for the number of switches or outlets required. No sectional device boxes will be permitted.

H. All boxes in exposed conduit runs shall be Crouse Hinds Type FS or FD, as applicable, or approved equal, copper free cast aluminum with threaded conduit entries.

I. Do not use switch boxes as junction boxes.

J. Coordinate final location of boxes with other trades to avoid any conflicts.

K. Support boxes independently of conduit.

L. Coordinate location of boxes to avoid conflicts with architectural and mechanical construction.

M. Align wall-mounted outlet boxes for switches, thermostats and similar devices.

N. Provide cast outlet boxes in exterior locations and wet locations.

O. Outlet boxes for switches shall be mounted at a height of 4'-0" from the floor, as required by ADA, except as otherwise noted.

P. Outlet boxes for receptacles shall be located 1'- 3" from the floor, as required by the ADA, unless otherwise noted.

Q. Mounting height shall be as measured from finished floor to center line of coverplate.

PART 3- EXECUTION

3.1 DELIVERY AND STORAGE

A. Delivery. Prepare boxes, fittings, and accessories for shipment.

B. Storage and Handling at Job Site. The Contractor shall store and handle all boxes and fittings at the job site, while such materials are awaiting installation, in conformance with the following:

1. Store boxes, fittings, and accessories in an area protected from weather, moisture or possible damage.
2. Do not store material directly on the ground.

3.2 INSTALLATION

A. All outlet boxes shall be mounted with suitable fasteners and they shall contain the proper knockouts. On sheet metal boxes, all unused knockouts shall remain closed. Outlet or utility boxes concealed in construction shall be firmly secured in place, set true, square and flush with the finished surface for the correct application of cover plates or other devices.

END OF SECTION

SECTION 26 05 33 - CONDUIT SYSTEMS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The work performed under this Section consists of providing all labor, material, tools, equipment and related items required to furnish, and install all of the following conduit systems:

1. Heavy wall aluminum conduit
2. Nonmetallic rigid polyvinyl chloride (PVC)
3. Flexible aluminum waterproof conduit
4. PVC-coated rigid aluminum conduit
5. PVC-coated rigid steel conduit

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00 - Submittals

B. Section 01 77 00 - Contract Closeout:

C. Section 26 01 00 - Electrical General Requirements

D. Section 26 05 19 - Wire and Cable

E. Section 26 05 33.01 - Boxes and Fittings:

F. Section 26 05 26 - Grounding

1.3 REFERENCE STANDARDS

A. ANSI/UL 1 - Safety Standard for Flexible Metal Conduit.

B. UL 5A – Nonmetallic Surface Raceway and Fittings

C. UL 6 Underwriters Laboratories Standard For Safety Electrical Rigid Metal Conduit - Steel

D. UL 6A - Underwriters Laboratories Standard For Electrical Rigid Metal Conduit - Aluminum, Bronze, and Stainless steel

E. UL 467 - Electrical Grounding and Bonding Equipment

F. UL 514B Underwriters Laboratories Standard For Safety

G. ANSI/UL 651 - Safety Standard for Rigid Nonmetallic Conduit.

H. ANSI/UL 870 - Safety Standard for Wireways, Auxiliary Gutters and Associated

Fittings.

I. ANSI C80.4 – Fittings for Rigid Metal Conduit and Electric Metallic Tubing

J. ANSI C80.5 – Specifications for Rigid Aluminum Conduit.

K. Federal Specification WW-C-540c – Specification for Rigid Metal Aluminum Conduit.

L. Federal Specification WW-C-581 - Specification for Rigid Metal Steel Conduit

M. NEC® (2008) Section 250.118(2)

N. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80) and Fittings.

O. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

P. NECA 102-2004 – Standards for Installing Rigid Metal Aluminum Conduit

1.4 ACCEPTABLE MANUFACTURERS

A. Rigid Aluminum Conduit

1. Allied Tube and Conduit
2. Triangle Wire and Cable, Inc.
3. Wheatland Tube Company
4. Engineer Approved Equal

B. PVC Coated Rigid Conduit

1. PermaCote
2. Kor-Kap
3. Plastibond
4. O'Kote
5. Engineer Approved Equal

C. PVC Conduit

1. Cantex.
2. Carlon Industries, Inc.
3. Engineer Approved Equal.

D. Flexible Conduit

1. Anaconda Sealtite
2. Engineer Approved Equal.

1.5 SUBMITTALS

A. The submittal shall comply with the requirements of Section 01 33 00.

B. The submittal shall include the following:

1. Conduit manufacturer's name as used on this project.
2. Conduit type and technical specifications.
3. Couplings and fittings.
4. Complete technical description of conduit coatings where applicable.

PART 2 PRODUCTS

2.1 HEAVY WALL ALUMINUM CONDUIT

A. Heavy wall aluminum conduit shall be copper free aluminum. All couplings and fittings will conform to this requirement.

2.2 POLYVINYL CHLORIDE (PVC) CONDUIT

A. Nonmetallic rigid polyvinyl chloride shall be type EPC-40-PVC where installed underground.

2.3 PVC COATED CONDUIT

A. The PVC coated aluminum and galvanized rigid conduit must be UL Listed. The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid metal conduit. Fittings and Ferrous fittings for general service locations must be UL Listed with PVC as the primary corrosion protection. All conduit and fittings must be new, unused material.

2.4 FLEXIBLE CONDUIT

A. Flexible conduit shall be flexible aluminum core with liquid tight jacket. Anaconda Sealtite Type EFL, or approved equal.

PART 3 EXECUTION

3.1 DELIVERY AND STORAGE

A. Storage and Handling at Job Site. The CONTRACTOR shall store and handle all conduit at the job site, while such materials are awaiting installation, in conformance with the following:

1. Store conduit and accessories in an area protected from weather, moisture or possible damage.
2. Do not store materials directly on the ground.

3.2 HEAVY WALL RIGID ALUMINUM CONDUIT

A. Heavy wall rigid aluminum conduit shall be used for all conduits installed above ground

unless otherwise noted.

B. Verify the actual physical conduit route from the drawings an prepare the conduit support system.

C. Verify the equipment locations to which the conduit will be connected and determine detail requirements for the connections.

D. No trade size shall be smaller than 3/4-inch.

E. A conduit's ends shall be cut square with a saw and reamed. Threads shall be cut to effect full thread joint engagement. No running threads are permitted.

F. Pull boxes shall be installed in appropriate intervals for long conduit runs.

G. Exposed rigid conduit shall be installed parallel to structural members and surfaces and multiple runs in the same direction shall be parallel with symmetrical bends.

H. All conduits shall be installed clear of structural openings.

I. Every necessary measure shall be taken to prevent the entry of dirt, stones, trash or water in the conduit system.

J. Future conduits shall be capped with threaded cap if exposed, or terminated in equipment or by galvanized couplings plugged flush with the structural surfaces if concealed. Provide all future conduits with a 0.125 inch nylon fish cord pull string.

K. Where drawings indicate future equipment, the concealed portions of conduits shall be provided unless shown otherwise on the drawings.

L. Minimum separation of twelve inches shall be maintained between hot pipes and electrical conduits.

M. Conduits shall be installed in such a manner that they do not penetrate the floor of the Chemical Building since it is a containment slab. Conduits shall instead be installed exposed and routed overhead through the use of 316 SS unistrut hangers.

N. Structural members and reinforcing steel shall not be cut, burned or damaged in any way. Holes cut through existing floors and walls shall be neatly repaired with zinc-coated pipe rings placed on conduits at entry points.

O. For above ground runs of conduits space supports not more than 5 feet apart and install with the runs parallel or perpendicular to walls and structural members. Use right angle turns and symmetrical bends. Do not use diagonal runs except to avoid two 90 degree bends. Do not locate conduit so as to reduce the strength of structural members. Install supports within 24” of each fitting, bend or outlet box.

P. Support and secure groups of conduits on wall hangers using toggle bolts in hollow masonry, expansion bolts in concrete or solid masonry, machine screws on metal surfaces, and wood screws on wood construction. Space conduits from mounting

surfaces using conduit clampbacks. Provide plastic sleeves for conduits passing through masonry or concrete. Single conduits shall be supported by one-hole malleable clamps.

Q. Where rigid conduits enter sheet metal boxes, secure with lock nuts and bushings.

R. Enter outside electrical enclosures from the bottom, unless shown otherwise on the Plans. Terminate conduit connections to exterior sheet metal cabinets and enclosures with Myers Scru-Tite, or equal, hubs.

S. Provide expansion fittings for all conduits which cross expansion joints.

T. Avoid trapped runs in conduits. When they are necessary, install a tee condulet with a drain fitting.

U. Provide double locknuts and bushings for conduit entries into sheet metal enclosures. Provide Myers hubs on all outdoor conduit entries into sheet metal enclosures.

V. Install conduit seals within 18” of all conduit entries into or exist from a hazardous area. Install seals also when conduits enter or exit from a corrosive gas atmosphere. Fill conduit seals with 3M 2123, approved equal, re-enterable sealant.

W. Provide a fire sealant for conduits which cross firewalls.

X. Provide room for 25% expansion on all conduit supports.

3.3 POLYVINYL CHLORIDE (PVC) CONDUIT

A. Schedule 40 PVC conduits shall be installed underground. All penetrations out of ground shall be made with PVC coated aluminum elbows as detailed on the drawings.

B. No PVC conduit shall be used in any location where it is exposed to direct sunlight, extreme heat, or within the building.

3.4 FLEXIBLE CONDUIT

A. Use flexible conduit to connect to motors, solenoid valves, transformers and any other equipment subject to vibration.

B. Maximum length not to exceed 18 inches unless otherwise approved by the Engineer.

3.5 PVC-COATED CONDUIT ALUMINUM

A. Follow applicable specifications for underground conduits.

B. Install with any special tools recommended by the manufacturer in the manner recommended. Do not use tools which will mar the PVC coating.

C. Patch any small nicks or abrasions in the PVC coating immediately upon discovery of the same. Replace any sections which, in the opinion of the Engineer, are badly damaged. Use touch up compound recommended by the conduit manufacturer.

D. Use only PVC-coated fittings and supports.

E. The conduit shall be aluminum inside and out.

F. A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.

G. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30°F (-1°C).

H. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils. in thickness to protect the coating from tool damage during installation.

I. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.

J. Independent certified test results shall be available to confirm coating adhesion under the following conditions:

1. The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
2. No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).
3. The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.

K. Installation of the PVC Coated Conduit System shall be performed in accordance with the Manufacturer's Installation Manual. PVC-coated galvanized conduit should not be coupled with PVC-coated Aluminum. To assure correct installation, the installer shall be certified by Manufacturer to install coated conduit.

L. Approved material: PVC-coated, aluminum rigid conduit and fittings as manufactured by Perma-Cote, Kor Kap, O'Kote or PlastiBond. Any deviation will require approval of the specifying Engineer and shall meet all the performance standards specified herein American Society for Testing and Materials (ASTM) and Underwriter Laboratories (UL). All performance standards require verification by a nationally recognized testing agency.

M. Installation of the PVC Coated Conduit System shall be performed in accordance with the Manufacturer's Installation Manual. To assure correct installation, the installer shall be certified by Manufacturer to install coated conduit. Any deviation will require approval of the specifying Engineer and shall meet all the performance standards specified herein American Society for Testing and Materials (ASTM) and Underwriter Laboratories (UL). All performance standards require verification by a nationally recognized testing agency.

3.6 UNDERGROUND INSTALLATION

A. Bury underground conduit a minimum of 24 inches below grade, unless indicated otherwise.

B. Provide a minimum of 3" of clear separation between conduits.

C. CONTRACTOR shall be responsible for excavating, draining, trenching, backfilling and removing excess earth in connection with installation of underground conduit.

D. Waterproof all underground conduit joints in accordance with the manufacturer's recommendation.

E. Provide sand bedding under the conduit and a sand cover over the top of the conduits that are not concrete-encased. Place compacted backfill over the sand layer. The backfill shall be free of any rocks and debris larger than 1/2" measured in any direction.

F. Backfilling shall be done in such a manner that voids will be minimized. Excess soil shall be piled on top and shall be well tamped. All rock and debris shall be removed from the site.

G. Install a warning tape the entire length of each conduit run. Locate tape 12 inches above the conduits. Tape is to be 4 mil polyethylene, 6 inches wide, with metallic lining and clear polyethylene backing, with the legend "CAUTION ELECTRIC LINE BURIED BELOW." Seton Style No. 6ELE, or approved equal.

H. Provide a reinforced concrete encasement for all underground conduits. Concrete shall be 3000 psi/28 day strength per ASTM 039-44. Sprinkle a red admixture "Sonabrite Red" by L. Sonneborn Sons, Inc., or equal, on top of the concrete to fully cover.

I. Stagger joints in concrete encasement a minimum of 6 inches vertically.

J. Use approved separators and chairs installed a maximum of 4 feet on centers. Securely anchor conduit to prevent movement during concrete placement.

K. Provide a minimum 12” separation horizontally and vertically between power and signal conduits.

L. Make transition from PVC to rigid aluminum conduit where conduit leaves the ground. Transitions shall consist of a PVC-to-rigid aluminum adapter and a 90 degree PVC-coated rigid aluminum bend. Continue coating for a minimum 6 inches above grade unless otherwise specified.

END OF SECTION

SECTION 26 20 00
LOW-VOLTAGE AC INDUCTION MOTORS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. This section applies only when referenced by a motor-driven equipment specification. Application, horsepower, enclosure type, mounting, shaft type, synchronous speed, and deviations from this section will be listed in the equipment specification. Where such deviations occur, they shall take precedence over this section.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Bearing Manufacturers Association (ABMA):
      a. 9, Load Ratings and Fatigue Life for Ball Bearings.
      b. 11, Load Ratings and Fatigue Life for Roller Bearings.
   2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
      b. 620, Guide for the Presentation of Thermal Limit Curves for Squirrel Cage Induction Machines.
      c. 841, Standard for Petroleum and Chemical Industry-Premium Efficiency Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors-Up to and Including 370 kW (500 hp).
   3. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
      b. C50.41, Polyphase Induction Motors for Power Generating Stations.
      c. MG 1, Motors and Generators.
   4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
   5. Underwriters Laboratories (UL):
      a. 83, Standard for Safety for Thermoplastic-Insulated Wire and Cables.
      b. 674, Standard for Safety for Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations.
      c. 2111, Standard for Safety for Overheating Protection for Motors.

1.3 DEFINITIONS

A. CISD-TEFC: Chemical industry, severe-duty enclosure.

B. DIP: Dust-ignition-proof enclosure.

C. EXP: Explosion-proof enclosure.

D. Inverter Duty Motor: Motor meeting applicable requirements of NEMA MG 1, Section IV, Parts 30 and 31.

E. Motor Nameplate Horsepower: That rating after any derating required to allow for extra heating caused by the harmonic content in the voltage applied to the motor by its controller.

F. ODP: Open drip-proof enclosure.

G. TEFC: Totally enclosed, fan-cooled enclosure.

H. TENV: Totally enclosed, nonventilated enclosure.

I. WPI: Open weather protected enclosure, Type I.

J. WPII: Open weather protected enclosure, Type II.

1.4 SUBMITTALS

A. Action Submittals:
   1. Descriptive information.
   2. Nameplate data in accordance with NEMA MG 1.
   3. Additional Rating Information:
      a. Service factor.
      b. Locked rotor current.
      c. No load current.
      d. Multispeed load classification (for example, variable torque).
      e. Adjustable frequency drive motor load classification (for example, variable torque) and minimum allowable motor speed for that load classification.
      f. Guaranteed minimum full load efficiency and power factor.
   4. Enclosure type and mounting (such as, horizontal, vertical).
   5. Dimensions and total weight.
   6. Conduit box dimensions and usable volume as defined in NEMA MG 1 and NFPA 70.
   7. Bearing type.
   8. Bearing lubrication.
   9. Bearing life.
   10. Space heater voltage and watts.
   11. Description, ratings, and wiring diagram of motor thermal protection.
   12. Motor sound power level in accordance with NEMA MG 1.
   13. Maximum brake horsepower required by the equipment driven by the motor.
   14. Description and rating of submersible motor moisture sensing system.

B. Informational Submittals:
   1. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:
   1. General Electric.
   2. Reliance Electric.
   3. MagneTek.

4. Siemens Energy and Automation, Inc., Motors and Drives Division.
5. Baldor.
6. U.S. Electrical Motors.
7. TECO-Westinghouse Motor Co.
8. Toshiba International Corp., Industrial Division.
9. WEG Electric Motors Corp.

2.2 GENERAL

A. For multiple units of the same type of equipment, furnish identical motors and accessories of a single manufacturer.

B. In order to obtain single source responsibility, use a single supplier to provide drive motor, its driven equipment, and specified motor accessories.

C. Meet requirements of NEMA MG 1.

D. For motors used in hazardous (classified) locations, Class I, Division 1, Groups B, C, and D, and Class II, Division 1, Groups E, F, and G provide motors that conform to UL 674 and have an applied UL listing mark.

E. Motors shall be specifically designed for the use and conditions intended, with a NEMA design letter classification to fit the application.

F. Lifting lugs on motors weighing 100 pounds or more.

G. Operating Conditions:
   1. Maximum ambient temperature not greater than 40 degrees C.
   2. Motors shall be suitable for operating conditions without reduction being required in nameplate rated horsepower or exceeding rated temperature rise.
   3. Overspeed in either direction in accordance with NEMA MG 1.

2.3 HORSEPOWER RATING

A. As designated in motor-driven equipment specification.

B. Constant Speed Applications: Brake horsepower of driven equipment at any operating condition not to exceed motor nameplate horsepower rating, excluding service factor.

C. Adjustable Frequency and Adjustable Speed Applications (Inverter Duty Motor): Driven equipment brake horsepower at any operating condition not to exceed motor nameplate horsepower rating, excluding service factor.

2.4 SERVICE FACTOR

A. Inverter-duty Motors: 1.0 at rated ambient temperature, unless otherwise noted.

B. Other Motors: 1.15 minimum at rated ambient temperature, unless otherwise noted.

2.5 VOLTAGE AND FREQUENCY RATING

A. System Frequency: 60 Hz.

B. Voltage Rating: Unless otherwise indicated in motor-driven equipment specification:

Voltage Rating		
Size	Voltage	Phase
½-hp and smaller	115	1
¾-hp through 400-hp	460	3

C. Suitable for full voltage starting.

D. Suitable for accelerating the connected load with supply voltage at motor starter supply terminals dipping to 90 percent of motor rated voltage.

2.6 EFFICIENCY AND POWER FACTOR

A. For all motors except single-phase, under 1 hp, multispeed, short-time rated and submersible motors, or motors driving gates, valves, elevators, cranes, trolleys, and hoists:

1. Efficiency:
   a. Tested in accordance with NEMA MG 1, Paragraph 12.59.
   b. Guaranteed minimum at full load in accordance with NEMA MG 1 Table 12-12, Full-load Efficiencies for NEMA Premium Efficiency Electric Motors Rated 600 Volts or Less (Random Wound), or as indicated in motor-driven equipment specification.
2. Power Factor: Guaranteed minimum at full load shall be manufacturer's standard or as indicated in motor-driven equipment specification.

2.7 LOCKED ROTOR RATINGS

A. Locked rotor kVA Code F or lower, if motor horsepower not covered by NEMA MG 1tables.

B. Safe Stall Time: 12 seconds or greater.

2.8 INSULATION SYSTEMS

A. Single-Phase, Fractional Horsepower Motors: Manufacturer's standard winding insulation system.

B. Motors Rated Over 600 Volts: Sealed windings in accordance with NEMA MG l.

C. Three-phase and Integral Horsepower Motors: Unless otherwise indicated in motor-driven equipment specification, Class B or Class F at nameplate horsepower and designated operating conditions.

2.9 ENCLOSURES

A. Enclosures to conform to NEMA MG 1.

B. TEFC and TENV: Furnish with drain hole with porous drain/weather plug.

C. Explosion-Proof (EXP):

1. TEFC listed to meet UL 674 and NFPA 70 requirements for Class I, Division 1, Group C and D hazardous locations.
2. Drain holes with drain and breather fittings.

3. Integral thermostat opening on excessive motor temperature in accordance with UL 2111 and NFPA 70.
4. Terminate thermostat leads in terminal box separate from main terminal box.

D. Submersible: In accordance with Article Special Motors.

E. Chemical Industry, Severe-Duty (CISD-TEFC): In accordance with Article Special Motors.

2.10 TERMINAL (CONDUIT) BOXES

A. Oversize main terminal boxes for motors.

B. Diagonally split, rotatable to each of four 90-degree positions. Threaded hubs for conduit attachment.

C. Except ODP, furnish gaskets between box halves and between box and motor frame.

D. Minimum usable volume in percentage of that specified in NEMA MG 1, Section 1, Paragraph 4.19 and NFPA 70, Article 430:

Terminal Box Usable Values		
Voltage	Horsepower	Percentage
Below 600	15 through 125	500
Below 600	150 through 300	275
Below 600	350 through 600	225
Above 600	All sizes	200

E. Terminal for connection of equipment grounding wire in each terminal box.

F. Coordinate motor terminal box conduit entries versus size and quantity of conduits shown on Drawings.

2.11 BEARINGS AND LUBRICATION

A. Horizontal Motors:
1. 3/4 hp and Smaller: Permanently lubricated and sealed ball bearings, or re-greasable ball bearings in labyrinth sealed end bells with removable grease relief plugs.
2. 1 hp through 400 hp: Re-greasable ball bearings in labyrinth sealed end bells with removable grease relief plugs.
3. Minimum 100,000 hours L-10 bearing life for ball and roller bearings as defined in ABMA 9 and ABMA 11.

B. Vertical Motors:
1. Thrust Bearings:
   a. Antifriction bearing.
   b. Manufacturer's standard lubrication
   c. Minimum 50,000 hours L-10 bearing life.
2. Guide Bearings:
   a. Manufacturer's standard bearing type.

b. Manufacturer's standard lubrication.
c. Minimum 100,000 hours L-10 bearing life.

C. Re-greasable Antifriction Bearings:
1. Readily accessible, grease injection fittings.
2. Readily accessible, removable grease relief plugs.

D. Oil Lubrication Systems:
1. Oil reservoirs with sight level gauge.
2. Oil fill and drain openings with opening plugs.
3. Provisions for necessary oil circulation and cooling.

E. Inverter Duty Rated Motors, Bearing Isolation: Motors larger than 50 hp shall have electrically isolated bearings to prevent stray current damage.

2.12 NOISE

A. Measured in accordance with NEMA MG 1.

B. Motors controlled by adjustable frequency drive systems shall not exceed sound levels of 3 dBA higher than NEMA MG 1.

2.13 BALANCE AND VIBRATION CONTROL

A. In accordance with NEMA MG 1, Part 7.

2.14 EQUIPMENT FINISH

A. Protect Motor for Service Conditions:
1. ODP Enclosures: Indoor industrial atmospheres.
2. Other Enclosures: Outdoor industrial atmospheres, including moisture and direct sunlight exposure.

B. Internal Finish: Bore and end turns coated with clear polyester or epoxy varnish.

2.15 SPECIAL FEATURES AND ACCESSORIES

A. Screen Over Air Openings: Stainless steel on motors with ODP, WPI, and WPII enclosures meeting requirements for guarded machine in NEMA MG 1 and attached with stainless steel screws.

B. Winding Thermal Protection:
1. Thermostats:
a. Motors for constant speed application and motors for adjustable speed application 40HP and larger
b. Bi-metal disk or rod type thermostats embedded in stator windings.
c. Automatic reset contacts rated 120 volts ac, 5 amps minimum, opening on excessive temperature (Provide manual reset at motor controller).
d. Leads extending to separate terminal box for motors 100HP and larger.

C. Space Heaters:
1. Provide winding space heaters with leads wired out to motor terminal box.
2. Provide extra hole or hub on motor terminal box, as required.

3. Unless shown otherwise, heater shall be suitable for 120V ac supply, with wattage suitable for motor frame size.

D. Anchor Bolts: Provide meeting manufacturer's recommendations and of sufficient size and number for specified seismic condition.

2.16 SPECIAL MOTORS

A. Requirements in this article take precedence over conflicting features specified elsewhere in this section.

B. Chemical Industry, Severe-Duty (CISD-TEFC):
   1. In accordance with IEEE 841.
   2. TEFC in accordance with NEMA MG 1.
   3. Suitable for indoor or outdoor installation in severe-duty applications including high humidity, chemical (corrosive), dirty, or salty atmospheres.
   4. Motor Frame, End Shields, Terminal Box, and Fan Cover: Cast iron.
   5. Ventilating Fan: Corrosion-resistant, nonsparking, external.
   6. Drain and Breather Fittings: Stainless steel.
   7. Nameplate: Stainless steel.
   8. Gaskets between terminal box halves and terminal box and motor frame.
   9. Extra slinger on rotor shaft to prevent moisture seepage along shaft into motor.
   10. Double shielded bearings.
   11. 125,000 hours minimum L-10 bearing life for direct-connected loads.
   12. External Finish: Double-coated epoxy enamel.
   13. Coated rotor and stator air gap surfaces.
   14. Insulation System, Windings, and Connections:
      a. Class F insulation, Class B rise or better at 1.0 service factor.
      b. Multiple dips and bakes of nonhygroscopic polyester varnish.
   15. Service Factor:
      a. At 40 Degrees C Ambient: 1.15.
      b. At 65 Degrees C Ambient: 1.00.
   16. Safe Stall Time Without Injurious Heating: 20 seconds minimum.

C. Severe-duty Explosion-proof: Meet requirements for EXP enclosures and CISD-TEFC motors.

D. Severe-duty, Dust-ignition-proof: Meet requirements for DIP enclosures and CISD-TEFC motors.

E. Multispeed: Meet requirements for speeds, number of windings, and load torque classification indicated in motor-driven equipment specification.

F. Inverter Duty Motor:
   1. Motor supplied power by adjustable voltage and adjustable frequency drives shall be inverter duty rated.
   2. Suitable for operation over entire speed range indicated.
   3. Provide forced ventilation where speed ratio is greater than published range for motor provided.

4. When installed in Division 1 hazardous (classified) location shall be identified as acceptable for variable speed when used in Division 1 location.
5. Shaft Grounding Device: Motors shall be provided with shaft grounding brush or conductive micro fiber shaft grounding ring. Shaft grounding device shall be solidly bonded to grounded motor frame per manufacturer's recommendations.
   a. Manufacturers:
      1) Grounding Brush: Sohre Turbomachinery, Inc.
      2) Grounding Ring: EST-Aegis.

G. Submersible Pump Motor:
1. Manufacturers:
   a. Reliance Electric.
   b. ITT Flygt Corp.
2. At 100 Percent Load:

Submersible Pump Motors		
Horsepower	Guaranteed Minimum Efficiency	Guaranteed Minimum Power Factor
5 through 10	80	82
10.1 through 50	85	82
50.l through 100	87	82
Over 100	89	82

3. Insulation System: Manufacturer's standard Class B or Class F.
4. Motor capable of running dry continuously.
5. Enclosure:
   a. Hermetically sealed, watertight, for continuous submergence up to 65-foot depth.
   b. Listed to meet UL 674 and NFPA 70 requirements for Class I, Division 1, Group D hazardous atmosphere.
   c. Seals: Tandem mechanical.
6. Bearing and Lubrication:
   a. Permanently sealed and lubricated, replaceable antifriction guide and thrust bearings.
   b. Minimum 15,000 hours L-10 bearing life.
7. Inrush kVA/horsepower no greater than NEMA MG 1 and NFPA 70, Code F.
8. Winding Thermal Protection:
   a. Thermal sensor and switch assembly, one each phase, embedded in stator windings and wired in series.
   b. Switches normally closed, open upon excessive winding temperature, and automatically reclose when temperature has cooled to safe operating level.
   c. Switch contacts rated at 5 amps, 120V ac.
9. Motor Seal Failure Moisture Detection:
   a. Probes or sensors to detect moisture beyond seals.
   b. Probe or sensor monitoring module for mounting in motor controller, suitable for operation from 120V ac supply.

c. Monitoring module with control power transformer, probe test switch and test light, and two independent 120V ac contacts, one opening and one closing when flux of moisture is detected.

10. Bearing Overtemperature Protection for Motors Larger than 100 hp:
    a. Sensor on lower bearing housing monitoring bearing temperature.
    b. Any monitoring relay necessary to provide 120V ac contact opening on bearing overtemperature.
11. Winding thermal protection, moisture detection, and bearing overtemperature specified above may be monitored by single device providing two independent 120V ac contacts, one closing and one opening on malfunction.
12. Connecting Cables:
    a. One cable containing power, control, and grounding conductors.
    b. Each cable suitable for hard service, submersible duty with watertight seal where cable enters motor.
    c. Length: 30 feet minimum.
    d. UL 83 listed and sized in accordance with NFPA 70.

2.17 FACTORY TESTING

A. Tests:
   1. In accordance with IEEE 112 for polyphase motors.
   2. Routine (production) tests in accordance with NEMA MG 1. Test multispeed motors at all speeds.
   3. For energy efficient motors, test efficiency and power factor at 50 percent, 75 percent, and 100 percent of rated horsepower:
      a. In accordance with IEEE 112, Test Method B, and NEMA MG 1, Paragraph 12.59. and Paragraph 12.60.
      b. For motors 500 hp and larger where facilities are not available to test by dynamometer (Test Method B), determine efficiency by IEEE 112, Test Method F.

B. Test Report Forms:
   1. Routine Tests: IEEE 112, Form A-1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. In accordance with manufacturer's instructions and recommendations.

B. Align motor carefully and properly with driven equipment.

C. Secure equipment to mounting surface with anchor bolts.

END OF SECTION

SECTION 26 21 00

ELECTRICAL SERVICE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work performed under this Section consists of providing all labor, material, tools, equipment and related items required to furnish and install electrical service to the proposed site.

1) The plant is served by Texas New Mexico Power.
2) There are two existing services. Only one of the two is active.
3) Only one service is metered.

B. Contractor shall furnish and install the following:
1) Meter for the second service.
2) Service disconnect for the second service.
3) Conduit and wiring from the existing pole to the new service disconnect.

1.02 GENERAL

A. Equipment furnished by the Manufacturer under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by the Engineer.

1.03 RELATED SECTIONS

A. Submittals: Section 01 33 00.

B. Electrical General Information: Section 26 01 00

C. Grounding: Section 26 05 26

D. Conduit Systems: Section 26 05 33

E. Wire and Cable: Section 26 05 19

1.04 REFERENCE STANDARDS

A. NEC

B. OSHA

C. ANSI

D. IEEE

E. NEMA

F. ASTM

G. Texas New Mexico Electric Utility.

1.05 COORDINATION

A. The Contractor shall pay the TMNU installation charges, which will include those items specified herein. Contractor shall communicate with TNMU to determine the respective scope of services of TNMU and the Contractor and all costs involved. Owner will not be responsible for any lack of communication between TNMU and the Contractor

B. Deviations from these drawings and specifications shall be noted on the shop drawing submittal.

C. The Contractor shall schedule work with TNMU to execute final connections and testing of equipment for a complete and functional electric service.

D. The Contractor shall coordinate his work with the TNMU to arrange for and pay for all required permits, inspections, and other required services. This includes TNMU design fees and Contribution in Aid of Construction (CIAC) fees that may be incurred.

1.06 SUBMITTALS

A. The submittals shall be in accordance with the complete requirements of Section 01 33 00.

B. The Contractor shall submit to the Engineer a schedule covering the time required to establish the proposed service shown on the drawings. The submittal shall include drawings and description of service routing changes if different from that shown on the drawings. Approval of routing shall be approved by the Engineer prior to construction

PART 2: PRODUCTS

2.01 CONDUIT

A. Comply with TNMU standards.

2.02 PRIMARY CABLE

A. Primary cable shall be installed from transformer to load side of primary switch.

1) Primary cable Per TNMU standards.

B. Manufacturer:

1) Per TNMU standards.

C. Primary service interrupter switch shall be installed on riser pole.

PART 3: EXECUTION

3.01 INSTALLATION, STARTUP AND FIELD TESTING

A. CONTRACTOR shall furnish and install secondary conduit and wiring from the transformer to the service disconnect at the administrative building, and shall make the connections.

END OF SECTION

SECTION 26 22 13 - DRY-TYPE TRANSFORMERS

PART 1: GENERAL

1.1 SCOPE OF WORK

A. The work performed under this Section consists of providing all labor, material, tools, equipment and related items required to furnish, install and place into operation dry-type transformers up to 500 KVA with 480 volt primaries.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01 33 00

B. Contract Closeout: Section 01 77 00

C. Electrical General Provisions: Section 26 01 00

D. Grounding: Section 26 05 26

1.3 REFERENCE STANDARDS

A. NEC

B. OSHA

C. ANSI/NEMA ST 20 - Dry Type Transformers for General Application

D. ANSI/UL 506 - Specialty Transformers

1.4 ACCEPTABLE MANUFACTURERS

A. Eaton Cutler Hammer

B. General Electric.

C. Schneider Square D.

D. Engineer Approved Equal

1.5 SUBMITTALS

A. The submittal shall be in accordance with the requirements of Section 01 33 00.

B. The submittal shall include but is not limited to the following:

1. Manufacturer's name and model number

2. Primary voltage rating
3. Secondary voltage rating
4. Number of phases
5. Frequency in Hertz
6. KVA rating
7. Percent Impedance
8. Temperature rise in degrees Celsius
9. Number and percent of taps
10. Connection diagram
11. NEMA type enclosure
12. Sound rating in decibels
13. Weight
14. Enclosure dimensions
15. Mounting requirements
16. Basic Impulse Level (BIL) rating if required
17. Lightning arresters and surge protectors if required

PART 2: PRODUCTS

2.1 TRANSFORMERS 600 VOLTS AND BELOW

A. Transformers shall be manufacturers' premium quality dry-type and suitable for outdoor installation.

B. Transformers shall have ratings indicated on the Plans. Primary and secondary voltages shall be as shown.

C. Enclosures shall include a wiring compartment at the bottom. Transformers 25 KVA and larger shall be floor mount type. Transformers shall have ventilation openings, corrosion resistance, cable bending space, grounding provisions, surface temperature rise, wiring compartment temperature rise, and terminations per UL 506 specifications. Furnish lifting lugs for each transformer 25 KVA and above. All exposed metal parts shall be cleaned, phosphatized, primed and finished with gray baked enamel.

D. Transformer coils shall be machine wound copper windings impregnated with high temperature varnish for protection against moisture and heat build-up.

E. Taps shall be furnished as follows:

1. 15 KVA and below: 2 - 5% taps below rated voltage

2. 25 KVA and above: 6 - 2½% taps: Two above rated voltage and four below rated voltage.

F. Sound levels shall be equal to or lower than ANSI standard C89 levels. Each transformer 30 KVA and above shall have an integral noise isolation system.

G. Temperature Rise to be 80° C above 40° C ambient. Capable of carrying 30% continuous overload at less than 150° C rise in a 40° C ambient. Insulation per NEMA ST20 for 220° C system.

PART 3: EXECUTION

3.1 DELIVERY AND STORAGE

A. Delivery. Prepare transformers and accessories for shipment to job site.

B. Storage and Handling at Job Site. The CONTRACTOR shall store and handle all transformers at the job site, while such materials are awaiting installation, in conformance with the following:

1. Store transformers and accessories in an area protected from weather, moisture or possible damage.

2. Do not store materials directly on the ground.

3. Handle items to prevent damage to interior or exterior surfaces.

4. If items are stored inside the proposed building, consideration shall be given to weight of the items and the effect of concentrated loads on the building slabs, foundation, and other structural members. CONTRACTOR shall contact ENGINEER for permission to store materials with a load exceeding 200 pounds per square foot.

3.2 LUGS

A. Furnish one lug per cable.

B. Lugs shall be copper and suitable for the termination of 75°C rated copper conductors.

C. Furnish grounding lug as required.

3.3 VOLTAGE TEST

A. Measure the secondary voltage of each transformer. Set taps on transformer to obtain a voltage reading within 5 percent of rated voltage output.

3.4 INSTALLATION

A. Install transformers in accordance with manufacturer's recommendations.

B. Make all connections with flexible conduit.

C. Install transformers on Korfund, or equal, vibration dampening pads.

END OF SECTION

SECTION 26 22 18

UNIT POWER CENTERS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work performed under this Section consists of providing all labor, material, tools, equipment and related items required to furnish, install and place into operation self contained unit power centers.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01 33 00

B. Contract Closeout: Section 01 77 00

C. Electrical General Information: Section 26 01 00

D. Grounding: Section 26 05 26

E. Conduit Systems: 26 05 33

F. Wire and Cable: 26 05 19

1.03 REFERENCE STANDARDS

A. NEC

B. OSHA

C. ANSI

D. IEEE

E. NEMA

F. UL

1.04 ACCEPTABLE MANUFACTURERS

A. Eaton Cutler Hammer
B. General Electric.
C. Schneider Square D

D. Engineer Approved Equal

1.05 SUBMITTALS

A. The submittal shall be in accordance with the requirements of Sections 01 33 00 and 26 01 26.

B. The submittal shall include but is not limited to the following:

1. Manufacturer's name and model number
2. Primary voltage rating
3. Secondary voltage rating
4. Number of phases
5. Frequency in Hertz
6. KVA rating
7. Percent Impedance
8. Temperature rise in degrees Celsius
9. Number and percent of taps
10. Connection diagram
11. NEMA type enclosure
12. Sound rating in decibels
13. Weight
14. Enclosure dimensions
15. Mounting requirements
16. Basic Impulse Level (BIL) rating if required
17. Rating and type of primary circuit breaker.
18. Rating and types of load center circuit breakers.

C. Provide O&M Manuals in accordance with 01 77 00.

PART 2: PRODUCTS

2.01 GENERAL

A. The power center shall consist of a primary circuit breaker, a dry type transformer and a secondary panelboard all assembled in one enclosure. All interconnecting wiring between the primary breaker and the transformer and between the transformer and the secondary panelboard shall be factory wired so that the only connections necessary in the field will be to the line side of the main circuit breaker and to the load side of the branch circuit breakers in the secondary panelboard.

B. The power center shall have the following ratings:

1. Primary Voltage - 480 volts, single phase.
2. Secondary Voltage - 120/240 volts, single phase, three wire.
3. Transformer – Rating as shown on the drawings.
4. Primary Breaker – Continuous rating as shown on the drawings with an interrupting rating of 14,000 amps at 480 volts.
5. Main Secondary Breaker – Continuous rating as shown on the drawings with an interrupting rating of 10,000 amps at 240 volts.
6. Branch Circuit Breakers - Continuous current rating as shown on the drawings with an interrupting rating equal to the main secondary breaker.

C. Units shall be designed for continuous 24 hours a day operation, 365 days per year with normal life expectancy per ANSI C57.96.

2.02 TRANSFORMER

A. Transformer shall be manufacturers' standard self ventilated dry-type suitable for outdoor installation.

B. Insulation shall be 185 C, flame retardant and will not support combustion as defined in ASTM Standard Test Method D635.

C. Core shall be high-grade silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Coils shall be continuously wound electrical grade aluminum. Core and coil assembly shall be resin encapsulated to provide a moisture proof shock resistant seal and to minimize the sound level.

2.03 CIRCUIT BREAKERS

A. Main breaker shall be molded case thermal magnetic sized to provide short circuit and overload protection for the transformer.

B. Secondary main circuit breaker shall be of the same type as the primary circuit breaker and shall be sized to provide protection for the panelboard.

C. The panelboard shall contain the number of circuit breakers indicated on the panel schedule. Breakers shall be one-inch plug-in molded case, thermal magnetic with the continuous current rating as indicated on the schedule.

2.04 ENCLOSURE

A. Totally enclosed, non-ventilated in a Nema 3R 316 Stainless Steel enclosure.

B. Equipped with a wiring compartment large enough to allow convenient wiring.

C. Maximum temperature not to exceed 90 C.

D. Core grounded to the enclosure.

2.05 SOUND LEVELS

A. Sound levels shall not exceed the following ANSI and NEMA levels for the self-cooled ratings:

1. Up to 9 kVA - 40 dB
2. Above 9 kVA - 45 dB

PART 3: EXECUTION

3.01 DELIVERY AND STORAGE

A. Delivery: Prepare transformers and accessories for shipment to job site.

B. Storage and Handling at Job Site. The CONTRACTOR shall store and handle all transformers at the job site, while such materials are awaiting installation, in conformance with the following:

C. Store transformers and accessories in an area protected from weather, moisture or possible damage.

D. Do not store materials directly on the ground.

E. Handle items to prevent damage to interior or exterior surfaces.

3.02 LUGS

A. Furnish one lug per cable.

B. Lugs shall be copper and suitable for the termination of 75^{o}C rated copper conductors.

C. Furnish grounding lug as required.

3.03 VOLTAGE TEST

A. Measure the secondary voltage of each transformer. Set taps on transformer to obtain a voltage reading within 5 percent of rated voltage output.

3.04 INSTALLATION

A. Install power centers in accordance with manufacturer's recommendations.

B. Mounting height shall be 3’-6” minimum to the bottom and 5’-6” maximum to the breakers.

C. Directory shall be located so that it is easy to read.

END OF SECTION

SECTION 26 24 13

LOW VOLTAGE SWITCHBOARD

PART 1: GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install, where indicated, a free-standing, dead-front type front access only low voltage distribution switchboard, utilizing group mounted circuit protective devices as specified herein, and as shown on the contract drawings.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals

B. Section 01 77 00 – Contract Closeout

C. Section 26 05 73 – Power System Studies

D. Section 26 01 00 – Electrical General Requirements

1.03 REFERENCES

A. The switchboard and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:

1. NEMA PB-2
2. UL Standard 891
3. UL Standard 1066
4. UL Standard 489
5. UL Standard 1449 4th edition.

1.03 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:

1. Master drawing index
2. Front view elevation
3. Floor plan
4. Top view
5. Single line
6. Schematic diagram
7. Nameplate schedule
8. Component list
9. Conduit entry/exit locations
10. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage

c. Continuous current

11. Major component ratings including:
    a. Voltage
    b. Continuous current
    c. Interrupting ratings
12. Cable terminal sizes
13. Product data sheets

B. Comply with Sections 01 33 00 and 26 01 00.

C. Where applicable, the following additional information shall be submitted to the Engineer:

1. Busway connection
2. Connection details between close-coupled assemblies
3. Composite floor plan of close-coupled assemblies
4. Key interlock scheme drawing and sequence of operations

1.04 O& M MANUALS

A. Contractor shall provide Operation and Maintenance Manuals in accordance with Sections 01 77 00 and 26 01 00. The following information shall be included:

1. Final as-built drawings and information for items listed in Paragraph 1.0, and shall incorporate all changes made during the manufacturing process
2. Wiring diagrams
3. Certified production test reports
4. Installation information
5. Recommended spare parts.

1.05 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.06 REGULATORY REQUIREMENTS

A. The low-voltage switchboard shall be UL labeled.

1.07 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton / Cutler-Hammer Pow-R-Line C

B. Schneider Square D

C. General Electric

D. Engineer Approved Equal

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.02 RATINGS

A. The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current of 65,000 amperes symmetrical at rated voltage.

B. Voltage rating to be as indicated on the drawings.

2.03 CONSTRUCTION

A. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

B. All sections of the switchboard shall be front and rear aligned with depth as required. All protective devices shall be group mounted. Devices shall be front removable and load connections front accessible enabling switchboard to be mounted against a wall.

C. The switchboard shall be of front access arrangement.

D. The assembly shall be provided with adequate lifting means.

E. The switchboard shall be equal to Cutler-Hammer type Pow-R-Line C utilizing the components herein specified and as shown on the drawings.

F. The switchboard shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.

2.04 BUS

A. All bus bars shall be silver-plated copper. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on NEMA standard temperature rise criteria of 65 degrees C over a 40 degrees C ambient (outside the enclosure).

B. Provide a full capacity neutral bus.

C. A copper ground bus (minimum 1/4 x 2 inch) shall be furnished firmly secured to each vertical section structure at the bottom and shall extend the entire length of the switchboard.

D. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

2.05 WIRING/TERMINATIONS

A. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

B. Mechanical-type terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of the size as indicated on the drawings.

C. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.

D. All control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

2.06 MOLDED CASE CIRCUIT BREAKERS

A. Where indicated circuit breakers shall be UL listed for series application.

B. Where indicated circuit breakers shall be current limiting.

C. Circuit breakers shall be UL listed for applications at 100% of their continuous ampere rating.

D. Breakers shall be as follows:

1. 225A – Eaton HFDE with Digitrip 310 trip unit.
2. 400 Amp – Eaton HKD with Digitrip 310 trip unit.
3. 800 Amp – Eaton NGH with Digitrip310 trip unit.
4. 1600 Amp – Eaton Magnum SB with RMS 520 LSIG trip unit.
5. 3000 Amp – Eaton Magnum SB with RMS 520 LSIG trip.
6. 4000 Amp – Magnum SB, electrically operated, shunt trip, with RMS 1150 LSIG trip.

E. Each main and tie insulated case circuit breaker shall be equipped with a tripping system consisting of three current sensors, true RMS microprocessor-based trip unit and flux-transfer shunt trip. Interchangeable current sensors with their associated rating plug shall establish the

continuous trip rating of each circuit breaker. The trip unit shall be equal in all aspects to Eaton type Digitrip RMS 520MC.

F. The trip unit shall be provided with an Arcflash Reduction Maintenance System. The Arcflash Reduction Maintenance System shall allow the operator to enable a maintenance mode using a 5-position switch which enables a preset accelerated instantaneous override trip to reduce arc flash energy. A blue LED on the trip unit shall indicate the trip unit is in the maintenance mode. The use of zone selective interlocking to emulate this feature does not meet the intent of these specifications and will not be accepted.

G. The trip unit shall have LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A reset button shall be provided to turn off the LED indication after an automatic trip. Provide battery backup for LEDs.

H. The trip unit shall be provided with a making-current release circuit. The circuit shall be armed for approximately two cycles after breaker closing and shall operate for all peak fault levels above 25 times the ampere value of the rating plug.

I. Trip unit shall have selectable thermal memory for enhanced circuit protection.

J. Protective device coordination shall be provided by the addition of the following individually adjustable time/current curve shaping solid-state elements:

1. Long delay pickup and time
2. Short delay pickup and time, and include I^2t settings
3. Instantaneous pickup
4. Ground fault current pickup and time, and include I^2t settings or ground alarm only

K. The trip unit shall have provisions for a single test kit to test each of the trip functions.

L. The trip unit shall provide zone interlocking for the short-time delay and ground fault delay trip functions for improved system coordination where indicated on contract documents. If provided, factory shall wire the zone interlocking system.

M. The trip unit shall have a 4-character LCD display showing phase, neutral, and ground current. The accuracy of these readings shall be +/- 2% of full scale.

N. The trip unit shall have provisions for connection to client's remote monitoring and control network. All monitored parameters and breaker status shall be transmitted in industry standard proto.

2.07 METERING

A. Provide solid state metering, complete with current transformers and potential transformers.

B. Metering shall be Cutler Hammer PMX 2270, CT's, with display.

2.08 SURGE PROTECTION

A. External surge protection shall be provided. Refer to Section 26 43 13 for a description.

2.09 ENCLOSURE

A. Enclosure shall be Nema 1.

2.10 NAMEPLATES

A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background or white characters on black background. Characters shall be 3/16-inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving switchboard designation, voltage ampere rating, short-circuit rating, manufacturer's name, general order number, and item number.

B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

2.11 FINISH

A. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the Nema 1 switchboards shall be ANSI 61 light gray.

2.16 ARC FLASH WARNING LABEL

A. Switchboard shall be furnished with an appropriate Arc Flash Warning Label that complies with the NEC.

PART 3 EXECUTION

3.01 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. The switchboard shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to ensure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (1) minute between live parts and ground

B. The manufacturer shall provide six (6) certified copies of factory test reports.

3.02 MANUFACTURER'S CERTIFICATION

A. A certified test report of all standard production tests shall be available to the Engineer upon request.

3.03 TRAINING

A. The Contractor shall provide a training session for up to four (4) owner's representatives at a job site location determined by the owner. A manufacturer's qualified representative shall conduct the training session. The training program shall consist of instruction on operation of the assembly, circuit breakers, fused switches, and major components within the assembly.

3.04 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's instructions, contract drawings and National Electrical Code.

B. Contractor shall provide a concrete housekeeping pad for the switchboard. The switchboard assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to Contractor supplied floor sills to be set level in concrete per manufacturer's recommendations. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

3.05 FIELD ADJUSTMENTS

A. The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study, protective device evaluation study and protective device coordination study.

B. Necessary field settings of devices, adjustments and minor modifications to equipment to accomplish conformance with an approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the owner.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The work performed under this Section consists of providing all labor, material, tools, equipment and related items required to furnish, install, and place into operation all lighting and power distribution panelboards either in their own enclosures or installed in other equipment such as motor control centers.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00 - Submittals

B. Section 01 77 00 - Contract Closeout

C. Section 26 01 00 - Electrical General Requirements

D. Section 26 05 26 - Grounding

1.3 REFERENCE STANDARDS

A. NEMA PB-1

B. ANSI

C. NEC

D. OSHA

E. Federal Spec W-P-115A, Type 1, Class 1

F. Federal Spec W-C-375A, WS 865 (Breakers & Switches)

G. Underwriters UL67, UL50

1.4 ACCEPTABLE MANUFACTURERS

A. Eaton Cutler Hammer

B. General Electric

C. Schneider Square D.

D. Siemens

E. Engineer Approved Equal

1.5 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Include the following:

1. Manufacturers' catalog number.
2. Size of main lugs, main circuit breaker and main bus.
3. Size, type and quantity of circuit breakers. Include panel schedule for each panel.
4. Type of bus material.
5. Voltage rating, e.g. 120/208 VAC, 3 phase, 4 wire.
6. Characteristic trip curve of largest circuit breaker plotted on 5 cycle log-log paper.
7. Other data sufficient to substantiate that the materials conform to the requirements of this section.

C. Submit O&M Manuals in accordance with Section 01 77 00.

PART 2 PRODUCTS

2.1 GENERAL

A. The equipment included in this Section consists of several panel types designated as lighting and power panelboards for use in applications up to 600 volts with interrupting ratings of 10,000 through 100,000 amps. Cabinets are galvanized code gauge steel and trims shall be door-in-door with one door over the interior and an additional door over the wiring gutters. Fast mounting type with release mechanisms mounted behind locked door which are keyed alike. The finished product shall bear an Underwriters Laboratory label and any panel, whether service entrance or not, shall bear a "Suitable for Service Entrance" label if it has the minimum number of disconnects to so classify it.

2.2 BREAKERS

A. Ratings shall be as shown on the drawings. Interrupting rating shall be as indicated on the drawings or as required to withstand the available fault current, whichever is greater.

B. Unless otherwise noted on the drawings, all breakers shall have the following minimum ratings according to Federal Spec WP375A or better:

WP Breaker Type	375	Trip Range	Poles	Interrupting Capacity
Bolted	2a	0-100	1	10,000 @ 277V
Bolted	2d	0-100	2 & 3	14,000 @ 480V
Bolted	3B	101-225	2 & 3	STD
Bolted	4B	226-400	2 & 3	STD
Bolted	5A	401-800	2 & 3	STD

C. Breakers shall be bolt-on quick-make, quick-break type having thermal and magnetic elements. Two and three pole circuit breakers shall be common-trip type with one handle. Handle ties are not acceptable.

D. Breakers shall be fully rated for operation at 40 C with no derating necessary.

E. Lugs: Approved for 75° C copper rated conductors.

F. Provide any test kits necessary to calibrate and test the circuit breakers.

2.3 BRANCH CIRCUIT PANELBOARDS

A. 120/240 V panelboard shall be Cutler Hammer PRL 1a, or approved equal.

B. 277/480 V panelboard shall be Cutler Hammer PRL 2a, or approved equal.

2.4 DISTRIBUTION PANELBOARDS

A. Cutler Hammer Type PRL 3a or PRL 4B as required, or approved equal

2.5 GROUND BUSSES

A. Each panel shall have a separate copper ground bus.

2.6 MAIN BUSSES AND NEUTRAL

A. All busses shall be tin plated copper with full capacity neutral where required of a type and size as shown on the drawings. Minimum bus ampacity shall be 100 Amps unless otherwise noted.

B. Bussing shall be full size distributed phase sequence type extending the full length of the panel.

2.7 SEQUENCING

A. All breakers shall be installed in panels in the same sequences shown in the schedules.

2.8 BOX SIZE

A. Minimum box width is 20-inches.

B. Box length shall be sufficient for 42 circuits unless otherwise noted on the Plans.

2.9 CABINET

A. Code gauge steel per NEMA PB1-1977 and UL 67.

B. Nema 12 enclosure for indoor locations.

C. NEMA 4X 316 SS for outdoor locations and in the Chemical Building. Furnish deadfront with latching front door.

2.10 IDENTIFICATION

A. Identify all circuit breakers with a circuit number corresponding to those shown on the panel schedules.

B. Provide a typewritten directory. Pencil in spares. Install directory in a permanent clear plastic holder securely attached to the panel door.

C. Provide a nameplate per 26 01 00.

D. Panelboards shall be labeled with a UL short circuit rating.

PART 3 EXECUTION

3.1 DELIVERY AND STORAGE

A. Delivery. Prepare panelboards, circuit breakers and accessories for shipment to job site.

B. Storage and Handling at Job Site. The CONTRACTOR shall store and handle all panelboards at the job site, while such materials are awaiting installation, in conformance with the following:

1. Store panelboards, circuit breakers and accessories in an area protected from weather, moisture or possible damage.

2. Do not store materials directly on the ground.
3. Handle items to prevent damage to interior or exterior surfaces.
4. If items are stored inside the proposed building, consideration shall be given to weight of the items and the effect of concentrated loads on the building slabs, foundation, and other structural members. CONTRACTOR shall contact ENGINEER for permission to store materials with a load exceeding 200 pounds per square foot.

3.2 INSTALLATION

A. The CONTRACTOR shall receive, set in place, wire and provide all labor incident to demonstration that the panels form an integral system prior to final acceptance.

B. Mount panel so that bottom is 3'- 0" from floor level. Mount lower only where necessary to have top breaker no more than 6'- 6" above floor level.

C. Provide wire tags on each wire as it leaves the panel and again at each termination.

D. Provide a neatly typed directory identifying each circuit as to the load it serves. Label spares in pencil. Indicate panelboard source of power.

E. Take and record load on each lighting circuit; identify the number of convenience outlets on each circuit and record the same. Identify the loads on all other circuits and record the VA of each.

END OF SECTION

SECTION 26 24 19

480V MOTOR CONTROL CENTERS

PART 1: GENERAL

1.01 SCOPE

A. Furnish all labor, materials, equipment and incidentals required to provide and make ready for operation, the Motor Control Centers (MCC) as specified herein.

1.02 RELATED WORK

A. Section 01 33 00: Submittals.

B. Section 01 77 00: Contract Closeout

C. Section 01 76 00: Warranties

D. Section 26 01 00: Electrical General Information.

E. Section 26 29 23: Adjustable Frequency Drives

1.03 QUALIFICATIONS

A. The manufacturer of the MCC shall also manufacture the majority of components and subsystems therein (i.e., circuit breakers, starters, control relays, etc.).

B. The motor control center shall be designed, constructed and tested in accordance with the latest applicable requirements of NEMA, ANSI, UL and NEC standards including:

1. ANSI 68.1
2. ANSI 255.1
3. NEMA AB-1
4. NEMA ICS-1
5. NEMA ICS-2
6. NFPA 70
7. UL 508
8. UL 98
9. UL 845
10. UL 489

C. All starters and contactors shall be rated and designated in accordance with NEMA standards. Starters and contactors rated in amperes and non- NEMA sizes will not be acceptable.

D. For specific requirements on the motor control center, refer to the drawings.

E. All products shall be of domestic (U.S.A.) manufacture and assembly where available.

1.04 SUBMITTALS

A. The submittals shall be in accordance with the requirements of Section 01 33 00.

B. The submittal shall include but is not limited to the following:

1. Motor control center elevation drawing showing dimensions and orientation of equipment within each section.

2. Manufacturer's name and model number.

3. Enclosure specifications including physical dimensions, color, wireways and weight.

4. Equipment specification sheets for each item included in the motor control center.

5. Schematic diagrams drawn or modified for this specific project.

6. Label legend showing size of lettering and label location.

7. Equipment sizes and ratings.

1.05 STORAGE AND HANDLING

A. The Contractor, and hence, the MCC supplier, shall be responsible for safety of the MCC during storage, transporting and handling.

B. At all times the MCC shall be housed inside a moisture free weatherproof housing.

C. The MCC shall have weatherproof non-porous extra heavy duty plastic covers at all times, until it is ready for test and start-up.

D. Interior and exterior of the motor control centers shall be kept clean at all times.

E. Space heaters within the MCC shall be energized during storage and installation.

1.06 TOOLS AND SPARE PARTS

A. Furnish the following spare parts with the equipment for each Motor Control Center in conformance with the Specifications:

1. One set (minimum 3) of fuses for each type and size used.
2. One set of starter contacts for each size used). If coil is not replaceable, a spare starter for each size used shall be supplied.
3. One contactor coil for each NEMA size installed (minimum of one coil per size).
4. One spare control relay for each type used (including timing relays).
5. One spare pushbutton, selector switch, indication light assembly for each type used.
6. One dozen lamps for each type used.
7. One spare lens for each type and color used.

8. One set of overload heaters for each size and type used.

1.07 OPERATION AND MAINTENANCE MANUALS

A. Furnish manuals including the following information on each component used:

1. Installation and operation manual.
2. Renewal parts bulletin.
3. Component description, rating, catalog number, etc.
4. Vendor drawings.
5. As built drawings.
6. Test data.
7. Protective relay settings (furnished by Motor Control Center Supplier).

B. Comply with Section 01 77 00.

1.08 ARC FLASH WARNING LABEL

A. All motor control centers shall have Arc Flash Warning labels in compliance with Section 26 01 00.

1.09 MANUFACTURER

A. Eaton Cutler Hammer
B. Allen Bradley
C. Square D
D. Engineer Approved Equal.

PART 2: PRODUCTS

2.01 GENERAL

A. For additional construction notes and special requirements, refer to the drawings.

2.02 CONSTRUCTION

A. Structure

1. MCC shall consist of the specified number of vertical sections bolted together to form a rigid, self-supporting free-standing assembly. NEMA rated enclosure per the drawings. Vertical sections shall be mounted on steel channel sills provided by Contractor. The structure shall be not more than 90 inches nominal height, and be fabricated of formed steel of not less than 14-gauge thickness. It shall be furnished with removal lifting facilities as well as base construction designed for rolling or skidding.

2. Motor control centers located indoors shall be housed in NEMA 1A gasketed enclosures. Those located outdoors shall be NEMA 1A housed in a Nema 3R non-walk-in enclosure.

3. Front mounted (dead front) units, where specified, shall not require rear access and shall be suitable for back to wall mounting. All wiring, bus joints and other mechanical parts requiring tightening or other maintenance shall be accessible from the front or top.

4. Each vertical section shall be divided into no more than six compartments that shall contain a feeder breaker, combination motor control unit, or other control assemblies connected to a common vertical power bus.

5. Vertical sections shall contain horizontal wireways at top and bottom of the structure. The design shall be such to permit a continuous wiring trough from end to end of the entire width of the motor control center. End vertical sections shall have cover plates that can be easily removed to allow continuation of wireways and horizontal bus extensions for future addition of vertical sections.

6. The vertical section shall also have a continuous vertical raceway extending the full height of the structure and shall intersect with the horizontal raceways. This wireway shall be completely barriered from the bus compartments, the controller compartment, and the adjacent vertical units, and shall have its own separate hinged door or bolted cover.

7. Holes or slots provided in wireways or other metal members for routing of wires shall be provided with bushings or grommets to avoid damage to the wiring insulation.

8. Combination motor control units (size 5 and smaller), as well as other electrical assemblies, including feeder tap units (225 amp and smaller), shall be provided with appropriately rated stab assemblies for drawout (plug-in) type construction.

9. Plug-in provisions shall include a positive guide rail system and stab shrouds to insure alignment of stabs with the vertical bus. The stab shall be designed to increase bus contact pressure during a fault. The stab design shall assure a consistent low resistance contact with the vertical bus, even after repeated insertions and removals. The unit shall be equipped with a latching mechanism to lock the drawer in an extended or stabbed position for maintenance and testing. Each drawout compartment is to have a separate hinged door.

10. Each unit compartment shall be provided with an individual front hinged door. Motor control and feeder units shall be interlocked mechanically with a unit disconnect device to prevent unintentional opening of the door while unit is energized. An interlock between the unit disconnect and the structure shall prevent the removal of reinsertion of the unit when the unit is in the "OFF" position. Means shall be provided for releasing the interlock for intentional access and/or application of power. Pad locking arrangements shall permit locking the disconnect device in the "OFF" position.

11. Each vertical section shall include at least one 120 V, 250 W space heater thermostatically controlled and wired to a terminal block. Each NEMA 3R section shall also contain a switched light with guard.

12. The MCC shall be furnished as a completely factory assembled unit where transportation facilities and installation requirements permit. Minimize shipping splits if required.

13. All painted steel work shall be treated with a primer coat and a finish coat, or bonderized and finished with a coat of baked enamel at the factory, such that no field painting will be required except for "touching up" of damaged areas. Color shall be manufacturer's standard.

14. Furnish documentation with the equipment as follows:

    a. Compartments containing motor starters shall each have an overload heater section table posted inside the door.

    b. All control compartments shall have a pocket on the inside of the door with a copy of the appropriate schematic and wiring diagram.

15. Provide screw on type engraved laminated nameplates as follows:

    a. Main equipment nameplate shall be located at the top of the MCC near the main breaker compartment.

    b. Individual compartment nameplates screwed to their respective door. Control device nameplates for all devices screwed on near the vicinity of each device as approved by the Engineer.

    c. Manufacturer's plaque shall be attached to the MCC giving model number, bus amps, voltage, maintenance reference documents and other applicable information.

16. Sections for future starters and breakers shall have shutters which cover the vertical bussing.

B. Buses

1. All power buses shall be tin plated copper. The main horizontal bus shall extend the entire length of the motor control center. The main bus bars shall be rated as shown on the drawings.

2. Each vertical drawout section shall have a full height vertical tin-plated copper bus rated as specified, but not less than 300 amperes. Each vertical bus shall be of uniform cross-sectional area from top to bottom. Tapered bus will not be acceptable. The bus support system shall be high dielectric strength, low moisture absorbing, high impact material.

3. A continuous tin-plated copper ground bus shall be furnished for the entire length of the MCC. Provide ground bolted connectors for ground wire at each end of the bus. Size as indicated on the drawings.

4. Bus bracing shall be 42,000 amperes RMS, symmetrical unless otherwise indicated on the drawings.

5. All buses, except ground buses, shall be completely concealed by steel plates or insulating material. Cutouts shall be provided in the vertical isolation barriers for stab connections to vertical bus. Unused cutouts shall be covered.

6. All bolted bus-mating surfaces shall be tin plated copper.

7. Vertical buses used for the tie circuit breaker or the tie feeder lugs between MCC's were specified, shall be rated for a continuous capacity equivalent to the main horizontal bus rating.

C. Wiring

1. Unless otherwise stated in the data sheets, the motor control center shall be wired Class II, Type B construction with master terminal blocks for each section.

2. All wiring shall be stranded copper not smaller than #14.

3. All control wiring to drawout units shall be run through split type terminal blocks (drawout) which can be split to allow easy unit removal. Motor "T" leads will bolt directly to starter or overloads and will not be split type.

4. All wiring shall be neatly bundled with ty-raps and supported to wireway supports. control wiring shall be bundled separately from power wiring. In addition, low signal wiring (millivolt and milliamp) shall be bundled separately from the rest of the control wiring.

5. One spare normally open and one normally closed contact on all auxiliary switches, relays, selector switches, alarm points, etc., shall be wired to terminal blocks.

6. Where "shipping splits" are required between the control compartments and the starter cubicles, interconnecting jumper wires shall be provided for field reconnection.

7. Selector switches, pushbuttons, motor starters contacts, alarm points, etc., shall have one normally open and one normally closed spare contact wired to a terminal board.

D. Identification

1. All component and control identification nameplates shall be engraved with the device name and number exactly as it appears on the MCC Single Line Drawing and/or as approved by the Engineer. For devices not show on the single line drawing such as time delay relays, the names will be as shown on the Control Schematic Drawings and/or as assigned by the Engineer. Nameplates shall comply with Section 16010.

2. All control wires will be tagged and coded with an identification number. Coding will be typed on a heat shrinkable tube applied to each end showing origination and destination of each wire. The marking shall be a permanent, non-smearing, solvent-resistant type similar to Raychem TMS, or equal.

3. All terminal blocks shall be identified by a system approved by the Engineer.

2.03 COMPONENTS

A. Adjustable Frequency Drives shall be as specified in Section 26 29 23.

B. Thermal Magnetic Circuit Breakers.

1. All circuit breakers shall be of the thermal magnetic trip type.

2. Main circuit breakers be equipped with electronic trip units to trip the breaker on phase and ground fault conditions.

3. Circuit breakers shall be draw out (plug-in) type, molded case, 600 volts.

4. Furnish lugs for terminating cable to starters and circuit breakers, sizes as specified on drawings and related data sheets. Allow adequate clearance for bending and terminating of cable type specified.

5. Main breaker shall be furnished with an adjustable solid-state trip LSIG unit.

C. Full Voltage Non-Reversing Motor Starters

1. Full voltage non-reversing motor starters shall be Cutler Hammer Advantage, or approved equal. All starters shall be full Nema Size. IEC starters and half-size starters will not be accepted. Minimum starter size shall be Nema Size 1.

2. Starters shall be equipped with the quantity of normally open and normally closed auxiliary contacts shown on the drawings plus one spare NO and one spare NC contact.

3. Each starter unit shall contain a selector switch and a run indicating light as shown on the drawings. Indicating lights shall be push-to-test transformer type with LED’s.

4. Starters shall be furnished with phase monitors where indicated on the drawings. Phase monitors shall be Diversified Model SLD, or approved equal. Furnish line fuse protection as shown.

5. Starters shall be equipped with solid state or thermal magnetic ambient compensated overload protection relays as shown on the Drawings.

D. Solid State Reduced Voltage Motor Starters:

1. The solid-state starter shall be UL, cULus and CSA listed and bear the CE mark for compliance with applicable IEC and Euro Norm standards for solid-state reduced voltage motor starters. The solid-state reduced voltage starter shall be an integrated unit with power SCR's, heat sink, logic board, paralleling bypass contactor, isolating contactor,

mainline fuse, HMCP motor circuit protector, and electronic overload relay enclosed in a single molded housing.

2. SCR based power section shall consist of six (6) back- to-back SCRs and shall be rated for a minimum peak inverse voltage rating of 1600 volts PIV. The starter shall be three-phase, 50 or 60 Hz, and rated for the a minimum of 125% of the full load current of the motor load.

3. Units shall include an integrated fan controlled by thermal sensors on the heat sink. Fan shall automatically operate during the start ramp and if internal temperature on the heat sinks exceeds 60-degree C. Units using triacs or SCR/diode combinations shall not be acceptable. Resistor/capacitor snubber networks shall be used to prevent false firing of SCRs due to dv/dt effects. The logic board shall be identical for all ampere ratings and voltage classes and shall be conformally coated to protect environmental concerns. The paralleling run bypass contactor shall energize when the motor reaches 90% of full speed and close/open under 1 times motor current.

4. The paralleling run bypass contactor shall utilize an intelligent coil controller to limit contact bounce and optimize coil voltage during varying system conditions.

5. Starter shall be provided with electronic overload protection as standard and shall be based on an inverse time-current algorithm. Overload protection shall be capable of being disable during ramp start for long acceleration loads via a DIP switch setting on the device keypad. Overload protection shall be adjusted via the device keypad and shall have a motor full load amp adjustment from 30 to 100% (3.2:1) of the max continuous ampere rating of the starter. Starter shall have selectable overload class setting of 5, 10, 20 or 30 via a DIP switch setting on the device keypad. Starter shall be capable of either an electronic or mechanical reset after a fault. Units using bi-metal overload relays are not acceptable. Overtemperature protection (on heat sink) shall be standard.

6. Starters shall provide protection against improper line side phase rotations as standard. Starter will shut down if a line side phase rotation other than A-B-C exists. This feature can be disabled via a DIP switch on the device keypad.

7. Starters shall provide protection against a phase loss as standard. Starter will shut down if a 50% current differential between any two phases is encountered. This feature can be disabled via a DIP switch on the device keypad.

8. Starter shall provide protection against a motor stall condition during the start ramp as standard. This feature can be disabled via a DIP switch on the device keypad.

9. Starter shall provide protection against a motor jam condition during run as standard. This feature can be disabled via a DIP switch on the device keypad.

10. Starter shall be provided with a form C normally open (NO), normally closed (NC) contact that shall change state when a fault condition exists. Contacts shall be rated 240V AC and 24V DC max, 3 amps as standard. In addition, an LED display on the device keypad shall indicate type of fault (Overtemp, Phase Loss, Jam, Stall, Phase Reversal, and

Overload).

11. The following control function adjustments on the device keypad are required:

    a. Selectable Torque Ramp Start or Current Limit Start
    b. Adjustable Kick Start Time, 0-2 seconds
    c. Adjustable Kick Start Torque, 0-85%
    d. Adjustable Ramp Start Time; 0.5 seconds - 12 minutes-
    e. Adjustable Initial Starting Ramp Torque; 0-85%
    f. Adjustable Smooth Stop Ramp Time; 0-60 seconds.

12. Each starter shall be provided with "pump control" module designed specifically for centrifugal pump applications.

13. Starters shall include a HMCP for short circuit protection and quick disconnect means. Starters and HMCPs are to be rated per UL508D for a withstand rating of 42 kAIC rms.

14. Maximum continuous operation shall be at 100% of continuous amp rating. Control power shall be 24V DC as standard for safety and reliability. Separate control terminals shall be provided for 24V DC power, logic level signals for permissive, start, jog forward, ramp start overload override and electric reset. Control terminals shall be pull-apart for easy access and wiring. Optional external interface circuitry shall include 120-volt relay logic interface capability.

15. A removable Customer Interface Module (CIM) shall be provided that allows for full adjustment of control and protection functions thru the use of potentiometers and DIP switches. Power terminations shall consist of pressure type terminals. The following shall be included: The operating handle of the disconnect, when supplied, shall always remain connected to the breaker or switch. The operating handle shall not be mounted on the door of the enclosure, but on the controller for safe "stand-aside" operation. The position of the operating handle will indicate ON or OFF position of switch or circuit breaker and include provision for padlocking in the OFF position. Interlock provisions shall prevent unauthorized opening or closing of the starter door with the disconnect in the ON position. The structure, when floor-mounted, shall be provided with adequate lifting means and shall be capable of being rolled or lifted into installation position and bolted to the floor.

16. Starters shall be furnished with SPD’s on the line and load sides.

17. Starters in Nema 3R MCC’s shall be upsized one size to account for higher temperatures.

Starters shall be Eaton Cutler Hammer S811, or approved equal.

2.04 PANELBOARD

A. The motor control center shall be furnished with a lighting panel where shown on the drawings. Panelboard shall comply with Section 16160.

2.05 TRANSFORMER

A. Furnish motor control center with a dry type transformer conforming to the requirements of Section 16460.

2.06 INCOMING LINE METERING

A. Furnish an incoming line meter where indicated. The meter shall be a Cutler Hammer IQ DP-4000, or approved equal.

PART 3: EXECUTION

3.01 FACTORY INSPECTION AND TESTS

A. The Motor Control Center shall be completely assembled, wired and adjusted at the factory and shall be give the manufacturer's routine shop tests and any other additional operational test to insure the workability and reliable operation of the equipment.

B. The operational test shall include the proper connection of supply and control voltage and, as far as practical, a mockup of simulated control signals and control devices shall be fed into the boards to check for proper operation.

C. Factory test equipment and test methods shall conform with the latest applicable requirements of ANSI, IEEE, UL and NEMA standards and shall be subject to the Engineer's approval.

3.02 FIELD INSTALLATION (BY CONTRACTOR)

A. Field installed wiring to MCC shall be neatly bundled with ty-raps and supported to wireway supports. Control wiring shall be bundled separately from power wiring. In addition, low signal wiring (millivolt and milliamp) shall be bundled separately from the rest of the control wiring.

B. All field wiring shall be tagged and coded with an identification number. Coding will be typed on a heat shrinkable tube applied to each end of the wire. The marking shall be a permanent, non-smearing, solvent-resistant type similar to Raychem TMS, or equal.

3.03 FIELD TESTS AND CHECKS

A. The following minimum tests and checks shall be made before energizing the MCC's. These tests shall be performed by a Factory Trained Field Technician (non sales type).

1. Thoroughly inspect MCC for items such as loose connections and presence of foreign material, and remedy prior to energizing.

2. Check all mechanical interlocks for proper operation.

3. Calibrate and verify operation of protective relays.

4. Megger terminals and buses for grounds after disconnecting devices sensitive to megger voltage.

5. Verify continuity of ground bus throughout MCC.

6. Verify heater circuits are operational.

7. Submit documentation of all tests outlined above. Include all data in operation and maintenance manuals.

B. Comply with Section 16950: Electrical Testing.

3.04 EQUIPMENT PROTECTION AND RESTORATION (BY CONTRACTOR)

A. Clean and vacuum clean all interior of the equipment.

B. Touch-up and restore damaged surfaces to factory finish.

C. After all connections have been made, the Contractor shall spray all terminals, terminal blocks, starters (with contacts closed) with a moisture repelling chemical such as provided by CHC or Dow Chemical Corporation, or approved equal.

D. Notify the Engineer 24 hours prior to this intent to spray each motor control center. If such notification is not made, it will be presumed that moisture proofing has not been accomplished.

E. Remove all current transformer shunts after completing secondary circuit.

F. Install overload relay heaters based on actual motor nameplate current. Set overload relay settings at maximum values permitted by the NEC 430-32.

G. Verify proper rotation of all loads.

END OF SECTION

SECTION 26 28 13

CIRCUIT BREAKERS

PART 1: GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the molded case circuit breakers as specified herein and as shown on the contract drawings.

B. Breakers in the switchboards and motor control centers shall comply with the specifications in those respective sections.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals

B. Section 01 77 00 – Contract Closeout.

C. Section 26 01 00 – Electrical General Information

D. Section 26 24 13 - Low Voltage Switchboard.

E. Section 26 24 19 – 480 Volt Motor Control Centers

F. Section 26 01 27 – Calibration and Testing

G. Section 26 05 73 – Power System Studies.

1.03 REFERENCES

A. The molded case circuit breakers and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of the following:

1. UL 489 – Molded Case Circuit Breakers
2. NEMA AB1 – Molded Case Circuit Breakers
3. NEMA 250 – Enclosures for Electrical Equipment

1.04 SUBMITTALS

A. The following information shall be submitted to the Engineer:

1. Master drawing index
2. Dimension sheet
3. Accessory information
4. Device ratings:
5. Voltage
6. Continuous current

7. Interrupting ratings
8. Cable terminal sizes
9. Product data sheets.

B. Comply with the requirements of Sections 01300 and 16010.

1.05 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in paragraph 1.04.

B. Comply with the requirements of Section 01 33 00 and 26 01 00.

1.06 QUALIFICATIONS

A. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

B. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.07 REGULATORY REQUIREMENTS

A. Circuit breakers shall be UL listed.

1.08 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.09 OPERATION AND MAINTENANCE MANUALS

Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

B. Manuals shall comply with Sections 01 77 00 and 26 01 00 and other sections referenced therein.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Eaton Cutler Hammer

B. General Electric

C. Schneider Square D.

D. Engineer approved equal.

2.02 MOLDED CASE PROTECTIVE DEVICES

A. Protective devices shall be molded case circuit breakers with inverse time and instantaneous tripping characteristics and shall be Cutler-Hammer type Series C or approved equal.

B. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make quick-break over-center switching mechanism that is mechanically trip-free.

C. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be non- welding silver alloy and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.

D. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.

E. Unless otherwise noted circuit breakers rated below 800 amperes shall be Cutler-Hammer type Series C with thermal-magnetic trip units and inverse time-current characteristics.

F. Unless otherwise noted circuit breakers 800 ampere through 2000-ampere frame shall be Cutler-Hammer type Series C with microprocessor-based RMS sensing trip units.

G. Provide ground fault protection shall be provided where indicated.

H. Where indicated circuit breakers shall be UL listed for series application.

2.03 ACCESSORIES

A. Provide shunt trips, bell alarms and auxiliary switches as shown on the contract drawings.

2.04 ENCLOSURES

A. Circuit breakers shall be installed in Nema 4X 316 SS enclosures for outdoor locations, Nema 7 in Class 1 hazardous areas and Nema 12 for all other locations.

B. All enclosed circuit breakers shall have nameplates that contain a permanent record of catalog number and maximum rating. Provide handle mechanisms that are padlockable in the both the ON and OFF positions.

PART 3: EXECUTION

3.01 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.02 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

B. Mounting height shall not exceed 6'-6" from the floor to the operating handle.

3.03 FIELD SETTINGS

A. The Contractor shall perform field adjustments of the circuit breakers as required to place the equipment in final operating condition. The settings shall be in accordance with the approved protective device coordination study or as directed by the Engineer.

B. Trip settings shall be in accordance with the study specified in Section 26 05 73.

END OF SECTION

SECTION 26 28 16.13

SAFETY SWITCHES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work performed under this Section consists of providing all labor, material, tools, equipment and related items required to furnish and install safety switches.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01 33 00.

B. Contract Closeout: Section 01 77 00.

B. Electrical General Information: Section 26 01 00

1.03 REFERENCE STANDARDS

A. NEMA KSI

B. ANSI

C. NEC

D. OSHA

E. UL

F. FED. SPEC. WS-865c

1.04 ACCEPTABLE MANUFACTURERS

A. Eaton Cutler Hammer

B. General Electric

C. Schneider Square D.

E. Engineer Approved Equal

1.05 SUBMITTALS

A. Make submittals in conformance Section 01 33 00.

B. Include the following:

1. Manufacturer's catalog number.

2. Voltage and current rating.

3. Enclosure type.

4. Nameplate designation.

5. Technical data including fuse curve plotted on 5 cycle log-log paper.

6. Additional data as necessary to substantiate that the materials conform to the requirements of this section.

PART 2: PRODUCTS

2.01 STANDARD DISCONNECT SWITCH

A. Type: Heavy duty Type HD fused or non-fused as shown on the Plans. U.L. labeled.

B. Construction: Quick-make, quick-break operating handles with provisions for padlocking in the "off" position. Handle interlocked with door to prevent unauthorized opening with the switch in the "on" position. Provide with equipment ground lug.

C. Enclosure: NEMA 12 indoors. NEMA 4X 316 SS surface mounted outdoors. Furnish Nema 7 explosion proof in Class 1 hazardous areas.

D. Ratings: Horsepower rated for 250 volts A.C. or 600 volts A.C. as required for their service.

E. Fuses: Dual element type sized per N.E.C. Bussman, Chase Shawmut, or equal.

2.02 MANUAL TRANSFER SWITCH (WHERE REQUIRED)

A. Type: Double pole, double throw. Furnish with solid neutral assembly. Load make and load break. U.L. Listed.

B. Construction: Quick-make, quick-break operating handles with provisions for padlocking in the "off" position and in the “on” positions. Handle interlocked with door to prevent unauthorized opening with the switch in the "on" position. Provide with equipment ground lug.

C. Enclosure: NEMA 12 indoor. NEMA 4X 316 SS surface mounted outdoors. Nema 7 in Class 1 hazardous areas.

D. Ratings: Horsepower rated for 250 volts A.C. or 600 volts A.C. as required for their service.

E. Lugs: Fully rated for continuous operation at 75 deg. C.

F. Fuses: Non-fused.

2.03 NAMEPLATES

A. Install a nameplate on the switch identifying the Normal and Emergency, as well as the Off positions. Nameplate shall comply with Section 26 01 00.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install at locations shown on the Plans.

B. Mounting height to be 4'- 0" above finished floor to bottom of switch unless otherwise noted. Maximum height of operating handle shall not exceed 5'-6".

C. Provide SS channel iron or SS Unistrut supports for mounting. Per Section 26 05 29.

END OF SECTION

SECTION 26 29 13

MOTOR STARTER AND CONTROL STATIONS

PART 1: GENERAL

1.01 SCOPE

A. This section covers furnishing and installing the motor starters and control stations.

1.02 PAYMENT

A. No separate payment shall be made for material or labor under this section. All costs shall be included in the lump sum or unit prices as shown in the proposal.

1.03 RELATED SPECIFICATION

A. 01 33 00 Submittals

B. 01 77 00 Contract Closeout

C. 26 01 00 General Electrical Requirements

1.04 SUBMITTALS

A. Submit shop drawings and product data for the products of this section in accordance with Section 01 33 00.

B. Provide O&M manuals in compliance with Sections 01 77 00 and 26 01 00.

PART 2: PRODUCTS

2.01 GENERAL

A. For manual starting of single-phase motors up to ½ HP, provide manual start switches. Manual start switches shall be Allen-Bradley, Bulletin 600 Series, Square D Class 2510 or 2512, Eaton Cutler Hammer or Engineer-approved equal.

B. Combination circuit protector magnetic starters for automatic starting of single or three phase motors shall be Allen-Bradley, Bulletin 713 Series, Square D Class 8539, Eaton Cutler Hammer or Engineer-approved equal.

2.02 STARTER SIZE

A. Motor starters shall be rated in compliance with NEMA sizes and HP ratings. No starter smaller than size one shall be used. All starters shall be gravity dropout. Starters shall be full Nema Size, Size 1 minimum. IEC starters will not be accepted.

2.03 CONTACTS

A. All starters size five and smaller shall have double break silver alloy contacts. Starters size six and larger shall employ single break contacts. All contacts shall be capable of being inspected and removable without removing line or load wiring.

2.04 ENCLOSURES

A. Starters shall be provided with enclosures as required for the environment. Enclosures shall be as follows:

1. Starters located indoors shall be in Nema 12 enclosures.
2. Starters for outdoor installation and indoors in corrosive areas shall have NEMA 4X 316 SS enclosures.
3. Starters in Class 1 hazardous areas shall be in Nema 7 explosion proof enclosures and shall be factory sealed.

2.05 COILS

A. Coils on starters size five and smaller and on timing relays shall be molded construction. Coils on starters size six and larger shall be form wound, taped, varnished, and baked. Starter coils are to be of the same voltage as the applicable control circuit.

2.06 OVERLOAD RELAYS AND THERMAL UNITS

A. Overload relays shall be solid state type with automatic reset features or ambient compensated thermal type as indicated on the drawings.

2.07 CONTROL CIRCUITS

A. Control circuit voltage shall not exceed 120 VAC and be obtained from a control circuit transformer of sufficient size to serve the control device and required accessories. Individual control transformers contained with the starter enclosure shall be used where practicable. Control transformers shall be encapsulated, fireproof, formed coils, and readily removable without disturbing starter contacts.

B. Control circuits shall comply with the following:

1. One side of the secondary of transformers shall be grounded.

2. One side of all operating coils of control devices shall be connected to ground side of the control circuit.

3. All contacts of relays, limit switches, etc. shall be connected in series on line side of control circuits.

4. Provide fuses on ungrounded side of secondary of all transformers. Fuses shall not be greater than 125 percent of transformer rating. Provide current limiting primary fuses on starters for meters 40 HP and larger.

5. Provide auxiliary contacts as required to serve all remote accessories, equipment, instrumentation, and control systems. Provide one additional N.O. and one

additional N.C. contact for future use.

2.08 CONTROL STATIONS

A. Control stations shall be heavy-duty, oil-tight type, Square D Bulletin 9001 Type K or Engineer-approved equal by Allen Bradley, General Electric or Cutter Hammer. Furnish NEMA 12 enclosures indoors and NEMA 4X 316 Stainless Steel outdoors and in corrosive areas.

B. Control stations installed in Class 1 hazardous areas shall be installed in Nema 7 enclosures and shall be factory sealed.

PART 3: EXECUTION

3.01 MOUNTING

A. Mount starters on walls five feet above finished floor (top of starter).

B. Mount control stations as detailed on plans.

C. Furnish 316 SS Unistrut supports as detailed on the drawings.

3.02 OVERLOAD PROTECTION

A. Install overload protection and verify that protection corresponds to motor full load current and that motors will start and operate immediately.

3.03 CONTROL CIRCUITS

A. Install control circuits and perform continuity tests. Check control and interlock wiring for proper operation.

END OF SECTION

SECTION 26 29 23

ADJUSTABLE FREQUENCY DRIVES

PART 1 GENERAL

1.01 SCOPE

A. This specification describes the electrical, mechanical, environmental, agency and reliability requirements for three-phase, Adjustable Frequency Drives (AFD) as specified herein and as shown on the contract drawings.

B. AFD's shall be included as part of the Motor Control Center lineup and shall include a passive filter where shown.

C. Adjustable frequency drives for motors 75 HP and above shall be Eaton Cutler Hammer CFX 9000, furnished with passive filters.

D. Adjustable frequency drives for motors below 75 HP shall be Eaton Cutler Hammer SVX 9000.

E. **Note that AFD's located outdoors in Nema 3R enclosures shall be rated one size larger than otherwise required to account for the higher outdoor temperatures.**

1.02 RELATED SECTIONS

A. Section 01 33 00: Submittals

B. Section 01 77 00: Contract Closeout

C. Section 26 01 00: Electrical General Requirements

D. Section 26 05 26: Grounding

E. Section 26 24 19: 480 Volt Motor Control Centers

1.03 REFERENCES

A. The adjustable frequency drives and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:

1. Institute of Electrical and Electronic Engineers (IEEE)

2. IEEE 519-1992: Guide for harmonic content and control

3. Underwriters Laboratories (UL508C: Power Conversion Equipment)

4. UL

5. National Electrical Manufacturer's Association (NEMA)

6. ICS 7.0: Industrial Controls & Systems for AFD.

7. IEC 61800-2 and –3. EN 50082-1 and –2

8. Fulfill all EMC immunity requirements

B. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

1.04 SUBMITTALS - FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer.

1. Dimensioned outline drawing

2. Schematic diagram

3. Power and control connection diagram(s)

B. Submit four (4) copies of the above information.

C. Comply with the requirements of Sections 01 33 00 and 26 01 00.

1.05 SUBMITTALS-FOR INFORMATION

A. Provide also four(4) copies of the following product information:

B. Descriptive bulletins

C. Product sheets

D. Harmonic Analysis

1.06 SUBMITTALS-FOR CLOSEOUT

A. The following information shall be submitted for record purposes prior to final payment.

B. Final as-built drawings and information for items listed section in 1.04.

C. Installation information.

D. Comply with the requirements of Sections 01 77 00 and 26 01 00.

1.07 QUALIFICATIONS

A. The supplier of the assembly shall be the manufacturer of the electromechanical power components used within the assembly, such as bypass contactors when specified.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 certified.

C. The supplier of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Adjustable Frequency Drives for motors 75 HP and greater shall be on the basis of Cutler-Hammer CFX9000 Series for function and quality. Drives for motors less than 75 HP shall be Cutler Hammer SVX 9000 Series. Products that are in compliance with the specification and manufactured by others will be considered as "Approved Equal" if pre-approved by the Engineer fourteen (14) days prior to bid date.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. Equipment shall be stored in a climate controlled warehouse until ready for installation in the field.

C. Space heaters shall be kept energized in equipment until it has been energized.

1.09 OPERATION AND MAINTENANCE MANUALS

A. Five (5) copies of the equipment operation and maintenance manuals shall be provided.

B. Operation and maintenance manuals shall include the following information:

1. Instruction books

2. Recommended renewal parts list

3. Drawings and information required by Section 1.06.

C. Comply with the requirements of Sections 01 77 00 and 26 01 00.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Eaton

B. General Electric

C. Schneider Square D.

D. Allen Bradley

E. Engineer Approved Equal

Naming specific venders does not imply acceptance of their standard products nor relieve them from meeting these specifications in their entirety.

2.02 ADJUSTABLE FREQUENCY DRIVES (AFD)

A. Where shown on the drawings, adjustable frequency drives shall have the following features:

1. The AFD shall be rated for 480 VAC. The AFD shall provide microprocessor-based control for three-phase induction motors. The controller's full load output current rating shall be based on 40° C ambient and not less than 3.6 kHz switching frequency to reduce motor noise and avoid increased motor losses.

2. The AFD shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation. Adjustable Current Source AFD are not acceptable. Insulated Gate Bipolar Transistors (IGBT's) shall be used in the inverter section. Bipolar Junction Transistors, GTO's or SCR's are not acceptable. The AFD shall run at the above listed switching frequencies.

3. The AFD shall have efficiency at full load and speed that exceeds 97%. The efficiency shall exceed 90% at 50% speed and load.

4. The AFD shall maintain the line side displacement power factor at no less than 0.96, regardless of speed and load.

5. The AFD shall have a one (1) minute overload current rating of 110%.

6. The AFD shall be capable of operating of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the AFD.

7. The AFD shall limit harmonic distortion reflected onto the utility system to a voltage and current level as defined by IEEE 519 for general systems applications.

8. Harmonic calculations shall be done based on the kVA capacity, X/R ratio and the impedance of the utility transformer feeding the installation, as noted on the drawings, and the total system load. The calculations shall be made with the point of common coupling being the point where the utility feeds multiple customers.

9. For systems with a standby generator, the harmonic distortion shall meet the distortion levels shown in table 10.3 of IEEE519-1992 for ISC/IL<20. The contractor shall provide the following data for the standby generator in order to perform the calculations: Voltage, kW, kVA and Subtransient Reactance (X"d), and total maximum demand ampere load for generator operation.

10. A harmonic analysis of the system shall be made consisting of the current and voltage harmonics expected from the addition of the adjustable frequency drives for all harmonics through the 25th per tables 10-2 and 10-3 of IEEE519-1992. This analysis shall be included as part of the bid submittal. A tuned passive filter integral to the drive enclosure shall be required as part of this specification.

11. The AFD shall be able to start into a spinning motor (flying start). The AFD shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the AFD shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor to the preset speed.

12. Standard operating conditions shall be:

a. Incoming Power: Three-phase, 480 Vac (+10% to -10%) and 60 Hz (+/-5 Hz) power is converted to a fixed potential DC bus level.

b. Maximum input voltage unbalance shall be 0.5% as defined in NEMA MG 1 section 14.35.2

c. Frequency stability of +/-0.05% for 24 hours with voltage regulation of +/-1% of maximum rated output voltage.

d. Speed regulation of +/- 0.5% of base speed.

e. Load inertia dependent carryover (ride-through) during utility loss.

f. Insensitive to input line rotation.

g. Humidity: 0 to 95% (non-condensing and non-corrosive).

h. Altitude: 0 to 3,300 feet (1000 meters) above sea level.

i. Ambient Temperature: -10 to 50 °C (CT), -10 to 40 °C (VT).

j. Storage Temperature: -40 to 60 °C.

B. Control Functions

1. Frequently accessed AFD programmable parameters shall be adjustable from a digital operator keypad located on the front of the AFD. The AFD shall have a 3 line alphanumeric programmable display with status indicators. Keypads must use plain English words for parameters, status, and diagnostic messages. Keypads that are difficult to read or understand are not acceptable, and particularly those that use alphanumeric code and tables. Keypads shall be adjustable for contrast with large characters easily visible in normal ambient light.

2. The keypad shall include a Local/Remote pushbutton selection. Both start/ stop source and speed reference shall be independently programmable for Keypad, Remote I/O, or Field Bus.

3. The keypad shall have copy / paste capability.

4. Upon initial power up of the AFD, the keypad shall display a start up guide that will sequence all the necessary parameter adjustments for general start up.

5. Standard advanced programming and trouble-shooting functions shall be available by using a personal computer's RS-232 port and Windows™ based software. In addition the software shall permit control and monitoring via the AFD RS232 port. The manufacturer shall supply a diskette with the required software. An easily understood instruction manual and software help screens shall also be provided. The computer software shall be used for modifying the drive setup and reviewing diagnostic and trend information as outlined herein. Provide one copy of the advanced programming software.

6. The operator shall be able to scroll through the keypad menu to choose between the following:

   a. Monitor

   b. Operate

   c. Parameter setup

   d. Actual parameter values

   e. Active faults

   f. Fault history

   g. LCD contrast adjustment

   h. Information to indicate the standard software and optional features software loaded.

7. The following setups and adjustments, at a minimum, are to be available:

   a. Start command from keypad, remote or communications port

   b. Speed command from keypad, remote or communications port

   c. Motor direction selection

   d. Maximum and minimum speed limits

e. Acceleration and deceleration times, two settable ranges

f. Critical (skip) frequency avoidance

g. Torque limit

h. Multiple attempt restart function

i. Multiple preset speeds adjustment

j. Catch a spinning motor start or normal start selection

k. Programmable analog output

l. DC brake current magnitude and time

m. PID process controller

C. The AFD shall have the following system interfaces:

1. Inputs – A minimum of six (6) programmable digital inputs, two (2) analog inputs and serial communications interface shall be provided with the following available as a minimum:

a. Remote manual/auto

b. Remote start/stop

c. Remote forward/reverse

d. Remote preset speeds

e. Remote external trip

f. Remote fault reset

g. Process control speed reference interface, 4-20mA DC

h. Potentiometer and 1-10VDC speed reference interface

i. RS-232 programming and operation interface port

j. Serial communications port

D. Outputs – A minimum of two (2) discrete programmable digital outputs, one (1) programmable open collector output, and one (1) programmable analog output shall be provided, with the following available at minimum.

1. Programmable relay outputs with one (1) set of Form C contacts for each, selectable with the following available at minimum:

2. Fault

3. Run

4. Ready

5. Reversed

6. Jogging

7. At speed

8. Torque Limit Supervision

9. Motor rotation direction opposite of commanded

10. Over-temperature

E. Programmable open collector output with available 24VDC power supply and selectable with the following available at minimum:

1. Fault

2. Run

3. Ready

4. Reversed

5. Jogging

6. At speed

7. Torque Limit Supervision

8. Motor rotation direction opposite of commanded

9. Over-temperature

10. Programmable analog output signal, selectable with the following available at minimum:

11. Motor current

12. Output frequency

13. Frequency reference

14. Motor speed

15. Motor torque

16. Motor power

17. Motor voltage

18. DC-bus voltage

F. Monitoring and Displays

The AFD display shall be a LCD type capable of displaying three (3) lines of text and the following thirteen (13) status indicators:

1. Run

2. Forward

3. Reverse

4. Stop

5. Ready

6. Alarm

7. Fault

8. Input/Output (I/O) terminal

9. Keypad

10. Bus/Communication

11. Local (LED)

12. Remote (LED)

13. Fault (LED)

G. The AFD keypad shall be capable of displaying the following monitoring functions at a minimum:

1. Output frequency

2. Frequency reference

3. Motor speed
4. Motor current
5. Motor torque
6. Motor power
7. Motor voltage
8. DC-bus voltage
9. Unit temperature
10. Calculated motor temperature
11. Voltage level of analog input
12. Current level of analog input
13. Digital inputs status
14. Digital and relay outputs status
15. Analog Input

H. Protective Functions

The AFD shall include the following protective features at minimum:

1. Over-current
2. Over-voltage
3. Inverter fault
4. Under-voltage
5. Input phase loss
6. Output phase loss
7. Under-temperature
8. Over-temperature
9. Motor stalled
10. Motor over-temperature

11. Motor under-load

12. Logic voltage failure

13. Microprocessor failure

I. The AFD shall provide ground fault protection during power-up, starting, and running. AFD with no ground fault protection during running are not acceptable.

J. Diagnostic Features

1. Fault History

2. Record and log faults

3. Indicate the most recent first, and store up to 30 faults

4. Display drive data at time of fault

In the event several faults occur simultaneously, the sequence of active faults shall be viewable.

K. Optional features to be included in the AFD if indicated on the drawings or if otherwise required::

1. HMCP or thermal magnetic breaker to provide a disconnect means. Operating handle shall protrude through the door. The disconnect shall not be mounted on the door. The handle position shall indicate ON, OFF, and TRIPPED condition. The handle shall have provisions for padlocking in the OFF position with at least three (3) padlocks. Interlocks shall prevent unauthorized opening or closing of the AFD door with the disconnect handle in the ON position. Door handle interlock can be defeated by qualified maintenance personnel.

2. Three contactor bypass with a drive input disconnect, an AFD input isolation contactor, bypass contactor and an AFD output contactor that is electrically and mechanically interlocked with the bypass contactor. This circuit shall include control logic, status lights and motor over-current relays. The complete bypass system. Inverter-Off-Bypass selector switch, and Inverter/Bypass pilot lights shall be packaged with the AFD. The unit may be set up for Manual bypass operation upon an AFD trip. Soft start starters equal to Eaton S811 shall be provided for bypass on motors larger than 50 HP.

3. AC output contactor to provide a means for positive disconnection of the drive output from the motor terminals.

4. Fused space heaters with thermostat for oversize enclosures to minimize condensation potential upon drive shutdown.

5. Laminated plastic or steel nameplate engraved with user's identifying name or number for oversize enclosures.

6. 120 VAC control to allow AFD to interface with remote dry contacts.

7. Motor over-current relay to provide sensing of a given level of load current.

8. A properly sized line reactor shall be installed at the AFD output to reduce dv/dt levels and the resultant peak voltage overshoots at the motor terminals.

9. A contactor to disconnect the capacitors when the AFD is de-energized.

L Spare Parts

1. The main logic board, keypad and power supply board shall be supplied as spares, one for each different part number supplied.

M. The AFD manufacturer shall maintain, as part of a national network, engineering service facilities within 100 miles of project to provide start-up service, emergency service calls, repair work, service contracts, maintenance and training of customer personnel.

PART 3 EXECUTION

3.01 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

B. All printed circuit boards shall be functionally tested via automatic test equipment prior to unit installation.

C. After all tests have been performed, each AFD shall undergo a burn-in test. The drive shall be burned in at 100% inductive or motor load without an unscheduled shutdown.

D. After the burn-in cycle is complete, each AFD shall be put through a motor load test before inspection and shipping.

E. The manufacturer shall provide three (3) certified copies of factory test report.

3.02 FIELD QUALITY CONTROL

A. Provide the services of a qualified manufacturer's employed Field Service Engineer to assist the Contractor in installation and start-up of the equipment specified under this section. Field Service personnel shall be factory trained with periodic updates and have experience with the same model of AFD on the job site. Sales representatives will not be acceptable to perform this work. The manufacturer's service representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment,

installation as specified in manufacturer's installation instructions, wiring, application dependant adjustments, and verification of proper AFD operation.

B. The Contractor under the technical direction of the manufacturer's service representative shall perform the following minimum work.

1 Inspection and final adjustments.

2. Operational and functional checks of AFD and spare parts.

3. The contractor shall certify that he has read the drive manufacturer's installation instructions and has installed the AFD in accordance with those instructions.

C. The Contractor shall provide three (3) copies of the manufacturer's field start-up report before final payment is made.

3.03 MAINTENANCE / WARRANTY SERVICE

A. Warranty for 12 months from the date of start-up, not to exceed 36 months from the date of shipment, and include all parts, labor, and travel time.

3.04 FIELD TESTING

A. The AFD manufacturer shall perform harmonic measurements at the point where the utility feeds multiple customers (PCC) to verify compliance with IEEE519-1992. A report of the voltage THD and current TDD shall be sent to the engineer. The contractor shall provide labor, material, and protection as needed to access the test points. The readings shall be taken with all drives and all other loads at full load, or as close as field conditions allow.

3.05 TRAINING

A. The Contractor shall provide a training session for up to 4 owner's representatives for 2 normal workdays with a maximum of 2 trips at a job site location determined by the owner. Training and instruction time shall be in addition to that required for start-up service.

B. The manufacturer's qualified representative shall conduct the training.

C. The training program shall consist of the following:

1. Instructions on the proper operation of the equipment.

2. Instructions on the proper maintenance of the equipment.

END OF SECTION

SECTION 26 36 23

AUTOMATIC TRANSFER SWITCH

PART 1: GENERAL

1.01 SCOPE

A. Furnish and install automatic transfer & bypass-isolation switch (ATS/BPS) system(s) with number of poles, amperage, voltage, withstand and close-on ratings as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All automatic transfer & bypass-isolation switches and controllers shall be the products of the same manufacturer.

1.02 CODES AND STANDARDS

A. The automatic transfer switches and controls shall conform to the requirements of:

1. UL 1008 - Standard for Transfer Switch Equipment

2. IEC 60947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment

3. NFPA 70 - National Electrical Code

4. NFPA 99 - Essential Electrical Systems for Health Care Facilities

5. NFPA 110 - Emergency and Standby Power Systems

6. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

7. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches

8. UL 508 Industrial Control Equipment

1.03 ACCEPTABLE MANUFACTURERS

A. Refer to the Equipment List for acceptable manufacturers.

1.04 SUBMITTALS

A. The submittals shall be in accordance with the requirements of Section 01 33 00.

B. The submittal shall include but is not limited to the following:

1. Elevation drawing showing dimensions.

2. Manufacturer's name and model number.

3. Enclosure specifications including physical dimensions, color and weight.

4. Equipment specification sheets for each item included in the motor control center.

5. Schematic diagrams drawn or modified for this specific project.

6. Label legend showing size of lettering and label location.

7. Equipment sizes and ratings.

1.05 STORAGE AND HANDLING

A. The Contractor, and hence, the ATS supplier, shall be responsible for safety of the ATS during storage, transporting and handling.

B. At all times the ATT shall be housed inside a moisture free weatherproof housing.

C. The ATS shall have weatherproof non-porous extra heavy duty plastic covers at all times, until it is ready for test and start-up.

D. Interior and exterior of the ATS shall be kept clean at all times.

1.06 TOOLS AND SPARE PARTS

A. Furnish the spare parts and expendables recommended by the manufacturer.

1.07 OPERATION AND MAINTENANCE MANUALS

A. Furnish six (6) copies of manuals including the following information on each component used:

1. Installation and operation manual.
2. Renewal parts bulletin.
3. Component description, rating, catalog number, etc.
4. Vendor drawings.
5. As built drawings.
6. Test data.

B. Comply with Section 01 77 00.

1.08 ARC FLASH WARNING LABEL

A. The ATS shall have an Arc Flash Warning label.

PART 2: PART 2: PRODUCTS

2.01 MECHANICALLY HELD TRANSFER SWITCH

A. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism. Main operators which include overcurrent disconnect devices, linear motors or gears shall not be acceptable. The switch shall be mechanically interlocked to ensure only two possible positions, normal or emergency.

B. All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.

C. The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.

D. All main contacts shall be silver composition. Switches rated 800 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.

E. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 600 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.

F. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

G. Where neutral conductors must be switched as shown on the plans, the AS shall be provided with fully rated overlapping neutral transfer contacts. The neutrals of the normal and emergency power sources shall be connected together only during the transfer and retransfer operation and remain connected together until power source contacts close on the source to which the transfer is being made. The overlapping neutral contacts shall not overlap for a period greater than 100 milliseconds. Neutral switching contacts which do not overlap are not acceptable.

H. Where neutral conductors are to be solidly connected as shown on the plans, a neutral conductor plate with fully rated AL-CU pressure connectors shall be provided.

2.02 BYPASS-ISOLATION SWITCH

A. A two-way bypass-isolation switch shall provide manual bypass of the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors. All main contacts shall be manually driven.

B. Power interconnections shall be silver-plated copper bus bar. The only field installed power connections shall be at the service and load terminals of the bypass-isolation switch. All control interwiring shall be provided with disconnect plugs.

C. Separate bypass and isolation handles shall be utilized to provide clear distinction between the functions. Handles shall be permanently affixed and operable without opening the

enclosure door. Designs requiring insertion of loose operating handles or opening of the enclosure door to operate are not acceptable.

D. Bypass to the load-carrying source shall be accomplished with no interruption of power to the load (make before break contacts). Designs which disconnect the load when bypassing are not acceptable. The bypass handle shall have three operating modes: "Bypass to Normal," "Automatic," and "Bypass to Emergency." The operating speed of the bypass contacts shall be the same as the associated transfer switch and shall be independent of the speed at which the manual handle is operated. In the "Automatic" mode, the bypass contacts shall be out of the power circuit so that they will not be subjected to fault currents to which the system may be subjected.

E. The isolation handle shall provide three operating modes: "Closed," "Test," and "Open." The "Test" mode shall permit testing of the entire emergency power system, including the automatic transfer switches with no interruption of power to the load. The "Open" mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the "Open" mode, it shall be possible to completely withdraw the automatic transfer switch for inspection or maintenance to conform to code requirements without removal of power conductors or the use of any tools.

F. When the isolation switch is in the "Test" or "Open" mode, the bypass switch shall function as a manual transfer switch.

G. Designs requiring operation of key interlocks for bypass isolation or ATS which cannot be completely withdrawn when isolated are not acceptable.

2.03 MICROPROCESSOR CONTROLLER

A. The controller’s sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.

B. A single controller shall provide twelve selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to ± 1% of nominal voltage. Frequency sensing shall be accurate to ± 0.2%. The panel shall be capable of operating over a temperature range of -20 to +60 degrees C and storage from -55 to +85 degrees C.

C. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator’s manuals.

D. All customer connections shall be wired to a common terminal block to simplify field-wiring connections.

E. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

1. EN 55011:1991 Emission standard - Group 1, Class A
2. EN 50082-2:1995 Generic immunity standard, from which:
   a) EN 61000-4-2:1995 Electrostatic discharge (ESD) immunity
   b) ENV 50140:1993 Radiated Electro-Magnetic field immunity
   c) EN 61000-4-4:1995 Electrical fast transient (EFT) immunity
   d) EN 61000-4-5:1995 Surge transient immunity
   e) EN 61000-4-6:1996 Conducted Radio-Frequency field immunity

2.04 ENCLOSURE

A. The ATS/BPS shall be furnished in a Type 1 enclosure unless otherwise shown on the plans.

B. All standard and optional door-mounted switches and pilot lights shall be 16-mm industrial grade type or equivalent for easy viewing & replacement. Door controls shall be provided on a separate removable plate, which can be supplied loose for open type units.

2.05 CONTROLLER DISPLAY AND KEYPAD

A. A four line, 20 character LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the serial communications input port. The following parameters shall only be adjustable via DIP switches on the controller:

1. Nominal line voltage and frequency
2. Single or three phase sensing
3. Operating parameter protection
4. Transfer operating mode configuration Open transition.

B. All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

2.06 VOLTAGE, FREQUENCY AND PHASE ROTATION SENSING

A. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout and trip setting capabilities (values shown as % of nominal unless otherwise specified):

Parameter	Sources	Dropout / Trip	Pickup / Reset
Undervoltage	N&E,3ϕ	70 to 98%	85 to 100%
Overvoltage	N&E,3ϕ	102 to 115%	2% below trip
Underfrequency	N&E	85 to 98%	90 to 100%
Over frequency	N&E	102 to 110%	2% below trip
Voltage unbalance	N&E	5 to 20%	1% below dropout

B. Repetitive accuracy of all settings shall be within ± 0.5% over an operating temperature range of -20°C to 60°C.

C. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.

D. The controller shall be capable (when activated by the keypad or through the serial port) of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).

E. Source status screens shall be provided for both normal & emergency to pro-vide digital readout of voltage on all 3 phases, frequency, and phase rotation.

F. The controller shall include a user selectable algorithm to prevent repeated transfer cycling to a source on an installation which experiences primary side, single phase failures on a Grounded Wye – Grounded Wye transformer which regenerates voltage when unloaded. The algorithm shall also inhibit retransfer to the normal (utility) source upon detection of a single phasing condition until a dedicated timer expires, the alternate source fails, or the normal source fails completely and is restored during this time delay period. The time delays associated with this feature shall be adjustable by the user through the controller keypad and LCD.

2.07 TIME DELAYS

A. An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 24 VDC power supply.

B. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.

C. Two time delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.

D. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.

E. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minute time delay in any of the following modes:

1. Prior to transfer only.
2. Prior to and after transfer.
3. Normal to emergency only.
4. Emergency to normal only.

5. Normal to emergency and emergency to normal.
6. All transfer conditions or only when both sources are available.

F. The controller shall also include the following built-in time delays for optional Closed Transition and Delayed Transition operation:

1. 1 to 5 minute time delay on failure to synchronize normal and emergency sources prior to closed transition transfer.
2. 0.1 to 9.99 second time delay on an extended parallel condition of both power sources during closed transition operation.
3. 0 to 5 minute time delay for the load disconnect position for delayed transition operation.

G. All time delays shall be adjustable in 1 second increments, except the extended parallel time, which shall be adjustable in .01 second increments.

H. All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the serial communications port.

2.08 ADDITIONAL FEATURES

A. A three position momentary-type test switch shall be provided for the *test / automatic / reset* modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to emergency or retransfer to normal.

B. A SPDT contact, rated 5 amps at 30 VDC, shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.

C. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed, when the ATS is connected to the emergency source.

D. LED indicating lights (16 mm industrial grade, type 12) shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).

E. LED indicating lights (16 mm industrial grade, type 12) shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.

F. Provide the ability to select “commit/no commit to transfer” to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

G. An Inphase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically ATS

manufacturer. The inphase monitor shall be equal to ASCO Feature 27.

H. The controller shall be capable of accepting a normally open contact that will allow the transfer switch to function in a non-automatic mode using an external control device.

I. Engine Exerciser - The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to seven different exercise routines. For each routine, the user shall be able to:

1. Enable or disable the routine.
2. Enable or disable transfer of the load during routine.
3. Set the start time.
   a) time of day
   b) day of week
   c) week of month (1st, 2nd, 3rd, 4th, alternate or every)
4. Set the duration of the run.

J. At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.

K. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad or serial port.

L. System Status - The controller LCD display shall include a “System Status” screen which shall be readily accessible from any point in the menu by depressing the “ESC” key a maximum of two times. This screen shall display a clear description of the active operating sequence and switch position. For example,

1. Normal Failed
2. Load on Normal
3. TD Normal to Emerg
4. 2min15s

M. Controllers that require multiple screens to determine system status or display “coded” system status messages, which must be explained by references in the operator’s manual, are not permissible.

N. Self Diagnostics - The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.

O. Communications Interface – The controller shall be capable of interfacing, through an optional serial communication module, with a network of transfer switches, locally (up to 4000 ft.) or remotely through modem serial communications. Standard software specific for transfer switch applications shall be available by the transfer switch manufacturer. This software shall allow for the monitoring, control and setup of parameters.

P. Data Logging – The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory:

1. Event Logging
   a) Data and time and reason for transfer normal to emergency.
   b) Data and time and reason for transfer emergency to normal.
   c) Data and time and reason for engine start.
   d) Data and time engine stopped.
   e) Data and time emergency source available.
   f) Data and time emergency source not available.

2. Statistical Data
   a) Total number of transfers.
   b) Total number of transfers due to source failure.
   c) Total number of days controller is energized.
   d) Total number of hours both normal and emergency sources are available.

Q. Communications Module - A full duplex RS485 interface shall be installed in the ATS controller to enable serial communications. The serial communications shall be capable of a direct connect or multi-drop configured network. This module shall allow for the seamless integration of existing or new communication transfer devices. The serial communication interface shall be equal to ASCO Accessory 72A.

2.09 WITHSTAND AND CLOSING RATINGS

A. The ATS/BPS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS/BPS terminals with the type of overcurrent protection shown on the plans.

B. The ATS/BPS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1½ and 3 cycle ratings. ATS/BPSs which are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.

2.10 TESTS AND CERTIFICATION

A. The complete ATS/BPS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

C. The ATS/BPS manufacturer shall be certified to ISO 9001 International Quality Standard

and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001.

2.11 SERVICE REPRESENTATION

A. The ATS/BPS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

2.12 POWER MANAGER

A. Furnish Power Managers at locations shown to monitor all functions specified below.

B. The Power Managers shall be listed to UL 3111-1, CSA, CE Mark, and industrially rated for an operating temperature range of -20°C to 60°C.

C. The Power Manager shall be accurate to 1% measured, 2% computed values and display resolution to .1%. Voltage and current for all phases shall be sampled simultaneously to assure high accuracy in conditions of low power factor or large waveform distortions (harmonics).

D. The Power Manager shall be capable of operating without modification at nominal frequencies of 45 to 66 Hz and over a control power input range of 20 – 32VDC.

E. Each Power Manager shall be capable of interfacing with an optional communications module to permit information to be sent to central location for display, analysis, and logging.

F. The Power Manager shall accept inputs from industry standard instrument trans-formers (120 VAC secondary PTs and 5A secondary CTs.) Direct phase voltage connections, 600 VAC and under, shall be possible without the use of PTs.

G. The Power Manager shall be applied in single, 3-phase, or three & four wire circuits. A fourth CT input shall be available to measure neutral or ground current.

H. All setup parameters required by the Power Manager shall be stored in non-volatile memory and retained in the event of a control power interruption.

I. The following metered readings shall be communicated by the Power Manager, via serial communication, when equipped with optional serial communications module
1. Current, per phase RMS and neutral (if applicable)
2. Current Unbalance %
3. Voltage, phase-to-phase and phase-to-neutral
4. Voltage Unbalance %
5. Real power (KW), per phase and 3-phase total
6. Apparent power (KVA), per phase and 3-phase total
7. Reactive power (KVAR), per phase and 3-phase total

8. Power factor, 3-phase total & per phase
9. Frequency
10. Accumulated Energy, (MWH, MVAH, and MVARH)

J. The following energy readings shall be communicated by the Power Manager:

1. Accumulated real energy KWH
2. Accumulated reactive energy KVAH
3. Accumulated apparent energy KVARH

NOTE: For real and reactive energy reported values, separate total for energy flow from each source shall be stored, including the arithmetic sum.

K. Power Manager Input/Output Options.

1. Power Managers shall be equipped with the following I/O:
   a) Provide (8) solid state status inputs.
   b) Provide four (4) relay output contacts

PART 3: EXECUTION

3.01 INSTALLATION

A. Install and test the transfer switch in accordance with the manufacturer's recommendations.

B. Install transfer switch on a 4" high concrete housekeeping pad.

C. Test all cables before making final connections.

D. Include a copy of the transfer switch test report in the O&M Manual.

3.02 MANUFACTURER'S CERTIFICATION

A. Manufacturer shall provide a letter of certification on the manufacturer's letterhead certifying that the transfer switch was installed correctly and tested in accordance with the manufacturer's recommendations and that the transfer switch is operating properly.

3.03 WARRANTY

A. Comply with Section 01 77 00.

END OF SECTION

SECTION 26 43 13
SURGE PROTECTION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The work performed under this Section consists of providing all labor, material, tools, equipment and related items required to furnish, install and place into operation incoming line protection

B. Incoming line protection shall be provided at the main service disconnect, the main switchboard, the power panels and at each motor control center.

C. Surge protection shall conform to this specification.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00: Submittals

B. Section 01 77 00: Contract Closeout

B. Section 26 01 00: Electrical General Requirements

C. Section 26 05 26: Grounding

1.03 REFERENCE STANDARDS

A. ANSI/IEEE C62.11, C62.41 and C62.45.

B. Federal Information Processing Standards Publication FIP Pub. 94.

C. NEMA LS-1.

D. NFPA 20, 70, 75 and 78.

E. UL 1449.

1.04 SUBMITTALS

A. Each submittal shall be in accordance with the requirements of Section 01 33 00.

B Each submittal shall include but is not limited to the following:

1. Manufacturer's name and model number.

2. Catalog cut sheet applicable to the specific unit proposed.

3. Specifications applicable to the specific unit proposed.

C. Submit O & M Manuals in accordance with Section 01 77 00 and sections referenced therein. Include certified shop drawings.

PART 2 PRODUCTS

2.01 GENERAL

A. Surge protection device (SPD) shall be UL1449 4th Edition Listed and labeled "Type 1" or "Type 2" Listed per NEC Art 285.23 and 285.24, and UL1283 Complimentary Listed.

B. The SPD shall have a warranty of not less than 10 years from original date of shipment. After the SPD has been installed in compliance with Part 3 of this specification, applicable national and local codes and the manufacturer's Installation, Operation and Maintenance Instructions, the warranty shall not be pro-rated and shall cover manufacturing defects, workmanship, or any end-of-life electrical event including lightning.

2.02 PRODUCTS

A. Approved manufacturers for service entrance, and branch panels are:

1. Thor Systems TSr product, and TSn product
2. Current Technology SL3 product, TG3 product
3. Liebert 570 / Interceptor II product, 510 /Accuvar product
4. Engineer approved equal.

B. SSCR or AIC: The SPD shall have a minimum SCCR rating of 100k AIC or greater than that of the connected switchgear, motor control center or panel that is being protected.

C. Service Entrance SPD's shall have a nominal discharge rating (I_n) of 20kA per UL96a 12th Edition.

D. The UL1449 4th Edition voltage protection rating (VPR) shall not be more than indicated on the following chart, and the per mode surge current rating shall not be less than indicated on the same following chart unless the riser, one line or panel schedule indicates otherwise.

Location	Surge Current Rating per Mode	UL Assigned VPR 208Y/120v / 480Y/277v	Modes of Protection
Service Entrance	250,000 Amps	800v / 1200	L-N, L-G, N-G
Distribution Panels	150,000 Amps	800v / 1200	L-N, L-G, N-G
Branch Panels	100,000 Amps	800v / 1200	L-N, L-G, N-G

Location	Per Mode Surge Current Rating	UL Assigned VPR			
		L-N 208Y/120v 480Y/277v	L-G 208Y/120v 480Y/277v	N-G 208Y/120v 480Y/277v	L-L 208Y/120v 480Y/277v
Service Entrance	250,000 Amps	800v 1200v	800v 1200v	800v 1200v	1200v 2000v
Distribution Panels	150,000 Amps	700v 1200v	700v 1200v	800v 1200v	1200v 2000v
Branch Panels	100,000 Amps	700v 1200v	700v 1200v	800v 900v	1000v 2000v

E. The SPD integral monitoring shall be LED Status indicators, and dry contacts. The service entrance SPD(s) shall have LED Status indicators, dry contacts, a surge event counter with re-set and audible alarm with silence switch.

F. Enclosure: The SPD shall have a NEMA rating of NEMA 12 for indoor applications and Nema 4X 316 SS for outdoor installation.

PART 3 EXECUTION

3.01 DELIVERY AND STORAGE

A. Delivery. Prepare equipment for shipment to job site.

B. Storage and Handling at Job Site. The CONTRACTOR shall store and handle all equipment at the job site, while such materials are awaiting installation, in conformation with the following:

C. Store equipment in an area protected from weather, moisture or possible damage.

D. Do not store materials directly on the ground.

E Handle items to prevent damage to interior or exterior surfaces.

3.02 INSTALLATION

A. SPD shall be mounted external the switchboard(s), distribution panel(s), branch panel(s) and/or load center(s), per manufacturers installation instructions, local codes, NEC Art.110.3B and Art.285, and IEEE 1100-2005 section 8.4.2.5.

B. The SPD connectivity shall be Type 2 per NEC2008 Art.285.24 via a dedicated 3-pole breaker, sized per the SPD manufacturers installation instructions.

1. If there is no available multi-pole breaker, the SPD shall have an integral to the SPD fused disconnect and the bus shall be tapped.

G. Connecting SPD conduits to electrical gear shall have fire stopping caulk.

H. Contractor may reasonably rearrange breaker locations to ensure short and straight leads to SPD(s) per NEC Art.285.12.

I. SPD's with test ports shall be delivered with full featured testing equipment and test training shall be provided to the project owners, both at no additional charge, after final acceptance of project.

END OF SECTION

SECTION 26 51 00 - LIGHTING

PART 1 GENERAL

1.1 SCOPE

A. Furnish and install lighting fixtures as specified herein and indicated on the drawings.

B. Comply with Section 23 01 00, General Electrical Requirements.

1.2 PAYMENT

A. No separate payment shall be made for labor or material under this item. All costs shall be included in the lump sum or unit prices shown in the proposal.

1.3 RELATED SPECIFICATIONS

A. Section 01 33 00 - Submittals

B. Section 26 01 00 - General Electrical Requirements

C. Section 26 01 27 - Calibration and Testing

1.4 SUBMITTALS

A. Submit a lighting fixture brochure for all fixtures indicating pertinent physical characteristics and complete photometric data.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. General: Furnish fixtures as required by the lighting fixture schedule shown on the plans.

B. Fixtures shall bear the U.L. label. Such labels shall apply to entire fixture as installed.

C. Accessories: Deliver all fixtures complete with suspension accessories, canopies, hickeys, casings, sockets, holders, reflectors, ballasts, diffusers, frames, recessing boxes, etc., all wired and assembled as indicated.

D. Lamps: All fixtures shall be LED type as shown on the drawings.

E. Protection: Protect all fixtures, lenses and louvers from damage. Leave protective coverings on lenses and louvers until fixtures are installed. Replace all damaged lenses and louvers immediately prior to final inspection at no cost to the Owner.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install lighting fixtures at the locations shown on the plans.

B. Maintain perfect horizontal and vertical alignment of fixtures throughout.

C. Do not locate splices or taps within an arm, stem or chain.

D. Locate fixtures to avoid interference with piping, fans, ducts, and other obstructions. Obtain approval of any location differing from the location shown on the plans.

E. Support fixtures adequately by approved means.

F. Replace any damaged fixtures or lens at no cost to the Owner. Leave any protective covering on lens until the fixture is installed.

G. Install all fixtures parallel to walls and structural members.

H. Receive, handle and store self-contained emergency fixtures in an upright position.

I. Install new lamps in all fixtures just prior to final inspection of the project.

J. Support fixtures mounted in suspended ceiling with exposed T-bar grid system shall be supported from the ceiling T-bar grid structure and secured thereto.

K. Support fixtures more than two feet wide by four hangers per luminaire minimum independent of ceiling structure or T-bars.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work performed under this Section consists of providing all labor, material, tools, equipment and related items required to furnish, install and place into operation exterior lighting fixtures, supports and accessories.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: 01 33 00.

B. Cast-in Place Concrete: 03 30 53.

C. Electrical General Requirements: 26 01 00.

D. Conduit Systems: 26 05 33.

E. Wire and Cable: 26 05 19.

1.03 REFERENCE STANDARDS

A. NEC

B. OSHA

C. ANSI

D. IEEE

E. NEMA

F. UL

1.04 SUBMITTALS

A. The submittal shall be in accordance with the requirements of 01 33 00. Include sufficient data to substantiate that the materials conform to the requirements of this section.

B. Furnish submittal for luminaires indicating physical characteristics, finish, pole, base, mounting, hardware including diagram of mounting and photometric data.

C. The ballast and lamp shall be included with the fixture submittal where applicable.

D. Submit all lighting fixtures in one brochure with sections labeled for each fixture according to the letter designation shown on the Lighting Fixture Schedule and include all pertinent

information with the fixture.

1.05 COORDINATION

A. Locations of lighting fixtures shown on the drawings are approximate only. the final location shall be dependent on physical conditions encountered during construction. where lighting fixtures conflict with work by other trades, and must be relocated, the Contractor shall have written approval from the Engineer prior to relocating the fixture(s).

PART 2 PRODUCTS

2.01 LIGHTING FIXTURE TYPE

A. The lighting fixture type and manufacturer are specified in the Lighting Fixture Schedule on the drawings.

B. Lighting fixtures with the same function and performance shall be acceptable as substitutions in accordance with 01 33 00.

2.02 FINISH

A. Prime coat all metal surfaces prior to application of two coats of paint finish.

B. Paint finish shall be suitable for a corrosive environment.

2.03 METAL POLES

A. Furnish structural concrete base as shown on the drawings. Concrete installation shall comply with 03 30 53.

B. Fixture anchor bolts, nuts and base plate shall be prime coated after installation.

C. Install steel pole on base in accordance with pole manufacturer's requirements using anchor bolts of a material and size specifically made for this application. Orient base parallel with curb line.

D. All conduits stubbing-up through the base shall be rigid galvanized steel with plastic insulated bushing on the end.

E. Install a 3/4" x 10'- 0" ground rod at the base of the pole to ground the pole.

F. Plumb pole first using leveling nuts, then grout in space between base of pole and footing with non-shrink grout.

2.04 CONTROLS

A. Area lighting shall be circuited through a lighting contactor controlled by a time switch.

B. Lighting contactor shall be combination type electrically operated, mechanically held with circuit breaker disconnect in a Nema 1 enclosure, ASCO Model 920, or approved equal.

Rating and number of poles shall be as indicated on the drawings.

C. Time switch shall have a 7 day astronomic dial and a battery backup to maintain load control even during power failure. Time switch shall be 2-circuit, 120 V input, Intermatic ET8215C, or approved equal by Tork or Paragon.

PART 3 EXECUTION

3.01 DELIVERY AND STORAGE

A. Delivery. Prepare lighting fixtures and accessories for shipment to the job site.

B. Storage and Handling at Job Site. The Contractor shall store and handle all lighting fixtures at the job site, while such materials are awaiting installation, in conformance with the following:

C. Store lighting fixtures accessories in an area protected from weather, moisture or possible damage.

D. Do not store materials directly on the ground.

E. Handle items to prevent damage to interior or exterior surfaces.

END OF SECTION

SECTION 27 13 23 - FIBER OPTIC CABLE

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The work performed under this Section consists of providing labor, material, tools, equipment and related items required to furnish, install and place into operation the fiber optic cable system shown on the plans or as otherwise required by these specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01 33 00

B. Electrical General Provisions: Section 26 01 00

C. Conduits: Section 26 05 23

D. Grounding: Section 26 05 26

E. Instrumentation: Section 40 70 00

F. SCADA System: Section 40 61 00.

1.3 REFERENCE STANDARDS

A. ANSI/TIA/EIA-492

B. IEEE 802.3

C. ANSI/ICEA S-87-640 – Standard for Outside Plant Communication Cable

D. ANSI/ICEA S-83-596 – Standard for Fiber Optic Premises Distribution Cable

E. 7 CFR 1755.900 –Specifications for Filled Fiber Optic Cable.

F. National Electrical Code

1.4 SUBMITTALS

A. Submit the following information for review

1. Detailed bill of materials.

2. Catalog data and installation instructions on the splice method, hardware, and splicing equipment.

3. Catalog data on the fiber optic cable, pull boxes, connectors, cable lubricant, duct sealant, closures, pull rope, enclosures, identification tape, and mounting hardware.

4. Catalog data on the extruded, jointless polyethylene duct or conduit as applicable including reel lengths, actual inside diameter, factory test reports, pulling strength, and technical data.

5. Catalog data on the testing equipment including a written test procedure outlining the steps and methods that will be used to test the cable during and after installation. Include a sample copy of the test form that will be used in the test procedure.

6. Cable installation procedures for the applicable method of installation, outlining the construction methods that will be used. Identify steps that will be taken to ensure that the cable is not damaged during the installation. Also provide a schematic of

entire system showing proposed locations of pull boxes, splices, pull and mid-assist points, calculated pulling tensions, and direction of pull as applicable.

7. Complete factory test results for each cable reel stating the signal loss for each fiber in the cable prior to and after extrusion of duct around cable if applicable.

8. Record drawings indicating the locations of all splices and pull boxes.

9. Certified test results for each cable after installation stating the signal loss of each fiber in the cable between splices, across all splices, and from end to end after splicing is complete.

PART 2 PRODUCTS

2.1 FIBER OPTIC CABLE

A. Fiber optic cable shall be stranded loose tube non-armored all dielectric cable, including a water blocking compound for the protection of the fiber strands. The cable shall be of single jacket construction providing 50/125um multimode fiber optic cable twelve (12) or twenty-four (24) strands as indicated on the plans, and shall meet or exceed all transmission characteristics set forth in IEEE 802.3 “10GB Ethernet at 850nm” standard (CommScope F-024-LN-5M F12NS).

B. All fibers are to have mechanically strippable acrylate coating with a nominal 245µm±10µm outside diameter.

C. The coating concentrically shall be ≤ 0.70µm.

D. Coating strip force shall be 0.70lbs. wet or dry.

E. Nominal bandwidth shall be:

1. 700MHz·km at 850nm

2. 500MHz·km at 1300nm

F. Nominal attenuation shall be:

1. ≤ 3.dB/km @ 850nm

2. ≤ 1.dB/km @ 1300nm

G. Operating temperature range shall be -60°C. to +85°C.

H. Core diameter shall be nominal 50µm ± 0.5%.

I. Numerical aperture measured at the one percent power angle of one-dimensional far-field scan at 1310nm shall be 0.2 ± 0.015.

J. Zero dispersion wavelength should be nominal 1300nm with zero dispersion slope of ≤ 0.11 ps/nm

K. Tensile proof stress shall be equivalent to 100kpsi for a 1. second dwell time.

2.2 FIBER OPTIC TERMINATION SHELVES

A. Fiber optic termination shelves shall consist of chassis, removable splice trays to ensure minimum bend radius and stabilize fiber strands and splices, strand connector sleeves, card for identifying each strand.

B. The termination shelf must be suitable for wall or rack mounting

C. Each sleeve mounting panel shall be equipped with SC connectors and a pre-terminated optic cable stub of the appropriate size and length for the cable stub to splice to the main cable sheath

D. Acceptable Manufacturer

1. Siecor

2. Accepted substitution

PART 3 EXECUTION

3.1 INSTALLATION

A. The fiber optic cable race way must be continuous between fiber distribution cabinets. The protective innerduct raceway system must enter and be secured to enclosures.

B. The fiber optic cable raceway system shall be routed with largest bend radius possible. Bends in the fiber optics raceway shall be accomplished with large radius pre-formed ells. Field bending shall be in accordance with NEC minimum radii requirements. Use only equipment specifically designed for the material and sized involved.

C. The entire fiber optics raceway system shall be complete and the raceway interior cleaned prior to the installation of the fiber optics cables

D. Securely fasten the fiber optics cables or raceway to the cable tray, or walls when routed inside buildings, using clamps, and clips designed for this purpose.

E. Provide a nylon or polyethylene pulling line in all fiber optics raceways. Clearly label as “pulling line”, indicating source and destination.

F. All fiber optics cables are to be run as efficiently as possible, minimizing the amount of cable required.

G. All fiber optics cable shall be continuously lubricated during the pulling-in process. The maximum pulling tensions specified by the cable manufacturers shall not be exceeded. Monitor cable pulling tension with a mechanical tension meter.

H. As fiber optic cables emerge from intermediate-point pull boxes, coil the cable in a figure eight pattern with loops not less than two feet in diameter.

I. Label all fiber optic cables at both ends. The label shall be permanent. Labels shall be produced by mechanical means, (not handwritten) and individual number strips are unacceptable. All cable labeling shall include numeric designation, source, destination, and cable type.

J. Fiber optics raceways shall be clearly marked with “CAUTION Fiber Optic Cable” markers on the outside at each pull box, indicating type and number of cables within.

K. If connectors have been factory installed on fiber optic cables, protect the connector during the pulling-in by wrapping with a thin layer of foam and insert in a stiff plastic sleeve for protection.

3.2 TESTING

A. Manufacturer shall provide an OTDR test on each fiber strand prior to shipping. Contractor must forward a copy of these test results to Engineer. A second “on-reel” OTDR test shall be preformed when the cable is delivered to the construction site. Any difference greater

than 5% of the Manufacturer's tests must be investigated and resolved before cable reel is dispatched to the construction site. Results of this "on-reel" test must be forwarded to the Engineer with 24 hours of test completion.

B. The fiber optic cable shall be acceptance tested by the Contractor prior to installation. An optical time-domain reflectometer or Power Source/Light Meter with printer output shall be used to generate a baseline performance test. The Contractor shall return, at his or the Manufacturer's sole expense, any span of fiber optic cable identified as noncompliant based on the results of this test. A copy of the baseline test of all fiber spans shall be provided to the Engineer for comparison to the final installed cable OTDR or Light Source and Power Meter test results to be performed upon completion of the installation.

C. Standard tests for correct fiber identification and termination shall be performed during the installation to ensure proper installation and cable placement. Engineer's representative may, at their discretion, perform tests in addition to those specified herein if there is any reason to question the condition of the material as furnished or installed. All testing accomplished shall be documented by the party conducting the test. These test results shall be submitted to the Engineer.

D. A final test of the working installed fiber optic system shall be performed to demonstrate the acceptability of the project as installed. Testing shall be performed in accordance with a test plan supplied by the Contractor and approved by the Engineer. All labor, equipment, and instruments required to conduct the test shall be furnished by the Contractor. Any defective workmanship or material shall be corrected by the Contractor and re-tested. As a minimum, final testing for the fiber optic cable system, including spare cable, shall verify the conformance of attenuation, length, and bandwidth parameters with the performance specifications. Testing shall be in accordance with EIA-455-53.

E. An optical Light Source and Power Meter such as Seicor's Optical Meter/Source Model #OTS/111D or approved equivalent shall be employed for the testing of signal strength and optical connectivity.

F. Testing Procedures. The tested actual loss value shall be compared to the theoretical loss calculated using the following attenuation criteria.

G. ST Type connectors (per mated pair): Multi-mode- 0.5 dB

H. Fiber Cable: Multi-mode

1. 3.75 dB/km @ 850 nm
2. 1.5 db/km # 1300 nm

I. The Cabling Contractor shall calculate the theoretical loss using installed cable lengths and compare and contrast this loss with the actual measured loss for each fiber, and submit these test results and comparisons to the Engineer for review.

J. If the actual loss exceeds the theoretical loss, then the fiber shall be considered as having not passed the acceptance criteria. Perform one of the following based on the requirements of the system and project schedules:

1. Re-test to insure accurate readings from the first test
2. Properly isolate the fiber from use in the system
3. Replace the defective fiber optic cable

K. Each strand of each cable shall be tested from each end at both 850nm and 1300nm using a Light Source and Power Meter.

END OF SECTION

SECTION 27 27 26 - WIRING DEVICES AND PLATES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. This Section of the Specifications covers wiring devices, i.e., switches, convenience outlets and special outlets; as well as device plates and special outlet boxes.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00 - Submittals

B. Section 01 77 00 - Contract Closeouts

C. Section 26 01 00 - Electrical General Provisions

D. Section 26 05 33.01 - Boxes and Fittings

E. Section 26 05 26 - Grounding

1.3 REFERENCE STANDARDS

A. FSW-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet.

B. NEMA WD 1 - General Purpose Wiring Devices

C. NEMA WD 5 - Specific Purpose Wiring Devices

D. ANSI/UL 20 - General Use Snap Switches

E. ANSI/UL 498 - Electrical Attachment Plugs and Receptacles

F. National Electrical Code

1.4 ACCEPTABLE MANUFACTURERS

A. Switches

1. Arrow Hart
2. Hubbell
3. Bryant
4. General Electric
5. Pass & Seymour (P&S)
6. Engineer Approved Equal

B. Receptacles

1. Arrow Hart

2. Hubbell
3. Bryant
4. General Electric
5. Pass & Seymour (P&S)
6. Engineer Approved Equal

PART 2 PRODUCTS

2.1 DEVICES

A. Wall Switches shall be specification grade rated 20 amp, 125 volts of appropriate color (ivory unless otherwise noted). Equal to G.E. 5951-2.

B. Convenience outlets shall be specification grade duplex, 3 wire, grounding, 20 amp, 125 volts, G.E. 4108-2, or equal. Furnish G.F.I. type P&S No. 1591, or equal, for installation outdoors and elsewhere as noted.

C. Use twist-lock receptacles for connection of cord connected equipment. Rating to be as required by equipment. Furnish matching plug.

D. For manual starting of single phase motors below 1/2 HP, provide manual start switches. Manual start switches to be Allen Bradley Bulletin 600 Series, Square D Class 2510 or 2512, or approved equal by General Electric or Eaton.

E. Wiring devices located in Class 1 hazardous areas shall be installed in Nema 7 enclosures and shall be factory sealed.

2.2 DEVICE PLATE AND COVERS

A. Cadmium or stainless steel plates shall be throughout. Plastic coverplates will not be accepted.

B. Plate mounting screws shall be the same finish as the plates and be constructed of stainless steel or brass.

C. Weatherproof device plates shall be lockable in the "on" or "off" position.

D. Weatherproof outlet covers shall be spring door with hasp suitable for pad locking in the closed door position. Covers shall accommodate wiring such that weatherproof rating is maintained even with the plug inserted in the receptacle (In-Use Type).

E. The circuit number of each circuit serving each receptacle shall be indicated on each coverplate by an engraved plastic nameplate.

PART 3 EXECUTION

3.1 DELIVERY AND STORAGE

A. Delivery. Prepare wiring devices and accessories for shipment in weatherproof and crush

resistant packaging.

B. Storage and Handling at Job Site. The Contractor shall store and handle all wiring devices at the job site, while such materials are awaiting installation, in conformity with the following:

1. Store wiring devices and accessories in an area protected from weather, moisture or possible damage.
2. Do not store materials directly on the ground.
3. Handle items to prevent damage to interior or exterior surfaces.

3.2 INSTALLATION

A. Wall switches shall be mounted 4'-0" above floor or grade unless noted otherwise.

B. Convenience outlets indoors will be mounted 15-inches above the floor unless otherwise indicated.

C. Install twist-lock plugs on cord connected equipment.

D. Mount convenience outlets outdoors on galvanized channel iron or stainless steel Unistrut supports per Section 26 05 29. Mounting height shall be 30" above finished grade or slab level as applicable.

END OF SECTION

SECTION 31 05 13 - TOPSOIL

PART 1 GENERAL

1.1 SUMMARY

A. Description: This item shall consist of preparing the ground surface for topsoil application, removing topsoil from designated stockpiles or areas to be stripped on the site or from approved sources off the site, and placing and spreading the topsoil on prepared areas in accordance with this specification at the locations shown on the Drawings or as directed by the Engineer.

B. Section Includes:
   1. Topsoil materials.

1.2 UNIT PRICES - MEASUREMENT AND PAYMENT

A. Basis of Measurement: The measurement of Topsoil will not be paid for as a separate bid item but shall be considered incidental to the item for which it pertains.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures

B. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.

C. Materials Source: Submit name of imported materials source.

1.4 QUALITY ASSURANCE

A. Furnish topsoil material from single source throughout the Work, unless directed otherwise by Engineer.

PART 2 PRODUCTS

2.1 TOPSOIL MATERIALS

A. Topsoil:
   1. This material shall consist of approved topsoil material and shall be clean, friable, loamy soil capable of supporting plant life
   2. This material can be excavated and reused material from on-site sources, or imported from an approved off-site source.
   3. Reasonably free of roots, rocks larger than 2 inches, subsoil, debris, weeds, and foreign matter.
   4. Acidity range (pH) of 5.5 to 7.5.
   5. Containing minimum of 4 percent and maximum of 25 percent organic matter.
   6. Conforming to ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System). Group Symbol OH or PT.

7. Limit decaying matter to 10 percent of total content by volume.

2.2 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements

B. When tests and/or observations indicate materials do not meet specified requirements, change material and retest.

C. Furnish materials of each type from same source throughout the Work, unless otherwise approved by Engineer. Off-site borrow sources shall be approved by the Engineer.

PART 3 EXECUTION

3.1 EXCAVATION

A. Perform as specified in Section 31 23 16 - Excavation

3.2 STOCKPILING

A. Stockpile materials at locations designated or approved by Engineer.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Stockpile topsoil to only a height which yields safe slope stability.

E. Prevent intermixing of soil types or contamination.

F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

3.4 PLACING TOPSOIL

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, and stones in excess of 2 inches in size.

C. Scarify surface to depth of 4 inches, or as indicated on the Drawings, where topsoil is scheduled.

D. Place topsoil in areas where seeding and/or sodding is required to nominal depth of four inches (plus or minus ½ inch), or as indicated on the Drawings. For areas that will receive sod, leave topsoil low. Place topsoil during dry weather.

E. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.

F. Remove roots, weeds, rocks, and foreign material while spreading.

G. Manually spread topsoil close to plant material, structures, water and wastewater appurtenances, concrete paving, and curbs to prevent damage.

H. Lightly roll placed topsoil.

I. Remove surplus topsoil from site.

J. Leave stockpile area and site clean and raked, ready to receive seeding or sodding.

K. Prohibit construction traffic over topsoil.

END OF SECTION

SECTION 31 10 00 - CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Removing and disposing of surface debris, rubbish, and other objectionable materials.
2. Removing and disposing of designated building slabs, paving, curbs, driveways, miscellaneous stone, brick, concrete, sidewalks, drainage structures, headwalls, safety end treatments, manholes, inlets, and abandoned railroad tracks.
3. Removing and disposing of designated fencing and signage.
4. Removing and disposing of designated trees, shrubs, and other plant life.
5. Removing and disposing of designated abandoned water and wastewater utilities and septic tanks.
6. Herbicide treatment
7. Excavating topsoil.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Clearing will not be paid for as a separate bid item, but shall be considered incidental to the item for which it pertains.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures

B. Product Data: Submit data for herbicide. Indicate compliance with applicable codes for environmental protection.

1.4 QUALITY ASSURANCE

A. Conform to applicable code for environmental requirements, disposal of debris, burning debris on site, and use of herbicides.

B. Herbicide:
1. License Requirements: Possess either a commercial pesticide applicator license from the Texas Department of Agriculture, or a Texas Structural Pest Control Service License. Provide documentation of license before beginning work. Conduct on-site supervision of all mixing, transporting, handling, spraying, and disposal of materials with licensed personnel.
2. Records: Document work in accordance with all Federal, State, and Local regulations. Submit a copy of the herbicide records on the next business day following application. Submit a final copy of all the herbicide application records upon completion of the work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Herbicide: Furnish herbicide materials in accordance with Section 15 of the 2022 TxDOT Herbicide Operations Manual.

B. Pathfinder II, Transline, & Capstone are acceptable products that can be used in conjunction with each other.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify existing plant life designated to remain is tagged or identified.

C. Identify spoils site for placing removed materials.

3.2 PREPARATION

A. Call Texas 811 service at 800-344-8377 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Prior to commencing this work, erosion control measures shall be in place.

3.3 PROTECTION

A. Locate, identify, and protect structures and utilities indicated to remain from damage.

B. Areas within the construction limits or as indicated shall be cleared of all trees, stumps, brush, etc. as defined above; except trees or shrubs indicated for preservation which shall be carefully trimmed as directed, and shall be protected from scarring, barking or other injuries during construction operations. Exposed ends of pruned limbs or scarred bark shall be pruned, trimmed and treated with an approved asphaltic material within 24 hours of the pruning or injury.

C. Locate, protect, and maintain benchmarks, monuments, control points, and project engineering reference points. Re-establishment of disturbed or destroyed items shall be by a Registered Professional Land Surveyor (licensed in the state of Texas), at no additional cost to Owner.

D. Construction equipment shall not be operated within the drip line of trees, unless indicated. Construction materials shall not be stockpiled under the canopies of trees. No excavation or embankment shall be placed within the drip line of trees until tree wells are constructed.

3.4 CLEARING

A. Strip and remove from construction area all topsoil, organics, and vegetation to a minimum depth of 6 inches below the existing natural ground surface.

B. Remove trees and shrubs within the construction limits unless noted otherwise in the Drawings. Remove stumps, main root ball, and root system. Holes remaining after the removal of all obstructions, objectionable materials, trees, stumps, etc. shall be backfilled with Select Fill and compacted in accordance with Section 31 23 23 - Fill.

C. Clear undergrowth and deadwood, without disturbing subsoil.

D. Apply herbicide to remaining stumps to inhibit growth.

3.5 REMOVAL

A. Remove surface debris, rock, and extracted trees, shrubs and other plant life from site, or as indicated on Drawings.

B. Remove designated building slabs, paving, curbs, driveways, miscellaneous stone, brick, concrete, sidewalks, drainage structures, headwalls, safety end treatments, manholes, inlets, and abandoned railroad tracks as indicated on Drawings. Neatly saw cut edges at right angle to surface.

C. Remove designated fencing and signage.

D. Remove abandoned water and wastewater utilities and septic tanks. Indicated removal termination point for underground utilities on Record Documents.

E. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

F. Do not burn or bury materials on site. Leave site in clean condition.

3.6 HERBICIDE TREATMENT

A. Season: Spray herbicide during active growing periods unless otherwise approved.

B. Equipment: Furnish all equipment.
   1. Broadcast application: furnish self-propelled equipment tractor mounted or pulled spray rigs with a low center of gravity that allows safe traverse on a maximum 3:1 slope. Provide equipment capable of making uniform broadcast applications calibrated at a rate between 20 and 40 gallons per acre (GPA).
   2. Basel Bark and Cut Tree applications: Furnish sprayers with low volume spray tips (spray system 5500 adjustable spray tip X-1 or X-2, or approved equivalent).
   3. Personal Protection Equipment: Follow the manufacturer’s label requirements for personal protection of employees.

C. Work Methods: Apply approved herbicide in accordance with the manufacturer’s label recommendations, as shown on the drawings or as approved. Add surfactant and blue dye

marker at the manufacturer's recommended rate unless otherwise approved. Prepare herbicide solution to the rates shown on the drawing using procedures on the herbicide container label. Dispose of empty containers and unused chemical mixtures in accordance with the label directions and local, state, and federal regulations. Cease spraying operation immediately when wind or other environmental conditions cause off-target spray drift, leaves are wet, or rainfall is imminent. An inspection of the treated areas will be made not less than 14 days and no later than 30 days after the application. Re-treat areas in which the undesirable vegetation has not be controlled for no additional compensation. Repair and replace any damaged desirable vegetation or erosion as a result of negligent applications.

1. Broadcast application: spray undesirable vegetation by broadcasting with spray nozzles at the desired rate. Ensure nozzles spray consistent across the area being covered.
2. Basal Bark treatment: apply herbicide solution with a low-volume, low pressure sprayer which thoroughly wets the lower 12-15 in. of stems on all sides, including the root collar area, but not to the point of run-off. Perform application at any time throughout the year, except when the stumps are wet from rainfall or dew prevents spraying to the base of the plant.
3. Cut-stump treatment: cut plants parallel to the ground, not to exceed 2 in. above the ground line. Apply the herbicide solution with a low-volume, low-pressure sprayer which thoroughly wets the area adjacent to the cambium and bard around the entire circumference of the stump. Thoroughly wet the sides of the stump, but not to the point of run-off. Make the herbicide application within 1 hr. from the time each plant is cut. Dispose of removed materials and debris at appropriate off-site locations in accordance with local, state, and federal requirements.

D. Engineer reserves the right to pay a partial payment of 50% of the lump sum price bid after the initial application is performed. The final 50% of the lump sum price bid will be paid after the inspection and required re-treatments have been completed and accepted.

3.7 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, relandscaped, regraded, or within the construction limits of a structure without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to a height which yields safe slope stability and protect from erosion.

D. Remove excess topsoil not intended for reuse from project.

END OF SECTION

SECTION 31 23 15 - TRENCH SAFETY SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Furnishing all equipment, materials and labor for a trench safety system meeting appropriate requirements established in Occupational Safety and Health Administration (OSHA) Safety and Health Regulations, 29 CFR Part 1926, OSHA Standards – Excavations; Final Rule, October 31, 1989. In the event of conflict of published and proposed rules, the more stringent requirement shall be used.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Trench Safety Plan and trench safety implementation will not be paid for as a separate bid item, but shall be considered incidental to the item for which they pertain.

1.3 REFERENCES

A. Federal Occupational Safety and Health Administration (OSHA) Standards – 29 CFR, Part 1926, Subpart P, as amended, including Proposed Rules published in the Federal Register (Vol. 52, No. 72) on April 15, 1987; Sections 1926-650 through 1926-653.

B. Texas Legislature House Bill No. 662 and House Bill No. 665 with regard to Trench Safety Systems.

1.4 DEFINITIONS

A. Trench: A trench shall be defined as a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures

B. Trench Safety Plan: Prior to construction the Contractor shall submit five copies of a trench safety system to the Engineer specifically for the construction of trench excavation. The trench safety system shall be in accordance with OSHA standards governing the presence and activities of individuals working in and around trench excavation. The trench safety system must be designed and sealed by a professional engineer registered in the State of Texas with professional experience in Soil Mechanics. The Contractor is responsible for obtaining borings and soil analysis as required for plan design. After receiving the trench safety system plans, the Engineer will forward a copy of the plan to the project inspector, to the Contractor and keep one file copy. The submittal is only for general conformance review with OSHA safety standards and the review does not relieve the Contractor or design professional of any or all construction means, methods, techniques and procedures. Any property damage, bodily injury or death that arises from use of the trench safety system or from the Owner’s failure to note exceptions to the system shall remain the sole responsibility of the Contractor. No trenching in excess of 5 feet below existing grade will be allowed until the plan is submitted. Any changes

in the trench safety system after the initiation of construction will not be cause for extension of time or change order and will require the same review process. On some projects, the Owner may elect to provide preliminary soil information to the Contractors for bid purposes only and not as a substitute for required soil data for design use. The Owner assumes no liability nor makes any guarantees by the inclusion of any soil data.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with OSHA Regulations, 29 CFR Part 1926, OSHA Standards.

B. Maintain one copy of OSHA Standards on site.

1.7 QUALIFICATIONS

A. Prepare Trench Safety Plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Texas.

PART 2 PRODUCTS

2.1 TIMBER

A. Trench sheeting materials shall be a minimum of 2 inches in thickness, solid and sound, free from weakening defects such as loose knots and splits. Shoring timber sizes shall not be less than that called for on the Trench Safety Plan.

2.2 STEEL SHEET PILING

A. Steel sheet piling and steel for stringers and cross braces shall conform to ASTM A36 – Standard Specification for Carbon Structural Steel.

2.3 TRENCH BOXES

A. Portable trench boxes shall be constructed of steel conforming to ASTM A36 - Standard Specification for Carbon Structural Steel. Connecting bolts shall conform to ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength. Welds shall conform to requirements of AWS Specification D1.1 – Structural Welding-Steel.

PART 3 EXECUTION

3.1 GENERAL

A. Trench safety systems shall be constructed, installed and maintained in accordance with the design prepared by the Contractor’s registered Professional Engineer licensed to practice in the State of Texas to prevent death or injury to personnel or damage to structures in or near these trench excavations. Materials excavated from trench to be stored no closer to the edge of trench than 1/2 the depth of the trench.

3.2 INSTALLATION

A. Timber Sheeting: Installed in accordance with detail shown on drawings. Drive timber sheeting to a depth below trench bottom as shown on Drawings. Size of uprights, stringers and cross bracing to be in accordance with details shown on Drawings. Place cross braces in true horizontal position, spaced vertically, and secured to prevent sliding, falling or kickouts.

B. Steel Sheet Piling: Steel sheet piling of equal or greater strength may be substituted for timber trench shoring shown on the drawings. Contractor to provide certification that steel sheet piling substituted provides equal or greater protection than timber trench shoring shown on drawings. Certification of steel sheet piling to be provided by registered Professional Engineer. Drive steel sheet piling to a minimum depth below trench bottom as recommended by Contractor's registered Professional Engineer licensed to practice in Texas providing design. Place cross braces in true horizontal position, spaced vertically and secured to prevent sliding, falling or kickouts.

C. Trench Boxes: Portable trench box to be substituted for timber trench shoring shown on Drawings shall be designed or the design checked by Contractor's registered Professional Engineer licensed to practice in Texas. Design trench box to provide equal or greater protection than timber trench shoring shown on Drawings. Certification of the design of trench boxes shall be provided by Contractor prior to its use on project. In cases where top of portable trench box will be below to top of trench, the trench must be sloped to an angle greater than the angle of repose for the soil conditions existing on the project. In areas where sloped trench will affect the integrity of existing structures, Contractor to protect structures prior to sloping trench.

D. Trench Jacks: When trench jacks are used for cross bracing and/or stringers, the Contractor shall provide certification by a registered Professional Engineer licensed to practice in Texas that the trench jacks provide protection greater than or equal to the timber cross bracing shown on Drawings.

3.3 SUPERVISION

A. Contractor shall provide competent supervisory personnel at each trench while work is in progress to ensure Contractor's methods, procedures, equipment and materials pertaining to the safety systems in this item are sufficient to meet requirements of OSHA Standards.

3.4 MAINTENANCE OF SAFETY SYSTEM

A. The safety system shall be maintained in the condition as shown on Drawings or as specified by the Contractor's registered Professional Engineer licensed to practice in Texas. The Contractor shall take all necessary precaution to ensure the safety systems are not damaged during their use. If at any time during its use a safety system is damaged, personnel shall be immediately removed from the trench or excavation area and the safety system repaired. The Contractor shall take all necessary precautions to ensure no loads, except those included in the safety system design, are imposed upon the excavation.

3.5 REMOVAL

A. Bed and backfill pipe to a point at least one foot above top of pipe prior to removal of any portion of trench safety systems. Bedding and backfill shall be in accordance to other applicable specification items. Backfilling removal of trench supports shall progress together from bottom of trench upward. Remove no braces or trench supports until all personnel have evacuated the trench. Backfill trench to within 4 feet of natural ground prior to removal of entire trench safety systems.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements.

B. Inspection: Contractor shall make daily inspection of trench safety systems to ensure that the systems meet OSHA requirements. Daily inspections shall be made by competent personnel. If evidence of possible cave-ins or slides is apparent, all work in the trench shall cease until necessary precautions have been taken to safeguard personnel entering trench. Contractor shall maintain permanent record of daily inspections.

END OF SECTION

SECTION 31 23 16 - EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

A. Description: This item shall consist of excavating and properly utilizing or otherwise satisfactorily disposing of all excavated material, of whatever character, within the limits of the work indicated and the constructing, compacting, shaping and finishing of all earthwork on the entire project in accordance with the specification requirements herein outlined and in conformity with the required lines, grades and typical cross sections indicated or as directed by the Engineer. **All excavation shall be unclassified and shall include all materials encountered regardless of their nature or the manner in which they are removed.**

B. Section Includes:
   1. Soil compaction.
   2. Excavating for structures and foundations.
   3. Excavating for paving, roads, and parking areas.
   4. Excavating for slabs-on-grade.
   5. Excavating for site structures.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Excavation will not be paid for as a separate bid item, but shall be considered incidental to the item for which it pertains.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

C. If an excavation can be defined as a “trench,” then a Trench Safety Plan must be submitted in accordance with Section 31 23 15 – Trench Safety Systems.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION

3.1 PREPARATION

A. Erosion control and tree protection measures shall be in place prior to commencing work.

B. Construction equipment shall not be operated within the drip line of trees, unless indicated.

C. Construction materials shall not be stockpiled under the canopies of trees. No excavation or embankment shall be placed within the drip line of trees until tree wells are constructed as indicated on the Drawings.

D. Call Texas 811 service at 800-344-8377 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

E. Call Local Municipality(ies) not less than 2 weeks before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

F. Notify utility company(ies) to remove and relocate utilities as indicated on the Drawings.

G. Protect utilities indicated to remain from damage.

H. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.

I. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.2 EXCAVATION

A. All excavation shall be performed as specified herein and shall conform to the established alignment, grades and cross sections.

B. Suitable excavated “on-site” materials (Subsoil Type S3) may be utilized, insofar as practicable and when the material meets the criteria outlined in Section 31 23 23 - Fill in constructing required embankments and “fill” areas.

C. Materials with a Plasticity Index (PI) greater than the surrounding materials or with a moisture content greater than 2 percent in excess of optimum shall be classified as unsuitable and must be manipulated to meet the above criteria before use or be removed.

D. Unsuitable excavated materials or excavation in excess of that needed for construction shall be known as “Waste” and shall become the property of the Contractor. It shall become his sole responsibility to dispose of this material off the limits of the right of way in an environmentally sound manner at a permitted disposal site.

E. When required by the Engineer, the Contractor will set “blue-tops” for the subgrade.

F. Excavate subsoil to the final subgrade elevation(s) to accommodate structural foundations, slabs-on-grade, paving, site structures, and civil site facilities.

G. Grade top perimeter of excavation to prevent surface water from draining into excavation.

H. Trim excavation. Remove loose matter.

I. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume. Remove larger material as specified in Section 31 23 23 - Fill.

J. Notify Engineer of unexpected subsurface conditions.

K. Correct areas over excavated with Structural Fill as specified in Section 31 23 23 – Fill.

L. Remove excess and unsuitable material from site.

M. Stockpile subsoil in area designated on site to depth not exceeding 8 feet and protect from erosion.

N. Repair or replace items indicated to remain damaged by excavation.

3.3 SUBGRADE PREPARATION FOR STRUCTURES AND PAVEMENTS

A. After final subgrade elevation has been achieved, the exposed subgrade soils (subsoils) shall be scarified to a minimum depth of 6 inches. Compaction of the subsoil shall be to a minimum of 95% and less than 100% of its maximum dry density when determined in accordance with ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort, Method D, Standard Proctor. The subsoil shall be no less than its optimum moisture to no greater than 3 percentage points above its optimum moisture content at the time of testing. The moisture content shall be maintained until subsequent construction activities commence.

3.4 FIELD QUALITY CONTROL

A. Sections 01 40 00 - Quality Requirements.

B. Request inspection of excavation, subgrade preparation, and density-controlled fill operations in accordance with Section 31 23 23 - Fill.

C. Request visual inspection of bearing surfaces by Engineer before installing subsequent work. The Engineer shall be notified not less than three working days prior to the visual inspection.

3.5 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 31 23 17 - TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Description: This work shall include the furnishing of all labor, materials, tools, equipment and machinery necessary for clearing and removing from the site of the work wherever located, all obstructions, trees, stumps, brush, vegetation, woods and debris; and all earth, rock and other materials to be excavated; the removal of existing structures except where specifically paid for as separate contract pay items; the replacement of topsoil after backfilling is completed; the installation and operation of all pumping, bailing and draining necessary to keep the excavation free from seepage water, water from sewer, drains, ditches, creeks and other sources, and to provide for the uninterrupted flow of sewers and surface waters during progress of the construction; the satisfactory disposal of excess and unsuitable materials not required or which cannot be used for backfilling; compacting and refilling, after settlement of all excavated areas; the restoration of all streets, alleys, rights-of-way and other lands, private or public, damaged or occupied by the Contractor in the performance of the contract to the same (or improved) condition as they were prior to the beginning of the work.

B. Section Includes:
1. Excavating trenches for utilities.
2. Compacted fill from top of embedment to subgrade elevations.
3. Backfilling and compaction.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Trenching measurement and payment shall be considered subsidiary to the utility construction for which it pertains.

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures

B. Trench Safety Plan: A Trench Safety Plan, which describes sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property shall be submitted in accordance with Section 31 23 15 – Trench Safety Systems.

C. Product Data: Submit data for geotextile fabric (when specified) indicating fabric properties and manufacturing data; and construction methods.

D. Materials Source: Submit name of imported fill materials suppliers

1.5 QUALIFICATIONS

A. Prepare Trench Safety Plan as per Section 31 23 15 – Trench Safety Systems.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to construction.

1.7 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 MATERIALS

A. Embedment Material: The type of embedment to be used for storm sewers, sanitary sewers or water mains shall be one of the following:
   1. Coarse Aggregate Type A1 (Flexible Base) per Section 32 11 23 – Flexible Base.
   2. Coarse Aggregate Type A4 (Gravel for Trench Backfill) per Section 32 05 16 - Aggregates for Civil Site Improvements.
   3. Flowable Fill per Section 31 23 24 – Flowable Fill.

B. Concrete Encasement: Concrete encasement shall consist of lean concrete with a compressive strength of 2000 psi.

C. Trench Backfill:
   1. Backfill above embedment material (outside traffic areas): Excavated backfill material outside of traffic areas shall consist of an excavated material of gravel, fine rock cuttings, sandy loam, or clay having dimensions no greater than 2 inches, and compacted per applicable sections of this specification.
   2. Backfill above embedment material (beneath pavements):
      a. Coarse Aggregate Type A1 (Flexible Base) per Section 32 11 23 – Flexible Base and compacted as specified herein.
      b. Coarse Aggregate Type A4 (Gravel for Trench Backfill) per Section 32 05 16 - Aggregates for Civil Site Improvements and compacted as specified herein.
      c. Flowable Fill per Section 31 23 24 – Flowable Fill.

2.2 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven or non-woven, from the following manufacturers:
   1. U.S. Fabrics, Inc.
   2. Alkzo Nobel Geosynthetic Co.
   3. Huesker, Inc.
   4. TC Mirafi.
   5. Tenax Corp.
   6. Tensar Earth Technologies, Inc.

PART 3 EXECUTION

3.1 LINES AND GRADES

A. Construct the trenches to lines and grades indicated on Drawings.
   1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with a qualified operator to establish lines and grades.

C. Submit electronic layout plans from the pipe manufacturer for review and approval at least 30 days in advance of any actual construction of the project. The Engineer will forward all comments of the review to the Contractor for revision. Revisions shall be made and forwarded to the Engineer for his acceptance. Prior to commencement of the Project, reviewed layout plans will be sent to the Contractor marked for construction.

D. Should the Contractor's procedures not produce a finished pipe placed to grade and alignment, the pipe shall be removed and re-laid, and the Contractor's procedures modified to the satisfaction of the Engineer. No additional compensation shall be paid for the removal and relaying of pipe required above.

3.2 PREPARATION

A. Call Texas 811 service at 800-344-8377 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 TRENCHING

A. Site Preparation: The construction site shall be prepared for construction operations by the removal and disposal of all obstructions and objectionable materials from the designated construction area. Such obstructions and objectionable materials shall include the removal of designated trees, bushes, grass, miscellaneous stone, brick, concrete, scrap iron and all rubbish and debris whether above or below ground level. It is the intent of this specification to provide for the removal and disposal of all objectionable materials not specifically provided for elsewhere by the Drawings and specifications. The removal of such items shall be

accomplished prior to grading and excavation operations. The removal and disposal of such items shall not be measured or paid for as a separate contract pay item. Such items shall be considered as incidental work and the cost thereof shall be included in such contract pay item as provided in the proposal and contract.

B. Maintenance of Streets During Construction:
   1. Maintain the surfaces of streets being worked on at all times. The maintenance required shall include the filling of holes, blading or otherwise smoothing of the street surfaces (particularly the trench area), cleaning and removal of surplus excavation material, rubbish, etc., sprinkling of streets with water or abate dust nuisances and the elimination of interference resulting from blocking the street to residents thereon. Any or all such operations shall be performed by the Contractor upon demand by the Owner, but the Contractor shall not wait for instruction from the Owner before performing maintenance work obviously in need of being done to meet the requirements of these specifications. All costs of work covered by this paragraph shall be included in the prices bid for the various items of work; and no separate payment shall be made.
   2. In the event the Contractor fails or refuses to properly maintain the surfaces of streets on which he is working or has worked, the Owner, after due notice to the Contractor, shall perform the necessary maintenance. All costs to the Owner incurred in the performance of such work shall be deducted from any monies due or to become due to the Contractor for work performed, or the Contractor shall be billed for such costs directly as the Owner shall elect. Notice to the Contractor to be given by the Owner shall be in writing, and it shall be delivered to the Contractor or his authorized agent. Except in emergency cases, where immediate action is required, the Contractor shall have 24 hours in which to comply with the instructions of the Owner. Should the Contractor fail to do so, the Owner shall proceed with the work as set forth above.
   3. Where traffic must cross open trenches, such as street intersections and driveways, the Contractor shall provide suitable backfill bridges, protective barricades and such other safety equipment as required. The use of machinery must be so regulated as to preclude any unnecessary interference with traffic, utilities, etc. The Contractor shall abide by all applicable federal, state or local laws governing excavation work.

C. Soil Borings: Whenever the Owner has caused certain test borings to be made on the site, or when any information pertaining of the character or depth of materials is found from observations, records or otherwise, such information revealed thereby may be provided to the Contractor. The action of the Owner in revealing such information shall not, in any manner, be construed as a warranty on the part of the Owner of the exact nature of the subsurface conditions that shall be encountered during construction of the work. Although the information is shown as accurately as possible, the Owner does not guarantee that any materials to be encountered at any point or points are even approximately the same, either in character or elevations, as those shown on the Drawings. The information thus furnished by the Owner is intended only as a guide to the Contractor in making his own investigations preliminary to submitting a bid for the work.

D. Existing Structures:
   1. All existing structures, improvements and utilities shall be adequately protected, at the expense of the Contractor, from damage that might otherwise occur due to construction operations. Where construction comes in close proximity to existing structures or utilities, or if it becomes necessary to move services, poles, guy wires, pipe lines or other obstructions, the Contractor shall notify and cooperate with the utility or structure Owner.

The utility lines and other existing structures shown on the Drawings are for information only and are not guaranteed by the Owner to be complete or accurate as to the location and/or depth. The Contractor shall be liable for damage to any utilities resulting from his operation. During construction, all fire hydrants, valve boxes and other existing utility controls shall be left intact, unobstructed and accessible as noted on the plan.

a. Relocation or Replacing Utilities: Unless noted on the Drawings that utilities are to be moved by others, any cost of temporarily or permanently relocating utilities shall be borne by the Contractor. The cost of these replacements shall be included in the Contractor's bid price for the various items of work; and no separate payment shall be made. In case damage to an existing structure or utility occurs, whether such damage results directly or indirectly from the Contractor's operations, the Contractor shall be responsible to restore the structure or utility to its original condition and position without extra compensation. Temporary shut down of water and/or sewer services shall not extend overnight, holidays or weekends. The Owner shall approve all shut downs and may assist in the shut down operations.

b. Sewer Services: All sewer services damaged during construction shall be replaced by the Contractor at his expense. Sewer service reconnections, including necessary adjustments to a sanitary sewer replacement, shall not require the services of a master plumber, if being replaced by a utility Contractor; however, in all cases, repair shall be inspected by the Owner. It shall be the responsibility of the Contractor to maintain such services throughout the construction process.

c. Water Services: Service lines shall not be removed during excavation; and the Contractor shall provide adequate support for the services across the open ditch.

d. Interrupted Service: Cuts or breaks in sewer mains and laterals, or service connections, shall be restored at the earliest practicable moment in order to give the least possible interruption in service. The Contractor shall be responsible for notifying customers of temporary interruption of service.

e. Other Utilities: All water mains, water services, sanitary sewers, sanitary sewer house laterals, storm sewers, power conduits, gas mains, gas service laterals and other appurtenances damaged during construction shall be repaired or replaced. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary. Extra compensation shall not be paid for such delays. When it is necessary to remove or adjust another utility, a representative of that utility shall be notified to decide method and work to be done. The Contractor shall make satisfactory arrangements with other utilities for the required cutting or adjustments at the Contractor's own expense. Other than for items that may be provided in the contract for such work. No extra compensation shall be paid due to delays caused by removal of public utility structures.

f. Street Sign Posts and Signs: The Contractor shall be responsible for all damage to street sign posts and signs within the limits of his operations that remain in place or are removed and replaced. In the event that street sign posts and signs are damaged or destroyed by the Contractor's operations, they shall be replaced at the Contractors' expense.

g. Methods of Removal and Disposal: Materials or parts of structures which are to be broken up, dismantled or removed, and which are to be salvaged, shall be removed, loaded, cleaned and unloaded at sites designated by the Owner.

Materials which are not designated to be salvaged shall become property of the Contractor; and he shall dispose of the material at his own cost and expense.

E. Do not advance open trench more than 200 feet ahead of installed pipe, unless preapproved by Engineer.

F. Trench Width
1. Trenches for pipes less than 20 inches in diameter shall have a minimum width of 10 inches and a maximum width of 1 foot on each side beyond the outside surfaces of the pipe bell or coupling.
2. Trenches for pipes between 21 and 48 inches in diameter shall have a minimum width of 12 inches and a maximum width not to exceed one pipe diameter on each side beyond the outside surfaces of the pipe.
3. Trenches for pipes 54 inches in diameter and larger shall have a minimum width of 15 inches and a maximum width of one pipe diameter beyond the outside surfaces of the pipe.
4. If trench width within the pipe zone exceeds this maximum, the entire pipe zone shall be refilled with approved backfill material, thoroughly compacted to a minimum of 95 percent of maximum density and then re-excavated to the proper grade and dimensions. Excavation along curves and bends shall be so oriented that the trench and pipe are approximately centered on the centerline of the curve, using short links for pipe and/or bend fillings if necessary.
5. For all utilities to be constructed in fill above natural ground, the embankment shall first be constructed to an elevation not less than 1 foot above the top of the utility after which excavation for the utility shall be made as indicated.

G. Alternative Trench Width for Use with Free-Flowing Granular Embedment Material
1. Based upon preapproval by Engineer, Contractor may use the alternative trench widths in conjunction with free-flowing granular embedment material. The minimum and maximum alternative trench widths are specified below; however, in most instances the minimum trench width shall be that width which is sufficient to insure working space between the outside surface of the pipe and the trench wall to safely place trench safety equipment and to properly place and compact the embedment materials.
a. Trenches for pipes less than 18 inches in diameter shall have a minimum width of 8 inches and a maximum width of 24 inches on each side beyond the outside surfaces of the pipe bell or coupling.
b. Trenches for pipes 18 inches in diameter or greater shall have a minimum width of 6 inches and a maximum width not to exceed one pipe diameter on each side beyond the outside surfaces of the pipe.

H. Trench Depth and Depth of Cover
1. All pipe and in-line appurtenances shall be laid to the grades indicated. The depth of cover shall be measured from the established finish grade, natural ground surface, subgrade for staged construction, street or other permanent surface to the top or uppermost projection of the pipe.
a. Where not otherwise indicated, all water piping shall be laid to the following minimum depths:
1) Water piping installed in undisturbed ground in easements of undeveloped areas which are not within existing or planned streets, roads or other traffic areas shall be laid with at least 42 inches of cover.

2) Water piping installed in existing streets, roads or other traffic areas shall be laid with at least 42 inches of cover below finish grade.

2. Provide uniform and continuous bearing and support for bedding material and pipe.

I. Classification of Excavation: Excavation will not be considered or paid for as a separate item of work, so excavated material will not be classified as to type or measured as to quantity. Full payment for all excavation required for the construction shall be included in the various unit or lump sum contract prices for the various items of work installed, complete in place. No extra compensation, special treatment or other consideration will be allowed due to rock, pavement, caving, sheeting and bracing, falling or rising water, working under and in the proximity of trees or any other handicaps to excavation.

J. Dewatering Excavation: Underground piped utilities shall not be constructed or the pipe laid in the presence of water. All water shall be removed from the excavation prior to the pipe placing operation to insure a dry firm granular bed on which to place the underground piped utilities and shall be maintained in such un-watered condition until all concrete and mortar is set. Removal of water may be accomplished by bailing, pumping or by a well-point installation as conditions warrant.
In the event that the excavation cannot be dewatered to the point where the pipe bedding is free of mud, a seal shall be used in the bottom of the excavation. Such seal shall consist of lean concrete with a minimum depth of 3 inches.

K. Trench Conditions:
1. Before attempting to lay pipe, all water, slush, debris, loose material, etc., encountered in the trench must be pumped or bailed out and the trench must be kept clean and dry while the pipe is laid and backfilled. Where needed, sump pits shall be dug adjoining the trench and pumped as necessary to keep the excavation dewatered.
2. Backfilling shall closely follow pipe laying so that no pipe is left exposed and unattended after initial assembly. All open ends, outlets or other openings in the pipe shall be protected from damage and shall be properly plugged and blocked watertight to prevent the entrance of trench water, dirt, etc. The interior of the pipeline shall at all times be kept clean, dry and unobstructed.
3. Where the soil encountered at established footing grade is a quicksand, saturated or unstable material, the following procedure shall be used unless other methods are indicated:
   a. All unstable soils shall be removed to a depth of 2 feet below bottom of piped utility. Such excavation shall be carried out to the trench widths above.
   b. All unstable soil so removed shall be replaced with concrete seal foundation rock for the entire trench width or coarse aggregate materials placed in uniform layers not to exceed 6 inches, loose measure and compacted by mechanical tamping or other means which will provide a stable foundation for the utility.
   c. All forms, concrete seals, sheathing and bracing, pumping, additional excavation and backfill required shall be done at the Contractor’s expense.

L. Trench sidewalls shall be sloped, or sheeting and/or shoring shall be used in accordance with the Trench Safety Plan in order to provide safety and protection in, and to, the excavation.

M. Trim excavation. Remove loose matter.

N. Correct over excavated areas with compacted backfill as specified for authorized excavation or replace with lean concrete, or Flexible Base as directed by Engineer.

O. Removing Old Structures: When out of service masonry structures or foundations are encountered in the excavation, such obstructions shall be removed for the full width of the trench and to a depth of 1 foot below the bottom of the trench. When abandoned inlets or manholes are encountered and no plan provision is made for adjustment or connection to the new sewers, such manholes and inlets within the construction limits shall be removed completely to a depth of 1 foot below the bottom of the trench. In each instance, the bottom of the trench shall be restored to grade by backfilling and compacting by the methods provided above. Where the trench cuts through storm or wastewater sewers which are known to be abandoned, these sewers shall be cut flush with the sides of the trench and blocked with a concrete plug in a manner satisfactory to the Engineer. When old structures are encountered, which are not visible from the existing surface and are still in service, they shall be protected and adjusted as required to the finished grade.

P. Excess material or material which cannot be made suitable for use in embankments will be declared surplus by the Engineer and shall become the property of the Contractor to dispose of offsite at a permitted fill site, without injury to the City or any individual. Such surplus material shall be removed from the work site promptly following the completion of the portion of the utility involved.

Q. Stockpile subsoil in area designated on site to only a height which yields safe slope stability and protect from erosion.

3.4 SHEETING AND SHORING

A. All excavations for trenches, structures, etc. 5 feet in depth or greater are required to have a Trench Safety Plan prepared and sealed by a Registered Professional Engineer in the State of Texas in accordance with OSHA requirements and Section 31 23 15 – Trench Safety Systems of the specifications.

B. Submit Trench Safety Plan prior to any excavation.

C. When specified in the Drawings, sheeting and shoring to be left in place as part of the completed Work, cut off minimum 18 inches below finished grade. Otherwise, sheeting and shoring shall be removed at completion of excavation work.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 PIPE BEDDING AND EMBEDMENT

A. Where not otherwise provided, all piping shall be installed in a continuous envelope of embedment material meeting the requirement of materials specified herein.

B. Embedment material shall extend from 6 inches below (bedding) to 12 inches above the outer parts of the pipe (unless indicated otherwise), fittings and accessories for pipe.

C. All bracing, struts, etc., installed by the pipe manufacturer (or temporary replacements by the Contractor) shall be kept in place in the pipe, undisturbed, until the trench has been backfilled at least to the top of the pipe. When installing mortar lined and mortar coated steel pipe, all bracings, struts, etc., installed by the pipe manufacturer shall be kept in the pipe, undisturbed until the pipe has been backfilled.

3.6 BACKFILLING

A. Backfill Procedure: Backfill procedure is that procedure required to return trenched or excavated areas to a condition satisfactory to the Engineer. Such backfilling occurs in two general areas. They are 1) areas not subjected to vehicular traffic; and 2) areas subjected to, or influenced by, vehicular traffic.

The methods of backfilling to be used shall vary with the width of trench, the character of the materials excavated, the method of excavation, the type of conduit and the degree of compaction required. The placing of backfill shall not begin until the pipe structure has been properly bedded and jointed.

1. Trench backfill material is the material required to fill the trench from the top of the embedment to ground elevation or subgrade of a pavement or structure.

B. Backfill trenches to contours and elevations with unfrozen fill materials.

C. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

D. Place geotextile fabric when specified in the Drawings.

E. Place fill material in continuous layers and compact to the density specified herein.

F. Employ placement method that does not disturb or damage utilities in trench.

G. Maintain optimum moisture content of fill materials to attain required compaction density.

H. Do not leave more than 50 feet of trench open at end of working day, unless preapproved by Engineer.

I. Protect open trench to prevent danger to the Owner, the public, and users of the Project site.

3.7 COMPACTION

A. Compaction of all bedding, embedment, and backfill materials shall be performed in a manner that shall not crack, crush and/or cause the installed pipe to be moved from the established grade and/or alignment, as shown on the Drawings. Satisfactory density shall be obtained at various depths on all backfill material as indicated from random selected test points prior to the required exfiltration or pressure tests that are to be performed on lines being constructed. The required moisture content shall be at not less than 2 percent below nor more than 4 percent above the optimum moisture of the material or as specified by the Engineer.

B. Densities for Bedding and Embedment:
   1. Coarse Aggregate Type A1 (Flexible Base) embedment shall be mechanically compacted in 6 inch lifts to a minimum of 95 percent Standard Proctor Density (ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3)), unless indicated otherwise on Drawings.
   2. Coarse Aggregate Type A2 (Crushed Stone) embedment shall be mechanically compacted in 6 inch lifts to a minimum of 95 percent of Maximum Dry Density in accordance with TEX-113-E – Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials, unless indicated otherwise on Drawings.
   3. Coarse Aggregate Type A4 (Gravel Trench Backfill) embedment shall be mechanically compacted in 6 inch lifts to a minimum of 95 percent Standard Proctor Density (ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3)), unless indicated otherwise on Drawings.

C. Backfill Densities – Areas Subjected to or Influenced by Vehicular Traffic: The trench backfill shall be mechanically compacted to the top of the subgrade in 6 inch loose lifts to at least 95 percent of maximum density as determined by ASTM D698 -Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3), at, or above, optimum moisture content.

D. Backfill Densities – Areas Not Subjected to or Influenced by Vehicular Traffic: The trench backfill shall be placed in layers not more than 10 inches loose depth and shall be compacted by mechanical means. Compaction methods to at least 95 percent of maximum density as determined by ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3), at, or above, optimum moisture content.

3.8 TOLERANCES

A. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch (0.08 feet) from required elevations.

B. Top Surface of General Backfilling: Plus or minus 1 inch (0.08 feet) from required elevations.

3.9 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements

B. Perform laboratory material tests in accordance with ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).

C. Perform in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Plane by Nuclear Methods.
   2. Moisture Tests: ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods.

D. Frequency of Tests: The in-place density/moisture content shall be tested and verified at an average frequency of once per 300 linear feet per lift for trenches in traffic areas, and an average of once per 1,000 linear feet per lift for trenches in non-traffic areas.

E. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

3.10 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

SECTION 31 23 23 - FILL

PART 1 GENERAL

1.1 SUMMARY

A. Description: This item shall consist of the placing and compacting of suitable materials obtained from approved sources for utilization in the construction of civil site improvements.

B. Section Includes:
1. Fill under structural foundations.
2. Fill for embankment for construction of highways, streets, and pavements.
3. Fill for the construction of earthen embankments, berms, levees, dikes, and structures.
4. Fill for over-excavation.
5. Backfilling of structural foundations, manholes, and utility structures to subgrade elevations.
6. Backfilling site structures to subgrade elevations.
7. Backfilling pipeline trenches.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Fill will not be paid for as a separate bid item but shall be considered incidental to the item for which it pertains.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures

B. Product Data: Submit data for geotextile fabric indicating fabric and construction.

C. Samples: Submit, in air-tight containers, 50 lb sample of each type of fill to testing laboratory.

D. Materials Source: Submit name of imported fill materials suppliers.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: All subsoil fill shall conform to the following material types:
1. Select Type S1 (Select Fill, or Select Borrow): This material shall consist of sand or other suitable granular material, free from vegetation or deleterious or objectionable matter reasonably free from lumps of earth and when tested by standard TxDOT laboratory methods, shall meet the following requirements:
   a. The Liquid Limits shall not exceed 35.
   b. The Plasticity Index shall not be less than 4 nor more than 15.
   c. Minimum and maximum passing No. 200 sieve: 10% and 70%, respectively.
   d. No rocks greater than 2 inches in diameter.

2. Subsoil Type S2 (Borrow):
   a. This material shall consist of suitable non swelling soils with plasticity index less than 20) earth material such as loam, clay or other such materials that will form a stable embankment.
   b. This material shall be free of lumps larger than 3 inches in diameter, and rocks larger than 4 inches in diameter.

3. Subsoil Type S3 (On-Site Material):
   a. This material shall be excavated from on-site and re-used for fills (embankment).
   b. This material shall be free of lumps larger than 3 inches in diameter, and rocks larger than 4 inches in diameter.

B. Structural Fill: Coarse Aggregate Type A1 (Flexible Base) as specified in Section 32 11 23 – Flexible Base.

C. Coarse Aggregate Fill: Coarse Aggregate Type A2 (Crushed Stone), Coarse Aggregate Type A3 (Gravel Base Course) or Coarse Aggregate Type A4 (Gravel for Trench Backfill) as specified in Section 32 05 16 – Aggregates for Civil Site Improvements.

D. Concrete: Lean concrete with a minimum compressive strength of 2000 psi.

E. Flowable Fill: As specified in Section 31 23 24 – Flowable Fill.

2.2 ACCESSORIES

A. Geotextile Fabric: Products and execution shall be specified in the drawings. Non-biodegradable, woven or non-woven, from the following manufacturers:
   1. Alkzo Nobel Geosynthetic Co.
   2. Huesker, Inc.
   3. TC Mirafi.
   4. Tenax Corp.
   5. Tensar Earth Technologies, Inc.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION FOR STRUCTURES AND PAVEMENTS

A. Strip and remove from the construction area any topsoil, organics, and vegetation to a minimum depth of 6 inches below the existing, natural ground surface in accordance with Section 31 10 00 - Clearing.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to the density specified herein.

C. Compact the subgrade (subsoil) in accordance with Section 31 23 16 – Excavation, prior to commencing with subsequent “fill” operations.

D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.2 EMBANKMENT/FILLING

A. Prior to placing any embankment (fill), all tree protection, tree wells and erosion control devices shall be in place and all "Clearing" operations shall have been completed on the areas over which the embankment (fill) is to be placed. Stump holes or other small excavations in the limits of the embankments shall be backfilled with suitable material and thoroughly tamped by approved methods before commencing embankment construction. The surface of the ground, including plowed loosened ground or surface roughened by small washes, shall be restored to approximately its original slope and the ground surface thus prepared shall be compacted by sprinkling and rolling.

B. Construction equipment shall not be operated within the drip line of the trees, unless indicated. Construction materials shall not be stockpiled under the canopies of trees. No excavation or embankment shall be placed within the drip line of trees unless indicated.

C. Unless otherwise indicated, the surface of the ground of all unpaved areas, other than rock which are to receive embankment (fill), shall be loosened by scarifying or plowing to a depth of not less than 4 inches. The loosened material shall be recompacted with the new embankment as hereinafter specified.

D. The surface of hillsides to receive embankment (fill) shall be loosened by scarifying or plowing to a depth of not less than 4 inches and benches cut before embankment materials are placed. The embankment shall then be placed in layers, as hereinafter specified, beginning at the low side in partial width layers and increasing the widths as the embankment is raised. The material which has been loosened shall be recompacted simultaneously with the embankment material placed at the same elevation.

E. Where embankments are to be placed adjacent to or over existing roadbeds, the roadbed slopes shall be plowed or scarified to a depth of not less than 6 inches and the embankment built up in successive layers, as hereinafter specified, to the level of the old roadbed before its height is increased. Then, if indicated, the top of the old roadbed shall be scarified and recompacted with the next layer of the new embankment. The total depth of the scarified and added material shall not exceed the permissible layer depth.

F. Trees, stumps, roots, vegetation or other unsuitable materials shall not be placed in embankment (fill).

G. All embankment shall be constructed in layers approximately parallel to the finished grade and unless otherwise indicated.

H. The embankment (fill) shall be continuously maintained at its finished section and grade until that portion of the work is accepted. After completion of the embankment to the finished section and grade, the Contractor shall proof roll the subgrade and revegetation procedures must commence immediately to minimize the soil loss and air pollution.

I. Except as otherwise indicated, embankments (fills) shall be constructed in successive 6 inch layers, loose measure, for the full width of the individual cross section and in such length as are best suited to the sprinkling and compaction methods utilized.

J. Minor quantities of rocks not larger than 4 inches, encountered in constructing earth embankment may be incorporated in the earth embankment layers, provided such placement of rock is not within 10 feet of any structure.

K. Each layer of embankment shall be uniform as to material, density and moisture content before beginning compaction. Where layers of unlike materials abut each other, each layer shall be feathered on a slope of 1:20 or the material shall be so mixed as to prevent abrupt changes in soil. No material placed in the embankment by dumping in a pile or windrows shall be incorporated in a layer in that position, but all such piles or windrows shall be moved by blading or similar methods. Clods or lumps of material shall be broken and the embankment material mixed by blading, harrowing, discing or similar methods to the end that a uniform material of uniform density is secured in each layer.

L. Water required for sprinkling to bring the material to the moisture content necessary for optimum compaction shall be evenly applied and it shall be the responsibility of the Contractor to secure a uniform moisture content throughout the layer by such methods as may be necessary.

M. All cuts, whether full width or partial width cuts in the side of a hill, which are not required to be excavated below subgrade elevation shall be scarified to a uniform depth of at least 6 inches below grade and the material shall be mixed and reshaped by blading and then sprinkled and rolled in accordance with the requirements outlined above for earth embankments and to the same density as that required for the adjacent embankment.

N. Compaction of embankments (fills) shall be to a minimum of 95% and less than 100% of its maximum dry density when determined in accordance with ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3), Method D, Standard Proctor, unless indicated otherwise on Drawings. The subsoil shall be no less than its optimum moisture to not greater than 3 percentage points above its optimum moisture content at the time of testing. After each layer of earth embankment (fill) is complete, density tests as necessary will be made. If the material fails to meet the density specified, the course shall be reworked as necessary to obtain the specified compaction.

O. Embankment (fill) shall slope away from building minimum 5 percent slope for minimum distance of 10 ft, unless noted otherwise.

P. Grade changes in embankment (fill) shall be made with gradual grade changes. Blend slope into level areas.

Q. Remove surplus fill materials from site.

3.3 BACKFILLING

A. As soon as practicable, all portions of excavation not occupied by the permanent structure shall be backfilled. Backfill material shall comply with “Subsoil Fill” as specified herein.

B. That portion of backfill which will not support any portion of completed structure, roadbed, or embankment shall be placed in layers not more than 10 inches in depth (loose measurement) and shall be compacted in accordance with Paragraph 3.4, "Compaction" for "Subsoil Fill."

C. That portion of the backfill which will support any portion of the structure, roadbed, or embankment shall be placed in uniform layers not more than 8 inches in depth (loose measurement) and shall be compacted in accordance with Paragraph 3.5, "Compaction" for "Subsoil Fill" and shall be compacted to that density by means of mechanical tampers or rammers, except that the use of rolling equipment of the type generally used in compaction embankments will be permitted on portions which are accessible to such equipment. All portions of embankment too close to any portion of a structure to permit compaction by the use of the blading and rolling equipment used on adjoining sections of embankment, shall be placed and compacted in the same manner as specified above for backfill material. Unless otherwise indicated, hand tamping will not be accepted as an alternate for mechanical compaction. As a general rule, material used in filling or backfilling the portions described in this paragraph shall be "Subsoil Fill," free of any appreciable amount of gravel or stone particles larger than 4 inches in greater dimension and of a gradation that permits thorough compaction. When required by the Drawings or by written order of the Engineer, structural fill or coarse aggregate material shall be used for backfilling.

D. The surface of hillsides to receive embankment (fill) shall be loosened by scarifying or plowing to a depth of not less than 4 inches and benches cut before embankment materials are placed. The embankment shall then be placed in layers, as hereinafter specified, beginning at the low side in partial width layers and increasing the widths as the embankment is raised. The material which has been loosened shall be recompacted simultaneously with the embankment material placed at the same elevation.

E. Where embankments are to be placed adjacent to or over existing roadbeds, the roadbed slopes shall be plowed or scarified to a depth of not less than 6 inches and the embankment built up in successive layers, as hereinafter specified, to the level of the old roadbed before its height is increased. Then, if indicated, the top of the old roadbed shall be scarified and recompacted with the next layer of the new embankment. The total depth of the scarified and added material shall not exceed the permissible layer depth.

3.4 COMPACTION

A. Subsoil Fill:
   1. Select Type S1 (Select Fill, or Select Borrow): Compaction shall be to a dry density of at least 95 percent Standard Proctor maximum dry density (ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3)) and shall be within the range of the materials optimum moisture content to 3 percentage points above the materials optimum moisture content. Placement shall be in lifts not exceeding 8 inches before compaction.
   2. Subsoil Type S2 (Borrow) and Subsoil Type S3 (On-Site Material): Compaction shall be to a dry density of at least 95 percent Standard Proctor maximum dry density (ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3)) and shall be within the range of the materials optimum moisture content to 3 percentage points above the materials optimum moisture content. Placement shall be in lifts not exceeding 8 inches before compaction.

B. Structural Fill, Coarse Aggregate Type A1 (Flexible Base): Flexible Base material used as structural fill beneath foundations and for backfilling structures shall be placed in loose lifts not exceeding 8 inches before compaction, and shall be compacted mechanically to a minimum 98 percent of Standard Proctor dry density (ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3)) and within 2 percentage points of the materials optimum moisture content, unless indicated otherwise on Drawings.

C. Course Aggregate Fill:
   1. Coarse Aggregate Type A2 (Crushed Stone): Compaction shall be a minimum of 95 percent of the maximum dry density in accordance with TxDOT Test Method TEX-113-E – Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials, unless indicated otherwise on Drawings.
   2. Coarse Aggregate Type A3 (Gravel Base Course): Gravel Base Course used as structural fill beneath foundations and for backfilling structures shall be placed in loose lifts not exceeding 8 inches before compaction, and shall be compacted mechanically to a minimum 95 percent of Standard Proctor dry density (ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3)) and within 2 percentage points of the materials optimum moisture content, unless indicated otherwise on Drawings.
   3. Coarse Aggregate Type A4 (Gravel Trench Backfill): Gravel Trench Backfill shall be placed in loose lifts not exceeding 8 inches before compaction, and shall be compacted mechanically to a minimum 95 percent of Standard Proctor dry density (ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3)) and within 2 percentage points of the materials optimum moisture content.

3.5 TOLERANCES

A. Top Surface of Fill Under Paved Areas: Plus or minus 0.50 inches from required elevations.

B. Top Surface of General Grading of Fill: Plus or minus 0.10 feet from required elevations.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements.

B. Perform laboratory material tests in accordance with ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).

C. Perform in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method, ASTM D2167 – Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method, ASTM D2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods, or TEX-115-E – Field Method for Determining In-Place Density of Soils and Base Materials as appropriate for the material being tested.
   2. Moisture Tests: ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

E. Proof roll compacted fill surfaces under structural foundations, pavers, paving, and sidewalks. Soft spots shall be removed, replaced, and retested.

F. Quality assurance shall be, as a minimum, as outlined below:

Type of Work	Item	Sample Frequency	Sample Size	Minimum Testing
Select Fill	Select Type S1 (Select Fill or Select Borrow) Compaction	1 per soil Type 1 per 5000 sq.ft. per lift (min. of 3 per lift)	50 lbs.	- Gradation - P.I. - Moisture-Density Relationship - Field Density Tests
Subsoil for Fill and Backfill	Subsoil Type S2 (Borrow); Subsoil Type S3 (On-Site) Compaction	1 per soil Type 1 per 5000 sq.ft. per lift (min. of 3 per lift)	50 lbs.	- Gradation - P.I. - Moisture-Density Relationship - Field Density Tests
Structural Fill	Coarse Aggregate Type A1 (Flexible Base) Compaction	1 per type per 1000 cu. yds. 1 per 2500 sq.ft. per lift (min. of 3 per lift)	50 lbs.	- Sieve - P.I. - Moisture-Density - Field Density Tests
Structural Fill	Coarse Aggregate Type A2 (Crushed Stone) Compaction	1 per type per 1000 cu. yds. 1 per 2500 sq.ft. per lift (min. of 3 per lift)	50 lbs	- Gradation/sieve - Field Density Tests
Structural Fill	Coarse Aggregate Type A3; Coarse Aggregate Type A4 Compaction	1 per type per 1000 cu. yds. 1 per 2500 sq.ft. per lift (min. of 3 per lift)	50 lbs	- Sieve - P.I. - Moisture-Density - Field Density Tests

3.7 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic.

B. Reshape and re-compact fills subjected to erosion.

END OF SECTION

SECTION 31 23 24 - FLOWABLE FILL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flowable fill for:
      a. Structure backfill.
      b. Utility bedding.
      c. Utility backfill.
      d. Filling abandoned utilities.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Flowable fill will not be paid for as a separate bid item but shall be considered incidental to the item for which it pertains.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Materials Source: Submit name of flowable fill materials suppliers.

C. Manufacturer's Certificate:
   1. Certify Product meets or exceeds specified requirements.

D. Mix Design:
   1. Submit flowable fill mix design for each specified strength. Submit separate mix designs as required for the following:
      a. Flowable fill work during hot and cold weather.
      b. Air entrained flowable fill work.
   2. Identify design mix ingredients, proportions, properties, admixtures, and tests.
   3. Submit test results to certify flowable fill mix design properties meet or exceed specified requirements.

E. Delivery Tickets:
   1. Submit duplicate delivery tickets indicating actual materials delivered to Project site.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not install flowable fill during inclement weather or when ambient temperature is less than 40 degrees F.

1.6 FIELD MEASUREMENTS

A. Verify field measurements before installing flowable fill to establish quantities required to complete the Work.

PART 2 PRODUCTS

2.1 FLOWABLE FILL

A. Flowable Fill - Excavatable Type: Lean cement concrete fill used where future excavation may be required such as fill for utility trenches, bridge abutments, and culverts.

B. Flowable Fill - Non-excavatable Type: Lean cement concrete fill used where future excavation is not anticipated such as fill below structure foundations and filling abandoned utilities.

2.2 MATERIALS

A. Portland Cement: ASTM C150 (Standard Specification for Portland Cement) Type I - Normal; Type IA - Air Entraining; Type II - Moderate.

B. Fine Aggregates: ASTM C33 – Standard Specification for Concrete Aggregates.

C. Water: Clean and not detrimental to concrete.

2.3 MIXES

A. Mix and deliver flowable fill in accordance with ASTM C94 - Standard Specification for Ready-Mixed Concrete, Option C.

FLOWABLE FILL DESIGN MIX

ITEM	EXCAVATABLE	NON-EXCAVATABLE
Cement Content	75-100 lbs/cy	100-150 lbs/cy
Water Content	Per mix design	Per mix design
28 Day Compressive Strength	Maximum 150 psi.	Minimum 250 psi
Unit Mass (Wet)	80-110 pcf	100-125 pcf
Temperature, Minimum at point of delivery	50 degrees F	50 degrees F

B. Provide water content in design mix to produce self-leveling, flowable fill material at time of placement.

2.4 SOURCE QUALITY CONTROL

A. Test and analyze properties of flowable fill design mix and certify results for the following:

1. Design mix proportions by weight of each material.
2. Fine Aggregate: ASTM C33 – Standard Specification for Concrete Aggregates - for material properties and gradation.
3. Properties of plastic flowable fill design mix including:
   a. Temperature.
   b. Slump.
   c. Wet unit mass.
   d. Yield.
   e. Cement factor.
4. Properties of hardened flowable fill design mix including:
   a. Compressive strength at 1 day, 7 days, and 28 days. Report compressive strength of each specimen and average specimen compressive strength.
   b. Unit mass for each specimen and average specimen unit mass at time of compressive strength testing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify excavation and trenching is complete.

C. Verify utility installation is complete and tested before placing flowable fill.

D. Verify excavation is dry and dewatering system is operating.

3.2 PREPARATION

A. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.

B. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.

C. Protect utilities and foundation drains to prevent intrusion of flowable fill.

3.3 INSTALLATION - FILL, BEDDING, AND BACKFILL

A. Place flowable fill by chute, pumping or other methods approved by Engineer.
   1. When required, place flowable fill under water using tremie procedure.
   2. Do not place flowable fill through flowing water.

B. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.

C. Place flowable fill evenly on both sides of utilities to maintain alignment.

D. Place flowable fill to elevations indicated on Drawings without vibration or other means of compaction.

3.4 INSTALLATION - FILLING ABANDONED UTILITIES

A. Verify pipes and conduits are not clogged and are sufficiently empty to permit gravity installation of flowable fill for entire length indicated to be filled.

B. Seal lower end of pipes and conduits by method to contain flowable fill and to vent trapped air caused by filling operations.

C. Place flowable fill using method to ensure there are no voids.
   1. Fill pipes and conduits from high end.
   2. Fill manholes, tanks, and other structures from grade level access points.

D. After filling pipes and conduits seal both ends.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements.

B. Perform inspection and testing in accordance with ASTM C94/C94M.
   1. Take samples for tests for every 150 cu-yd of flowable fill, or fraction thereof, installed each day.
   2. Sample, prepare and test four compressive strength test cylinders in accordance with ASTM D4832. Test one specimen at 3 days, one at 7 days, and two at 28 days.
   3. Measure temperature at point of delivery when samples are prepared.

C. Perform in place penetration (density) tests using hand held penetrometer to measure penetration resistance of hardened flowable fill, in accordance with ASTM C403.
   1. Perform tests at locations as directed by Engineer.

D. Perform in-place density tests using nuclear test device, in accordance with ASTM C1040.
   1. Perform tests at locations as directed by Engineer.

E. Defective Flowable Fill: Fill failing to meet the following test requirements or fill delivered without the following documentation.
   1. Test Requirements:
      a. Minimum temperature at point of delivery.
      b. Compressive strength requirements for each type of fill.

F. Submit delivery tickets indicating actual materials delivered to Project site. Delivery tickets shall contain project description, date, time, class and quantity of mix, actual batch proportions, free moisture content of aggregate and quantity of water withheld.

3.6 CLEANING

A. Remove spilled and excess flowable fill from Project site.

B. Restore facilities and site areas damaged or contaminated by flowable fill installation to existing condition before installation.

END OF SECTION

SECTION 31 25 12 – STORM WATER POLLUTION PREVENTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Implementation, maintenance inspection, and termination of storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, off-site vehicle tracking, and other appropriate practices.
2. Documentation to be prepared and signed by Contractor before conducting construction operations, in accordance with the Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit Number TXR 150000, latest issue date (the Construction General Permit).
3. Review of the Storm Water Pollution Prevention Plan (SWP3) implementation in a meeting with Engineer prior to start of construction.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Storm Water Pollution Prevention Plan will not be paid for as a separate bid item but shall be considered incidental to the items for which it pertains.

1.3 REFERENCES

A. Construction General Permit (TPDES No. TXR 150000).

B. Clean Water Act.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Submit one copy of the SWP3 to Engineer for record retention purposes only. Engineer will not review or approve the SWP3

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with the SWP3 as per the submission of the Notice of Intent.

B. Maintain one copy of the SWP3 document on site.

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION

3.1 SITE SPECIFIC STORM WATER POLLUTION PREVENTION PLAN (SWP3)

A. Fulfill all TPDES Construction General Permit (TXR 150000) requirements.

B. Contractor shall fulfill the role of Primary Operator as defined by the TPDES Construction General Permit (TXR 150000) for this project.

Prepare and submit all required documentation and pay all applicable fees to TCEQ required by the TPDES Construction General Permit (TXR 150000). This includes but is not limited to Notice of Intent, Site Notices, Notice of Termination, and Notification of MS4 Operator.

C. SWP3:
1. Prepare a SWP3 following Part III of the TPDES Construction General Permit (TXR 150000).
2. Update or revise the SWP3 as needed during the construction following Part III, Section E of the TPDES Construction General Permit (TXR 150000).
3. Submit the SWP3 and any updates or revisions to the Engineer for review and address comments prior to commencing, or continuing, construction activities.
4. Conduct inspections in accordance with TPDES Construction General Permit (TXR 150000).
5. Maintain copies of SWP3, inspection reports, and other documentation as required by TPDES Construction General Permit (TXR 150000).

3.2 SWP3 IMPLEMENTATION

A. Implement SWP3 utilizing state of the art Best Management Practice controls as required by the Construction General Permit, the site specific SWP3, and local government.

B. Inspect and maintain controls throughout the course of construction per the Construction General Permit requirements.

C. Remove controls per the Construction General Permit requirements.

D. On-Site Waste Material Storage:
1. Self-contain on-site waste material storage and satisfy appropriate location, state, and federal rules and regulations.
2. Prepare list of waste material to be stored on-site. Update list as necessary to include up-to-date information. Keep a copy of updated list with the SWP3.
3. Prepare description of controls to reduce pollutants generated from on-site storage. Include storage practices necessary to minimize exposure of materials to storm water, and spill prevention and response measures consistent with best management practices. Keep a copy of the description with the SWP3.

END OF SECTION

SECTION 32 05 16 - AGGREGATES FOR CIVIL SITE IMPROVEMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Coarse aggregate materials.
   2. Fine aggregate materials.

B. Related Sections:
   1. Section 31 23 17 - Trenching.
   2. Section 31 23 23 - Fill.
   3. Section 32 11 23 - Flexible Base.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Aggregate:
   1. Basis of Measurement and Payment: Fine aggregate and course aggregate will not be paid for as a separate bid item, but shall be considered incidental to the items for which they pertain.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
   2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   2. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction
   3. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   5. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   6. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Samples: Submit, in air-tight containers, 10 lb samples of each type of fill to testing laboratory.

C. Materials Source: Submit name of imported materials suppliers.

D. Manufacturer's Certificate: Certify that aggregates meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance with Texas Department of Transportation's Standard Specifications for Construction of Highways, Streets, and Bridges (latest Edition).

C. Maintain one copy of Texas Department of Transportation's Standard Specifications for Construction of Highways, Streets, and Bridges (latest Edition) document on site.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

A. Coarse Aggregate Type A1 (Flexible Base): Conforming to TxDOT's Standard Specifications Item 247, Grade 1 or 2, Type A.

B. Coarse Aggregate Type A2 (Crushed Stone): washed; free of shale, clay, friable material and debris; graded in accordance with ASTM C136; within the following limits, based on ASTM D448:

Coarse Aggregate Type A2 Grading
Grade No. 2

Sieve Size	Percent Passing
2 inches	100%
1-1/2 inches	95-100%
3/4 inch	40-70%
3/8 inches	10-30%
No. 4	0-5%

OR

Coarse Aggregate Type A2 Grading
Grade No. 3

Sieve Size	Percent Passing
1-1/2 inches	95-100%
3/4 inch	60-90%
1/2 inch	25-60%
No. 4	0-5%

C. Coarse Aggregate Type A3 (Gravel Base Course): Durable particles of gravel mixed with approved binding material; and shall be free from thin or elongated pieces, clay lumps, soil loam or vegetable matter. The material may be bank-run; or the binder may be added and incorporated by methods approved by Engineer. Should the material be secured from pits, the overburden or stripping from the site of the pits shall be removed to such a distance that none shall fall or wash into the pit; and it shall be placed so as to divert surface drainage away from the pit site. The pit shall be well drained at all times. The pits shall be opened in such a manner as to expose the vertical faces of all strata of acceptable materials; and, unless otherwise directed by Owner, the materials shall be secured in successive vertical cuts extending through all the exposed strata, in order that a uniformity mixed material shall be secured.

1. Tests: The soil binder shall meet the following requirements:
   a. The liquid limit shall not exceed 35 when tested in accordance with ASTM D423.
   b. The plastic limit shall be determined by testing in accordance with ASTM D424.
   c. The plasticity index shall not exceed 12 nor be less than 4 when calculated in accordance with ASTM D424.
   d. The preparation of samples for testing according to ASTM D423 and D424 shall be in accordance with the requirements of ASTM D2217.
   e. The linear shrinkage shall not exceed 6 percent.
2. Gradation: The material when tested by standard laboratory methods shall meet the following percentages by weight:

Passing 1 ¾ in. sieve (45.0 mm)	100%
Passing ¾ in. sieve (9.5 mm)	40 to 80%
Passing No. 4 sieve (4.75 mm)	25 to 60%
Passing No. 40 sieve (425 µm)	15 to 35%

   a. Material passing the No. 40 sieve (425 µm) shall be known as “soil binder.”
   b. Materials containing conglomerate or gravel larger than 2” (50 mm) in any dimension shall be broken up and uniformly mixed with the remainder of the materials. Upgrading by the addition of washed gravel in order to meet the requirements of this section shall be permitted.
   c. If additional binder and/or soil binder are considered necessary by the Owner after gravel materials are spread and shaped, same shall be furnished and applied in the amount directed by the Owner; such additional binder and/or soil binder shall be carefully and evenly

incorporated with the pit materials in place by scarifying, harrowing or other methods approved by the Owner.

3. Rejection: Gravel which fails to meet the requirements of these specifications may be rejected by the Engineer. Such rejection shall incur no cost to the Owner.

D. Coarse Aggregate Type A4 (Gravel for Trench Backfill): Sandy gravel material, free of clay, shale, organic matter; meeting the following requirements:

1. Tests:
   a. The liquid limit shall not exceed 35 when tested in accordance with ASTM Designation D423.
   b. The plasticity index shall not exceed 12 nor be less than 4 when calculated in accordance with ASTM Designation D424.
   c. The linear shrinkage shall not exceed six percent.
2. Gradation: The material when tested by standard laboratory methods shall meet the following percentages by weight:

Passing 2 in. sieve	100%
Passing 1/2 inch sieve	50 to 85%
Passing No. 4 sieve	20 to 65%
Passing No. 100 sieve	0 to 5%

2.2 FINE AGGREGATE MATERIALS

A. Fine Aggregate Type A5 (Sand): Conforming to TxDOT's Standard Specifications Item 421.2(5), "Fine Aggregate."

2.3 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and inspection services.

B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.

C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.

D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 STOCKPILING

A. Stockpile materials on site at locations designated by Engineer.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.2 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 32 11 23 - FLEXIBLE BASE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Crushed stone foundation course for structural backfill, embedment, trench backfill, surfacing, pavement or other base courses, furnished and installed on a prepared surface. The "Flexible Base" shall be constructed as herein specified in one or more courses in conformity with the typical sections and to the lines and grades as indicated or as established by the Engineer.

B. Related Sections:
1. Section 31 23 17 - Trenching.
2. Section 31 23 23 - Fill.
3. Section 32 05 16 - Aggregates for Civil Site Improvements.
4. Section 32 12 16 - Hot Mix Asphaltic Concrete Paving.
5. Section 32 13 13 - Concrete Paving.
6. Section 32 91 19 - Landscape Grading.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Flexible Base: Flexible Base will not be paid for as a separate bid item but shall be considered incidental to the item for which it pertains.

1.3 REFERENCES

A. Texas Department of Transportation's Standard Laboratory Test Procedures:

1.	Moisture Content	Tex-103-E
2.	Liquid Limit	Tex-104-E
3.	Plasticity Index	Tex-106-E
4.	Bar Linear Shrinkage	Tex-107-E, Part II
5.	Sieve Analysis	Tex-110-E
6.	Moisture-Density Determination	Tex-113-E
7.	Roadway Density	Tex-115-E
8.	Wet Ball Mill	Tex-116-E
9.	Triaxial Tests (Part I or II as selected by the Engineer)	Tex-117-E
10.	Particle Count	Tex-460-A, Part I

B. American Association of State Highway and Transportation Officials:
1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit data for geotextile fabric and herbicide.

C. Samples: Submit, in air-tight containers, 10 lb sample of each type of Flexible Base to testing laboratory.

D. Materials Source: Submit name of aggregate materials suppliers.

E. Manufacturer's Certificate: Certify Flexible Base meets or exceeds specified requirements outlined herein.

1.5 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance with Texas Department of Transportation's Standard Specifications for Construction of Highways, Streets, and Bridges (latest Edition).

C. Maintain one copy of Texas Department of Transportation's Standard Specifications for Construction of Highways, Streets, and Bridges (latest Edition) on site.

PART 2 PRODUCTS

2.1 FLEXIBLE BASE MATERIAL REQUIREMENTS

A. Flexible Base: Texas Department of Transportation's Standard Specification Item 247, Grade 1 or 2, Type A.

2.2 ACCESSORIES

A. Geotextile Fabric: As specified in the Drawings.

B. Herbicide: As specified in the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted substrate is dry and ready to support paving and imposed loads.
   1. Proof roll substrate in accordance with Texas Department of Transportation Standard Specification Item 216, "Rolling (Proof)" to identify soft spots.
   2. Remove soft substrate and replace with compacted fill as specified in Section 31 23 23 – Fill.

3. No additional compensation will be made for materials, equipment or labor required for “Proof Rolling,” but shall be considered subsidiary to “Flexible Base.”

C. Verify substrate has been inspected, gradients and elevations are correct.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 BASE PLACEMENT

A. When specified in the Drawings, install geotextile fabric over subgrade in accordance with manufacturer's instructions.
1. Lap ends and edges minimum 6 inches.
2. Anchor fabric to subgrade when required to prevent displacement until aggregate is installed.

B. When the Flexible Base compacted thickness is less than (or equal to) 6 inches, spread base material over prepared substrate to total compacted thickness indicated on Drawings.

C. When the Flexible Base compacted thickness exceeds 6 inches, place base material equal thickness layers to total compacted thickness indicated on Drawings.
1. Maximum Layer Compacted Thickness: 6 inches.
2. Minimum Layer Compacted Thickness: 3 inches.

D. Roller compact Flexible Base to density indicated in Texas Department of Transportation’s Standard Specification Item 247.

E. Level and contour surfaces to elevations, profiles, and gradients indicated.

F. Maintain optimum moisture content of base materials to attain specified compaction density.

G. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements and Texas Department of Transportation Item 247.3(1)(f), “Tolerances.”

B. Maximum Variation from Flat Surface: 1/4 inch measured with 16-foot straight edge.

C. Maximum Variation from Thickness: 1/2 inch.

D. Maximum Variation from Elevation: 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Compaction testing will be performed in accordance with Texas Department of Transportation's Test Method Tex-113-E.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

D. Frequency of Tests: One test for every 1000 square yards of each course (layer) of compacted base material.

3.6 COMPACTION

A. Each course of flexible base shall be compacted to not less than 100 percent density when tested in accordance with TxDOT Test Method Tex-113-E. Field density determination shall be made in accordance with TxDOT Test Method Tex-115-E.

END OF SECTION

SECTION 32 11 24 – PORTLAND CEMENT TREATED BASE (PLANT MIXED)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Portland Cement Treated Base (Plant Mixed).

B. Related Sections:
   1. Section 31 23 17 - Trenching: Compacted fill under base course.
   2. Section 31 23 23 - Fill: Compacted fill under base course.
   3. Section 32 05 16 - Aggregates for Civil Site Improvements.
   4. Section 32 12 16 - Hot Mix Asphaltic Concrete Paving.
   5. Section 32 13 13 - Concrete Paving: Finish concrete surface course.
   6. Section 32 91 19 - Landscape Grading: Topsoil fill at areas adjacent to base course.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Portland Cement Treated Base Course will not be paid for as a separate bid item but shall be considered incidental to the items for which it pertains.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D2940 - Standard Specification for Graded Aggregate Material For Bases or Subbases for Highways or Airports.
   3. ASTM C31/C31M – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   4. ASTM C39/C39M – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   5. ASTM C42/C42M – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   6. ASTM C94/C94M – Standard Specification for Ready-Mixed Concrete.
   7. ASTM C150 – Standard Specification for Portland Cement.
   8. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.
   9. ASTM C685/C685M – Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit data for geotextile fabric and herbicide, when indicated in Drawings.

C. Mix Design: Prior to construction, submit a proposed mix design for review and approval by Engineer. The design data shall include type and amount of Portland cement; source, gradation, and amount of gravel; and compressive strength verification tests. Compressive strength shall be in the range of 500 to 1200 psi at 7 days.

D. Materials Source: Submit name of aggregate materials suppliers.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance Texas Department of Transportation's Standard Specifications for Construction of Highways, Streets, and Bridges (latest Edition)

C. Maintain one copy of Texas Department of Transportation's Standard Specifications for Construction of Highways, Streets, and Bridges (latest Edition) document on site.

PART 2 PRODUCTS

2.1 AGGREGATE MATERIALS

A. Coarse Aggregate: Type A3 (Gravel Base Course) as specified in Section 32 05 16.

2.2 PORTLAND CEMENT: Type 1 as per ASTM C150.

2.3 WATER: ACI 318; potable, less than 250 ppm of chlorides.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted substrate is dry and ready to support paving and imposed loads.
   1. Proof roll substrate to identify soft spots.
   2. Remove soft substrate and replace with compacted fill as specified in Section 31 23 23 - Fill.

C. Verify substrate has been inspected, gradients and elevations are correct.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 CEMENT TREATED BASE PLACEMENT

A. Cement Plant Mixing: The gravel, base materials, cement, and water shall be thoroughly mixed in a stationary (pugmill) plant, either of the batch or continuous-flow type. The plant shall be equipped with feeding and metering devices which shall add the gravel, cement, and water into the mixer in the specified quantities.
   1. Gravel and cement shall be mixed sufficiently to prevent cement balls from forming when water is added.
   2. Mix until a uniform and homogeneous mixture of gravel, cement, and water is obtained. After mixing is completed, no additional water shall be added to the mixture unless otherwise approved by Engineer.
   3. Haul mixture to construction site in suitable vehicles equipped with protective covers.

B. Spread mixture over moistened, prepared subgrade in a uniform layer to a total compacted thickness as indicated on Drawings.
   1. Not more than 30 minutes shall elapse between the placement of cement treated base in adjacent lanes at any location except at longitudinal construction joints. Not more than 30 minutes shall elapse between the start of spreading the mixture and start of compaction. Not more than 60 minutes shall elapse between the start of mixing and the start of compaction of the cement treated base. The layer of cement treated base shall be uniform in thickness and surface contour; and in such quantity that the completed base shall conform to the required grade and cross section.
   2. At the end of each days operation or at a lapse of more than two hours between loads, a full depth transverse header (butt-joint) shall be installed, so that proper compaction and performance can be attained. No longitudinal joints will be allowed.

C. Roller compact base to 95 percent maximum density determined by ASTM D698. Moisture content shall be within minus 2 to plus 2 percent of optimum.

D. Roll surface with a pneumatic tire roller and “clipped,” “skinned,” and “tight-bladed” by a power grader to a depth of approximately ¼ inch, moving all loosened soil and cement from the section. The surface shall then be thoroughly compacted with the pneumatic roller, adding small increments of moisture as needed during rolling. When approved by Engineer, surface finishing methods may be varied form this procedure, provided a dense, uniform surface, free of surface material, is maintained at its specified optimum during all finishing operations. Surface compaction and finishing shall proceed in such a manner as to produce, in not more than two hours, a smooth, closely knit surface; free of cracks, ridges or loose material; conforming to the lines and grades shown on Drawings.

E. Protection and Cover: Protect surface against rapid drying by applying two-tenths (0.2) gallon per square yard RC-2 cut-back asphalt. Immediately prior to application of RC-2, the section shall be wetted by the use of pressure water distributors so that all voids in the cement treated base surface are filled with water; but without free water standing on the surface. The RC-2

cure shall be applied while this moisture condition exists so that undue asphalt penetration of the surface shall be prevented.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Flat Surface: 1/4 inch measured with 16 foot straight edge.

C. Maximum Variation From Thickness: 1/2 inch.

D. Maximum Variation From Elevation: 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Sections 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Compaction testing will be performed in accordance with ASTM D698. One test for every 1000 square yards of compacted base.

C. Compression testing shall be performed as follows:
1. One sample per day of operations, per mix design (three specimens per sample).
2. Take other samples as directed by Engineer.
3. Perform Unconfined Compression Strength testing at 7 days.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

END OF SECTION

SECTION 32 12 16 - HOT MIX ASPHALTIC CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Asphalt materials.
2. Aggregate materials.
3. Asphalt paving surface course.
4. Asphalt paving overlay for existing paving.

B. Related Sections
1. Section 31 23 23 - Fill.
2. Section 32 05 16 - Aggregates for Civil Site Improvements.
3. Section 32 11 23 - Flexible Base.

1.2 UNIT PRICE MEASUREMENT AND PAYMENT PROCEDURES

A. Basis of Measurement for hot mix asphaltic paving will not be paid for as a separate bid item but shall be considered incidental to the item for which they pertain.

1.3 REFERENCE STANDARDS

A. Texas Department of Transportation's Standard Specifications for Construction of Highways, Streets and Bridges (latest Edition):
1. Tex-101-E – Preparing Soil and Flexible Base Materials for Testing
2. Tex-107-E – Determining the Bar Linear Shrinkage of Soils
3. Tex-200-F – Sieve Analysis of Fine and Coarse Aggregates
4. Tex-203-F – Sand Equivalent Test
5. Tex-204-F – Design of Bituminous Mixtures
6. Tex-206-F – Compacting Specimens Using the Texas Gyratory Compactor (TGC)
7. Tex-207-F – Determining Density of Compacted Bituminous Mixtures
8. Tex-210-F – Determining Asphalt Content of Bituminous Mixtures by Extraction
9. Tex-217-F – Determining Deleterious Material and Decantation Test for Coarse Aggregates
10. Tex-227-F – Theoretical Maximum Specific Gravity of Bituminous Mixtures
11. Tex-228-F – Determining Asphalt Content of Bituminous Mixtures by the Nuclear Method
12. Tex-229-F – Combined HMAC Cold-Belt Sampling and Testing Procedure
13. Tex-404-A – Determining Unit Mass (Weight) of Aggregates
14. Tex-410-A – Abrasion of Coarse Aggregate Using the Los Angeles Machine
15. Tex-411-A – Soundness of Aggregate Using Sodium Sulfate or Magnesium Sulfate
16. Tex-431-A – Pressure Slaking Test of Synthetic Coarse Aggregate
17. Tex-432-A – Coarse Aggregate Freeze-Thaw Test
18. Tex-433-A – Absorption and Dry Bulk Specific Gravity of Lightweight Coarse Aggregate
19. Tex-438-A – Accelerated Polish Test for Coarse Aggregate
20. Tex-460-A – Determining Crushed Face Particle Count

B. American Association of State Highway and Transportation Officials:
   1. AASHTO M17 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
   2. AASHTO M29 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
   3. AASHTO M140 - Standard Specification for Emulsified Asphalt.
   4. AASHTO M208 - Standard Specification for Cationic Emulsified Asphalt.
   5. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
   6. AASHTO M320 - Standard Specification for Performance-Graded Asphalt Binder.
   7. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
   8. AASHTO MP1a - Standard Specification for Performance-Graded Asphalt Binder.

C. Asphalt Institute:
   1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
   2. AI MS-19 - Basic Asphalt Emulsion Manual.
   3. AI SP-2 - Superpave Mix Design.

D. ASTM International:
   1. ASTM D242 - Standard Specification for Mineral Filler For Bituminous Paving Mixtures.
   2. ASTM D692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
   3. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
   4. ASTM D977 - Standard Specification for Emulsified Asphalt.
   5. ASTM D1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
   6. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
   7. ASTM D2027 - Standard Specification for Cutback Asphalt (Medium-Curing Type).
   8. ASTM D2397 - Standard Specification for Cationic Emulsified Asphalt.
   9. ASTM D2041 - Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
   10. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
   11. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
   12. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
   13. ASTM D3515 - Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
   14. ASTM D3549 - Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
   15. ASTM D3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal.
   16. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit product information for asphalt and aggregate materials.
   2. Submit mix design with laboratory test results supporting design.

C. The Contractor shall designate in writing the source of all materials proposed for use in the mixture. Material certificates signed by the material producer and contractor certifying that each material complies with specification requirements shall be furnished.

D. Pavement marking plan indicating lane separations and defined parking places. Note dedicated handicapped spaces with international graphics symbol.

1.5 QUALITY ASSURANCE

A. Mixing Plant: Conform to Texas Department of Transportation's Standard Specifications for Construction of Highways, Streets and Bridges (latest Edition).

B. Obtain materials from same source throughout.

C. Perform Work in accordance with Texas Department of Transportation's Standard Specifications for Construction of Highways, Streets and Bridges (latest Edition).

D. Maintain one copy of Texas Department of Transportation's Standard Specifications for Construction of Highways, Streets and Bridges (latest Edition) on site.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 2 years documented experience as approved by Engineer.

1.7 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.

B. Do not place asphalt mixture when ambient air temperature is less than 50 degrees F and is falling (or surface is wet or frozen), but it may be placed when the air temperature is above 40 degrees F and is rising.

C. Place asphalt mixture when temperature is not more than 30 degrees F less than initial mixing temperature.

PART 2 PRODUCTS

2.1 ASPHALT PAVING

A. Asphalt Materials:
1. Asphalt Cement: Asphalt cement for the paving mixture shall meet the requirements of TxDOT Standard Specifications Item 300, "Asphalts, Oils, and Emulsions."
2. Tack Coat: Asphaltic materials for tack coats, shown on the plans or approved by the Engineer, shall meet the requirements of TxDOT Standard Specifications Item 300, "Asphalts, Oils, and Emulsions."
3. Additives: Additives to facilitate mixing and/or improve the quality of the asphaltic mixture shall be used when noted on the Drawings or may be used with the authorization of the Engineer. The Contractor may choose to use either lime or a liquid anti-stripping agent to reduce the moisture susceptibility of the aggregate. The evaluation and addition of anti-stripping agents will be in accordance with TxDOT Standard Specifications Item 301, "Asphalt Anti-stripping Agents."

B. Aggregate Materials:
1. Coarse Aggregate: ASTM D692; crushed stone or crushed gravel in accordance with TxDOT Standard Specifications Item 340.
2. Fine Aggregate: ASTM D1073; natural sand or sand manufactured from stone, gravel, or blast furnace slag in accordance with TxDOT Standard Specifications Item 340.
3. Mineral Filler: ASTM D242; thoroughly dried stone dust or finely ground mineral particles, free of foreign matter; Portland cement, lime, or fly ash, in accordance with TxDOT Standard Specifications Item 340.

2.2 MIXES

A. Asphalt Paving Mixtures: Designed in accordance with TxDOT Standard Specifications Item 340 with a maximum 20 percent by weight reclaimed asphalt pavement.
1. Surface Course: TxDOT Standard Specifications Item 340, Type D "Fine Graded Surface Course" composed of angular crushed limestone. Smooth, uncrushed gravel is not allowed.
2. Stability: The materials used in the mixture design shall produce a mixture with a stability of at least 35 when tested in accordance with TxDOT Test Method TEX-208-F.

2.3 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Submit proposed mix design for review prior to beginning of Work.

C. Test samples in accordance with TxDOT Standard Specifications Item 340.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.

C. Verify compacted Flexible Base is dry and ready to support paving and imposed loads.

D. Verify gradients and elevations of base are correct.

E. Verify manhole frames and valve boxes are installed in correct position and elevation.

3.2 INSTALLATION

A. Prime Coat:
   1. Apply prime coat in accordance with TxDOT Standard Specifications Item 340.
   2. Use clean sand to blot excess primer.

B. Tack Coat:
   1. Apply tack coat in accordance with TxDOT Standard Specifications Item 340.
   2. Apply tack coat on asphalt and concrete surfaces and over Flexible Base surface at uniform rate.
      a. New Surfaces: 0.10 gal/sq yd.
      b. Existing Surfaces: 0.10 gal/sq yd.
   3. Apply tack coat to contact surfaces of curbs, gutters and structures.
   4. Coat surfaces of manhole and valve box frames with oil to prevent bond with asphalt paving. Do not tack coat these surfaces.

C. Single Course Asphalt Paving:
   1. Install Work in accordance with TxDOT Standard Specifications Item 340.
   2. Place asphalt within 24 hours of applying primer or tack coat.
   3. Place asphalt surface course to thickness indicated on Drawings.
   4. Compact paving by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
   5. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

D. Double Course Asphalt Paving:
   1. Place asphalt binder course within 24 hours of applying primer or tack coat.
   2. Place binder course to thickness indicated on Drawings.
   3. Place surface course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.
   4. Place surface course to thickness indicated on Drawings.
   5. Compact each course by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.

6. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

E. Asphalt Paving Overlay
1. Apply tack coat to existing paving surface at rate recommended by Engineer.
2. When indicated on the Drawings, install geotextile fabric in accordance with manufacturer's instructions to permit asphalt saturation of fabric. Lap fabric edge and end joints 4 inches.
3. Place surface course to thickness indicated on Drawings.
4. Compact overlay by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
5. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.3 COMPACTION

A. Hot Mix Asphaltic Concrete (HMAC) Pavement shall be compacted to between 91 and 96 percent of the maximum theoretical density as measured by ASTM D2041 and in accordance with TxDOT Standard Specifications Item 340, “Hot Mix Asphaltic Concrete Pavement” for Air Void Control.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge applied parallel with and at right angles to centerline of paved area.

C. Scheduled Compacted Thickness: Within 1/4 inch.

D. Variation from Indicated Elevation: Within 1/4 inch.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting, testing.

B. Take samples and perform tests in accordance with TxDOT Standard Specifications Item 340.

C. Asphalt Paving Mix Temperature: Measure temperature at time of placement.

D. Asphalt Paving Thickness: ASTM D3549; test one core sample from every 1000 square yards compacted paving.

E. Asphalt Paving Density: Test Method Tex-207-F; test one core sample from every 1000 square yards or 1 per day (minimum) of compacted paving.

F. Stability: Test Method Tex-208-F; one test per day during production.

G. Extraction: Test Methods Tex-210-F; Tex-228-F; or Tex-229-F; one test per day during production.

3.6 PROTECTION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Immediately after placement, protect paving from mechanical injury until surface temperature is less than 140 degrees F.

END OF SECTION

SECTION 32 13 13 - CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aggregate base course.
   2. Concrete paving for:
      a. Concrete streets and roads.
      b. Concrete parking lots.
      c. Concrete curbs and gutters.
      d. Concrete median barriers.
      e. Concrete sidewalks.
      f. Concrete stair steps.
      g. Concrete driveways.

B. Related Requirements:
   1. Section 32 13 15 - Joint Sealer.
   2. Structural Notes in Plans

1.2 UNIT PRICE MEASUREMENT AND PAYMENT

A. Concrete Paving will not be paid for as a separate bid item but shall be considered incidental to the item for which it pertains.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

B. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

C. ASTM International:
   1. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
   2. ASTM A185/A185M - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
   3. ASTM A497/A497M - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
   4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   5. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   6. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

7. ASTM A775/A775M - S Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
8. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
9. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
10. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
11. ASTM C33 - Standard Specification for Concrete Aggregates.
12. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
13. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
14. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
15. ASTM C150 - Standard Specification for Portland Cement.
16. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
17. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
18. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
19. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
20. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
21. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
22. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
23. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
24. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
25. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
26. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
27. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
28. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
29. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
30. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
31. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
32. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.4 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit data on concrete materials, joint filler, admixtures, and curing compounds.

C. Design Data:
   1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
      a. Hot and cold weather concrete work.
   2. Identify mix ingredients and proportions, including admixtures.
   3. Identify chloride content of admixtures and whether chloride was added during manufacture.

D. Source Quality Control Submittals: Indicate results of shop factory tests and inspections.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and the requirements of Structural Notes on Plans.

B. Obtain cementitious materials from same source throughout.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.8 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.

B. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.1 CONCRETE PAVING

A. Form Materials:
   1. Form Materials: As specified in Section Structural Notes on Plans.
   2. Joint Sealer: Shall be in accordance with Section 32 13 15 - Joint Sealer.

B. Reinforcement:
   1. Reinforcing Steel: Type specified in Structural Notes on Plans.

a. Dowel Bars: Dowel bars shall be plain steel bars conforming to ASTM A615 or ASTM A966 and shall be free from burring or other deformation restricting slippage in the concrete. Before delivery to the construction site each dowel bar shall be painted with one coat of paint conforming to MIL-DTL-24441/20A.SSPC Paint 5 or SSPC Paint 25. Metal or plastic collars (when indicated on Drawings) shall be full circular device supporting the dowel until the epoxy hardens.

The sleeves for dowel bars used in expansion joints shall be translucent of an approved design to cover 2 inches (minimum) of the dowel, with a closed end and with a suitable stop to hold the end of the bar at least 1½ inches from the closed end of the sleeve. Sleeves shall be of such design that they will not collapse during construction.

C. Concrete Materials:
1. Concrete Materials shall be as specified in Structural Notes on Plans.

2.2 FABRICATION

A. Fabricate reinforcing in accordance with CRSI Manual of Practice.

B. Form standard hooks for 180-degree bends and 90-degree bends as indicated on the Drawings.

2.3 MIXES

A. Concrete Mix:
1. Mix and deliver concrete in accordance with ASTM C94/C94M, Option a.
2. Select proportions for normal weight concrete in accordance with ACI 301 Method 1.
3. Provide concrete to the following criteria:
   a. Compressive Strength: 4000 psi at 28 days.
   b. Slump: 3 inches to ±1 inch.
   c. Minimum Cement Content: 564 pounds/cu yd.
   d. Maximum Water/Cement Ratio: 0.45 (non-air entrained); 0.35 (air entrained).
   e. Air Entrainment: ASTM C94/C94M; for severe exposure condition; maximum variation of 1.5 percent from required air content.
4. Limit the following cementitious materials to maximum percentage by mass of all cementitious materials:
   a. Fly Ash: 0 percent. Fly ash shall not be used.
5. Use accelerating admixtures in cold weather only when approved by the Engineer in writing. Use of admixtures will not relax cold weather placement requirements.
6. Use calcium chloride only when approved by the Engineer in writing.
7. Use set retarding admixtures during hot weather only when approved by the Engineer in writing.

2.4 ACCESSORIES

A. Curing Compound: ASTM C309, Type 2, Class B.

B. Joint Sealers: Specified in Section 32 13 15 – Joint Sealer.

C. Premolded Joint Filler: Premolded resilient joint filler for expansion joints shall conform to the requirements of ASTM D1751 and shall be punched to admit the dowels where called for on the plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint, unless otherwise specified by the Engineer. When the use of more than one piece is required for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening means satisfactory to Engineer. Joint filler shall be compatible with joint sealant.

2.5 SOURCE QUALITY CONTROL

A. In accordance with Structural Notes on Plans.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify compacted base or subgrade is dry and ready to support paving and imposed loads.
1. Proof roll subgrade with two perpendicular passes to identify soft spots.
2. Remove soft subgrade or base and replace with Flexible Base.

C. Verify gradients and elevations of base are correct.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Moisten substrate to minimize absorption of water from fresh concrete.

C. Coat surfaces of manhole frames with oil to prevent bond with concrete paving.

D. Notify Engineer minimum 24 hours prior to commencement of concrete operations.

3.3 INSTALLATION

A. Forms:
1. Place and secure forms and screeds to correct location, dimension, profile, and gradient.
2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

B. Reinforcement:
1. Place reinforcing as indicated on Drawings.
2. Interrupt reinforcing at expansion joints.
3. Provide doweled joints as indicated on Drawings. Dowel bars or other load-transfer units of an approved type shall be placed across joints in the manner as shown on Drawings. They shall be of the dimensions and spacings as shown and held rigidly in the middle of the slab depth in the proper horizontal and vertical alignment of by an approved assembly

device to be left permanently in place. The dowel or load-transfer and joint devices shall be rigid enough to permit complete assembly as a unit ready to be lifted and placed into position. A dowel expansion cap or sleeve shall be furnished for each dowel bar used with expansion joints. These caps shall be substantial enough to prevent collapse and shall be placed on the ends of the dowels as shown on Drawings. The caps or sleeves shall fit the dowel bar tightly and the closed end shall be watertight. The portion of each dowel painted with rust preventative paint, as required under paragraph 2.1(B) and shown on Drawings to receive a debonding lubricant, shall be thoroughly coated with asphalt MC-70, or an approved lubricant, to prevent the concrete from bonding to that portion of the dowel. If free-sliding plastic-coated or epoxy-coated steel dowels are used, a lubrication bond breaker shall be used except when approved pullout tests indicate it is not necessary. Where butt-type joints with dowels are designated, the exposed end of the dowel shall be oiled.

4. Repair damaged galvanizing and/or epoxy coating to match shop finish.
5. Install tie bars consisting of deformed bars in joints as shown on Drawings. Tie bars shall be placed at right angles to the centerline of the concrete slab and shall be spaced at intervals shown on Drawings. They shall be held in position parallel to the pavement surface and in the middle of the slab depth. When tie bars extend into an unpaved lane, they may be bent against the form at longitudinal construction joints, unless threaded bolt or other assembled tie bars are specified. These bars shall not be painted, greased, or enclosed in sleeves. When slip-form operations call for tie bars, two-piece hook bolts can be installed in the female side of the keyed joint provided the installation is made without distorting the keyed dimensions or causing edge slump. If a bent tie bar installation is used, the tie bars shall be inserted through the keyway liner only on the female side of the joint. In no case shall a bent tie bar installation for male keyways be permitted.

C. Placing Concrete:
   1. Place concrete as specified in Structural Notes on Plans.
   2. Ensure reinforcing, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
   3. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

D. Joints: Joints shall be constructed as shown on Drawings and in accordance with these requirements. All joints shall be constructed with their faces perpendicular to the surface of the pavement and finished or edged as shown on Drawings. Joints shall not vary more than ½-inch from their designated position and shall be true to line with not more than ¼-inch variation in 10 feet. The surface across the joint shall be tested with a 10-foot straightedge as the joints are finished and any irregularities in excess of ¼-inch shall be corrected before the concrete has hardened. All joints shall be so prepared, finished, or cut to provide a groove of uniform width and depth as shown on Drawings.
   1. Place expansion joints as indicated on Drawings. Premolded joint filler of the thickness as shown on Drawings shall extend for the full depth and width of the slab at the joint, except for space for sealant at the top of the slab. The filler shall be securely staked or fastened into position perpendicular to the proposed finished surface. A cap shall be provided to protect the top edge of the filler and to permit the concrete to be placed and finished. After the concrete has been placed and struck off, the cap shall be carefully withdrawn leaving the space for the premolded filler. The edges of the joint shall be finished and tooled while the concrete is still plastic. Any concrete bridging the joint

space shall be removed for the full width and depth of the joint. Align curb, gutter, pavement, and sidewalk joints.

2. Place isolation joints between paving components and building or other structures as indicated on Drawings. Construct isolation joints identically to expansion joints as specified in (1), above. Isolation joints shall not be dowelled.
3. Provide construction joints as indicated on Drawings. Longitudinal construction joints shall be slip-formed or formed against side forms with or without keyways, as shown on Drawings. Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for more than 30 minutes or it appears that the concrete will obtain its initial set before fresh concrete arrives. The installation of the joint shall be located at a planned contraction or expansion joint. If placing of the concrete is stopped, the Contractor shall remove the excess concrete back to the previous planned joint.
4. Install contraction joints at the locations and spacing as shown on Drawings. Contraction joints shall be installed to the dimensions required by forming a groove or cleft in the top of the slab while the concrete is still plastic or by sawing a groove into the concrete surface after the concrete has hardened. When the groove is formed in plastic concrete the sides of the grooves shall be finished even and smooth with an edging tool. If an insert material is used, the installation and edge finish shall be according to the manufacturer's instructions. The groove shall be finished or cut clean so that spalling will be avoided at intersections with other joints. Groove or saw cut contraction joints ¼-inch wide at an optimum time as soon as possible after finishing. Cut ¼ of depth of slab into the slab. If contraction joint spacing is not indicated on Drawings, maximum contraction joint spacing shall be thirty (30) times the depth of the concrete paving.
5. Seal joints as indicated on Drawings and in accordance with Section 32 13 15 – Joint Sealer.
6. Provide keyways as indicated on Drawings. Form keyways (only female keys permitted) in the plastic concrete by means of side forms or the use of keyway liners that are inserted during the slip-form operations. The keyway shall be formed to a tolerance of ¼ inch in any dimension and shall be of sufficient stiffness to support the upper keyway flange without distortion or slumping of the top of the flange. The dimensions of the keyway forms shall not vary more than plus or minus ¼ inch from the mid-depth of the pavement. Liners that remain in place permanently and become part of the keyed joint shall be made of galvanized, copper clad, or of similar rust-resistant material compatible with plastic and hardened concrete and shall not interfere with joint reservoir sawing and sealing.

E. Finishing Schedule:
   1. Vehicular Paving: Light broom

F. Curing and Protection
   1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
   2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   3. Cure concrete surfaces as specified in Structural Notes on Plans.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

C. Maximum Variation From True Position: 1/4 inch.

D. Maximum Variation in Thickness: 1/4 inch.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting, testing.

B. Inspect reinforcing placement for size, spacing, location, support.

C. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.

D. Strength Test Samples:
   1. Sampling Procedures: ASTM C172.
   2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cured.
   3. Sample concrete and make one set of three standard cylinders for every 50 cu yds or less of each class of concrete placed each day and for every 2500 sf of surface area paving.
   4. Make one additional cylinder during cold weather concreting, and field cure.

E. Field Testing:
   1. Slump Test Method: ASTM C143/C143M.
   2. Air Content Test Method: ASTM C173/C173M ASTM C231.
   3. Temperature Test Method: ASTM C1064/C1064M.
   4. Measure slump and temperature for each compressive strength concrete sample.
   5. Measure air content in air entrained concrete for each compressive strength concrete sample.

F. Cylinder Compressive Strength Testing:
   1. Test Method: ASTM C39/C39M.
   2. Test Acceptance: Average compressive strength of three consecutive test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive by more than 500 psi.
   3. Test one cylinder at 7 days.
   4. Test one cylinder at 28 days.
   5. Retain one cylinder for reserve for testing later when requested by Engineer.
   6. Dispose remaining cylinders when testing is not required.

G. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.6 PROTECTION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

C. Do not permit vehicular traffic over paving for 14 days (minimum) after finishing.

END OF SECTION

SECTION 32 13 15 - JOINT SEALER

PART 1 GENERAL

1.1 SUMMARY

A. Section includes sealants, joint backer rod, and accessories.

B. Related Sections:
   1. Section 32 13 13 – Concrete Paving: Sealants required in conjunction with concrete paving.

1.2 REFERENCES

A. ASTM International:
   1. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
   2. ASTM C1193 - Standard Guide for Use of Joint Sealants.
   3. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
   4. ASTM D1667 - Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
   5. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Conform to submittal requirements.

B. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.

E. Warranty: Include coverage for installed sealants and accessories failing to achieve watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Texas Department of Transportation’s Standard Specifications for Construction of Highways, Streets, and Bridges (latest Edition).

B. Maintain one copy ofTexas Department of Transportation’s Standard Specifications for Construction of Highways, Streets, and Bridges (latest Edition) document on site.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 MOCKUP

A. Section 01 40 00 - Quality Requirements: Requirements for mockup.

B. Construct mockup with specified sealant types and with other components noted.
   1. Determine preparation and priming requirements based on manufacturers recommendations; take action necessary for correction of failure of sealant tests on mock-up.
   2. Verify sealants, primers, and other components do not stain adjacent materials.

C. Locate where directed by Engineer.

D. Incorporate accepted mockup as part of Work.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with sections referencing this section.

PART 2 PRODUCTS

2.1 JOINT SEALERS

A. Manufacturers:
   1. Sonneborne Building Products.
   2. Substitutions: Section 01 60 00 - Product Requirements.

B. Products Description:
   1. General Purpose Traffic Bearing Sealant (Sealant self-leveling): Polyurethane; ASTM C920, Grade P, Class 25, Use T,M; single component.
      a. Type: Sonolastic SLI manufactured by Sonneborne.
      b. Color: Colors as selected.
      c. Applications: Use for exterior, pedestrian, and vehicular traffic bearing joints.

2.2 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. Joint Backer Rod: Round foam rod compatible with sealant; ASTM D1056, sponge or expanded rubber; D1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces and joint openings are ready to receive work.

C. Verify joint backer rod and release tapes are compatible with sealant.

3.2 PREPARATION

A. Saw joints in accordance with Drawings.

B. Immediately after sawing the joint, remove slurry and foreign matter from the joint and adjacent area by flushing with high-pressure water jet, and by use of other tools as necessary.

C. Immediately before sealing, clean and prime joints. Upon completion of cleaning, the joints shall be blown out with compressed air, free of oil and water. The joint faces shall be surface dry when the sealant is applied.

D. Perform preparation in accordance with ASTM C1193.

E. Protect elements surrounding Work of this section from damage or disfiguration.

3.3 INSTALLATION

A. Perform installation in accordance with ASTM C1193.

B. Apply joint sealant by means of pressure equipment that will force the sealing material to the bottom of the joint and completely fill the joint without spilling the material on the surface of the pavement. A backing material shall be placed as shown on Drawings and shall be nonreactive and nonadhesive to the concrete or the sealant material. Sealant that does not bond to the concrete surface of the joint walls, contains voids, or fails to set to a tack-free condition will be rejected and replaced by the Contractor at no additional cost. Before sealing the joints, the Contractor shall demonstrate that the equipment and procedures for preparing,

mixing, and placing the sealant will produce a satisfactory joint seal. Any sealant spilled on the surface of the pavement, structures and/or adjacent areas shall be removed immediately.

C. Surface bond area on each side not less than 75 percent of joint width.

D. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints as detailed on Drawings.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean adjacent soiled surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect sealants until cured.

END OF SECTION

SECTION 32 91 19 - LANDSCAPE GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Final grade topsoil for finish landscaping.

B. Related Sections:
   1. Section 31 05 13 - Topsoil
   2. Section 31 23 17 - Trenching.
   3. Section 31 23 23 - Fill.
   4. Section 32 92 19 - Seeding.
   5. Section 32 92 23 - Sodding.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Landscape Grading will not be paid for as a separate bid item but shall be considered incidental to the item for which it pertains.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Materials Source: Submit name of imported materials source.

1.4 QUALITY ASSURANCE

A. Furnish each topsoil material from single source throughout the Work.

PART 2 PRODUCTS

2.1 MATERIAL

A. Topsoil: As specified in Section 31 05 13 – Topsoil.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify structural and trench backfilling have been inspected.

C. Verify substrate base has been contoured and compacted.

3.2 PREPARATION

A. Protect landscaping and other features remaining as final Work.

B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.

3.3 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, stones, in excess of 2 inches in size. Remove contaminated subsoil.

C. Scarify surface to depth of 4 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.4 PLACING TOPSOIL

A. Place topsoil in areas where seeding and/or sodding is required to nominal depth of four inches, or as indicated on the Drawings. Place topsoil during dry weather.

B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.

C. Remove roots, weeds, rocks, and foreign material while spreading.

D. Manually spread topsoil close to plant material, structures, water and wastewater appurtenances, concrete paving, and curbs to prevent damage.

E. Lightly roll the placed topsoil.

F. Remove surplus subsoil and topsoil from site.

G. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.5 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Top of Topsoil: Plus or minus 1/2 inch.

3.6 PROTECTION OF INSTALLED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Prohibit construction traffic over topsoil.

END OF SECTION

SECTION 32 92 19 - SEEDING

PART 1 GENERAL

1.1 SUMMARY

A. Description: This item shall consist of preparing a seed bed to the lines and grades indicated, sowing of seed, fertilizing, mulching with straw, asphalt, cellulose fiber and other management practices along and across such areas as are indicated or as directed by the Engineer.

B. Section Includes:
1. Fertilizing.
2. Seeding.
3. Hydroseeding.
4. Mulching.
5. Maintenance.

C. Related Sections:
1. Section 31 05 13 - Topsoil.
2. Section 32 91 19 - Landscape Grading.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Seeding will not be paid for as a separate bid item but shall be considered incidental to the items for which it pertains.

1.3 REFERENCES

A. ASTM International:
1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

1.4 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, Brome Grass, or vegetative species other than specified species to be established in given area.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for seed mix, fertilizer, mulch, stabilizer and other accessories.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; and types, application frequency, and recommended coverage of fertilizer.

1.7 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

1.8 QUALIFICATIONS

A. Seed Supplier: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.10 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance service.

B. Maintain seeded areas immediately after placement until grass is well established and exhibits vigorous growing condition.

PART 2 PRODUCTS

2.1 SEED

A. All seed must meet the requirements of the Texas Seed Law including the labeling requirements for showing pure live seed (PLS), name and type of seed. Seed furnished shall be of the previous season’s crop and the date of analysis shown on each bag shall be within nine months of the time of delivery to the project. Each variety of seed shall be furnished and delivered in separate bags or containers. A sample of each variety of seed shall be furnished for analysis and testing when directed by the Engineer. The amount of seed planted per acre shall be of the type specified below.

B. Substitutions: Section 01 60 00 - Product Requirements.

2.2 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. Straw mulch shall be spread uniformly over the area indicated or as designated by the Engineer at the rate of 2 to 2 1/2 tons of straw per acre. The actual rate of application will be designated by the Engineer. Straw may be hand or machine placed and adequately secured.

B. Cellulose Fiber Mulch: Cellulose fiber mulch shall be spread uniformly over the area indicated or as designated by the Engineer at the rate of 45 to 80 lbs per 1000 square feet.

C. Fertilizer: All fertilizer shall be delivered in bags or containers clearly labeled showing the analysis. The fertilizer is subject to testing by the State Chemist in accordance with the Texas Fertilizer Law. A pelleted or granulated fertilizer shall be used with an analysis indicated below. The figures in the analysis represent the percent of nitrogen, phosphoric acid and potash nutrients, respectively, as determined by the methods of the Association of Official Agricultural Chemists. Fifty percent or greater of the Nitrogen required shall be in the form of Nitrate Nitrogen (NO_3). The remaining Nitrogen required may be in the form of Urea Nitrogen ($CO(NH_2)_2$).

   In the event it is necessary to substitute a fertilizer of a different analysis, it shall be a pelleted or granulated fertilizer with a lower concentration. The total amount of nutrients furnished and applied per acre shall equal or exceed that specified for each nutrient.

   Fertilizer shall be commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil to the following proportions: Nitrogen 15 percent, phosphoric acid 15 percent, soluble potash 15 percent.

D. Lime: ASTM C602, Class T agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

E. Water: Clean, fresh and free of industrial wastes and other substances or matter capable of inhibiting vigorous growth of grass.

F. Soil Retention Blanket: Jute mesh or matting (open weave), or other material used as a soil retention blanket for erosion control purposes.

G. Herbicide: As specified.

H. Stakes: Softwood lumber, chisel pointed.

I. String: Inorganic fiber.

2.3 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

C. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.

D. Testing is not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify prepared soil base is ready to receive the Work of this section.

3.2 PREPARING SEED BED

A. After the designated areas have been rough graded to the lines, grades and typical sections indicated or as provided for in other items of this contract and any other soil area disturbed by the construction, a suitable seed bed shall be prepared. The seed bed shall consist of either 4 inches of approved topsoil or 4 inches of approved salvaged topsoil cultivated and rolled sufficiently to a state of good tilth which could prevent the seed from being covered too deep for optimum germination. The optimum depth for seeding shall be 1/4 inch. Water shall be applied as required to prepare the seed bed. Seeding shall be performed in accordance with the requirements hereinafter described.

3.3 FERTILIZING

A. Apply lime at application rate recommended by soil analysis. Work lime into top 6 inches of soil.

Apply fertilizer at application rate as indicated below:

Use	Type	Application Rate Pound Per Acre
Broadcast Seeding	Any	400
Hydraulic Seeding	Water Soluble	653
Sodding	Any	300

B. Apply after smooth raking of topsoil and prior to roller compaction.

C. Do not apply fertilizer at same time or with same machine used to apply seed.

D. Mix fertilizer thoroughly into upper 2 inches of topsoil.

E. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.4 BROADCAST SEEDING

A. The seed or seed mixture in the quantity specified shall be uniformly distributed over the prepared seed bed areas indicated or where directed. If the sowing of seed is by hand, rather than by mechanical methods, the seed shall be sown in two directions at right angles to each other. If mechanical equipment is used, all varieties of seed, as well as fertilizer, may be distributed at the same time, provided that each component is uniformly applied at the specified rate. After planting, the planted area shall be rolled with a corrugated roller of the "Culitpacker" type. All rolling of the slope areas shall be on the contour.

B. Seed Mixture and Rate of Application for Broadcast Seeding: From September 15 to March 1, seeding shall be with a combination of unhulled Bermuda Grass at a rate of 2 pounds per 1000 square feet and winter rye at a rate of 7 pounds per 1000 square feet that has a PLS = 0.83. From March 1 to September 15, seeding shall be with hulled Bermuda Grass at a rate of 2 pounds per 1000 square feet with a PLS = 0.83. Fertilizer shall be applied as specified herein.

C. Do not seed areas in excess of that which can be mulched on same day.

D. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

E. Lightly roll seeded area with roller not exceeding 112 lbs/linear foot.

F. Immediately following seeding and rolling, apply mulch to thickness of 1/8 inch. Maintain clear of shrubs and trees.

G. The broadcast seeded areas shall immediately be watered with a minimum of 5 gallons of water per square yard or as needed and in the manner and quantity as directed by the Engineer. Water shall be applied at a minimum rate of 10 gallons per square yard weekly except when rainfall of 1/2 inch or greater occurs on the site, the water can be postponed for one week or as directed, until the grass is uniformly 1 1/2 inches in height.

3.5 HYDRAULIC SEEDING

A. The seed bed shall be prepared as specified above and hydraulic seeding equipment, which is capable of placing all materials in a single operation, shall be used.

March 1 to September 15: Hydraulic seeding mixture and minimum rate of application per 1000 square feet:

Hulled Bermuda Seed (PLS = 0.83)	**Water Soluble Fertilizer**	**Cellulose Fiber Mulch**	**Soil Tackifier**
1 lb.	15 lbs.	45.9 lbs.	1.4 lbs.

September 15 to March 1: Add 7 pounds per 1000 square feet of winter rye with a PLS = 0.83 to above mixture. Fertilizer shall be applied as specified herein.

B. Watering: Hydraulically planted seeded area shall be watered weekly, except when rainfall of 1/2 inch or greater occurs on the site, the watering can be postponed for one week, commencing after the tackifier has dried or until the grass is uniformly 1 1/2 inches in height.

The native grass seeded area shall be watered at a minimum rate of 5 gallons per square yard weekly commencing after the tackifier has dried or until the grass is uniformly 1 1/2 inches in height. The watering can be postponed for one week or as directed, when rainfall of 1 1/2 inches or greater occurs on the site.

3.6 SEED PROTECTION

A. Cover seeded slopes where grade is 3:1 (Horizontal:Vertical) or greater with soil retention blanket. Roll fabric onto slopes without stretching or pulling.

B. Lay fabric smoothly on surface, bury top end of each section in 6-inch-deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth, level with adjacent soil.

C. Secure outside edges and overlaps at 36-inch intervals with stakes.

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.7 MAINTENANCE

A. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.

D. Water to prevent grass and soil from drying out.

E. Lightly roll surface to remove minor depressions or irregularities.

F. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

G. Immediately reseed areas showing bare spots.

H. Repair washouts or gullies.

I. Protect seeded areas with warning signs during maintenance period.

END OF SECTION

SECTION 32 92 23 - SODDING

PART 1 GENERAL

1.1 SUMMARY

A. Description: This item shall consist of providing fertilizer and planting Bermuda Grass or other acceptable sod indicated, along or across such areas as are indicated and in accordance with specification requirements outlined herein.

B. Section Includes:
1. Preparation of subsoil.
2. Placing topsoil.
3. Fertilizing.
4. Sod installation.
5. Maintenance.

C. Related Sections:
1. Section 31 05 13 - Topsoil.
2. Section 32 91 19 - Landscape Grading.
3. Section 32 92 19 - Seeding.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Sodded Areas will not be paid for as a separate bid item but shall be considered incidental to the items for which they pertain.

1.3 REFERENCES

A. ASTM International:
1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

B. Turfgrass Producers International:
1. TPI - Guideline Specifications to Turfgrass Sodding.

1.4 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, Brome Grass or vegetative species other than specified species to be established in given area.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for sod grass species, fertilizer, mulch, herbicide and other accessories.

C. Submit minimum 10 oz sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.

D. Test Reports: Indicate topsoil nutrient and pH levels with recommended soil supplements and application rates.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Submit maintenance instructions, cutting method and maximum grass height; and types, application frequency, and recommended coverage of fertilizer.

1.7 QUALITY ASSURANCE

A. Sod: Root development capable of supporting its own weight without tearing, when suspended vertically by holding upper two corners.

1.8 QUALIFICATIONS

A. Sod Producer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience approved by sod producer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver sod on pallets or in rolls as specified. Protect exposed roots from dehydration.

C. Do not deliver more sod than can be laid within 24 hours.

1.10 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate with installation of underground sprinkler system piping and watering heads.

1.11 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Maintenance service.

B. Maintain sodded areas immediately after placement until grass is well established and exhibits vigorous growing condition.

PART 2 PRODUCTS

2.1 SOD

A. Sod: The sod shall consist of live, growing Bermuda Grass or other acceptable sod indicated secured from sources where the soil is fertile. St. Augustine and Bermuda sod shall have a healthy, virile root system of dense, thickly matted roots throughout the soil of the sod for minimum thickness of 1 inch. The thickness measure does not include grass. The sod shall be cut in rectangular pieces with its shortest side not less than 12 inches. The Contractor shall not use sod from areas where the grass is thinned out nor where the grass roots have been dried out by exposure to the air and sun to such an extent as to damage its ability to grow when transplanted. The sod shall be free from noxious weeds or other grasses and shall not contain any matter deleterious to its growth or which might affect its subsistence or hardiness when transplanted. Unless the area has been closely pastured, it shall be closely mowed and raked to remove all weeds and long-standing stems. Sources from which sod is to be secured shall be approved by the Engineer.

   Care shall be taken at all times to retain the native soil of the roots of the sod during the process of excavating, hauling and planting. Sod material shall be kept moist from the time it is dug until planted. When so directed by the Engineer, the sod existing at the source shall be watered to the extent required prior to excavating.

2.2 SOIL MATERIALS

A. Topsoil: As specified in Section 31 05 13.

2.3 ACCESSORIES

A. Fertilizer: Commercial grade; recommended for grass, with fifty percent of elements derived from organic sources; of proportion necessary to eliminate deficiencies of topsoil to the following proportions: nitrogen 15 percent, phosphoric acid 15 percent, soluble potash 15 percent.

B. Lime: ASTM C602, Class T agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

C. Water: Clean, fresh and free of industrial wastes and other substances or matter capable of inhibiting vigorous growth of grass.

D. Wood Pegs: Softwood, sufficient size and length to anchor sod on slope.

E. Herbicide: As specified.

2.4 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

C. Provide recommendation for fertilizer and lime application rates for specified sod grass species as result of testing.

D. Testing is not required when recent tests are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify prepared soil base is ready to receive the Work of this section.

3.2 PREPARATION OF SUBSOIL

A. Prepare sub-soil and eliminate uneven areas and low spots.

B. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

C. Remove foreign materials and undesirable plants and their roots. Do not bury foreign material beneath areas to be sodded.

D. Remove contaminated subsoil.

E. Scarify sub-soil to depth of 4 inches where topsoil is to be placed.

F. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

3.3 PLACING TOPSOIL

A. Spread topsoil to minimum depth of 4 inches over area to be sodded.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas and to ensure positive drainage.

E. Install edging at periphery of sodded areas in straight lines to consistent depth.

3.4 FERTILIZING

A. Apply lime at application rate recommended by soil analysis. Work lime into top 6 inches of soil.

B. Apply fertilizer at application rate of 300 pounds per acre.

C. Apply fertilizer after smooth raking of topsoil and prior to installation of sod.

D. Apply fertilizer no more than 48 hours before laying sod.

E. Mix fertilizer thoroughly into upper 4 inches of topsoil.

F. Lightly water soil to aid dissipation of fertilizer.

3.5 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod.

B. Lay sod immediately after delivery to site to prevent deterioration.

C. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.

D. Lay smooth. Align with adjoining grass areas.

E. Place top elevation of sod 1/2 inch below adjoining edging, paving, curbs, sidewalks or flatwork.

F. On slopes 3:1 (Horizontal:Vertical) and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. When using “big roll”, lay sod parallel to slope. Drive pegs flush with soil portion of sod.

G. Do not place sod when temperature is lower than 32 degrees F.

H. Watering: Immediately after the area is sodded, it shall be watered with a minimum of 5 gallons of water per square yard or at 10-day intervals as needed and as directed by the Engineer. Water shall be applied a minimum rate of 3 gallons per square yard as required or as directed by the Engineer until final acceptance or until the grass uniformly reaches 2 1/2 inches in height.

I. After sod and soil have dried, roll sodded areas to bond sod to soil and to remove minor depressions and irregularities.

3.6 MAINTENANCE

A. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing.

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 or irregularities.

F. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

G. Immediately replace sod on areas showing deterioration or bare spots.

H. Protect sodded areas with warning signs during maintenance period.

END OF SECTION

SECTION 33 01 30 – FRAMES, GRATES, RINGS AND COVERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Construction of frames, grates, rings and covers.
   2. Raising manhole frames and covers.
   3. Replacing manhole frames and covers.

B. Related Sections:
   1. Section 33 05 14 - Manholes and Structures.
   2. Structural Notes in Plans

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Frames, Grates, Rings and Covers will not be measured and payment for furnishing all materials, tools, equipment, labor and incidentals necessary to complete the work will be included in the Bid items for the items which include these items.

1.3 REFERENCES

A. ASTM International:
   1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
   2. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
   3. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
   4. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete.
   5. ASTM C672 - Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
   6. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
   7. ASTM D395 - Standard Test Method for Rubber Property - Compression Set.
   8. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
   9. ASTM D573 - Standard Test Method for Rubber-Deterioration in an Air Oven.
   10. ASTM D575 - Standard Test Methods for Rubber Properties in Compression.
   11. ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness.
   12. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   13. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manhole covers and riser rings construction, features, configuration and dimensions.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual grade elevation of manhole.

1.6 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 three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in undamaged, unopened containers, bearing manufacturer’s original labels. Inspect for damage.

C. Protect materials from damage by storage in secure location.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

PART 2 PRODUCTS

2.1 FRAMES, GRATES, RINGS AND COVERS

A. Manufacturers:
   1. East Jordan Iron Works (EJ Group, Inc.).
   2. Neenah Foundry (Neenah Enterprises, Inc.).
   3. Substitutions: Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Welded Steel:
   1. Welded steel grates and frames shall conform to the member, size, dimensions and details indicated and shall be welded into an assembly in accordance with those details. Steel shall conform to the requirements of ASTM A36.

B. Castings:
   1. Castings, whether Carbon-Steel, Gray Cast Iron or Ductile Iron shall conform to the shape and dimensions indicated and shall be clean substantial castings, free from sand or blowholes or other defects. Surfaces of the castings shall be free from burnt on sand and shall be reasonably smooth. Runners, risers, fins and other cast on pieces shall be removed from the castings and such areas ground smooth. Bearing surfaces between manhole rings and covers or grates and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact. Pairs of machined castings shall be matchmarked to facilitate subsequent identification at installation.
   2. Steel castings shall conform to ASTM A27, “Mild to Medium Strength Carbon Steel Castings for General Application.” Grade 70-36 shall be furnished unless otherwise specified.
   3. Cast iron castings shall conform to ASTM A48, “Gray Iron Castings,” Class 30.
   4. Ductile Iron castings shall conform to ASTM A536, “Ductile Iron Castings.” Grade 60-40-18 shall be used unless otherwise indicated.

C. Rings:
   1. ASTM A536, “Gray Iron Castings.”
   2. Precast Concrete: Section 03 41 00

D. Nuts and Bolts:
   1. Stainless Steel ASTM F593

E. Mortar:
   1. Mortar for bedding castings shall consist of one part cement and 3 parts sand meeting the requirements Structural Notes on Plans.

F. Accessories:
   1. Joint Sealant: ASTM C990.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify and locate manholes requiring grade adjustment.

3.2 CONSTRUCTION METHODS

A. Frames, grates, rings and covers shall be constructed of the materials as specified and in accordance with the details indicated and shall be placed carefully to the lines or grades indicated or as directed by the Engineer.

B. All welding shall conform to the requirements of the AWS-D-1-72. Welded frames, grates, rings and covers shall be hot-dipped galvanized (ASTM F1554).

C. Painting of gray iron castings will not be required, except when used in conjunction with structural steel shapes.

END OF SECTION

SECTION 33 05 14 - MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Cast-in-Place concrete manholes and structures with transition to cover frame, covers, anchorage, and accessories.
2. Modular precast concrete manholes and structures with tongue-and-groove joints with transition to cover frame, covers, anchorage, and accessories.
3. Doghouse manhole connections to existing sanitary and storm sewer lines.
4. Bedding, embedment, and backfill materials.

B. Related Sections:
1. Section 31 23 16 - Excavation
2. Section 31 23 23 - Fill
3. Section 32 05 16 - Aggregates for Civil Site Improvements.
4. Section 33 01 30 - Frames, Grates, Rings, and Covers.
5. Section 33 01 32 - Sewer and Manhole Testing.

1.2 REFERENCES

A. American Association of State Highway Transportation Officials:
1. AASHTO M288 - Geotextiles.
2. AASHTO M306 - Drainage Structure Castings.
3. AASHTO M91 - Sewer and Manhole Brick (Made from Clay or Shale).

B. American Concrete Institute:
1. ACI 530/530.1 - Building Code Requirements for Masonry Structures and Specifications for Masonry Structures.

C. ASTM International:
1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale).
4. ASTM C55 - Standard Specification for Concrete Brick.
5. ASTM C361 - Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.
6. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
7. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
8. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
9. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate structure locations, elevations, piping, conduit, and invert sizes and elevations of penetrations.

C. Product Data: Submit manhole covers, component construction, features, configuration, dimensions and invert configuration.

1.4 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.

1.5 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Comply with precast concrete manufacturer's instructions and ASTM C913 for unloading, storing and moving precast manholes and drainage structures.

C. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.

D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Cold Weather Requirements: ACI 530/530.1.

1.7 WARRANTY

A. Warranty on equipment and installation is one (1) year from Final Completion, in accordance with Article 6.19 of the General and Supplemental Conditions.

PART 2 PRODUCTS

2.1 MANHOLES AND STRUCTURES

A. Furnish materials in accordance with City of Gatesville standards.

B. Precast Concrete Manholes and Structures (Wastewater): Precast Reinforced Concrete Manhole sections shall be made from crushed limestone coarse aggregates and natural silica fine sand aggregates. The concrete shall be sulfate resistant concrete with Type V Portland Cement and antimicrobial admixture as per Paragraph 2.4(A). The maximum water-cement ratio shall be 0.40 and the 28-day concrete compressive strength shall not be less than 5000 psi and the absorption shall not exceed 9%. Fly ash may be used for up to 30% of the cementitious material provided it has been tested in accordance with ASTM C1012 and exhibits a positive sulfate resistance when used with the sulfate-resistant concrete mix design. Type C fly ash shall not be used in sulfate resistant concrete. The structure shall be "moist-cured" for a minimum period of four (4) days.

The minimum wall thickness of the manhole shall be as follows:

Manhole Size	Minimum Wall Thickness
48" I.D.	5"
60" I.D.	6"
72" I.D.	7"
84" I.D.	8"

Cone sections will be made with 5" minimum wall at the bottom and an 8" wall thickness at the top. All base riser sections will be made with the bottom cast monolithically. The minimum thickness of the bottom shall be 6" for all manhole diameters. The manhole diameter to be used shall be as indicated on Drawings.

C. Cast-in-Place Manholes and Structures (Wastewater): Reinforced cast-in-place concrete as specified in Structural Notes on Plans with antimicrobial admixture per Paragraph 2.4(A).

D. Grout: As specified in Structural Notes on Plans.

E. Reinforcement: As specified in Structural Notes on Plans.

2.2 FRAMES, GRATES, RINGS AND COVERS

A. Furnish and install in accordance with Section 33 01 30 - Frames, Grates, Rings and Covers.

2.3 CONFIGURATION

A. Shaft Construction and Concentric or Eccentric (as indicated) Cone Top Section: Reinforced precast or Cast-In-Place Concrete pipe sections, lipped male/female gasketed joints, sleeved to receive pipe.

B. Shape: Cylindrical.

C. Clear Inside Dimensions: 48, 60, or 72-inch diameter as indicated on Drawings.

D. Design Depth: As indicated on Drawings.

E. Clear Cover Opening: 30 inches diameter.

F. Pipe Entry: Furnish openings as indicated on Drawings.

G. Structure Joint Gaskets: ASTM C361; ASTM C990; and Federal Specification No. SS-S-00210; rubber.
   1. Manufacturers:
      a. Ram-Neck.
      b. Kent-Seal No. 2.

2.4 ACCESSORIES

A. Antimicrobial Admixture for Sulfate Resistant Concrete for Wastewater Manholes:
   1. An antimicrobial agent, ConmicShield®, or approved equal, shall be used to render the concrete uninhabitable for bacteria growth.
   2. The liquid antibacterial admixture shall be an EPA registered material and the registration number shall be submitted for approval prior to use in the project.
   3. The amount to be used shall be as recommended by the manufacturer of the antibacterial admixture. This amount shall be included in the total water content of the concrete mix design.
   4. The admixture shall be added into the concrete mix water to insure even distribution of the admixture throughout the concrete mixture.
   5. ConTint concrete colorant, or approved equal, shall be added at the manufacturer's recommended dosage.
   6. Acceptance: acceptance of a product on the basis of a letter of certification to the Engineer stating that the correct amount and correct mixing procedure was followed for all antimicrobial concrete.
   7. Product Marking: add the name of the antimicrobial product.

B. Concrete: Structural Notes on Plans.

C. Cement: ASTM C150, Type V – sulfate resistant Portland type.

D. Grout: Structural Notes on Plans.

E. Watertight Polyethylene: Heat-shrinkable manhole encapsulation system:
   1. Manufacturers:
      a. WrapidSeal by CCI Pipeline Systems.
      b. Substitutions: Section 01 60 00 - Product Requirements.

2.5 FOUNDATION AND BACKFILL MATERIALS

A. Foundation: Coarse Aggregate Type A2 (Grade No. 3) as specified in Section 32 05 16.

B. Backfill Materials:
   1. Backfill Materials Outside of Traffic Areas: Excavated backfill material outside of traffic areas shall consist of an excavated material of gravel, fine rock cuttings, sandy loam, or clay having dimensions no greater than 2 inches.
   2. Backfill Materials Beneath Pavements:
      a. Coarse Aggregate Type A1 (Flexible Base) per Section 32 11 23 – Flexible Base.
      b. Aggregate Type A3 (Gravel for Trench Backfill) per Section 32 05 16 – Aggregates for Civil Site Improvements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify items provided by other sections of Work are properly sized and located.

C. Verify built-in items are in proper location, and ready for roughing into Work.

D. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe.

B. Do not install manholes and structures where site conditions induce loads exceeding structural capacity of manholes or structures.

C. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify manholes and structures are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION - GENERAL

A. Excavation:
   1. Excavate for manholes and structures in accordance with Section 31 23 16 - Excavation in location and to depth shown. Provide clearance around sidewalls of manhole or structure for construction operations.
   2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes or structures in dry trench.
   3. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation.

B. Install manholes and structures supported at proper grade and alignment on Coarse Aggregate Type A2 (Crushed Stone) foundation as shown on Drawings. When indicated on Drawings, install geotextile fabric over subgrade in accordance with manufacturer’s instructions.

C. Backfill excavations for manholes and structures in accordance with Section 31 23 17 - Trenching.

D. Form and place manhole or structure cylinder plumb and level, to correct dimensions and elevations.

E. Grout base of manhole to construct invert and achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings.

F. Set cover frames and covers level without tipping, to correct elevations.

3.4 DOGHOUSE MANHOLE AND STRUCTURE INSTALLATION

A. Stake out location and burial depth of existing sewer line in area of proposed manhole or structure.

B. Carefully excavate around existing sewer line to adequate depth for foundation slab installation. Protect existing pipe from damage. Cut out soft spots and replace with select fill compacted to 95% dry density.

C. Prepare crushed stone bedding as shown on Drawings.

D. Install precast concrete or construct cast-in-place concrete manhole or structure around existing pipe in accordance with the appropriate paragraphs specified herein.

E. Grout pipe entrances in accordance with Structural Notes on Plans.

F. Perform connection to existing pipe at an appropriate time preapproved by Engineer.

G. Block upstream flow at existing manhole or structure with expandable plug.

H. Use hydraulic saw to cut existing pipe at manhole or structure entrance and exit and along pipe length at a point halfway up the outside diameter on each side of the pipe. Bottom half of pipe shall remain as manhole flow channel. Saw cut to have a smooth finish with top half of pipe flush with interior of manhole or structure.

I. Grout base of manhole or structure to achieve slope to manhole or structure channel in accordance with Structural Notes on Plans. Trowel smooth.

3.5 SANITARY MANHOLE DROP CONNECTIONS

A. Construct drop connections into sanitary manholes in accordance with Drawings.

B. Form channel from pipe drop to sweep into main channel at maximum angle of 30 degrees.

3.6 CASTINGS INSTALLATION

A. Set frames using mortar as indicated on Drawings. Install precast concrete grade rings with 1/4 inch thick joints. Lay concrete rings in full bed of mortar and completely fill joints.

B. Unless indicated otherwise, set frame and cover 8 inches above finished grade for manholes and other structures with covers located within unpaved areas to allow area to be graded away from cover beginning 2 inches below top surface of frame.

3.7 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test cast-in-place concrete in accordance with Structural Notes on Plans.

C. Test concrete manhole and structure sections in accordance with ASTM C497.

END OF SECTION

SECTION 33 05 78 - FIBERGLASS WETWELL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Fiberglass reinforced polyester wetwells shall be manufactured from commercial grade polyester resin or vinyl ester resin, with fiberglass reinforcements. Resin system shall be suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases normally associated with wastewater collection systems.

B. Wetwell shall be a one-piece unit manufactured by:
1. L. F. Manufacturing, Inc.
2. Containment Solutions, Inc.,
3. an approved equal.

1.2 RELATED SECTIONS

A. Section 01 33 00 - Submittals

B. Section 06 80 00 – Composite Fabrications

1.3 WARRANTY

A. Warranty on equipment and installation is one (1) year from Final Completion, in accordance with Article 6.19 of the General and Supplemental Conditions.

PART 2 - MATERIALS

2.1 PHYSICAL REQUIREMENTS

A. Load Rating
1. Complete wetwell shall have a minimum dynamic-load rating of 16,000 ft-lbs when tested in accordance with A.S.T.M.-D3753 latest edition, Section 8.
2. To establish this rating, complete wetwell shall not leak, crack, or suffer other damage when load tested to 40,000 ft-lbs. and shall not deflect vertically downward more than 1/4” at point of load application when loaded to 24,000 lbs.

B. Properties
1. Wetwell cylinder shall have a minimum pipe-stiffness value (F/AY) of 3.02 psi.
2. Stiffness requirements shall be per Table 1 below:

Table 1
Stiffness Requirements

Physical Properties	Hoop Direction	Axial Direction
Tensile Strength (psi)	18,000	5,000
Tensile Modulus (psi)	0.8 x	0.7 x

	10^6	10^6
Flexural Strength (psi)	26,000	4,500
Flexural Modulus (psi) (No Ribs)	$1.4\ 10^6$	0.7×10^6

C. Manufacturing
1. Wet well shall be manufactured to perform as an underground structure to diameter and height shown on Drawings and to withstand necessary axial and lateral pressures with a minimum factor of safety of 2.5.
2. Wet well shall be of sufficient strength to support elements of a sanitary sewer lift station shown to be located above fiberglass wet well on Drawings.
3. Manufactured wet well shall have a buoyancy ring within the concrete base that would serve as a tie-down to prevent up-lift. Engineer must confirm proposed counter- buoyancy plan prior to wet well slab installation.

2.2 FABRICATION

A. Resin: Resins used shall be a commercial grade unsaturated polyester resin.

B. Reinforcing Materials: Reinforcing materials shall be commercial Grade "E" type glass in form of mat, continuous roving, chopped roving, roving fabric or a combination of above, having a coupling agent that will provide a suitable bond between glass reinforcement and resin.

C. Surfacing Materials: If reinforcing materials are used on surface exposed to contained substance, it shall be a commercial grade chemical-resistant glass that will provide a suitable bond with resin and leave a resin rich surface.

D. Fillers and Additives
1. Fillers, when used, shall be inert to environment and wetwell construction.
2. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by specific manufacturing process to be used.
3. Resulting reinforced plastic material must meet the requirement of this Specification.

E. Exterior Surface
1. Exterior surface shall be relatively smooth with no sharp projections.
2. Handwork finish is acceptable if enough resin is present to eliminate fiber show.
3. Exterior surface shall be free of blisters larger than 1/2” in diameter, delamination and fiber show.

F. Interior Surface
1. Interior surface shall be resin rich with no exposed fibers. Surface shall be free of grazing, delamination, and blisters larger than 1/2” in diameter, and wrinkles of 1/8” or greater in depth.
2. Surface pits shall be permitted up to 6 per square foot if they are less than 3/4” in diameter and less than 1/16” deep.

G. Fiberglass Reinforced Bottom and Top
1. Bottom to be attached to wetwell pipe with fiberglass layup to comply with

A.S.T.M.- D3299 specifications. When reinforcement is necessary for strength, reinforcement shall be fiberglass channel laminated to wetwell bottom.

2. Fiberglass Reinforced Top: Top to be attached to wetwell pipe with fiberglass layup to comply with A.S.T.M.-D3299 specifications. When reinforcement is necessary for strength, reinforcement shall be fiberglass channel laminated to wetwell top.

H. Installation of Studbolts: Effluent, service, or discharge lines may be factory installed. Approved methods are PVC sewer pipe, Inserta-Tee fittings, or Kor-N-Seal boots. Installation of stubouts to be fiberglass layup to comply with A.S.T.M.-D3299 specifications.

I. Defects Not Permitted
1. Exposed fibers: glass fibers not wet out with resin.
2. Resin runs: runs of resin and sand on the surface.
3. Dry areas: areas with glass not wet out with resin.
4. Delamination: separation in the laminate.
5. Blisters: light colored areas larger than 1/2” in diameter.
6. Crazing: cracks caused by sharp objects.
7. Pits or Voids: air pockets.
8. Wrinkles: smooth irregularities in surface.
9. Sharp projection: fiber or resin projections necessitating gloves for handling.

PART 3 - EXECUTION

3.1 EXCAVATION

A. General:
1. Limits of excavation shall be such to allow for placing and removing forms, installing sheeting, shoring, bracing, etc.
2. Contractor shall pile excavated material in a manner that will not endanger work and will avoid obstructing sidewalks, driveways, power poles, etc.
3. Drainage shall be kept clear.
4. Other Excavation requirements are in Section 31 23 16 - Excavation

B. Vertical Sides: When necessary to protect existing or proposed structures or other improvements, Contractor shall maintain vertical sides of the excavation. Limit shall not exceed three feet outside footing on a vertical plane parallel to footing except where specifically approved otherwise by Engineer. Contractor shall provide and install any sheeting, shoring, and bracing as necessary to provide a safe work area as required to protect workmen, structures, equipment, power poles, etc. Contractor shall be responsible for design and adequacy of all sheeting, shoring, and bracing. Sheeting, shoring, and bracing shall be removed as the excavation is backfilled in such a manner as to prevent injurious caving.

C. Dewatering: Contractor shall keep the excavation free from water by use of cofferdams, bailing, pumping, well pointing, or any combination as particular situation may warrant. All dewatering devices shall be installed in such a manner as to provide clearance for construction, removal of forms, and inspection of exterior of form work. It is intent of these Specifications that foundation be placed on a firm dry bed. Foundation bed shall be kept in a dewatered condition a sufficient period of time to insure safety of structure. All dewatering methods and procedures are subject to approval of Engineer. Excavation shall be protected from excessive rainfall, drainage and drying. Excavation shall be inspected

and approved by Engineer before work on structure is started. Contractor shall provide a relatively smooth, firm foundation bed for footings and slabs that bear directly on undisturbed earth without additional cost to Owner, regardless of soil conditions encountered. Engineer will be sole judge as to whether these conditions have been met. Contractor shall pile excavated material in a manner that will not endanger work.

D. Unauthorized Over Excavation: Excavation for slabs, footings, etc., that bear on earth shall not be carried below elevation shown on Drawings. In the event excavation is carried on below indicated elevation, Contractor shall bring slab, footing, etc., to required grade by filling with concrete having a minimum compressive strength of at least 3,000 psi at 28 days.

E. Handling
1. Do not drop or impact wetwell.
2. Wetwells shall be chocked if stored horizontally.
3. If wetwells must be moved by rolling, the ground transversed shall be smooth and free of rocks, debris, etc.
4. FRP wetwells may be lifted by installation of 2 lifting lugs as specified by the manufacturer on outside surface near top or by a sling or "choker" connection around center.
5. Use of chains or cables in contact with wetwell surface is prohibited.
6. Wetwells may be lifted horizontally using 1 support point.

F. Appurtenances
1. Cutouts in wetwell wall should be made with proper cutting tools, such as jig saw or hole saw. Do not use axe or other impact-type tools.
2. Tee. Install Insert-A-Tee type fitting per manufacturer’s instruction. Fowler Mfg. Co., or approved equal.

G. Wetwell Installation
1. Fiberglass wetwell shall be lowered into wet concrete, placed on undisturbed soil, and brought to plumb. Pour reinforced concrete over anti-flotation flange. Allow concrete base to set and proceed to install remaining backfill around walls as soon as possible.
2. Wetwells with internal bottom stiffening ribs will require that concrete be poured on inside of wetwell to a depth equal to that of stiffening ribs. This is typically 4” to 6”.
3. Fiberglass top may have stubouts installed or may have a raised fiberglass collar around hatch opening. Fiberglass top has been designed to withstand weight of a concrete reinforced slab to be installed over it.

3.2 BACKFILL

A. Backfill Material
1. Backfill materials shall be as specified on Drawings and in Section 13 23 23 - Fill.

B. Schedule of Backfill
1. Contractor may begin backfilling of wetwell as soon as buoyancy concrete has been allowed to cure and forms removed.

C. Backfill Lifts
1. Backfill shall be placed in layers of not more than 9” of loose measure and mechanically tamped to at least 95% Standard Proctor Density. Flooding will not

be permitted. Backfill shall be placed in such a manner as to prevent any wedging action against the structure.

D. Top Slab Support
   1. Top slab for each wet well shall be made of concrete and be constructed in accordance with Drawings.

3.3 MARKING AND IDENTIFICATION

A. Each wetwell shall be marked with the following information:
   1. Manufacturer's name or trademark
   2. Manufacturing special number
   3. Total length and nominal diameter

END OF SECTION

SECTION 33 34 10 - TEMPORARY BYPASS PIPELINE SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Design Requirements.
   2. Performance Requirements.

B. Related Requirements:
   1. Section 01 33 00 - Submittal Procedures.
   2. Section 04 40 00 - Quality Requirements.

1.2 DESCRIPTION

A. The Owner shall furnish all materials, labor, equipment, maintenance, etc. to implement temporary pumping and other necessary appurtenances for the purpose of diverting the existing flow around the work area identified within the drawings.

B. The design, installation and operation of the temporary pipeline system shall be the Owner's responsibility. The Owner shall coordinate with the Contractor for the schedule and duration of bypass pumping. The Owner shall estimate the flowrate of bypass pumping needed.

C. The installation, inspection and removal of pipeline plugs and dikes shall be the Contractors' responsibility.

D. After installation of plugs and dikes, the Contractor shall pump out and clean the work area so that the work can be completed.

E. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

1.3 DESIGN REQUIREMENTS

A. Bypass pipeline system shall have sufficient capacity to pump a peak flow of 2,000 gpm. Bypass pipeline system will be required to be operated 24 hours per day.

B. The Contractor shall provide all pipeline plugs to ensure that the total flow of the main can be safely diverted around the section to be replaced.

C. The Owner shall provide adequate standby piping available and ready for immediate operation and use in the event of an emergency.

D. Bypass pipeline system shall have the capacity of bypassing the flow around the work area.

E. The Contractor shall coordinate with the Owner to ensure that the bypass piping is installed and operable prior to shutdown, and notify the Owner when the bypass piping is no longer needed.

1.4 PERFORMANCE REQUIREMENTS

A. It is essential to the operation of the existing wastewater treatment facility that there be no interruption in the flow throughout the duration of the installation work. To this end, the Contractor shall provide, maintain and operate all temporary facilities such as dams and plugs to intercept the flow before it reaches the point where it would interfere with his work, and also downstream past his work so that the bypass piping can be used to return the flow to the wastewater treatment stream downstream of his work.

B. The design, installation and operation of the temporary pipeline system shall be the Owner's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

C. The Contractor will not be permitted to stop or impede the main flows under any circumstances.

D. Maintain wastewater flow around the work area in a manner that will not cause surcharging nor damage and that will protect public and private property from damage and flooding.

E. Protect water resources, wetlands and other natural resources.

F. Any spillage, backups and/or overflows, etc. as a result of dam or plug malfunction will be the sole responsibility of the Contractor.

1.5 COORDINATION

A. Section 01 30 00 - Administrative Requirements specifies requirements for coordination.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures specifies requirements for submittals.

B. Shop Drawings:
   1. Prepare a specific description of the proposed bypass schedule and submit it for review and approval.
   2. No construction requiring bypass shall begin until all provisions and requirements have been reviewed by the Engineer.
   3. Plan shall include but not limited to details of the following:
      a. Wastewater plugging method and types of plugs;
      b. Schedule for installation of and maintenance of plugs and dikes;
      c. Plan indicating selection of bypass pumping locations.

PART 2 PRODUCTS

2.1 DISCHARGE PIPING

A. Bypass pumping and piping equipment to be provided and installed by the Owner.

PART 3 EXECUTION

3.1 PREPARATION

A. Before commencing the Work requiring bypass pumping, the Contractor shall notify the Owner with 7 days' notice so that bypass pumping and piping can be installed.

B. Ensure that bypass pumping and piping is installed and operating satisfactorily before performing line plugging or damming.

3.2 WORK REQUIREMENTS

A. Once the bypass piping system is operational, the Contractor can install pipeline plugs and dikes.

B. The Contractor shall pump out the work area and maintain the work area to allow the work to be completed.

C. When working inside manhole or existing wastewater piping, exercise caution and comply with OSHA requirements when working in the presence of sewer gases, combustible or oxygen-deficient atmospheres, and confined spaces.

D. Upon completion of the work requiring bypass pipeline operations, the Contractor shall notify the Owner and remove plugs and dams prior to bypass pumping being completed.

3.3 FIELD QUALITY CONTROL AND MAINTENANCE

A. Inspect bypass plugs and dams daily to ensure that the system is working correctly.

B. Notify Owner if bypass pumping has leaks or if pumping has stopped.

END OF SECTION

SECTION 40 05 06 - COUPLINGS, ADAPTERS, AND SPECIALS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe penetrations.
2. Connectors.
3. Expansion joints.
4. Flexible expansion joints.
5. Expansion loops.
6. Service saddles.
7. Sleeve-type couplings.
8. Miscellaneous specialties – strainers, water hose, hose nozzles.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
1. C153/A21.53, Ductile Iron Compact Fittings for Water Service.
2. C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
3. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
4. AWWA C219 - Bolted, Sleeve-Type Couplings for Plain-End Pipe.
5. M11, Steel Pipe—A Guide for Design and Installation.

B. American Welding Society:
1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

C. ASME International:
1. ASME A13.1 - Scheme for the Identification of Piping Systems.
2. B16.1, Gray Iron Pipe Flanges and Flanged Fittings.
3. B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24.
4. ASME B31.3 - Process Piping.
5. ASME B31.9 - Building Services Piping.
6. ASME Boiler and Pressure Vessel Code (BPVC), Section IX - Welding, Brazing, and Fusing Qualifications.

D. ASTM International:
1. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. A276, Standard Specification for Stainless Steel Bars and Shapes.
3. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
5. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
6. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

7. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems

E. Expansion Joint Manufacturers Association, Inc.:
1. EJMA Standards.

F. NSF International:
1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
1. Submit manufacturer catalog information for each specified product.
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. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Welder Certificates: Certify welders and welding procedures employed on Work, verifying qualification within previous 12 months.

F. 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.

G. Manufacturer Instructions: Submit special procedures and setting dimensions.

H. Source Quality-Control Submittals: Indicate results of shop or factory tests and inspections.

I. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping appurtenances.

C. Identify and describe unexpected variations to pipe routing or discovery of uncharted utilities.

1.5 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 or ASME B31.9 for installation of piping systems.

1.6 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.

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.

1.7 EXISTING CONDITIONS

A. Field Measurements:
1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish one-year manufacturer's warranty.

PART 2 - PRODUCTS

2.1 PIPE PENETRATIONS

A. Flashing:
1. Metal Flashing:
a. Material: Galvanized steel.
b. Thickness: 26 gauge.
2. Metal Counterflashing:
a. Material: Galvanized steel.
b. Thickness: 22 gauge.
3. Lead Flashing:
a. Material: Sheet lead.
b. Weight:
1) Waterproofing: 5 psf.
2) Soundproofing: 1 psf.
4. Flexible Flashing Materials:
a. Material: Butyl sheet.
b. Thickness: 47 mils.
5. Caps:
a. Material: Steel.
b. Minimum Thickness: 22 gauge, and 16 gauge at fire-resistive elements.

B. Sleeves:
1. Steel Pipe Sleeve:
a. Minimum Thickness: 3/16 inch.
b. Seep Ring:
1) Center steel flange for water stoppage on sleeves in exterior or water-bearing walls, 3/16-inch minimum thickness.
2) Outside Diameter: Unless otherwise shown, 3 inches greater than pipe sleeve outside diameter.
3) Continuously fillet weld on each side all around.
c. Factory Finish:
1) Galvanizing:
a) Hot-dip applied, meeting requirements of ASTM A153/A153M.
b) Electroplated zinc or cadmium plating is unacceptable.
2) Shop Lining and Coating: Factory prepare, prime, and finish coat in accordance with Section 09 90 00 - Painting and Coating.
2. Molded Polyethylene Pipe Sleeve:
a. Molded HDPE with integral water stop ring not less than 3 inches larger than sleeve.
b. Provided with end caps for support during concrete placement.
c. Manufacturer and Product: Century-Line, Model CS sleeves as manufactured by PSI-Thunderline/Link-Seal.
3. Insulated and Encased Pipe Sleeve:
a. Manufacturer and Product: Pipe Shields, Inc.; Models WFB, WFB-CS and -CW Series, as applicable.
4. Modular Mechanical Seal:
a. Type: Interconnected synthetic rubber links shaped and sized to continuously fill annular space between pipe and wall sleeve opening.
b. Fabrication:

1) Assemble interconnected rubber links with ASTM A276, Type 316 stainless steel bolts and nuts.
2) Pressure plates shall be reinforced nylon polymer.

c. Size: According to manufacturer's instructions for size of pipes shown to provide a watertight seal between pipe and wall sleeve opening.
d. Manufacturer: Thunderline Corp., Link-Seal Division.

C. Slab, Floor, Wall and Roof Penetrations:
1. Ductile Iron Wall Pipe:
a. Diameter and Ends: Same as connecting ductile iron pipe.
b. Thickness: Equal to or greater than remainder of pipe in line.
c. Fittings: In accordance with applicable Pipe Data Sheet.
d. Thrust Collars:
1) Rated for thrust load developed at 250 psi.
2) Safety Factor: 2, minimum.
3) Material and Construction: Ductile iron or cast iron, cast integral with wall pipe wherever possible, or thrust rated, welded attachment to wall pipe.
e. Manufacturers:
1) American Cast Iron Pipe Co.
2) U.S. Pipe and Foundry Co.
2. Steel or Stainless-Steel Wall Pipe:
a. Same material and thickness as connecting pipe, except 1/4-inch minimum thickness.
b. Lining: Same as connecting pipe.
c. Thrust Collar:
1) Outside Diameter: Unless otherwise shown, 3 inches greater than outside diameter of wall pipe.
2) Continuously fillet welded on each side all around.

2.2 CONNECTORS

A. Teflon Bellows Connector:
1. Type: Two convolutions, unless otherwise shown, with metal reinforcing bands.
2. Flanges: Ductile iron, drilled 150 psi ASME B16.5 standard.
3. Working Pressure Rating: 140 psi, minimum, at 120 degrees F.
4. Thrust Restraint: Limit bolts to restrain force developed by specified test pressure.
5. Manufacturers and Products:
a. Garlock; Style 214.
b. Resistoflex; No. R6904.
c. Unisource Manufacturing, Inc.; Style 112.
d. Proco Products, Inc.; Series 442.

B. Elastomer Bellows Connector:
1. Type: Fabricated spool, with single filled arch.
2. Materials: Nitrile tube and wrap-applied neoprene cover.
3. End Connections: Flanged, drilled 125-pound ASME B16.1 standard, with full elastomer face and steel retaining rings.
4. Working Pressure Rating: 140 psig, minimum, at 180 degrees F for sizes 12 inches and smaller.
5. Thrust Restraint: Control rods to limit travel of elongation and compression.

6. Manufacturers and Products:
    a. Goodall Rubber Co.; Specification E-1462.
    b. Garlock; Style 204
    c. Unisource Manufacturing, Inc.; Style 1501.
    d. Proco Products, Inc.; Series 220.

C. Metal Bellows Connector:
1. Type: Single-ply, annular corrugated metal bellows with limit rods. Circumferential convolution welds not permitted.
2. Material: Type 316 stainless steel.
3. End Connections: ANSI 150-pound carbon steel flanges.
4. Minimum Design Working Pressure: 150 psig at 750 degrees F.
5. Length: Minimum of four convolutions and minimum manufacturer recommendation for vibration isolation.
6. Manufacturers and Products:
    a. Victaulic Depend-O-Lok, Omniflex with short metal bellows.
    b. Metraflex, Model MN.

D. Flexible Metal Hose Connector:
1. Type: Close pitch, annular corrugated with single braided jacket.
2. Material: Bronze.
3. End Connections: Female copper solder joint.
4. Minimum Burst Pressure: 500 psig at 70 degrees F.
5. Length: Minimum manufacturer recommendation for vibration isolation.
6. Manufacturers:
    a. Senior Flexonics.
    b. Anamet Industrial, Inc.
    c. Unisource Manufacturing, Inc.
    d. Proco Products, Inc.

E. Closure Collar Concrete: As specified in Structural Notes and Details in Plans.

F. Quick Connect Couplings for Chemical Services:
1. Type: Twin cam arm actuated, male and female, locking, for chemical loading and transfer.
2. Materials: Glass-filled polypropylene or PVDF with EPDM, Viton-A or Teflon gaskets as recommended for the service by manufacturer.
3. End Connections: NPT threaded or flanged to match piping connections. Hose shank for chemical installations.
4. Plugs and Caps: Female dust cap for each male end; male dust plug for each female end.
5. Pressure Rating: 125 psi, minimum, at 70 degrees F.
6. Manufacturers and Products:
    a. OPW; Kamlock.
    b. Ryan Herco; 1300 Series.

2.3 EXPANSION JOINTS

A. Elastomer Bellows:
1. Type: Reinforced molded wide arch.

2. End Connections: Flanged, drilled 125-pound ASME B16.1 standard, with split galvanized steel retaining rings.
3. Washers: Over retaining rings to help provide leak-proof joint under test pressure.
4. Thrust Protection: Control rods to protect the bellows from overextension.
5. Bellows Arch Lining: Buna-N, nitrile, or butyl.
6. Rated Temperature: 250 degrees F.
7. Rated Deflection and Pressure:
   a. Lateral Deflection: 3/4 inch, minimum.
   b. Burst Pressure: Four times the working pressure.
   c. Compression deflection and minimum working pressure as follows:

Size (inch)	Deflection (inch)	Pressure (psig)
2-1/2 to 12	1.06	150
14	1.65	130
16 to 20	1.65	110

8. Manufacturers and Products:
   a. General Rubber Corp.; Style 1015 Maxijoint.
   b. Mercer; Flexmore Style 450.
   c. Goodall Rubber Co.; Specification E-711
   d. Unisource Manufacturing, Inc.; Series 1500.
   e. Proco Products, Inc.; Series 251.

B. Teflon Bellows:
1. Type: Three convolutions, with metal reinforcing bands.
2. Flanges: Ductile iron, drilled 150 psi ASME B16.5 standard.
3. Working Pressure Rating: 100 psig, minimum, at 120 degrees F.
4. Thrust Restraint: Limit bolts to restrain force developed by specified test pressure.
5. Manufacturers and Products:
   a. Garlock; Style 215
   b. Resistoflex; No. R6905.
   c. Unisource Manufacturing, Inc.; Style 113,
   d. Proco Products, Inc.; Series 443.

C. Metal Bellows:
1. Type: Single-ply, annular corrugated metal bellows with limit rods. Circumferential convolution welds not permitted.
2. Material: Type 316 stainless steel.
3. End Connections: ASME 150-pound carbon steel flanges.
4. Minimum Design Working Pressure: 150 psig at 750 degrees F.
5. Length: Minimum of four convolutions and minimum axial compression of 3 inches.
6. Manufacturers and Products:
   a. Victaulic Depend-O-Lok, Omniflex with long metal bellows.
   b. Metraflex, Model MN.
   c. Senior Flexonics, Free Flexing Expansion Joints.

D. Copper Pipe Expansion Compensator:
1. Material: Stainless steel bellows with female copper solder joint ends.
2. Working Pressure Rating: 175 psig, minimum.
3. Accessories: Anti-torque device to protect bellows.

4. Manufacturers and Products:
    a. Senior Flexonics; Model HB.
    b. Hyspan; Model 8510.
    c. Unisource Manufacturing, Inc.; Style EC-FFS.

E. Galvanized and Black Steel Pipe Expansion Compensator:
1. Material: All stainless steel.
2. Working Pressure Rating: 175 psig, minimum.
3. Accessories: Anti-torque device to protect bellows.
4. Manufacturers and Products:
    a. Senior Flexonics; Model H2 or H3
    b. Hyspan; Model 8503
    c. Unisource Manufacturing, Inc.; Style EC-MMT.

F. Flexible Metal Hose:
1. Type: Close pitch, annular corrugated with single braided jacket.
2. Material: Stainless steel, ASTM A276, Type 321.
3. End Connections:
    a. 3 Inches and Larger: Shop fabricated flanged ends to match mating flanges.
    b. 2-1/2 Inches and Smaller: Screwed ends with one union end.
4. Minimum Burst Pressure: 600 psig at 70 degrees F for 12 inches and smaller.
5. Length: Provide hose live-length equal to lengths shown on Drawings.
6. Manufacturers:
    a. Senior Flexonics; Series 401M.
    b. Anamet Industrial, Inc.; BWC21-1.

2.4 FLEXIBLE EXPANSION JOINTS

A. Design:
1. Ball and socket type for earth settlement compensation.
2. Joints shall be double ball assemblies rated for 15-degree minimum deflection and not less than 4 inches offset from centerline of connecting piping.
3. Assembly shall accommodate up to 4 inches of expansion in length.
4. Ductile iron conforming to AWWA C153/A21.53.
5. Rated for 350 psi.
6. Components shall be lined and coated by manufacturer with fusion- bonded epoxy on all surfaces not bearing gaskets.
7. End Connections: Flanged or mechanical joint as shown and as required by connecting pipe and fittings.
8. Joint connecting to mechanical joint shall be thrust restrained.
9. Bonding:
    a. Manufacturer shall factory install thermite welded joint bonds for assembled expansion joint.
    b. Provide 24-inch bond wires for field bonds to adjacent metallic piping.
    c. Bond wires shall be No. 2 AWG with two 12-inch-long THHN insulated No. 12 AWG wire pigtails.

B. Manufacturer and Product: EBAA Iron Sales Co.; Flex-Tend.

2.5 EXPANSION LOOPS

A. Provide expansion loops as indicated on Drawings.

2.6 SERVICE SADDLES

A. Double-Strap Iron:
   1. Pressure Rating: Capable of withstanding 150 psi internal pressure without leakage or over stressing.
   2. Run Diameter: Compatible with outside diameter of pipe on which saddle is installed.
   3. Taps: Iron pipe threads.
   4. Materials:
      a. Body: Ductile iron.
      b. Straps: Galvanized steel.
      c. Hex Nuts and Washers: Steel.
      d. Seal: Rubber.
   5. Manufacturers and Products:
      a. Smith-Blair; Series 313 or 366**.**
      b. Dresser; Style 91**.**

B. Nylon-Coated Iron:
   1. Pressure Rating: Capable of withstanding 150 psi internal pressure without leakage or over stressing.
   2. Run Diameter: Compatible with outside diameter of pipe on which saddle is installed.
   3. Materials:
      a. Body: Nylon-coated iron.
      b. Seal: Buna-N.
      c. Clamps and Nuts: Stainless steel.
   4. Manufacturer: Smith-Blair; Style 315 or 317

2.7 SLEEVE-TYPE COUPLINGS

A. General.
   1. Coupling linings for use in potable water systems shall be in conformance with NSF 61.
   2. Couplings shall be rated for working pressure not less than indicated in Piping Schedule for the service and not less than 150 psi.
   3. Couplings shall be lined and coated with fusion-bonded epoxy in accordance with AWWA C213**.**
   4. Unless thrust restraint is provided by other means, couplings shall be harnessed in accordance with requirements of AWWA Manual M11 and restrained with retainer bar or ring welded to pipe end, or as shown on Drawings.
   5. Sleeve type couplings shall conform to AWWA C219 and shall be hydraulically expanded beyond minimum yield for accurate sizing and proofing of tensile strength.

B. Flexible Sleeve Type Coupling:
   1. Manufacturers and Products:
      a. Steel Pipe:
         1) Dresser Piping Specialties; Style 38**.**
         2) Smith-Blair, Inc.; Style 411
   2. Ductile Iron Pipe:

a. Dresser Piping Specialties; Style38.
b. Smith-Blair, Inc.; Style 411.

C. Bolted Split Sleeve Type Coupling: Victaulic Co., Depend-O-Lok couplings.

D. Transition Coupling for Steel Pipe:
1. Manufacturers and Products:
a. Dresser Piping Specialties; Style 62
b. Smith-Blair, Inc.; Style 413.

E. Flanged Coupling Adapter:
1. Manufacturers and Products:
a. Steel Pipe:
1) Dresser Piping Specialties; Style 63.
2) Smith-Blair, Inc.; Style 913.
b. Ductile Iron Pipe:
1) Dresser Piping Specialties; Style 63
2) Smith-Blair, Inc.; Style 912

F. Restrained Flange Adapter:
1. Pressure Rating:
a. Minimum Working Pressure Rating: Not less than 150 psi.
b. Safety Factor: Not less than two times working pressure and shall be supported by manufacturer's proof testing.
2. Thrust Restraint:
a. Provide hardened steel wedges that bear against and engage outer pipe surface and allow articulation of pipe joint after assembly while wedges remain in their original setting position on pipe surface.
b. Products employing set screws that bear directly on pipe will not be acceptable.
3. Manufacturer and Product: EBAA Iron Sales Co.; Mega-Flange.

G. Dismantling Joints:
1. Pressure Rating:
a. Minimum working pressure rating shall not be less than rating of the connecting flange.
b. Proof testing shall conform to requirements of AWWA C219 for bolted couplings.
2. Manufacturers and Products:
a. Dresser Piping Specialties; Style 131.
b. Viking Johnson.

H. Exposed Metallic Piping Plain End Couplings:
1. Plain end pipe couplings shall be self-restrained against hydrostatic thrust forces equal to not less than two times the working pressure rating of the coupling. Couplings shall accommodate 4 degrees angular deflection at the time of installation and subsequent to pressurization.
2. Casing, bolts, and nuts shall be Type 304 or Type 316 stainless steel. The sealing sleeve shall be EPDM or NBR elastomer as best suited for the fluid service.
3. Couplings manufacturer and products shall be Straub Couplings, Grip-L or Metal Grip, or equal.

2.8 Miscellaneous Specialties

A. Strainers, Water Service, 2 Inches and Smaller:
   1. Type: Bronze body, Y-pattern, 200 psi non-shock rated, with screwed gasketed bronze cap.
   2. Screen: Heavy-gauge Type 304 stainless steel or Monel, 20-mesh.
   3. Manufacturers and Products:
      a. Armstrong International; Inc.; Model F.
      b. Mueller Steam Specialty; Model LF351.

B. Strainers, Water Service, 2-1/2 Inches and Larger:
   1. Type: Cast iron or ductile iron body, Y-pattern, 175 psi non-shock rated, with flanged gasketed iron cap.
   2. Screen: Heavy-gauge Type 316 stainless steel, 0.045-inch perforations.
   3. Manufacturers and Products:
      a. Armstrong International, Inc.; Model A7FL 125.
      b. Mueller Steam Specialty

C. Strainers, Plastic Piping Systems, 4 Inches and Smaller:
   1. Type: Y-pattern PVC body, 150 psi non-shock rated, with screwed PVC cap and Viton seals.
   2. End Connections: Screwed or solvent weld, 2 inches and smaller. Class 150 ANSI flanged, 2-1/2 inches and larger.
   3. Screen: Heavy-gauge PVC, 1/32-inch mesh, minimum 2 to 1 screen area to pipe size ratio.
   4. Manufacturer: Hayward.

D. Basket Strainer:
   1. Not Applicable

E. Water Hose
   1. 50-foot lengths of 1-inch and/or 50-foot lengths of 1-1/2-inch rubber hose. EPDM black cover and EPDM tube, reinforced with two textile braids. Provide each length with brass male and female NST hose thread couplings to fit hose nozzle and hose valve.
   2. Rated minimum working pressure of 200 psi.
   3. Manufacturers:
      a. Goodyear.
      b. Boston.

F. Hose Nozzles:
   1. 1-inch and 1-1/2-inch cast brass, satin finish, nozzles with adjustable fog, straight-stream, and shut-off feature and rubber bumper. Provide nozzles with female NST hose thread.
   2. Manufacturers:
      a. Croker.
      b. Elkhart.

G. Pump Seal Water Sight Flow Indicators:
   1. Bronze body, 3/8-inch, horizontal, ball action with tempered glass.
   2. Rated 125 psi with NPT screwed ends.
   3. Operate with a minimum flow of 0.25 gpm.

4. Manufacturers and Products:
   a. Eugene Ernst Co.; Series E-57-4.
   b. Jacoby Tarbox Co.

2.9 INSULATION

A. As specified in Section 40 42 13 - Process Piping Insulation.

2.10 FINISHES

A. Prepare piping appurtenances for field finishes as specified in Section 09 90 00 - Painting and Coating

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that field dimensions are as indicated on 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

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.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

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.

3.3 INSTALLATION

A. According to ASME B31.3 or 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. Application:
         1) Above Grade in Non-submerged Areas: Hot-dip galvanized after fabrication.
         2) Below Grade or in Submerged or Damp Environments: Shop-lined and coated.
         3) Alternatively, Molded Polyethylene Pipe Sleeve as specified may be applied.
      b. Installation:
         1) Support non-insulating type securely in formwork to prevent contact with reinforcing steel and tie-wires.
         2) Caulk joint with specified sealant in non-submerged applications and seal below grade and submerged applications with wall penetration seal.
   3. Slab, Floor, Wall and Roof Penetrations
      a. Applications:
         1) Watertight and Below Ground Penetrations:
         2) Wall pipes with thrust collars.
         3) Provide taps for stud bolts in flanges to be set flush with wall face.
         4) Nonwatertight Penetrations: Pipe sleeves with seep ring.
         5) Existing Walls: Rotary drilled holes.
         6) Fire-Rated or Smoke-Rated Walls, Floors or Ceilings: Insulated and encased pipe sleeves.
      b. Wall Pipe Installation:
         1) Isolate embedded metallic piping from concrete reinforcement [A: using coated pipe penetrations as specified in Section 09 90 00, Painting and Coating].
         2) Support wall pipes securely by formwork to prevent contact with reinforcing steel and tie-wires.

D. Piping Flexibility Provisions:
   1. General:
      a. Thrust restraint shall be provided as specified.
      b. Install flexible couplings to facilitate piping installation, in accordance with approved shop drawings.
   2. Flexible Joints at Concrete Backfill or Encasement: Install within 18 inches or one-half pipe diameter, whichever is less, from the termination of any concrete backfill or concrete encasement.
   3. Flexible Joints at Concrete Structures:
      a. Install 18 inches or less from face of structures; joint may be flush with face.
   4. Flexible expansion joints shall be provided to compensate for earth settlement at buried piping connections to structure wall pipes. Wrap complete joint assembly in a double layer of polyethylene encasement, as specified.

E. Piping Transition
   1. Applications:
      a. Provide complete closure assembly where pipes meet other pipes or structures.

b. Pressure Pipeline Closures: Plain end pieces with double flexible couplings, unless otherwise shown.
c. Restrained Joint Pipe Closures: Install with thrust tie-rod assemblies as shown or in accordance with NFPA 24**.**
d. Gravity Pipe Closures: As specified for pressure pipelines, or concrete closures.
e. Concrete Closures: Use to make connections between dissimilar pipe where standard rubber gasketed joints or flexible couplings are impractical, as approved.
f. Elastomer sleeves bonded to pipe ends are not acceptable.

2. Installation:
   a. Flexible Transition Couplings: Install in accordance with coupling manufacturer's instructions to connect dissimilar pipe and pipes with a small difference in outside diameter.
   b. Concrete Closures:
      1) Locate away from structures so there are at least two flexible joints between closure and pipe entering structure.
      2) Clean pipe surface before placing closure collars.
      3) Wet nonmetallic pipe thoroughly prior to pouring collars.
      4) Prevent concrete from entering pipe.
      5) Extend collar a minimum of 12 inches on each side of joint with minimum thickness of 6 inches around outside diameter of pipe.
      6) Make entire collar in one placement.
      7) After concrete has reached initial set, cure by covering with well- moistened earth.

F. Piping Expansion
1. Piping Installation: Allow for thermal expansion due to differences between installation and operating temperatures.
2. Expansion Joints:
   a. Grooved Joint and Flanged Piping Systems: Elastomer bellows expansion joint.
   b. Nonmetallic Pipe: Teflon bellows expansion joint.
   c. Screwed and Soldered Piping Systems: Copper or galvanized and black steel pipe expansion compensator, as applicable.
   d. Air and Water Service above 120 Degrees F: Metal bellows expansion joint.
   e. Pipe Run Offset: Flexible metal hose.
3. Anchors: Install as specified in Section 40 05 07 - Hangers and Supports for Process Piping to withstand expansion joint thrust loads and to direct and control thermal expansion.

G. Service Saddles
1. Ferrous Metal Piping (except stainless steel): Double-strap iron.
2. Plastic Piping: Nylon-coated iron.

H. Couplings
1. General:
   a. Install in accordance with manufacturer's written instructions.
   b. Before coupling, clean pipe holdback area of oil, scale, rust, and dirt.
   c. Application:
      1) Metallic Piping Systems: Flexible couplings, transition couplings, and flanged coupling adapters.
      2) Concrete Encased Couplings: Flexible coupling.

I. Flexible Pipe Connections to Equipment
   1. Install to prevent piping from being supported by equipment, for vibration isolation, and where shown.
   2. Product Applications Unless Shown Otherwise:
      a. Nonmetallic Piping: Teflon bellows connector.
      b. Copper Piping: Flexible metal hose connector.
      c. Compressor and Blower Discharge: Metal bellows connector.
      d. All Other Piping: Elastomer bellows connector.
   3. Limit Bolts and Control Rods: Tighten snug prior to applying pressure to system.

J. Miscellaneous Specialties
   1. Basket Strainers:
      a. Install in accordance with manufacturer's instructions.
      b. Field Quality Control: Conduct test on each basket strainer.
      c. Manufacturer's Services: Provide manufacturer's representative at Site in accordance with the equipment specification sections for installation assistance, inspection and certification of proper installation, equipment testing, startup assistance, and training of Owner's personnel for specified component, subsystem, equipment, or system.

K. Insulation: As specified in Section 40 42 13 - Process Piping Insulation.

3.4 FIELD QUALITY CONTROL

A. In accordance with Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. In accordance with Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. After installation, inspect for proper supports and interferences.

D. Repair damaged coatings with material equal to original coating.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Keep equipment interior clean as installation progresses.

END OF SECTION

SECTION 40 05 07 - HANGERS AND SUPPORTS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe hangers and supports.
2. Hanger rods.
3. Structural attachments.
4. Pipe guides.
5. Formed-steel channel.
6. Pipe Saddles.
7. Wall Brackets

1.2 REFERENCE STANDARDS

A. American Welding Society:
1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

B. ASME International:
1. ASME B31.1 - Power Piping.
2. ASME B31.9 - Building Services Piping.

C. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
3. ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.
5. ASTM A576 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
6. ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
7. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacturer, Selection, Application, and Installation.

1.3 DEFINITIONS

A. Wetted or Submerged: Submerged, less than 1 foot above liquid surface, below top of channel wall, under cover or slab of channel or tank, or in other damp locations.

1.4 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with piping and equipment connections specified in other Sections and as indicated on Drawings.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information, including load capacity.

C. Shop Drawings: Indicate system layout with location, including critical dimensions, sizes, hanger and support locations, and details of trapeze hangers, anchors, and guides.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.

F. Delegated Design Submittals:
1. Submit signed and sealed Shop Drawings with design calculations and assumptions for load carrying capacity of trapeze, multiple pipe, and riser support hangers.
2. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.
3. Design, size, and locate piping support systems throughout facility, whether shown or not.
4. Piping Smaller than 30 Inches: Supports are shown only where specific types and locations are required; additional pipe supports may be required.
5. Piping 30 Inches and Larger: Support systems have been designed for piping shown.
6. Meet requirements of MSS SP 58 and ASME B31.1 or as modified by this section.
7. Pipe Support Systems:
    a. Design pipe support systems for gravity and thrust loads imposed by weight of pipes or internal pressures, including insulation and weight of fluid in pipes.
    b. Seismic loads in accordance with governing codes and as shown on Structural General Drawings.
    Wind loads in accordance with governing codes and as shown on Structural General Drawings.
    c. Maximum Support Spacing and Minimum Rod Size: In accordance MSS SP 58 Table 3 and Table 4.
        1) Ductile-iron Pipe 8 Inches and Under: Maximum span limited to that for standard weight steel pipe for water service.
        2) Ductile-iron Pipe 10 Inches and Larger: Maximum span limited to 20 feet.
8. 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.
9. Vertical Sway Bracing: 10-foot maximum centers or as shown.
10. Existing Support Systems: Use existing supports systems to support new piping only if Contractor can show they are adequate for additional load, or if they are strengthened to support additional load.

G. Manufacturer Instructions: Submit special procedures and assembly of components.

PART 2 - PRODUCTS

2.1 GENERAL

A. When specified items are not available, fabricate pipe supports of correct material and to general configuration indicated.

B. Special support and hanger details may be required for cases where standard catalog supports are not applicable.

C. Materials: In accordance with Table 1 and Table 2, attached as Supplements at end of section.

2.2 HANGERS

A. Clevis: MSS SP 58, Type 1:
   1. Anvil; Figure 260 for steel pipe and Figure 590 for ductile-iron pipe, sizes 1/2 inch through 30 inches.
   2. Insulated Steel Pipe: Anvil; Figure 260 with insulated saddle system (ISS), sizes 1/2 inch through 16 inches.
   3. B-Line; Figure B3100, sizes 1/2 inch through 30 inches.

B. Adjustable Swivel Split-Ring Pipe Clamp: MSS SP 58, Type 6:
   1. Anvil; Figure 104, sizes 3/4 inch through 8 inches.
   2. B-Line; Figure B3171, sizes 3/4 inch through 8 inches.

C. Steel Yoke Pipe Rolls and Roller Supports: MSS SP 58, Type 41 or Type 43:
   1. Anvil; Figure 181 for sizes 2-1/2 inches through 24 inches, and Figure 171 for sizes 1 inch through 30 inches.
   2. B-Line; Figure B3110 for sizes 2 inches through 24 inches and Figure B3114 for 30 inches.

D. Pipe Rollers and Supports: MSS SP 58, Type 44:
   1. Anvil; Figure 175, sizes 2 inches through 30 inches.
   2. B-Line; Figure B3120, sizes 2 inches through 24 inches.

2.3 WALL BRACKETS, SUPPORTS, AND GUIDES

A. Welded Steel Wall Bracket: MSS SP 58, Type 33 (heavy-duty):
   1. Anvil; Figure 199, 3,000-pound rating.
   2. B-Line; Figure B3067, 3,000-pound rating.

B. Adjustable “J” hanger MSS SP 58, Type 5:
   1. Anvil; Figure 67, sizes 1/2 inch through 8 inches.
   2. B-Line; Figure B3690, sizes 1/2 inch through 8 inches.

C. Offset Pipe Clamp: Anvil; Figure 103, sizes 3/4 inch through 8 inches.

D. Channel Type:
   1. Unistrut.
   2. Anvil; Power-Strut.
   3. B-Line; Strut System.
   4. Aickinstrut (FRP).

2.4 PIPE SADDLES

A. Provide 90-degree to 120-degree pipe saddle for pipe 6 inches and larger with baseplates drilled for anchors bolts.
   1. Sizes 20 inches though 60 inches, Piping Technology & Products, Inc.; Fig. 2000.

B. Saddle Supports, Pedestal Type:
   1. Minimum standard weight pipe stanchion, saddle, and anchoring flange.
   2. Nonadjustable Saddle: MSS SP, Type 37 with U-bolt.
      a. Anvil; Figure 259, sizes 4 inches through 36 inches with Figure 63C base.
      b. B-Line; Figure B3095, sizes 1 inch through 36 inches with B3088S base.
   3. Adjustable Saddle: MSS SP 58, Type 38 without clamp.
      a. Anvil; Figure 264, sizes 2-1/2 inches through 36 inches with Figure 62C base.
      b. B-Line; Figure B3092, sizes 3/4 inch through 36 inches with Figure B3088S base.

2.5 CHANNEL TYPE SUPPORT SYSTEMS

A. Channel Size: 12-gauge, 1-5/8-inch wide minimum steel, or 1-1/2-inch wide, minimum FRP.

B. Members and Connections: Design for loads using one-half of manufacturer’s allowable loads.

C. Fasteners: Vinyl ester fiber, polyurethane base composite nuts and bolts, or encapsulated steel fasteners.

D. Manufacturers and Products:
   1. B-Line; Strut System.
   2. Unistrut.
   3. Anvil; Power-Strut.

2.6 FRP PIPE SUPPORT SYSTEMS

A. General:
   1. FRP with UV additive, protective veil, and vinyl ester resins resistance to chemicals listed in Supplement at end of section.
   2. Fire Retardant: ASTM E84.
   3. Include hangers, rods, attachments, and fasteners.

B. Clevis Hangers:
   1. Factor of Safety: 3 to 1.
   2. Minimum Design Load: 200 pounds.

C. Design:
   1. Design pipe supports spacing and hanger rod sizing based upon manufacturer's recommendations.
   2. Identify and highlight non-FRP fasteners or components in Shop Drawing.

D. Manufacturers:
   1. Aickinstrut.
   2. Enduro.
   3. Century Composite.

2.7 PIPE CLAMPS

A. Riser Clamp: MSS SP 58, Type 8.
   1. Anvil; Figure 261, sizes 3/4 inch through 24 inches.
   2. B-Line; Figure B3373, sizes 1/2 inch through 30 inches.

2.8 ELBOW AND FLANGE SUPPORTS

A. Elbow with Adjustable Stanchion: Sizes 2 inches through 18 inches, Anvil; Figure 62C base.

B. Elbow with Nonadjustable Stanchion: Sizes 2-1/2 inches through 42 inches, Anvil; Figure 63A or Figure 63B base.

C. Flange Support with Adjustable Base: Sizes 2 inches through 24 inches, Standon; Model S89.

2.9 INTERMEDIATE PIPE GUIDES

A. Type: Hold down pipe guide.
   1. Manufacturer and Product: B-Line; Figure B3552, 1-1/2 inches through 30 inches.

B. Type: U-bolts with double nuts to provide nominal 1/8-inch to 1/4-inch clearance around pipe; MSS SP 58, Type 24.
   1. Anvil; Figure 137 and Figure 137S.
   2. B-Line; Figure B3188 and Figure B3188NS.

2.10 PIPE ALIGNMENT GUIDES

A. Type: Spider.

B. Manufacturers and Products:
   1. Anvil; Figure 255, sizes 1/2 inch through 24 inches.

2. B-Line; Figure B3281 through Figure B3287, sizes 1/2 inch through 24 inches.

2.11 PIPE ANCHORS

A. Type: Anchor chair with U-bolt strap.

B. Manufacturer and Product: B-Line; Figure B3147A or Figure B3147B.

2.12 SEISMIC RESTRAINTS

A. Solid pipe bracing attachment to pipe clevis with clevis cross brace and angle rod reinforcement.

B. Manufacturers:
1. Mason Industries.
2. B-Line.
3. Anvil.

2.13 ACCESSORIES

A. Anchor Bolts:
1. Size and Material: Sized by Contractor for required loads with 1/2-inch minimum diameter, and as specified in Section 05 50 00 - Metal Fabrications.
2. Bolt Length (Extension Above Top of Nut):
   a. Minimum Length: shall be no more than one thread recessed below top of nut.
   b. Maximum Length: No more than a full nut depth above top of nut.

B. Dielectric Barriers:
1. Plastic coated hangers, isolation cushion, or tape.
2. Manufacturer and Products:
   a. B-Line; B1999 Vibra Cushion.
   b. B-Line; Iso Pipe, Isolation Tape.

C. Insulation Shields:
1. Type: Galvanized steel or stainless steel, MSS SP 58, Type 40.
2. Manufacturers and Products:
   a. Anvil; Figure 167, sizes 1/2 inch through 24 inches.
   b. B-Line; Figure B3151, sizes 1/2 inch through 24 inches.

D. Welding Insulation Saddles:
1. Type: MSS SP 58, Type 39.
2. Manufacturers and Products:
   a. Anvil; Figure Series 160, sizes 1 inch through 36 inches.
   b. B-Line; Figure Series B3160, sizes 1/2 inch through 24 inches.

E. Plastic Pipe Support Channel:
1. Type: Continuous support for plastic pipe and to increase support spacing.

2. Manufacturer and Product: B-Line; Figure Series B3106V, sizes 1/2 inch through 6 inches with Figure B3106 Vee bottom hanger.

F. Hanger Rods, Clevises, Nuts, Sockets, and Turnbuckles: In accordance with MSS SP 58.

G. Attachments:
1. I-Beam Clamp: Concentric loading type, MSS SP 58, Type 21, Type 28, Type 29, or Type 30, which engage both sides of flange.
2. Concrete Insert: MSS SP 58, Type 18, continuous channel insert with load rating not less than that of hanger rod it supports.
3. Welded Beam Attachment: MSS SP 58, Type 22.
   a. Anvil; Figure 66.
   b. B-Line; Figure B3083.
4. U-Channel Concrete Inserts: As specified in Section 05 50 00, Metal Fabrications.
5. Concrete Attachment Plates:
   a. Anvil; Figure 47, Figure 49, or Figure 52.
   b. B-Line; Figure B3084, Figure B3085, or Figure B3086.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that field dimensions are as indicated on Shop Drawings.

C. General:
1. Install support systems in accordance with MSS SP 58, unless shown otherwise.
2. Install pipe hanger rods plumb, within 4 degrees of vertical during shut down, start up or operations.
3. Support piping connections to equipment by pipe support and not by equipment.
4. Support large or heavy valves, fittings, and appurtenances independently of connected piping.
5. Support no pipe from pipe above it.
6. Support pipe at changes in direction or in elevation, adjacent to flexible joints and couplings, and where shown.
7. Do not use adhesive anchors for attachment of supports to ceiling or walls.
8. Do not install pipe supports and hangers in equipment access areas or bridge crane runs.
9. Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing and to reduce movement after startup.
10. Install lateral supports for seismic loads at changes in direction.
11. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
12. Repair mounting surfaces to original condition after attachments are completed.

D. Standard Pipe Supports:
1. Horizontal Suspended Piping:
   a. Single Pipes: Clevis hangers or adjustable swivel split-ring.

b. Grouped Pipes: Trapeze hanger system.

2. Horizontal Piping Supported from Walls:
   a. Single Pipes: Wall brackets, or attached to wall, or to wall mounted framing with anchors.
   b. Stacked Piping: Wall mounted framing system and "J" hangers acceptable for pipe smaller than 3-inch.
   c. Pipe clamp that resists axial movement of pipe through support is not acceptable. Use pipe rollers supported from wall bracket.
3. Horizontal Piping Supported from Floors:
   a. Saddle Supports:
      1) Pedestal Type, elbow and flange.
      2) Provide minimum 1-1/2-inch grout beneath baseplate.
   b. Floor Mounted Channel Supports:
      1) Use for pipe smaller than 3-inch running along floors and in trenches at pipe elevations lower than can be accommodated using pedestal pipe supports.
      2) Attach channel framing to floors with baseplate on minimum 1-1/2-inch nonshrink grout and with anchor bolts.
      3) Attach pipe to channel with clips or pipe clamps.
   c. Concrete Cradles: Use for pipe larger than 3 inches along floor and in trenches at pipe elevations lower than can be accommodated using stanchion type.
4. Insulated Pipe:
   a. Pipe hanger and support shall be on outside of insulation. Do not enclose within insulation.
   b. Provide precut 120-degree sections of rigid insulation (minimum length same as shield), shields and oversized hangers or insulated saddle system (ISS).
   c. Wall-mounted pipe clips not acceptable for insulated piping.
5. Vertical Pipe: Support with wall bracket and elbow support, or riser clamp on floor penetration.

E. Standard Attachments:
1. New Concrete Ceilings: Concrete inserts, concrete attachment plates, or concrete anchors as limited below:
   a. Single point attachment to ceiling allowed only for 3/4-inch rod and smaller (8 inches and smaller pipe).
   b. Where there is vibration or bending considerations, do not connect a single pipe support hanger rod directly to a drilled concrete anchor (single point attachment) regardless of size.
      1) These lines include air operated diagram pumps and other lines, if any, as identified below:
2. Existing Concrete Ceilings: Channel type support with minimum of two anchor points, concrete attachment plates or concrete anchors as limited below:
   a. Single point attachment to ceiling is allowed only for 3/4-inch rod and smaller (8 inches and smaller pipe).
   b. Where there is vibration or bending considerations do not connect a single pipe support hanger rod directly to a drilled concrete anchor (single point attachment) regardless of size.
      1) These lines include air operated diagram pumps and other lines, if any, as identified below:
3. Steel Beams: I-beam clamp or welded attachments.

4. Wooden Beams: Lag screws and angle clips to members not less than 2-1/2 inches thick.
5. Concrete Walls: Concrete inserts or brackets or clip angles with concrete anchors.
6. Concrete Beams: Concrete inserts, or if inserts are not used attach to vertical surface similar to concrete wall. Do not drill into beam bottom.

F. Saddles for Steel or Concrete Pipe: Provide 90-degree to120-degree pipe saddle for pipe sizes 6 inches and larger when installed on top of steel or concrete beam or structure, pipe rack, trapeze, or where similar concentrated point supports would be encountered.

G. Intermediate and Pipe Alignment Guides:
1. Provide pipe alignment guides, or pipe supports that provide same function, at expansion joints and loops.
2. Guide pipe on each side of expansion joint or loop at 4 pipe and 14 pipe diameters from each joint or loop.
3. Install intermediate guides on metal framing support systems not carrying pipe anchor or alignment guide.

H. Accessories:
1. Insulation Shield: Install on insulated piping with oversize rollers and supports.
2. Welding Insulation Saddle: Install on insulated steel pipe with oversize rollers and supports.
3. Dielectric Barrier:
   a. Provide between painted or galvanized carbon steel members and copper or stainless-steel pipe or between stainless-steel supports and ferrous metal piping.
   b. Install rubber wrap between submerged metal pipe and oversized clamps.

3.2 FIELD FINISHING

A. Paint atmospheric exposed surfaces hot-dip galvanized steel components as specified in Section 09 90 00, Painting and Coating.

3.3 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are a part of this specification:
1. Table 1: Nonchemical Areas.
2. Table 2: Chemical Areas.

END OF SECTION 40 05 07

Table 1
Nonchemical Areas

Exposure Conditions	Support Material
Office Areas	Galvanized steel or precoated steel, plastic coated hangers for uninsulated copper or stainless steel piping
Shops and Warehouse Areas	Galvanized steel or precoated steel, plastic coated hangers for uninsulated copper or stainless steel piping
Pipe Galleries	Galvanized steel or precoated steel, plastic coated hangers for uninsulated copper or stainless steel piping
Headworks	Stainless steel or FRP
Process Areas: High Humidity or Hydrogen sulfide	Stainless steel or FRP
Process Areas: Wetted or Submerged	Stainless steel or FRP
Pipes conveying chemicals listed in Table 2	Provide with corresponding support per Table 2.

Notes:

1. Precoated steel to be fusion bonded epoxy or vinyl copolymer (Plastisol).
2. Stainless steel to be Type 304.
3. Galvanized steel to be per ASTM A653/A653M, Class G90, or hot-dip galvanized after fabrication to ASTM A123/A123M.
4. Do not use galvanized steel or aluminum where lime dust can accumulate on these surfaces.

Table 2
Chemical Areas

Exposure Conditions	Support for Direct Exposure	Support for Remote Exposure
Alum	FRP	Precoated steel
Aqua Ammonia	Stainless steel	Precoated steel
Coagulants	FRP	Precoated steel or galvanized steel
Ferric Chloride	FRP	Precoated steel
Ferric Sulfate	FRP	Precoated steel
Hydrofluorosilic Acid	FRP	Precoated steel
Lime	Stainless steel, FRP, precoated steel	Stainless steel, FRP, precoated steel
Methanol	Galvanized steel	Galvanized steel
Polymers	FRP	Precoated steel
Potassium Permanganate	Precoated steel	Precoated steel
Powdered Activated Carbon	Precoated steel	Precoated steel
Sodium Carbonate	Stainless steel	Precoated steel
Sodium Hydroxide	Stainless steel	Precoated steel
Sodium Hypochlorite	FRP	Precoated steel
Sulfuric Acid	Stainless steel	Precoated steel

Notes:

1. Direct exposure includes entire area within containment area; area within 20 feet horizontal and 10 feet vertical of chemical pumps or chemical mixing stations; or as specified.
2. Remote exposure is area beyond area defined as direct exposure, but within designated building.
3. Precoated steel to be fusion bonded epoxy or vinyl copolymer (Plastisol).
4. Stainless steel to be Type 304.
5. Galvanized steel to be per ASTM A653/A653M, Class G90, or hot-dip galvanized after fabrication to ASTM A123/A123M.
6. Do not use galvanized steel or aluminum where lime dust can accumulate on these surfaces.

SECTION 40 05 10 – COMMON REQUIREMENTS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS:

A. Section 09 90 00 - Painting and Coating: Product and execution requirements for painting specified by this Section.

B. Section 40 05 06 - Couplings, Adapters, and Specials for Process Piping: Piping appurtenances.

C. Section 40 05 51 - Common Requirements for Process Valves: Common product requirements for valves for placement by this Section.

D. Section 40 05 07 – Hangers and Supports for Process Piping

E. Section 40 42 13 - Process Piping Insulation

F. Section 40 05 40 - Process Piping Leakage Testing

G. Section 40 41 13 – Process Piping Electrical Heat Tracing

1.2 REFERENCES

The following is a list of standards which may be referenced in this section.

A. Air Force: A-A-58092, Tape, Antiseize, Polytetrafluorethylene.

B. American Association of State Highway and Transportation Officials (AASHTO): HB-17, Standard Specifications for Highway Bridges.

C. American Petroleum Institute (API): SPEC 5L, Specification for Line Pipe.

D. American Society of Mechanical Engineers (ASME):
1. Boiler and Pressure Vessel Code, Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
2. B1.20.1, Pipe Threads, General Purpose (Inch).
3. B16.1, Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
4. B16.3, Malleable Iron Threaded Fittings Classes 150 and 300.
5. B16.5, Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.
6. B16.9, Factory-Made Wrought Buttwelding Fittings.
7. B16.11, Forged Fittings, Socket-Welding and Threaded.
8. B16.15, Cast Copper Alloy Threaded Fittings Classes 125 and 250.
9. B16.21, Nonmetallic Flat Gaskets for Pipe Flanges.
10. B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
11. B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings Classes 150, 300, 600, 900, 1500, and 2500.
12. B16.25, Buttwelding Ends.

13. B16.42, Ductile Iron Pipe Flanges and Flanged Fittings Classes 150 and 300.
14. B31.1, Power Piping.
15. B31.3, Process Piping.
16. B31.9, Building Services Piping.
17. B36.10M, Welded and Seamless Wrought Steel Pipe.

E. American Society for Nondestructive Testing (ASNT): SNT-TC-1A, Recommended Practice for Personal Qualification and Certification in Nondestructive Testing.

F. American Water Works Association (AWWA):
1. C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. C105/A21.5, Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. C110/A21.10, Ductile-Iron and Gray-Iron Fittings.
4. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. C115/A21.15, Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast.
7. C153/A21.53, Ductile-Iron Compact Fittings.
8. C207, Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
9. C606, Grooved and Shouldered Joints.

G. American Welding Society (AWS):
1. Brazing Handbook.
2. A5.8M/A5.8, Specification for Filler Metals for Brazing and Braze Welding.
3. D1.1/D1.1M, Structural Welding Code - Steel.
4. QC1, Standard for AWS Certification of Welding Inspectors.

H. ASTM International (ASTM):
1. A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
2. A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. A105/A105M, Standard Specification for Carbon Steel Forgings for Piping Applications.
4. A106/A106M, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
5. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
6. A135/A135M, Standard Specification for Electric-Resistance-Welder Steel Pipe.
7. A139/A139M, Standard Specification for Electro-Fusion (Arc)–Welded Steel Pipe (NPS 4 Inches and Over).
8. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
9. A181/A181M, Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.
10. A182/A182M, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
11. A183, Standard Specification for Carbon Steel Track Bolts and Nuts.
12. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.

13. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
14. A197/A197M, Standard Specification for Cupola Malleable Iron.
15. A216/A216M, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
16. A234/A234M, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
17. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
18. A276, Standard Specification for Stainless Steel Bars and Shapes.
19. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
20. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
21. A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
22. A320/A320M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.
23. A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
24. A395/A395M, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
25. A403/A403M, Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.
26. A409/A409M, Standard Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service.
27. A536, Standard Specification for Ductile Iron Castings.
28. A563, Standard Specification for Carbon and Alloy Steel Nuts.
29. A587, Standard Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry.
30. A743/A743M, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
31. A744/A744M, Standard Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service.
32. A774/A774M, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
33. A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
34. B32, Standard Specification for Solder Metal.
35. B43, Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
36. B61, Standard Specification for Steam or Valve Bronze Castings.
37. B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
38. B75/B75M, Standard Specification for Seamless Copper Tube.
39. B88, Standard Specification for Seamless Copper Water Tube.
40. B98/B98M, Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes.
41. B462, Standard Specification for Forged or Rolled UNS N06030, UNS N06022, UNS N06035, UNS N06200, UNS N06059, UNS N10362, UNS N06686, UNS N08020, UNS N08024, UNS N08026, UNS N08367, UNS N10276, UNS N10665, UNS N10675, UNS N10629, UNS N08031, UNS N06045, UNS N06025, and UNS R20033 Alloy Pipe Flanges, Forged Fittings, and Valves and Parts for Corrosive High-Temperature Service.

42. B464, Standard Specification for Welded UNS N08020 Alloy Pipe.
43. B474, Standard Specification for Electric Fusion Welded Nickel and Nickel Alloy Pipe.
44. C582, Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment.
45. D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
46. D413, Standard Test Methods for Rubber Property-Adhesion to Flexible Substrate.
47. D543, Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
48. D1248, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
49. D1330, Standard Specification for Rubber Sheet Gaskets.
50. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
51. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
52. D2000, Standard Classification System for Rubber Products in Automotive Applications.
53. D2310, Standard Classification for Machine-Made “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
54. D2464, Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
55. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
56. D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
57. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
58. D2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
59. D2996, Standard Specification for Filament-Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
60. D3222, Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
61. D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
62. D4101, Standard Specification for Polypropylene Injection and Extrusion Materials.
63. D4894, Standard Specification for Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials.
64. D4895, Standard Specification for Polytetrafluoroethylene (PTFE) Resin Produced from Dispersion.
65. F423, Standard Specification for Polytetrafluoroethylene (PTFE) Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges.
66. F436, Standard Specification for Hardened Steel Washers.
67. F437, Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
68. F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
69. F441/F441M, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
70. F493, Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
71. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

72. F656, Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

I. FM Global (FM).
1. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS): SP-43, Wrought and Fabricated Butt-Welding Fittings for Low-Pressure, Corrosion Resistant Applications.

J. NSF International (NSF):
1. ANSI 61: Drinking Water System Components - Health Effects.
2. ANSI 372: Drinking Water System Components - Lead Content.

K. National Electrical Manufacturers Association (NEMA): LI 1, Industrial Laminating Thermosetting Products.

L. National Fire Protection Association (NFPA): 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

1.3 DEFINITIONS

A. Submerged or Wetted:
1. Zone below elevation of:
a. Top face of channel walls and cover slabs
b. Top face of aeration basin walkways
c. Top face of clarifier walkways.
d. Liquid surface or within 1 feet above top of liquid surface.
e. Top of tank wall or under tank cover.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Action Submittals:
1. Shop Fabricated Piping:
a. Detailed pipe fabrication or spool drawings showing special fittings and bends, dimensions, coatings, and other pertinent information.
b. Layout drawing showing location of each pipe section and each special length; number or otherwise designate laying sequence on each piece.
2. Pipe Wall Thickness: Identify wall thickness and rational method or standard applied to determine wall thickness for each size of each different service including exposed, submerged, buried, and concrete-encased installations for Contractor-designed piping.
3. Hydraulic Thrust Restraint for Restrained Joints: Details including materials, sizes, assembly ratings, and pipe attachment methods.
4. Thrust Blocks: Concrete quantity, bearing area on pipe, and fitting joint locations.
5. Dissimilar Buried Pipe Joints: Joint types and assembly drawings.

C. Informational Submittals:
1. Manufacturer’s Certification of Compliance, in accordance with Section 01 60 00, Product Requirements

a. Pipe and fittings.
b. Factory applied resins and coatings.

2. Flanged Pipe and Fittings: Manufacturer's product data sheets for gaskets including torquing requirements and bolt tightening procedures.
3. Qualifications:
   a. Nondestructive Testing Personnel: SNT-TC-1A Level II certification and qualifications.
   b. AWS QC1 Certified Welding Inspector: Submit evidence of current certification prior to commencement of welding activities.
   c. Welders:
      1) Continuity log for welders and welding operators.
      2) Welder qualification test records conducted by Contractor or manufacturer.
4. Welding Procedures: Qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX for weld type(s) and base metal(s).
5. Nondestructive inspection and testing procedures.
6. Test logs.
7. Pipe coating applicator certification.
8. CWI inspection records and NDE test records.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Independent Inspection and Testing Agency:
      a. Ten years' experience in field of welding and welded pipe and fittings' testing required for this Project.
      b. Calibrated instruments and equipment.
      c. Has documented standard procedures for performing specified testing.
      d. Certified in accordance with ASNT SNT-TC-1A for testing procedures required for this Project.
      e. Testing Agency: Personnel performing tests shall be NDT Level II certified in accordance with ASNT SNT-TC-1A.
      f. Verification Welding Inspector: AWS QC1 Certified.
   2. Welding Procedures: In accordance with ASME BPVC SEC IX (Forms QW-482 and QW-483) or AWS D1.1/D1.1M (Annex N Forms).
   3. Welder Qualifications: In accordance ASME BPVC SEC IX (Form QW-484) or AWS D1.1/D1.1M (Annex N Forms).
   4. Contractor's CWI: Certified in accordance with AWS QC1 and having prior experience with specified welding codes. Alternate welding inspector qualifications require approval by Engineer.

B. Quality Assurance: Provide services of independent inspection and testing agency for welding operations.
   1. Note, the presence of Owner's Special Inspector or Verification CWI does not relieve Contractor from performing own quality control, including 100 percent visual inspection of welds.

1.6 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01 60 00, Product Requirements, and:
   1. Flanges: Securely attach metal, hardboard, or wood protectors over entire gasket surface.

2. Threaded or Socket Welding Ends: Fit with metal, wood, or plastic plugs or caps.
3. Linings and Coatings: Prevent excessive drying.
4. Cold Weather Storage: Locate products to prevent coating from freezing to ground.
5. Handling: Use heavy canvas or nylon slings to lift pipe and fittings.

PART 2 - PRODUCTS

2.1 GENERAL

A. Components and Materials in Contact with Water for Human Consumption:
   1. Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.
   2. Use or reuse of components and materials without a traceable certification is prohibited.

2.2 PIPING

A. As specified on Piping Schedule located on Drawings.

B. Diameters Shown:
   1. Standardized Products: Nominal size.
   2. Fabricated Steel Piping (Except Cement-Lined): Outside diameter, ASME B36.10M.
   3. Cement-Lined Steel Pipe: Lining inside diameter.

2.3 JOINTS

A. Grooved End System:
   1. Rigid type.
   2. Use of flexible grooved joints allowed where shown on Drawings or with prior approval by Engineer.
   3. Flanges: When required, furnish with grooved type flange adapters of same manufacturer as grooved end couplings.

B. Flanged Joints:
   1. Flat-faced, carbon steel, or alloy flanges when mating with flat-faced cast or ductile iron flanges.
   2. Higher pressure rated flanges as required to mate with equipment when equipment flange is of higher-pressure rating than required for piping.

C. Threaded Joints: NPT taper pipe threads in accordance with ASME B1.20.1.

D. Mechanical Joint Anchor Gland Follower:
   1. Ductile iron anchor type, wedge action, with break-off tightening bolts.
   2. Thrust rated to 250 psi minimum.
   3. Rated operating deflection not less than:
      a. 3 degrees for sizes through 12 inches.
      b. 2 degrees for sizes 14 inches through 16 inches.
      c. 1.5 degrees for sizes 18 inches through 24 inches.

d. 1 degree for sizes 30 inches through 48 inches.

4. UL and FM approved.

E. Flexible Mechanical Compression Joint Coupling:
1. Stainless steel, ASTM A276, Type 305 bands.
2. Manufacturers:
a. Pipeline Products Corp.
b. Fernco Joint Sealer Co.

F. Mechanical connections of high-density polyethylene pipe to auxiliary equipment such as valves, pumps, tanks, and other piping systems shall be through-flanged connections consisting of the following:
1. Polyethylene stub end thermally butt-fused to end of pipe.
2. ASTM A240/A240M, Type 304 stainless steel backing flange, 125-pound, ASME B16.1 standard. Use insulating flanges where shown.
3. Bolts and nuts of sufficient length to show a minimum of three complete threads when joint is made and tightened to manufacturer's standard. Retorque nuts after 4 hours.
4. Gaskets as specified on Data Sheet.

2.4 GASKET LUBRICANT

A. Lubricant shall be supplied by pipe manufacturer and no substitute or "or-equal" will be allowed.

2.5 DOUBLE WALL CONTAINMENT PIPING SYSTEM

A. System components shall be pre-engineered, factory fabricated, tested, and assembled such that field assembly is minimized to primarily that of straight joints.

2.6 PIPE CORROSION PROTECTION

A. Coatings: See Section 09 90 00, Painting and Coating, for details of coating requirements.

B. Heat Shrink Wrap:
1. Type: Cross-linked polyolefin wrap or sleeve with mastic sealant.
2. Manufacturer and Product: Raychem; WPC or TPS

C. Polyethylene Encasement (Bagging):
1. Encasement Tube: Black polyethylene encasement tube, 8 mils minimum thickness, conforming to AWWA C105/A21.5, free of gels, streaks, pinholes, foreign matter, undispersed raw materials, and visible defects such as tears, blisters, and thinning at folds.
2. Securing Tape: Thermoplastic tape, 8 mils minimum thickness, 1 inch wide, pressure sensitive adhesive face capable of bonding to metal, bituminous coating, and polyethylene encasement tube.

D. Insulating Flanges, Couplings, and Unions:
1. Materials:

a. In accordance with applicable piping material specified in Pipe Data Sheet. Complete assembly shall have working pressure rating equal to or higher than that of joint and pipeline.
b. Galvanically compatible with piping.
c. Resistant for intended exposure, operating temperatures, and products in pipeline.

2. Union Type, 2 Inches and Smaller:
   a. Screwed or solder-joint.
   b. O-ring sealed with molded and bonded insulation to body.
3. Flange Type, 2-1/2 Inches and Larger:
   a. Flanged, complete with bolt insulators, dielectric gasket, bolts, and nuts.
   b. Bolt insulating sleeves shall be provided full length between insulating washers.
   c. Ensure fit-up of components of insulated flange assembly to provide a complete functioning installation.
   d. AWWA C207 steel flanges may be drilled oversize up to 1/8-inch to accommodate insulating sleeves.
   e. No less than minimum thread engagement in accordance with specified bolting standards will be permitted to accommodate thicknesses of required washers, flanges, and gasket.
4. Flange Insulating Kits:
   a. Gaskets: Full-face, Type E with elastomeric sealing element. Sealing element shall be retained in a groove within retainer portion of gasket.
   b. Insulating Sleeves: Full-length mylar
   c. Insulating Washers: High-strength phenolic
   d. Steel Washers: Plated, hot-rolled steel, 1/8 inch thick.
      1) Flange Diameters 36 Inches or Less: Provide two washers per bolt.
      2) Flange Diameters Larger Than 36 Inches: Provide four washers per bolt.
5. Manufacturers and Products:
   a. Dielectric Flanges and Unions:
      1) PSI, Houston, TX.
      2) Advance Products and Systems, Lafayette, LA.
   b. Insulating Couplings:
      1) Dresser; 39

2.7 THRUST BLOCKS

A. All piping will be restrained, so no thrust blocks are required.

2.8 THRUST TIES

A. Steel Pipe: Fabricated lugs and rods in accordance with details shown on Drawings.

B. Buried Ductile Iron Pipe and Fittings: Unless restraint is otherwise specified or shown, conform to NFPA 24. Tie-rod attachments relying on clamp friction with pipe barrel to restrain thrust are unacceptable.

2.9 VENT AND DRAIN VALVES

A. Pipelines 2-Inch Diameter and Smaller: 1/2-inch vent, 1-inch drain, unless shown otherwise.

B. Pipelines 2-1/2-Inch Diameter and Larger: 3/4-inch vent, 1-inch drain, unless shown otherwise.

2.10 FABRICATION

A. Mark each pipe length on outside with the following:
1. Size or diameter and class.
2. Manufacturer's identification and pipe serial number.
3. Location number on laying drawing.
4. Date of manufacture.

B. Code markings according to approved Shop Drawings.

C. Shop fabricate flanged pipe in shop, not in field, and delivered to Site with flanges in place and properly faced. Threaded flanges shall be individually fitted and machine tightened on matching threaded pipe by manufacturer.

2.11 FINISHES

A. Factory prepare, prime, and finish coat in accordance with Piping Schedule.

2.12 Galvanizing:

A. Hot-dip applied, meeting requirements of ASTM A153/A153M.

B. Electroplated zinc or cadmium plating is unacceptable.

C. Stainless steel components may be substituted where galvanizing is specified.

PART 3 - PART 3 EXECUTION

3.1 EXAMINATION

a. Verify size, material, joint types, elevation, horizontal location, and pipe service of existing pipelines to be connected to new pipelines or new equipment.
b. Inspect size and location of structure penetrations to verify adequacy of wall pipes, sleeves, and other openings.

3.2 PREPARATION

A. See Piping Schedule

B. See Section 09 90 00 - Painting and Coating, for additional requirements.

C. Notify Engineer at least 2 weeks prior to field fabrication of pipe or fittings.

D. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.

E. Damaged Coatings and Linings: Repair using original coating and lining materials in accordance with manufacturer's instructions.

3.3 WELDING

A. Perform in accordance with Section IX, ASME Boiler and Pressure Vessel Code and ASME B31.3 for Pressure Piping, as may be specified on Piping Data Sheets, and if recommended by piping or fitting manufacturer.

B. Weld Identification: Keep paper record of which welder welded each joint.

C. Pipe End Preparation:
1. Machine Shaping: Preferred.
2. Oxygen or Arc Cutting: Smooth to touch, true, and slag removal by chipping or grinding.
3. Beveled Ends for Butt Welding: ASME B16.25.

D. Surfaces:
1. Clean and free of paint, oil, rust, scale, slag, or other material detrimental to welding.
2. Clean stainless-steel joints with stainless steel wire brushes or stainless-steel wool prior to welding.
3. Thoroughly clean each layer of deposited weld metal, including final pass, prior to deposition of each additional layer of weld metal with a power-driven wire brush.

E. Alignment and Spacing:
1. Align ends to be joined within existing commercial tolerances on diameters, wall thicknesses, and out-of-roundness.
2. Root Opening of Joint: As stated in qualified welding procedure.
3. Minimum Spacing of Circumferential Butt Welds: Minimum four times pipe wall thickness or 1 inch, whichever is greater.

F. Climatic Conditions:
1. Do not perform welding if there is impingement of any rain, snow, sleet, or wind exceeding 5 mph on the weld area, or if ambient temperature is below 32 degrees F.
2. Stainless Steel and Alloy Piping: If ambient is less than 32 degrees F, local preheating to a temperature warm to the hand is required.

G. Tack Welds: Performed by qualified welder using same procedure as for completed weld, made with electrode similar or equivalent to electrode to be used for first weld pass, and not defective. Remove those not meeting requirements prior to commencing welding procedures.

H. Surface Defects: Chip or grind out those affecting soundness of weld.

I. Weld Quality: Meet requirements of governing welding codes.

3.4 INSTALLATION—GENERAL

A. Join pipe and fittings in accordance with manufacturer’s instructions, unless otherwise shown or specified.

B. Remove foreign objects prior to assembly and installation.

C. Flanged Joints:
1. Install perpendicular to pipe centerline.

2. Bolt Holes: Straddle vertical centerlines, aligned with connecting equipment flanges or as shown.
3. Use torque-limiting wrenches to ensure uniform bearing and proper bolt tightness.
4. Plastic Flanges: Install annular ring filler gasket at joints of raised-face flange.
5. Grooved Joint Flange Adapters: Include stainless steel washer plates as required for mating to serrated faces and lined valves and equipment.
6. Raised-Face Flanges: Use flat-face flange when joining with flat-faced ductile or cast-iron flange.
7. Verify compatibility of mating flange to adapter flange gasket prior to selecting grooved adapter flange.
8. Flange fillers are to be avoided, but, if necessary, may be used to make up for small angles up to 6 degrees and for filling gaps up to 2 inches between flanges. Stacked flange fillers shall not be used.
9. Threaded flanged joints shall be shop fabricated and delivered to Site with flanges in-place and properly faced.

D. Threaded and Coupled Joints:
1. Conform to ASME B1.20.1.
2. Produce sufficient thread length to ensure full engagement when screwed home in fittings.
3. Countersink pipe ends, ream and clean chips and burrs after threading.
4. Make connections with not more than three threads exposed.
5. Lubricate male threads only with thread lubricant or tape as specified on Piping Data Sheets.

E. Grooved-End Joints:
1. Piping shall be grooved in accordance with manufacturer's latest published instructions and shall be accurately cut with tools conforming to coupling manufacturer's standards and to AWWA C606.
2. Install grooved joint couplings and gaskets in accordance with manufacturer's latest published installation instructions.

F. Soldered Joints:
1. Use only solder specified for particular service.
2. Cut pipe ends square and remove fins and burrs.
3. After thoroughly cleaning pipe and fitting of oil and grease using solvent and emery cloth, apply noncorrosive flux to the male end only.
4. Wipe excess solder from exterior of joint before hardened.
5. Before soldering, remove stems and washers from solder joint valves.

G. Brazed Joints for Refrigerant Piping:
1. Braze copper piping with silver solder complying with AWS A5.8/A5.8M.
2. Construct joints according to AWS Brazing Handbook, Chapter Pipe and Tube.
3. Inside of tubing and fittings shall be free of flux.
4. Clean parts to be joined with emery cloth and keep hot until solder has penetrated the full depth of the fitting and extra flux has been expelled.
5. Cool joints in air and remove flame marks and traces of flux.
6. During brazing operation, prevent an oxide film from forming on inside of tubing by slowly flowing dry nitrogen to expel the air.

7. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion valve bulb.

H. Pipe Connections at Concrete Structures: As specified in Article Piping Flexibility Provisions in Section 40 05 06 - Couplings, Adapters and Specials for Process Piping.

I. PVC and CPVC Piping:
1. Provide Schedule 80 threaded nipple where necessary to connect to threaded valve or fitting.
2. Use strap wrench for tightening threaded plastic joints. Do not overtighten fittings.
3. Do not thread Schedule 40 pipe.

J. Ductile Iron Piping:
1. Cutting Pipe: Cut pipe with milling type cutter, rolling pipe cutter, or abrasive blade cutter. Do not flame cut.
2. Dressing Cut Ends:
   a. General: As required for the type of joint to be made.
   b. Rubber Gasketed Joints: Remove sharp edges or projections.
   c. Push-On Joints: Bevel, as recommended by pipe manufacturer.
   d. Flexible Couplings, Flanged Coupling Adapters, and Grooved End Pipe Couplings: As recommended by the coupling or adapter manufacturer.

K. PVDF-Lined Steel Pipe Installation:
1. Cut, make up, and install pipe in accordance with pipe manufacturer's written instructions.
2. Weld vent extension half-couplings in-place prior to lining pipe.
3. Do not weld on pipe after lining is installed.
4. Prevent plugging of vent extensions with insulation or paint.

L. High-Density Polyethylene Piping:
1. Join pipes, fittings, and flange connections by means of thermal butt-fusion.
2. Perform butt-fusion in accordance with pipe manufacturer's recommendations as to equipment and technique.
3. Special Precautions at Flanges: Polyethylene pipe connected to heavy fittings, manholes, and rigid structures shall be supported in such a manner that no subsequent relative movement between polyethylene pipe at flanged joint and rigid structures is possible.

M. Fiberglass Reinforced Piping:
1. Cut, fabricate, and install in accordance with manufacturer's written instructions.
2. Provide manufacturer's representative for instructing workers on proper installation and jointing methods.
3. Installation shall be made by workers experienced in FRP pipe lay-up techniques.

3.5 INSTALLATION—EXPOSED PIPING

A. Piping Runs:
1. Parallel to building or column lines and perpendicular to floor, unless shown otherwise.
2. Piping upstream and downstream of flow measuring devices shall provide straight lengths as required for accurate flow measurement.

B. Supports: As specified in Section 40 05 07 – Hangers and Supports for Process Piping.

C. Group piping wherever practical at common elevations; install to conserve building space and not interfere with use of space and other work.

D. Unions or Flanges: Provide at each piping connection to equipment or instrumentation on equipment side of each block valve to facilitate installation and removal.

E. Install piping so that no load or movement in excess of that stipulated by equipment manufacturer will be imposed upon equipment connection; install to allow for contraction and expansion without stressing pipe, joints, or connected equipment.

F. Piping clearance, unless otherwise shown:
   1. Over Walkway and Stairs: Minimum of 7 feet 6 inches, measured from walking surface or stair tread to lowest extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
   2. Between Equipment or Equipment Piping and Adjacent Piping: Minimum 3 feet, measured from equipment extremity and extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
   3. From Adjacent Work: Minimum 3inch(es) from nearest extremity of completed piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
   4. Do not route piping in front of or to interfere with access ways, ladders, stairs, platforms, walkways, openings, doors, or windows.
   5. Headroom in front of openings, doors, and windows shall not be less than the top of the opening.
   6. Do not install piping containing liquids or liquid vapors in transformer vaults or electrical equipment rooms.
   7. Do not route piping over, around, in front of, in back of, or below electrical equipment including controls, panels, switches, terminals, boxes, or other similar electrical work.

3.6 INSTALLATION—BURIED PIPE

A. Joints:
   1. Dissimilar Buried Pipes:
      a. Provide flexible mechanical compression joints for pressure pipe.
      b. Provide concrete closure collar for gravity piping or as shown.
   2. Concrete Encased or Embedded Pipe: Do not encase joints in concrete, unless specifically shown.

B. Placement:
   1. Keep trench dry until pipe laying and joining are completed.
   2. Pipe Base and Pipe Zone: As specified in Section 31 23 23 - Trench Backfill.
   3. Exercise care when lowering pipe into trench to prevent twisting or damage to pipe.
   4. Measure for grade at pipe invert, not at top of pipe.
   5. Excavate trench bottom and sides of ample dimensions to permit visual inspection and testing of entire flange, valve, or connection.
   6. Prevent foreign material from entering pipe during placement.
   7. Close and block open end of last laid pipe section when placement operations are not in progress and at close of day’s work.

8. Lay pipe upgrade with bell ends pointing in direction of laying.
9. Install closure sections and adapters for gravity piping at locations where pipe laying changes direction.
10. Deflect pipe at joints for pipelines laid on a curve using unsymmetrical closure of spigot into bell. If joint deflection of standard pipe lengths will not accommodate horizontal or vertical curves in alignment, provide:
    a. Shorter pipe lengths.
    b. Special mitered joints.
    c. Standard or special fabricated bends.
11. After joint has been made, check pipe alignment and grade.
12. Place sufficient pipe zone material to secure pipe from movement before next joint is installed.
13. Prevent uplift and floating of pipe prior to backfilling.

C. PVC, CPVC, or HDPE Pipe Placement:
1. Lay pipe snaking from one side of trench to other.
2. Offset: As recommended by manufacturer for maximum temperature variation between time of solvent welding and during operation.
3. Do not lay pipe when temperature is below 40 degrees F, or above 90 degrees F when exposed to direct sunlight.
4. Shield ends to be joined from direct sunlight prior to and during the laying operation.

D. Tolerances:
1. Deflection from Horizontal Line (Except PVC, CPVC, or HDPE): Maximum 2 inches.
2. Deflection From Vertical Grade: Maximum 1/4 inch(es).
3. Joint Deflection: Maximum of 75 percent of manufacturer's recommendation.
4. Horizontal position of pipe centerline on alignment around curves maximum variation of 1.75 feet from position shown.
5. Pipe Cover: Minimum 3 feet, unless otherwise shown.

3.7 INSTALLATION—CONCRETE ENCASED

A. Provide reinforced concrete pipe encasement where shown on Drawings and where otherwise required. Some piping may be required to be concrete encased for pipe strength requirements that are included in the Specifications. Piping under and within the influence of buildings, utility trenches, vaults, slabs, and other structures shall be concrete encased. See details on Drawings for encasement requirements.

B. Where concrete encased piping crosses structure construction and expansion joints, provide flexible piping joints to coincide with structure joints to prevent excessive pipe stress and breakage.

3.8 INSTALLATION—DOUBLE WALL CONTAINMENT PIPING SYSTEM

A. Install according to manufacturer's instructions.

B. Valves and equipment shall be supported independently from pipe. Anchor valves such that turning moment resulting from their operation will not be transmitted to pipe.

C. Centering Devices for Double Wall Containment Piping:

1. Center and support carrier pipe within the containment pipe with centering devices. Locate not less than every 9 feet, or within 24 inches of the termination of containment pipe on fabricated pieces.
2. Install centering devices such that leak detection cable (if specified) will be unrestricted and such that system maintains free drainage.

D. Following Installation and Testing:
1. Flush clean carrier and containment piping system.
2. Purge annular space of moisture with clean, dry air.

3.9 LEAK DETECTION SYSTEM FOR DOUBLE WALL CONTAINMENT PIPING

A. Install in accordance with system manufacturer's instructions and recommendations.

3.10 PIPE CORROSION PROTECTION

A. Ductile Iron Pipe:
1. Exposed: As specified in Section 09 90 00 - Painting and Coating, and as shown in Piping Schedule.
2. Buried: Wrap with polyethylene bagging
3. Submerged or Embedded: Coat with coal-tar epoxy as specified in Section 09 90 00 - Painting and Coating. If in potable water service, use NSF/ANSI 61 approved epoxy.

B. Carbon Steel Pipe:
1. Exposed: As specified in Section 09 90 00 - Painting and Coating.
2. Buried:
a. Pipe: Wrap with tape coating system as specified in Section 09 90 00 - Painting and Coating
b. Joints: Wrap with tape coating system as specified in Section 09 90 00 - Painting and Coating, or heat shrink wrap as specified herein.
3. Submerged or Embedded: Shop coat with coal-tar epoxy as specified in Section 09 90 00, Painting and Coating. If in potable water service, use NSF/ANSI 61 approved epoxy.

C. PVC and CPVC Pipe, Exposed: As specified in Section 09 90 00 - Painting and Coating.

D. Piping Accessories:
1. Exposed:
a. Field paint black and galvanized steel, brass, copper, and bronze piping components as specified in Section 09 90 00 - Painting and Coating, as applicable to base metal material.
b. Accessories include, but are not limited to, pipe hangers, supports, expansion joints, pipe guides, flexible couplings, vent and drain valves, and fasteners.
2. Buried:
a. Ferrous-Metal and Stainless-Steel Components: Coat with coal-tar epoxy as specified in Section 09 90 00 - Painting and Coating.
b. Bolts, Nuts, and Similar Items: Coat with bituminous paint.
c. Flexible Couplings, Grooved Couplings and Similar Items: Wrap with heat shrink wrap
d. Buried Valves and Similar Elements on Wrapped Pipelines: Coat with bituminous paint and wrap entire valve in polyethylene encasement.

e. Cement-Coated Pipelines: Cement coat appurtenances same as pipe

E. Polyethylene Encasement: Install in accordance with AWWA C105/A21.5 and manufacturer's instructions.

F. Tape Coating System: As specified in Section 09 90 00 - Painting and Coating.

G. Heat Shrink Wrap: Apply in accordance with manufacturer's instructions to surfaces that are cleaned, prepared, and primed.

H. Insulating Flanges, Couplings, and Unions:
1. Applications:
a. Dissimilar metal piping connections.
b. Cathodically protected piping penetration to buildings and watertight structures
c. Submerged to unsubmerged metallic piping connections.
d. Connections to existing metallic pipe.
e. Where required for electrically insulated connection.
2. Pipe Installation:
a. Insulating joints connecting immersed piping to non-immersed piping shall be installed one foot above maximum water surface elevation.
b. Submerged carbon steel, ductile iron, or galvanized piping in reinforced concrete shall be isolated from the concrete reinforcement steel.
c. Align and install insulating joints as shown on the Drawings and according to manufacturer's recommendations. Bolt lubricants that contain graphite or other metallic or electrically conductive components that can interfere with the insulating capabilities of the completed flange shall not be used.

3.11 THRUST RESTRAINT

A. Location:
1. Buried Piping: Where shown and where required to restrain force developed at pipeline tees, plugs, caps, bends, and other locations where unbalanced forces exist because of hydrostatic testing and normal operating pressure.
2. Exposed Piping: At all joints in piping.

B. Thrust Ties:
1. Steel Pipe: Attach with joint harness specified in Section 40 05 07 - Hangers and Supports for Process Piping.
2. Ductile Iron Pipe: Attach with socket clamps anchored against grooved joint coupling or flange.
3. Flanged Coupling Adapters: For exposed installations, install manufacturer's anchor studs through coupling sleeve or use dismantling joints.

C. Mechanical Joint Valve Restraint in Proprietary Restrained Joint Piping: Install pipe joint manufacturer's adapter gland follower and pipe end retainer, or mechanical joint anchor gland follower.

D. Thrust Blocking:
1. Place between undisturbed ground and fitting to be anchored.

2. Quantity of Concrete: Sufficient to cover bearing area on pipe and provide required soil bearing area as shown.
3. Place blocking so that pipe and fitting joints will be accessible for repairs.
4. Place concrete in accordance with Structural Notes on Plans.

3.12 SLAB, FLOOR, WALL, AND ROOF PENETRATIONS

A. Application and Installation: As specified in Section 40 05 06 – Couplings, Adapters and Specials for Process Piping.

3.13 BRANCH CONNECTIONS

A. Do not install branch connections smaller than 1/2-inch nominal pipe size, including instrument connections, unless shown otherwise.

B. When line of lower pressure connects to a line of higher pressure, requirements of Piping Data Sheet for higher pressure rating prevails up to and including first block valve in the line carrying the lower pressure, unless otherwise shown.

C. Threaded Pipe Tap Connections:
1. Ductile Iron Piping: Connect only with service saddle or at tapping boss of a fitting, valve body, or equipment casting.
2. Welded Steel or Alloy Piping: Connect only with welded threadolet or half-coupling as specified on Piping Data Sheet.
3. Limitations: Threaded taps in pipe barrel are unacceptable.

3.14 VENTS AND DRAINS

A. Vents and drains at high and low points in piping required for completed system may or may not be shown. Install vents on high points and drains on low points of pipelines.

3.15 INSULATION

A. See Section 40 42 13- Process Piping Insulation.

3.16 HEAT TRACING

A. See Section 40 41 13.13 - Process Piping Electrical Resistance Heat Tracing

3.17 FIELD FINISHING

A. Notify Engineer at least 3 days prior to start of surface preparation or coating application work.

B. As specified in Section 09 90 00 - Painting and Coating

3.18 PIPE IDENTIFICATION

A. As specified in Section 09 90 00 - Painting and Coating

3.19 FIELD QUALITY CONTROL

A. Pressure Leakage Testing: As specified in Section 40 05 40 - Process Piping Leakage Testing.

B. Minimum Duties of Welding Inspector:
   1. Job material verification and storage.
   2. Qualification of welders.
   3. Certify conformance with approved welding procedures.
   4. Maintenance of records and preparation of reports in a timely manner.
   5. Notification to Engineer of unsatisfactory weld performance within 24 hours of weld test failure.

C. Required Weld Examinations:
   1. Perform examinations in accordance with ASME B31.3
   2. Perform examinations for every pipe thickness and for each welding procedure, progressively, for piping covered by this section.
   3. Examine at least one of each type and position of weld made by each welder or welding operator.
   4. For each weld found to be defective under the acceptance standards or limitations on imperfections contained in the applicable Piping Code, examine two additional welds made by the same welder that produced the defective weld. Such additional examinations are in addition to the minimum required above. Examine, progressively, two additional welds for each tracer examination found to be unsatisfactory.

3.20 CLEANING

A. Following assembly and testing, and prior to final acceptance, flush pipelines, except as stated below, with water at 2.5 fps minimum flushing velocity until foreign matter is removed.

B. Blow clean of loose debris using plant process air lines with compressed air at 4,000 fpm; do not flush with water.

C. Immediately after cleaning service piping, dry to minus 40 degrees F dew point with dry compressed instrument air or compressed commercial grade nitrogen.

D. If impractical to flush large diameter pipe at 2.5 fps or blow at 4,000 fpm velocity, clean in-place from inside by brushing and sweeping, then flush or blow line at lower velocity.

E. Insert cone strainers in flushing connections to attached equipment and leave in-place until cleaning is complete.

F. Remove accumulated debris through drains 2 inches and larger or by removing spools and valves from piping.

3.21 SUPPLEMENTS

The supplements listed below, shown in the Plans are a part of this Specification:
1. Piping Schedule.

END OF SECTION

SECTION 40 05 19 - DUCTILE IRON PROCESS PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ductile-iron pipe.
   2. Ductile-iron, malleable-iron, and cast-iron fittings.
   3. Accessories.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
   2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
   3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
   4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   5. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
   6. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
   7. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
   8. AWWA C153 - Ductile-Iron Compact Fittings.
   9. AWWA C606 - Grooved and Shouldered Joints.

B. ASME International:
   1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   2. ASME B16.21, Nonmetallic Flat Gaskets for Pipe Flanges
   3. ASME B16.42, Ductile Iron Pipe Flanges and Flanged Fittings Classes 150 and 300.
   4. ASME B31.3 - Process Piping.

C. ASTM International:
   1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
   2. ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

D. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

E. Society for Protective Coatings:
   1. SSPC SP 6 - Commercial Blast Cleaning.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Section 40 05 10 – Common Requirements for Process Piping: Requirements in this section related to ductile iron pipe.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Section 40 05 10 – Common Requirements for Process Piping subsection 1.4 Submittals.

C. Section 01 60 00 -Product Requirements: Submit manufacturer information regarding pipe and fittings.

D. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, sizes, and materials lists.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, with invert elevations for gravity lines and centerline elevation for pressure lines.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Section 40 05 10 – Common Requirements for Process Piping: Requirements of subsection 1.5 Quality Assurance

B. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Section 40 05 10 – Common Requirements for Process Piping: Requirements of subsection 1.6 - Delivery, Storage, and Handling.

C. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

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 piping and appurtenances by storing off ground.
   3. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

A. Piping:
   1. Buried Liquid Service Using Mechanical Restrained Joints: AWWA C111/A21.11, and AWWA C151/A21.51, pressure class conforming to Table 5 and Table 7 for Type 4 trench, 250 psi minimum working pressure. Follower glands shall be ductile iron.
   2. Buried Air Service Using Mechanical Restrained Joints: AWWA C151/A21.51, pressure class conforming to Table 5 and Table 7 for Type 4 trench, 250 psi minimum working pressure. Follower glands shall be ductile iron.
   3. Exposed Pipe Using Grooved End and Flange Joints: AWWA C115/A21.15, thickness Class 53 minimum, 250 psi minimum working pressure.

B. Fittings:
   1. Material: As indicated on piping schedule.
   2. Mechanical: AWWA C110/A21.10, AWWA C111/A21.11, and AWWA C153/A21.53 ductile iron, 250 psi minimum working pressure. Follower glands shall be ductile iron.
   3. Proprietary Restrained: AWWA C110/A21.10, AWWA C111/A21.11, and AWWA C153/A21.53, ductile iron, 250 psi minimum working pressure. Restraint shall be achieved with removable metal elements fitted between a welded bar on the pipe barrel and the inside of the joint bell or fitting sizes smaller than 16 inches may be mechanical joint, restrained by anchor gland followers, ductile iron anchor type, wedge action, with break-off tightening bolts. Assembled joints shall be rated for deflection in operation at rated pressure. Rated deflection shall be not less than 1 1/2 degrees for 36 inch and smaller pipe. Rated deflection shall be not less than 1/2 degree for 42 inch and larger pipe. Clow Corp., American Cast Iron Pipe Co., U.S. Pipe. Restrained joints relying on metal teeth molded into the gasket to prevent joint separation under pressure will not be accepted.
   4. Grooved End: AWWA C606 and AWWA C110/A21.10, ductile iron, 250 psi minimum working pressure; Victaulic.
   5. Flange: AWWA C110/A21.10 ductile iron, faced and drilled, Class 125

C. Joints:
1. Mechanical: 250 psi minimum working pressure.
2. Proprietary Restrained: 150 psi minimum working pressure. Clow Corp., Super-Lock; American Cast Iron Pipe Co., Flex-Ring or Lok Ring; U.S. Pipe, TR Flex.
3. Grooved End: Rigid type radius cut conforming to AWWA C606, 250 psi minimum working pressure; Victaulic.
4. Flange: Class 125 flat face, or Class 250 raised face, ductile iron, threaded conforming to AWWA C115/A21.15. Gray cast iron will not be allowed.
5. Branch connections 3 inches and smaller shall be made with service saddles as specified in Section 40 05 06, Couplers, Adapters and Specials for Process Piping

D. Cement-Mortar Lining:
1. Comply with AWWA C104.
2. Thickness: Standard.

E. Ceramic-epoxy Lining: Pipe and fittings to be ceramic epoxy lined shall not have been previously lined. Surface preparation shall be made to surfaces free of grease, oil, or other substance with abrasive blasting using clean sand or grit abrasive. Lining shall be done within 8 hours of surface preparation and surfaces shall be re-blasted if rusting appears before lining. Line with a total dry film thickness of 40-mils of ceramic epoxy. Ceramic epoxy shall be amine cured Novolac epoxy with 20 percent minimum volume ceramic quartz pigment, Protecto 401 by Induron Coating, or equal. Lining shall be applied above 40 degrees F ambient temperature and shall not be applied to flange faces. Lining thickness shall be tested using a magnetic film thickness gauge. Lining integrity shall be tested on surfaces with a nondestructive, 2,500-volt dielectric resistance test.

F. Outside Coating:
1. Buried Service:
a. Type: Asphaltic.
b. Thickness: 0.04 inch.
2. Exposed Service: As specified in Section 09 90 00 - Painting and Coating

2.2 ACCESSORIES

A. Couplings:
1. Grooved End: 250 psi minimum working pressure, malleable iron per ASTM A47/A47M or ductile iron per ASTM A536; Victaulic.
2. Grooved End Adapter Flanges: 250 psi minimum working pressure, malleable iron per ASTM A47/A47M or ductile iron per ASTM A536; Victaulic.

B. Bolting:
1. Mechanical, Proprietary Restrained, and Grooved End Joints: Manufacturer’s standard.
2. Class 125 Flat-Faced Flange: ASTM A307, Grade A carbon steel hex head bolts, ASTM A563, Grade A carbon steel hex head nuts and ASTM F436/F436M hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.
3. Flanged Joints in Sumps, Wet Wells, and Submerged and Wetted Installations: Type 316 stainless steel, ASTM A320/A320M, Grade B8M hex head bolts; ASTM A194/A194M,

Grade 8M hex nuts and ASTM F436/F436M Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.

4. Class 250 Raised-Face Flange: ASTM A307, Grade B carbon steel hex head bolts, ASTM A563, Grade A carbon steel heavy hex head nuts and ASTM F436/F436M hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.

C. Gaskets:
   1. General: Gaskets in contact with potable water shall be NSF 61 certified.
   2. Mechanical Restrained Joints; Water and Sewage Service: Rubber conforming to AWWA C111/A21.11.
   3. Mechanical Restrained Joints; Hot Air Service: EPDM or Viton and conforming to AWWA C111/A21.11.
   4. Grooved End Joints: Halogenated butyl conforming to ASTM D2000 and AWWA C606.
   5. Flanged, Water, Sewage and Hot Air Services: 1/8 inch-thick, homogeneous black rubber (EPDM), hardness 60 (Shore A), rated to 275 degrees F, conforming to ASME B16.21 and ASTM D2000 4CA 415 A25 B35 C32 EA14 F19.
   6. Full face for Class 125 flat-faced flanges, flat-ring type for Class 250 raised-face flanges. Blind flanges shall be gasketed covering entire inside face with gasket cemented to blind flange.
   7. Gasket pressure rating to equal or exceed the system hydrostatic test pressure.

D. Joint Lubricant:
   1. Manufacturer’s standard.

PART 3 - EXECUTION

3.1 Section 40 05 10 - Common Requirements for Process Piping. Requirements listed in subsection PART 3 EXECUTION.

END OF SECTION

SECTION 40 05 23
STAINLESS STEEL PROCESS PIPE AND TUBING

PART 1 - GENERAL

△3 *Added per Addendum No. 3*

1.1 SUMMARY

A. Section Includes:
   1. Stainless-steel pipe and fittings.
   2. Stainless-steel tube and fittings.
   3. Accessories.

1.2 REFERENCE STANDARDS

A. American Welding Society:
   1. AWS D1.1/D1.1M - Structural Welding Code – Steel.

B. ASME International:
   1. ASME B1.20.1 - Pipe Threads, General Purpose, Inch.
   2. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, 250 and 800.
   3. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
   4. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings.
   5. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded.
   6. ASME B16.20 - Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed.
   7. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
   8. ASME B31.3 - Process Piping.
   9. ASME Boiler and Pressure Vessel Code (BPVC), Section IX - Welding and Brazing Qualifications.

C. ASTM International:
   1. ASTM A182/A182M - Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
   2. ASTM A193/A193M - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
   3. ASTM A194/A194M - Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
   4. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   5. ASTM A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

6. ASTM A351/A351M - Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
7. ASTM A403/A403M - Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.
8. ASTM A479/A479M - Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
9. ASTM A632 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small Diameter) for General Service.
10. ASTM A789/A789M - Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service.
11. ASTM A813/A813M - Standard Specification for Single- or Double-Welded Austenitic Stainless Steel Pipe.
12. ASTM A814/A814M - Standard Specification for Cold-Worked Welded Austenitic Stainless Steel Pipe.
13. ASTM D3308 - Standard Specification for PTFE Resin Skived Tape.

D. NSF International:
1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 COORDINATION

A. Section 40 05 10 – Common Requirements for Process Piping: Requirements in this section related to stainless steel pipe and tubing.

1.4 SUBMITTALS

A. Section 01 33 00 – Submittals: Requirements for submittals.

B. Section 40 05 10 – Common Requirements for Process Piping; Subsection 1.4 Submittals.

C. Product Data: Submit manufacturer information on pipe materials, tube materials, and fittings.

D. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, sizes, and materials lists.

E. Welder Certificates: Submit welders' certification of compliance with ASME BPVC, Section IX, verifying qualification within previous 12 months.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 – Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves, fittings, and appurtenances.

1.6 QUALITY ASURANCE

A. Section 40 05 10 – Common Products for Process Piping: Requirements of Subsection 1.5 Quality Assurance.

B. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Section 40 05 10 – Common Requirements for Process Piping: Requirements of Subsection 1.6 Delivery, Storage, and Handling.

C. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

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 piping and appurtenances by storing off ground.
   3. Provide additional protection according to manufacturer instructions.

1.8 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 STAINLESS-STEEL PIPE AND FITTINGS

A. General Service Piping:
   1. 2 1/2" & smaller: Schedule 40S: ASTM A312/A312M, Type 316 seamless, pickled and passivated.
   2. 3" thru 6":Schedule 10S: ASTM A778, "as-welded" grade, Type 316L, pickled and passivated.
   3. 8" & larger: Schedule 5S: ASTM A778, "as-welded" grade, Type 316L, pickled and passivated.

B. Joints:
   1. 1-1/2" & smaller: Threaded or flanged at equipment as required or shown.
   2. 2" & larger: Butt-welded or flanged at valves and equipment.

C. Fittings:
   1. 1-1/2" & smaller: Threaded: Forged 1,000 CWP minimum, ASTM A182/A182M, Grade F316 or cast Class 150, ASTM A351/A351M, Grade CF8M/316.
   2. 2" & 2-1/2": Butt Welded: ASTM A403/A403M, Grade WP316L conforming to ASME B16.9 and MSS SP 43, annealed, pickled and passivated; fitting wall thickness to match adjoining pipe; long radius elbows, unless shown otherwise.
   3. 3" & larger: Butt-Welded: ASTM A774/A774M Grade 316L conforming to MSS SP 43, "as-welded" grade, pickled and passivated; fitting wall thickness to match adjoining pipe; long radius elbows, unless shown otherwise.

D. Branch Connections:
   1. 1-1/2" & smaller: Tee or reducing tee in conformance with fittings above.
   2. 2" & larger: Butt-welding tee or reducing tee in accordance with fittings above.

E. Flanges:
   1. Forged Stainless Steel: ASTM A182/A182M, Grade F316L, ASME B16.5 Class 150 or Class 300, slip-on weld neck or raised face. Weld slip-on flanges inside and outside.
   2. Cast Carbon Steel: ASTM A216/A216M Grade WCA, drilled, ASME B16.5 Class 150 or Class 300 Van Stone Type with stainless steel stub ends, ASTM A240 Type 316L "as-welded grade", conforming to MSS SP 43, wall thickness same as pipe.
   3. Blind Flanges, exposed to the atmosphere and not buried nor immersed in liquid, may be either stainless steel or Class 125 ductile iron or Class 150 carbon steel with gaskets as specified herein.

F. Unions:
   1. 2" & smaller: Threaded Forged: ASTM A182/A182M, Grade F316, 2,000 pound or 3,000 pound WOG, integral ground seats, AAR design meeting the requirements of ASME B16.11, bore to match pipe.

G. Bolting:
   1. Forged Flanges: Type 316 stainless steel, ASTM A320/A320M Grade B8M hex head bolts, ASTM A194/A194M Grade 8M hex head nuts and ASTM F436/F436M Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.
   2. Van Stone Flanges and anywhere mating flange on equipment is cast iron and gasket is flat ring: Carbon steel ASTM A307 Grade B hex head bolts, ASTM A563 Grade A hex head nuts and ASTM F436/F436M hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.
   3. Flanged Joints in Sumps, Wet Wells, and Submerged and Wetted Installations: Type 316 stainless steel, ASTM A320/A320M, Grade B8M hex head bolts and ASTM A194/A194M, Grade 8M hex nuts and ASTM F436/F436M Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.

H. Gaskets:
   1. Flanges Flanged, Water, Hot Air, Fuel Gas and Sewage Services: 1/8 inch thick, homogeneous black rubber (EPDM), hardness 60 (Shore A), rated to 250 degrees F. continuous and conforming to ASME B16.21 and ASTM D1330, Steam Grade.
   2. Blind flanges shall be gasketed covering entire inside face with gasket cemented to blind flange.

I. Thread Lubricant:
   1. 2" & smaller:
      a. General Service: 100 percent virgin PTFE Teflon tape.
      b. Fuel Gas Service: Yellow Teflon tape designed for fuel gas service, Air Force A A 58092, AA Thread Seal Tape, Inc.

2.2 STAINLESS-STEEL TUBE AND FITTINGS

A. Tube:

1. ASTM A269, Type 316 stainless steel, seamless, fully annealed hydraulic tubing, 0.065 inch wall thickness minimum.

B. Tubing Joints:
   1. Flareless compression fitting.

C. Tubing Fittings:
   1. Flareless Compression Type Forged: ASTM A182/A182M, Grade F316, Parker-Hannifin Ferulok, Flodar BA Series.

D. Tubing Branch Connections:
   1. Compression type tees or reducing tees in accordance with Tubing Fittings above.

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. Section 40 05 10 – Common Requirements for Process Piping: Requirements listed in Subsection PART 3 EXECUTION.

END OF SECTION

SECTION 40 05 24 - STEEL PROCESS PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel pipe.
2. Steel tube.
3. Cement-mortar-lined steel pipe.
4. Plastic-lined steel pipe.
5. Glass-lined steel pipe.
6. Rubber-lined steel pipe.
7. Internally coated steel pipe.
8. Fittings.
9. Accessories.

B. Related Requirements:
1. Section 09 90 00 - Painting and Coating: Finishes as specified by this Section.
2.
3. Section 40 05 06 - Couplings, Adapters, and Specials for Process Piping: Pipe penetrations, restrained joints, flexible connections, expansion joints and loops, and sleeve-type couplings.
4. Section 40 05 10- Common Requirements for Process Piping.
5. Section 40 05 51 - Common Requirements for Process Valves: Common product requirements for valves for placement by this Section.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
1. AWWA C200 - Steel Water Pipe, 6 In. (150 mm) and Larger.
2. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipe.
3. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. (100 mm) and Larger - Shop Applied.
4. AWWA C206 - Field Welding of Steel Water Pipe.
5. AWWA C207 - Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
6. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
7. AWWA C210 - Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
8. AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
9. AWWA C222 - Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings.
10. AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants.
11. AWWA C606 - Grooved and Shouldered Joints.
12. AWWA M11 - Steel Water Pipe - A Guide for Design and Installation.

B. American Welding Society:
1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

C. ASME International:
1. ASME B1.20.1 - Pipe Threads, General Purpose, Inch.
2. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
3. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.
4. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
5. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings.
6. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded.
7. ASME B16.20 - Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed.
8. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
9. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.
10. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
11. ASME Boiler and Pressure Vessel Code (BPVC) Section IX - Welding, Brazing, and Fusing Qualifications.

D. ASTM International:
1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A105/A105M - Standard Specification for Carbon Steel Forgings for Piping Applications.
4. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
5. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
6. ASTM A193/A193M - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
7. ASTM A194/A194M - Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
8. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
9. ASTM A334/A334M - Standard Specification for Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service.
10. ASTM A423/A423M - Standard Specification for Seamless and Electric-Welded Low-Alloy Steel Tubes.
11. ASTM A576 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
12. ASTM A727/A727M -Standard Specification for Carbon Steel Forgings for Piping Components with Inherent Notch Toughness.
13. ASTM A858/A858M - Standard Specification for Heat-Treated Carbon Steel Fittings for Low-Temperature and Corrosive Service.
14. ASTM A865/A865M - Standard Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints.
15. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
16. ASTM C150/C150M - Standard Specification for Portland Cement.
17. ASTM C600 - Standard Test Method of Thermal Shock Test on Glass Pipe.
18. ASTM D1418 - Standard Practice for Rubber and Rubber Latices - Nomenclature.
19. ASTM D3308 - Standard Specification for PTFE Resin Skived Tape.
20. ASTM E438 - Standard Specification for Glasses in Laboratory Apparatus.

21. ASTM F336 - Standard Practice for Design and Construction of Nonmetallic Enveloped Gaskets for Corrosive Service.
22. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
23. ASTM F1545 - Standard Specification for Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges.

E. NSF International:
1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

F. SSPC - The Society for Protective Coatings:
1. SSPC-SP 6 - Commercial Blast Cleaning.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Section 40 05 10 – Common Requirements for Process Piping: Requirements in this section related to steel process pipe.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Section 40 05 10 – Common Requirements for Process Piping subsection 1.4 Submittals.

C. Product Data: Submit manufacturer information regarding pipe and fittings.

D. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, sizes, and material lists.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Welder Certificates: Submit welders' certification of compliance with ASME BPVC Section IX, verifying qualification within previous 12 months.

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.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

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.

1.6 QUALITY ASSURANCE

A. Section 40 05 10 – Common Requirements for Process Piping: Requirements of subsection 1.5 Quality Assurance.

B. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' experience.

C. Welders: AWS qualified within the previous 12 months for employed weld types.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Section 40 05 10 – Common Requirements for Process Piping: Requirements of subsection 1.6 Delivery, Storage, and Handling.

C. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

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 piping and appurtenances by storing off ground.
   3. Provide additional protection according to manufacturer instructions.

1.9 AMBIENT CONDITIONS

1.10 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 CARBON STEEL PIPE AND FITTINGS—GENERAL SERVICE

A. Pipe:
1. All: Black carbon steel, ASTM A106/A106M, Grade B seamless or ASTM A53/A53M, Grade B seamless or ERW. Threaded, buttwelded, grooved end, and flanged joints.
2. Screwed:
   a. 2" & smaller: Schedule 40.
3. Welded:
   a. 2-1/2" thru 10": Schedule 40.
   b. 12" thru 16" : Schedule 30.
   c. 18" thru 24": Schedule 20.
4. Grooved:
   a. 2-1/2" thru 6": Schedule 40.
   b. 8" thru 12" inch: Schedule 30.
   c. 14": Standard weight.

B. Joints
1. 2" & smaller: Threaded or flanged at valves and equipment or grooved end meeting the requirements of AWWA C606.
2. 2-1/2" & larger: Butt-welded or flanged at valves and equipment, or grooved end meeting the requirements of AWWA C606.

C. Fittings
1. 2" & smaller:
   a. Threaded: 150- or 300-pound malleable iron, ASTM A197/A197M or ASTM A47/A47M, dimensions in accordance with ASME B16.3. Fire sprinkler fittings to be UL listed.
   b. Grooved End: Malleable iron ASTM A47/A47M or ductile iron ASTM A536, grooved ends to accept couplings without field preparation. Victaulic Co.; Anvil International, Inc., Gruvlok.
2. 2-1/2" & larger:
   a. Butt Welded: Wrought carbon steel buttwelding, ASTM A234/A234M, Grade WPB meeting the requirements of ASME B16.9; fitting wall thickness to match adjoining pipe; long radius elbows unless shown otherwise.
   b. Grooved End: Malleable iron ASTM A47/A47M, ductile iron ASTM A536, forged steel ASTM A234/A234M, or factory fabricated from ASTM A53/A53M pipe. Grooved ends to accept couplings without field preparation. Victaulic Co.; Anvil International, Inc., Gruvlok; Shurjoint Piping Products.

D. Branch Connections
1. 2" & smaller:
   a. For threaded pipe: Threaded, straight, or reducing tees in conformance with Fittings specified above.
   b. For welded or grooved pipe, use threadolet.
2. 2-1/2" & larger:
   a. Butt-welding or grooved end tee in conformance with Fittings specified above.

E. Flanges
   1. 2" & smaller:
      a. Forged carbon steel, ASTM A105/A105M, Grade II, ASME B16.5 Class 150 or Class 300 socket-weld or threaded, 1/16-inch raised face.
   2. 2-1/2" & larger:
      a. Butt-Welded Systems: Forged carbon steel, ASTM A105/A105M, ASME B16.5 Class 150 or Class 300 slip-on or welding neck, 1/16-inch raised face; weld neck bore to match pipe internal diameter. Use weld neck flanges when abutting butt-weld fittings. Weld slip-on flanges inside and outside.
      b. Grooved End Adapter Flange: Malleable iron ASTM A47/A47M or ductile iron ASTM A536. Victaulic Style 741 or 743; Anvil International, Inc., Gruvlok Figure 7012 or 7013; Shurjoint Model 7041-A. Include stainless steel washer plates as required for mating to serrated faces and lined valves and equipment.
      c. Cast Iron Mating Flange: AWWA C207, Class D or E, hub or ring type to mate with ASME B16.1, Class 125 cast-iron flange. AWWA C207 Class F hub type or ASTM A105/A105M, ASME B16.5 Class 300 to mate with ASME B16.1 Class 250 cast-iron flange.

F. Unions
   1. 2" & smaller-Threaded malleable iron, ASTM A197/A197 orASTM A47/A47M, 150- or 300-pound WOG, meeting the requirements of ASME B16.3.

G. Couplings
   1. 2-1/2" & larger
      a. Grooved End: Rigid joint malleable iron, ASTM A47/A47M or ductile iron, ASTM A536. Victaulic Co.; Anvil International, Inc., Gruvlok; Shurjoint Piping Products.
      b. Screwed End: Malleable iron, ASTM A197/A197M or ASTM A47/A47M.

H. Bolting
   1. Flanges: Carbon steel ASTM A307, Grade A hex head bolts; ASTM A563, Grade A hex head nuts and ASTM F436/F436M hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.
   2. When mating flange on equipment is cast iron and gasket is flat ring, provide ASTM A307, Grade B hex head bolts; ASTM A563, Grade A heavy hex nuts and ASTM F436/F436M hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.
   3. Grooved End Couplings: Carbon steel, ASTM A183 bolts and nuts, 110,000 psi minimum tensile strength.
   4. Flanged Joints in Sumps, Wet Wells, and Submerged, Wetted and Buried Installations: Type 316 stainless steel, ASTM A320/A320M, Grade B8M hex head bolts; ASTM A194/A194M, Grade 8M hex nuts and ASTM F436/F436M Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.

I. Gaskets
   1. Water and Air Services: 1/16-inch-thick, compressed inorganic fiber with nitrile binder, rated 400 degrees F. continuous.
   2. Blind flanges shall be gasketed covering the entire inside face with the gasket cemented to the blind flange.
   3. Grooved Couplings: EPDM per ASTM D2000 for water and oil-free air to 230 degrees F, nitrile for oil vapor in air and oil services to 180 degrees F.

J. Thread Lubricant
1. 2" & smaller General Service: 100 percent virgin PTFE Teflon tape.

2.2 WELDED STEEL PIPE AND FITTINGS

A. Pipe
1. Carbon steel plate per ASTM A283/A283M, Grade C or ASTM A285/A285M Grade C, fabricated in accordance with AWWA C200, straight seam, thickness designed for 66 percent of minimum yield stress at hydrostatic test pressure, minimum thickness 1/4-inch.

B. Coatings
1. As indicated on the Piping Schedule.

C. Interior Bracing
1. 60 degree spiders set 2 feet from each end and at the one-third points capable of withstanding backfill loadings. Bracing at one-third point not required for sections less than 10 feet in length.

D. Joints
1. Exposed Piping: Butt weld AWWA C200 or flanged.

E. Fittings
1. Fabricated: Carbon steel fabricated from pipe in accordance with AWWA C208; elbows to have a 22.5-degree maximum miter section angle, minimum of three sections; wyes, tees, crosses, and outlets to be reinforced in accordance with AWWA M-11.
2. Forged: Butt-welding fittings, ASTM A234/A234M, Grade WPB meeting the requirements of ANSI B16.9. Fitting wall thickness to match adjoining pipe. Elbows to be long radius unless shown otherwise.

F. Flanges
1. AWWA C207, Class D (150 psi), hub or ring type.

G. Bolting
1. Carbon steel ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts.

H. Gaskets
1. Flanged, Water, Sewage, and Low-Pressure Air Service: 1/8-inch thick, unless otherwise specified, homogeneous black rubber (EPDM), hardness 60 (Shore A), rated to 300 degrees F, conforming to ANSI B16.21 and ASTM D1330 Steam Grade.
2. Ring gaskets shall not be permitted. Blind flanges shall be gasketed covering the entire inside face with the gasket cemented to the blind flange.

2.3 GALVANIZED STEEL PIPE AND MALLEABLE IRON FITTINGS

A. Pipe
1. Galvanized carbon steel, ASTM A106, Grade B seamless or ASTM A53, Grade B seamless or ERW.
2. 2" & smaller: Schedule 80.

3. 2-1/2" thru 6": Schedule 40.
4. 8" thru 12": Schedule 30.
5. 14": Standard weight.

B. Joints
1. 2" & smaller: Threaded or flanged at valves and equipment, or grooved end meeting requirements of AWWA C606.
2. 2-1/2" & larger: Flanged at valves and equipment, or grooved end meeting requirements of AWWA C606.

C. Fittings
1. Threaded: 150- or 300-pound malleable iron, ASTM A197 or ASTM A47, dimensions in accordance with ASME B16.3.
2. Grooved End: Malleable iron ASTM A47 or ductile iron ASTM A536, 250 psi working pressure, grooved ends to accept couplings without field preparation. Victaulic; Anvil International, Inc., Gruvlok.

D. Branch Connections
1. 2" & smaller: Tee or reducing tee in conformance with Fittings above, galvanized 2,000-pound WOG threadolet or welding boss; galvanize after welding.
2. 2-1/2" & larger: Branch Same Size as Run: Grooved end tee in accordance with Fittings above. Branch One or More Sizes Smaller Than Run: grooved end reducing tee in accordance with Fittings above.

E. Flanges
1. Galvanized forged carbon steel, ASTM A105/A105M, ASME B16.5 Class 150 or Class 300, threaded, 1/16-inch raised face.
2. Grooved end adapter flange, malleable iron ASTM A47 or ductile iron ASTM A536. Victaulic; Anvil International, Inc., Gruvlok.

F. Unions
1. Threaded malleable iron, ASTM A197 or ASTM A47, 300-pound WOG, brass to iron seat, meeting the requirements of ASME B16.3.

G. Couplings
1. Grooved End: Rigid joint malleable iron, ASTM A47 or ductile iron, ASTM A536, 250 psi working pressure. Victaulic; Anvil International, Inc., Gruvlok.

H. Plugs
1. Forged carbon steel, ASTM A181/A181M, Grade II, round head, threaded, galvanized.

I. Bolting
1. Grooved End Couplings: Carbon steel, ASTM A183 bolts and nuts, 110,000 psi minimum tensile strength.
2. Flanges: Carbon steel ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts.

J. Gaskets
1. All flanges

a. Flanged, Water and Sewage Service: 1/8-inch thick, homogeneous black rubber (EPDM), hardness 60 (Shore A), rated to 250 degrees F. continuous and conforming to ASME B16.21 and ASTM D1330, Steam Grade.
b. Blind flanges shall be gasketed covering entire inside face with gasket cemented to blind flange.

2. Grooved end couplings
   a. EPDM or chlorinated butyl per ASTM D2000 for water, and air to 230 degrees F, dimensions conforming to AWWA C606.

K. Thread Lubricant
   1. 2" & smaller: Teflon tape or joint compound that is insoluble in water.

2.4 BURIED STEEL PIPE EXTERIOR COATING

A. Description: Shop-applied prime coat and coal-tar enamel protective coating.

B. Comply with AWWA C203.

2.5 CEMENT-MORTAR-LINED STEEL PIPE AND FITTINGS

A. Comply with AWWA C205.

B. Shop-apply lining after fabrication and before installation.

C. Cement: Comply with ASTM C150/C150M.

D. Aggregate:

   1. Material: Silica sand.
   2. Comply with ASTM C33/C33M.

E. Water: Clean with no organic matter or strong alkalis.

F. Liner Thickness: Comply with AWWA C205

2.6 GLASS-LINED STEEL PIPE AND FITTINGS

A. Liner:
   1. Material: Chemically resistant, low-expansion, borosilicate glass.
   2. Comply with ASTM E438.

B. Operating Temperature Range: Minus 20 degrees F to plus 200 degrees F.

C. Working Pressure: 50 psig and full vacuum.

D. Minimum Liner Thickness: 30 mils.

E. Lock liner to shell.

F. Gaskets:
   1. Material: PTFE.

2. Comply with ASTM F336.

2.7 INTERNALLY LINED STEEL PIPE AND FITTINGS

A. Polyurethane Liner:
1. Description: Self-priming, plural component, 100 percent solids, and non-extended polyurethane.
2. Comply with AWWA C222.
3. As indicated in piping schedule.
4. Dry Film Thickness: 30 mils.

B. Spray-Applied Liquid Epoxy Liner:
1. Description: Thermosetting, fusion-bonded, 100 percent solids, and dry powder epoxy resin.
2. Comply with AWWA C210 and AWWA C550.
3. As indicated in piping schedule.

2.8 FINISHES

A. 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.

2.9 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Testing:
1. Provide shop inspection and testing of completed pipe sections.
2. Conduct 15,000-V minimum electrostatic spark test on each plastic-lined pipe to ensure integrity of plastic liner.
3. Test thermal shock resistance of glass-lined pipe according to ASTM C600.

PART 3 - EXECUTION

3.1 Section 40 05 10 – Common Requirements for Process Piping: Requirements listed in subsection PART 3 EXECUTION.

END OF SECTION

SECTION 40 05 31 - THERMOPLASTIC PROCESS PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. PVC pipe.
2. PVC tube.
3. CPVC pipe.
4. Polyvinylidene fluoride (PVDF) pipe and tube.
5. Acrylonitrile-butadiene-styrene (ABS) pipe.
6. Polyethylene (PE) pipe and tube.
7. Fittings.
8. Accessories for plastic piping.

B. Related Requirements:
1. Section 33 11 16 - Site Water Utility Distribution Piping: Pipe laying requirements and tolerances, excavation, backfill, and thrust restraints.
2. Section 40 05 06 - Couplings, Adapters, and Specials for Process Piping: Pipe penetrations, restrained joints, flexible connections, expansion joints and loops, and sleeve-type couplings.
3. Section 40 05 51 - Common Requirements for Process Valves: Common product requirements for valves for placement by this Section.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
2. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 12 In., for Water Transmission and Distribution.
3. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) through 3 In. (76 mm), for Water Service.
4. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) through 63 In. (1,600 mm), for Water Distribution and Transmission.

B. ASME International:
1. ASME B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form).
2. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).
3. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, 250 and 800.
4. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
5. ASME B16.20 - Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed.
6. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
7. ASME B31.3 - Process Piping.

C. ASTM International:
1. ASTM A193/A193M - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
2. ASTM A194/A194M -Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
3. ASTM D1527 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80.
4. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
5. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
6. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
7. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
8. ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
9. ASTM D2464 - Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
10. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
11. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
12. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
13. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
14. ASTM D2657 - Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
15. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
16. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
17. ASTM D2737 - Standard Specification for Polyethylene (PE) Plastic Tubing.
18. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
19. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
20. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
21. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
22. ASTM D3222 - Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
23. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
24. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
25. ASTM D3892 - Standard Practice for Packaging/Packing of Plastics.

26. ASTM D3965 - Standard Classification System and Basis for Specifications for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Materials for Pipe and Fittings.
27. ASTM F402 - Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
28. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
29. ASTMF438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
30. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
31. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
32. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
33. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
34. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
35. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
36. ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.
37. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
38. ASTM F1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing.
39. ASTM F1056 - Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings.
40. ASTM F1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings.

D. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Section 40 05 10 – Common Requirements for Process Piping: Requirements in this section related to thermoplastic process pipe.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Section 40 05 10 – Common Requirements for Process Piping subsection 1.4 Submittals.

C. Product Data: Submit manufacturer's catalog information regarding pipe and fittings.

D. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, sizes, and materials lists.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, and invert elevations. for gravity pipe and centerline elevations for pressure pipe

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Section 40 05 10 – Common Requirements for Process Piping: Requirements of subsection 1.5 Quality Assurance.

B. Materials in Contact with Potable Water: Certified according to NSF 61.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Section 40 05 10 – Common Requirements for Process Piping: Requirements of subsection 1.6 Delivery, Storage, and Handling

C. Inspection:
   1. Accept materials on Site in manufacturer's original packaging and inspect for damage.
   2. Manufacturer's Packaging: Comply with ASTM D3892.

D. Store materials according to manufacturer instructions.

E. 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.

1.9 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PVC PIPE, TUBE, AND FITTINGS

A. PVC Pipe and Fittings:
1. Pipe:
a. Schedule 80 PVC: Type I, Grade I or Class 12454 B conforming to ASTM D1784 and ASTM D1785. Pipe shall be manufactured with titanium dioxide for ultraviolet protection.
b. Threaded Nipples: Schedule 80 PVC.
2. Fittings: Schedule 80: ASTM D2466 and ASTM D2467 for socket weld type and Schedule 80 ASTM D2464 for threaded type. Fittings shall be manufactured with titanium dioxide for ultraviolet protection.
3. Joints: Solvent socket weld except where connection to threaded valves and equipment may require future disassembly.
4. Flanges: One-piece, molded hub type PVC flat face flange in accordance with Fittings above, ASME B16.1, Class 125 drilling
5. Bolting:
a. Flat Face Mating Flange and In Corrosive Areas: ASTM A193/A193M, Type 316 stainless steel Grade B8M hex head bolts, ASTM A194/A194M Grade 8M hex head nuts and ASTM F436 Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.
b. With Raised Face Mating Flange: Carbon steel ASTM A307 Grade B square head bolts, ASTM A563 Grade A heavy hex head nuts and ASTM F436 hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.
6. Gaskets:
a. Flat Face Mating Flange: Full faced 1/8 inch-thick ethylene propylene (EPR) rubber.
b. Raised Face Mating Flange: Flat ring 1/8 inch ethylene propylene (EPR) rubber, with filler gasket between OD of raised face and flange OD to protect the flange from bolting moment.
7. Solvent Cement: Socket type joints shall be made employing solvent cement that meets or exceeds the requirements of ASTM D2564 and primer that meets or exceeds requirements of ASTM F656, chemically resistant to the fluid service, and as recommended by pipe and fitting manufacturer, except solvent weld cement for PVC pipe joints in sodium hypochlorite service shall be free of silica filler and shall be certified by the manufacturer to be suitable for that service, IPS Weld-On 724 or approved equal. Certification shall be submitted. Solvent cement and primer shall be listed by NSF 61 for contact with potable water.
8. Thread Lubricant: Teflon Tape

B. PVC Tube and Fittings:
1. Tube:
a. Type: Clear
b. Size and Wall Thickness: As indicated in piping schedule.
c. Pressure Rating: As indicated in piping schedule.
2. Fittings:
a. Type: Compression.
b. Materials: Suitable for application.

3. Threads:
   a. Type: Straight.
   b. Comply with ASME B1.1.

2.2 CPVC PIPE AND FITTINGS

A. Pipe:
   1. Schedule 80 CPVC: Type IV, Grade I or Class 23447 B conforming to ASTM D1784 and ASTM F441/F441M. Pipe shall be manufactured with titanium dioxide for ultraviolet protection.
   2. Threaded Nipples: Schedule 80 CPVC.

B. Fittings: Schedule 80: ASTM F439 for socket weld type and Schedule 80 ASTM F437 for threaded type. Fittings shall be manufactured with titanium dioxide for ultraviolet protection.

C. Joints: Solvent socket weld except where connection to threaded valves and equipment may require future disassembly.

D. Flanges: One-piece, molded hub type CPVC flat face flange in accordance with Fittings above, ASME B16.1, Class 125 drilling

E. Bolting:
   1. Flat Face Mating Flange and In Corrosive Areas: ASTM A193/A193M, Type 316 stainless steel Grade B8M hex head bolts, ASTM A194/A194M Grade 8M hex head nuts and ASTM F436 Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.
   2. With Raised Face Mating Flange: Carbon steel ASTM A307 Grade B square head bolts, ASTM A563 Grade A heavy hex head nuts and ASTM F436 hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.

F. Gaskets:
   1. Flat Face Mating Flange: Full faced 1/8-inch-thick ethylene propylene (EPR) rubber.
   2. Raised Face Mating Flange: Flat ring 1/8-inch ethylene propylene (EPR) rubber, with filler gasket between OD of raised face and flange OD to protect the flange from bolting moment.

G. Solvent Cement: Socket type joints shall be made employing solvent cement that meets or exceeds the requirements of ASTM F493 and primer that meets or exceeds requirements of ASTM F656, chemically resistant to the fluid service, and as recommended by pipe and fitting manufacturer, except solvent weld cement for CPVC pipe joints in sodium hypochlorite service shall be free of silica filler and shall be certified by the manufacturer to be suitable for that service, IPS Weld-On 724 or approved equal. Certification shall be submitted. Solvent cement and primer shall be listed by NSF 61 for contact with potable water.

H. Thread Lubricant: Teflon Tape

2.3 PVDF PIPE, TUBE, AND FITTINGS

A. Pipe: PVDF: Type I of ASTM D3222, conforming to ASTM D2837. Use unpigmented PVDF resin and size according to SDR system to 230 psi for sizes 3/8 inch to 2-1/2 inches and 150 psi for 3 inches through 12 inches at 73.4°F.

B. Fittings: PVDF as specified under Pipe above. All pressure fittings shall be injection mold for butt fusion.

C. Joints: Butt Fusion. Temperatures, times, and pressures of fusion shall be according to the manufacturer. Pipe joining equipment shall be provided by the pipe and fitting manufacturer.

D. Flanges: Stub end and polypropylene coated steel backing ring with ANSI, 150-pound bolt hole pattern. Follow manufacturers torque and tightening procedures.

E. Bolting: ASTM A193/A193M Rev A Type 316 stainless steel Grade B8M hex head bolts and ASTM A194/A194M Grade 8M hex head nuts.

F. PVDF Tube and Fittings:
1. Tube:
   a. Size and Wall Thickness: As indicated in piping schedule**.**
   b. Pressure Rating: As indicated in piping schedule.
2. Fittings:
   a. Type: Compression.
   b. Materials: Suitable for application.

2.4 High Density Polyethylene (HDPE) Tubing

A. General: Pipe lengths, fittings, and connections to be joined by thermal butt-fusion shall be of the same type, grade, and class of polyethylene compound and supplied from the same raw material supplier.

B. Tube:
1. HDPE tubing shall meet the requirements of AWWA C901.
2. HDPE tubing shall be rated for use at a pressure class of at least 150 psi.
3. Polyethylene tubing shall be made from HDPE resin having a material designation code of PE4710 or higher.
4. Tubing material shall meet the requirements of ASTM D 3350 and shall have a minimum cell classification of PE445474C.
5. HDPE Pressure tubing for potable water shall meet the requirements of NSF 61.
6. Pressure tubing shall be approved by the Underwriter’s Laboratory (UL) or Factory Mutual (FM).
7. Tubing Markings shall meet the minimum requirements of AWWA C901.
8. Only smooth wall HDPE will be permitted.

C. Fittings: Molded fittings, butt-fusion joined, conforming to ASTM D1248-84. Shall have the same pressure rating as the adjoining pipe unless otherwise specified.

D. Joints: Butt-fusion joints per ASTM D3261. Joints shall have same pressure rating as the adjoining pipe.

2.5 FINISHES

A. Coat machined faces of metallic flanges with temporary rust-inhibitive coating.

PART 3 - EXECUTION

3.1 Section 40 05 10 – Common Requirements for Process Piping: Requirements listed in subsection PART 3 EXECUTION.

END OF SECTION

SECTION 40 05 40 – PROCESS PIPING LEAKAGE TESTING

PART 1 - GENERAL

1.1 SUBMITTALS

A. Informational Submittals:
   1. Testing Plan:
      a. Submit prior to testing and include at least the information that follows.
         1) Testing dates.
         2) Piping systems and section(s) to be tested.
         3) Test type.
         4) Method of isolation.
         5) Calculation of maximum allowable leakage for piping section(s) to be tested.
   2. Certifications of Calibration: Testing equipment.
   3. Certified Test Report.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

A. Notify Owner's Representative or Engineer in writing 5 days in advance of testing. Perform testing in the presence of Owner's Representative or Engineer.

B. Pressure Piping:
   1. Install temporary thrust blocking or other restraint as necessary to protect adjacent piping or equipment and make taps in piping prior to testing.
   2. Wait 5 days minimum after concrete thrust blocking is installed to perform pressure tests. If high-early strength cement is used for thrust blocking, wait may be reduced to 2 days.
   3. Prior to test, remove or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.
   4. Chlorine and Sulfur Dioxide Piping: Test, dry, and clean in accordance with requirements of Chlorine Institute Pamphlet 6
   5. New Piping Connected to Existing Piping:
      a. Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to Engineer.
      b. Test joint between new piping and existing piping by methods that do not place entire existing system under test load, as approved by Engineer
   6. Items that do not require testing include: Piping between wetwells and wetwell isolation valves, Equipment seal drains, tank overflows to atmospheric vented drains, tank atmospheric vents.
   7. Test Pressure: As indicated on Piping Schedule

C. Test section may be filled with water and allowed to stand under low pressure prior to testing.

D. Gravity Piping:
   1. Perform testing after service connections, manholes, and backfilling have been completed between stations to be tested.

2. Determine groundwater level at time of testing by exploratory holes or other method acceptable to Engineer
3. Pipe 42 Inches Diameter and Larger: Joint testing device may be used to isolate and test individual joints.

3.2 HYDROSTATIC TEST FOR PRESSURE PIPING

A. Fluid: Clean water of such quality to prevent corrosion of materials in piping system.

B. Exposed Piping:
1. Perform testing on installed piping prior to application of insulation.
2. Maximum Filling Velocity: 0.25 foot per second, applied over full area of pipe.
3. Vent piping during filling. Open vents at high points of piping system or loosen flanges, using at least four bolts, or use equipment vents to purge air pockets.
4. Maintain hydrostatic test pressure continuously for 60 minutes, minimum, and for such additional time as necessary to conduct examinations for leakage.
5. Examine joints and connections for leakage.
6. Correct visible leakage and retest as specified.
7. Empty pipe of water prior to final cleaning or disinfection.

C. Buried Piping:
1. Test after backfilling has been completed.
2. Expel air from piping system during filling.
3. Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.
4. Maintain hydrostatic test pressure continuously for 2 hours minimum, reopening isolation valve only as necessary to restore test pressure. Test pressure cannot vary more than +-5% psi for the duration of the test.
5. Determine actual leakage by measuring quantity of water necessary to maintain specified test pressure for duration of test.
6. Maximum Allowable Leakage:
   a. Ductile Iron Pipe, Steel Pipe and AWWA Rubber Gasket Pipe

$$L = \frac{SD(P)^{1/2}}{148{,}000}$$

where:

L = Allowable leakage, in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of pipe, in inches.
P = Test pressure during leakage test, in pounds per square inch.

   b. When testing against closed metal-seated valves, an additional testing allowance per closed valve of 0.0078 gallons per hour per inch diameter of valve size.
7. See individual pipe specification for other buried piping not described above.

3.3 PNEUMATIC TEST FOR PRESSURE PIPING

A. Do not perform on:
1. PVC or CPVC pipe.

2. Piping larger than 18 inches.
3. Buried and other non-exposed piping.

B. Fluid: Oil-free, dry air.

C. Procedure:
1. Apply preliminary pneumatic test pressure of 25 psig maximum to piping system prior to final leak testing, to locate visible leaks. Apply soap bubble mixture to joints and connections; examine for leakage.
2. Correct visible leaks and repeat preliminary test until visible leaks are corrected.
3. Gradually increase pressure in system to half of specified test pressure. Thereafter, increase pressure in steps of approximately one-tenth of specified test pressure until required test pressure is reached.
4. Maintain pneumatic test pressure continuously for minimum of 10 minutes and for such additional time as necessary to conduct soap bubble examination for leakage.
5. Correct visible leakage and retest as specified.

D. Allowable Leakage: Piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of leakage.

E. After testing and final cleaning, purge with nitrogen those lines that will carry flammable gases to assure no explosive mixtures will be present in system during filling process.

3.4 HYDROSTATIC TEST FOR GRAVITY PIPING

A. Testing Equipment Accuracy: Plus or minus 1/2-gallon water leakage under specified conditions.

B. Maximum Allowable Leakage: 0.16 gallon(s) per hour per inch diameter per 100 feet. Include service connection footage in test section, subjected to minimum head specified.

C. Gravity Sanitary and Roof Drain Piping: Test with 15 feet of water to include highest horizontal vent in filled piping. Where vertical drain and vent systems exceed 15 feet in height, test systems in 15-foot vertical sections as piping is installed.

D. Exfiltration Test:
1. Hydrostatic Head:
   a. At least 6 feet above maximum estimated groundwater level in section being tested.
   b. No less than 6 feet above inside top of highest section of pipe in test section, including service connections.
2. Length of Pipe Tested: Limit length such that pressure on invert of lower end of section does not exceed 30 feet of water column.

E. Infiltration Test:
1. Groundwater Level: At least 6 feet above inside top of highest section of pipe in test section, including service connections.

F. Piping with groundwater infiltration rate greater than allowable leakage rate for exfiltration will be considered defective even if pipe previously passed a pressure test.

G. Defective Piping Sections: Test and seal individual joints, and retest as specified.

3.5 PNEUMATIC TEST FOR GRAVITY PIPING

A. Equipment:
1. Calibrate gauges with standardized test gauge provided by Engineer at start of each testing day. Engineer will witness calibration.
2. Install gauges, air piping manifolds, and valves at ground surface.
3. Provide pressure release device, such as rupture disc or pressure relief valve, to relieve pressure at 6 psi or less.
4. Restrain plugs used to close sewer lines to prevent blowoff.

B. Procedure:
1. Require that no person enter manhole where pipe is under pressure.
2. Slowly introduce air into pipe section until internal air pressure reaches 4 psi greater than average back pressure of groundwater submerging pipe.
3. Allow 2 minutes minimum for air temperature to stabilize.

C. Allowable Leakage: Test section will be considered defective when time required for pressure to decrease from 3.5 psi to 2.5 psi greater than average back pressure of groundwater submerging pipe is less than that computed using values from following table:

Table 1*

A Pipe Diameter (Inches)	**B Time per Foot up to Length in Col C (Seconds)**	**C Test Length (Feet)**	**D Test Time for any Length Between Col C & E (Min:Sec)**	**E Length at Which Time in Col F Applies (Feet)**	**F Time per Foot for Total Length (Seconds)**
4	0.18	636	1:54	1,114	0.10
6	0.40	424	2:50	743	0.23
8	0.71	318	3:47	557	0.41
10	1.11	255	4:43	446	0.63
12	1.60	212	5:40	371	0.91
15	2.50	170	7:05	297	1.42
18	3.62	141	8:30	248	2.06
21	4.92	121	9:55	212	2.81
24	6.42	106	11:20	187	3.67

Example: 15-inch diameter pipe:
For 150 feet, T = 2.50 sec (Col B) x 150 ft = 375 sec = 6:15
For 250 feet, T = 7:05 (Col D)
For 500 feet, T = 1.42 sec (Col F) x 500 ft = 710 sec = 11:50

*Based on 0.003 cfm per square foot with a minimum significant loss of 2 cfm and a maximum loss of 3.5 cfm.

D. Piping with groundwater infiltration rate greater than allowable leakage rate for exfiltration will be considered defective even if pipe previously passed a pressure test.

E. Defective Piping Sections: test and seal individual joints, and retest as specified.

3.6 FIELD QUALITY CONTROL

A. Test Report Documentation:
   1. Test date.
   2. Description and identification of piping tested.
   3. Test fluid.
   4. Test pressure.
   5. Remarks, including:
      a. Leaks (type, location).
      b. Repair/replacement performed to remedy excessive leakage.
   6. Signed by Contractor and Engineer to represent that test has been satisfactorily completed.

END OF SECTION

SECTION 40 05 51 - COMMON REQUIREMENTS FOR PROCESS VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Valve general requirements.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
1. AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
2. AWWA C541 - Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates.
3. AWWA C542 - Electric Motor Actuators for Valves and Slide Gates.
4. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.
5. AWWA C606, Grooved and Shouldered Joints.
6. AWWA C800, Underground Service Line Valves and Fittings.

B. ASTM International:
1. ASTM A276, Standard Specification for Stainless Steel Bars and Shapes.
2. ASTM A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
3. ASTM A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
4. ASTM A564/A564M, Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
5. ASTM B61, Standard Specification for Steam or Valve Bronze Castings.
6. ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
7. ASTM B98/B98M, Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
8. ASTM B127, Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip.
9. ASTM B139/B139, Standard Specification for Phosphor Bronze Rod, Bar and Shapes.
10. ASTM B164, Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire.
11. ASTM B194, Standard Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar.
12. ASTM B584, Standard Specification for Copper Alloy Sand Castings for General Applications.
13. ASTM D429, Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.
14. ASTM D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

C. Manufacturers Standardization Society:
1. MSS SP-25 - Standard Marking System for Valves, Fittings, Flanges, and Unions.

D. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NFPA:
   1. NFPA 70 - National Electrical Code (NEC).

F. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

G. Equipment Directory.

H. Chlorine Institute (CI): Pamphlet 6, Piping Systems for Dry Chlorine.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit manufacturer information for actuator with model number and size indicated.
   2. Submit valve cavitation limits.

C. Shop Drawings: Indicate parts list, materials, sizes, position indicators, limit switches, actuator mounting, wiring diagrams, control system.

D. Valve-Labeling Schedule: Indicate valve locations and nametag text.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Certification of Valves Larger Than 12 Inches: Furnish certified copies of hydrostatic factory tests, indicating compliance with applicable standards.

G. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for sizing of control valves.

H. Manufacturer Instructions: Submit installation instructions and special requirements.

I. Source Quality-Control Submittals: Indicate results of shop or factory tests and inspections.

J. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections, including factory-applied coatings.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves and actuators.

1.5 QUALITY ASSURANCE

A. Maintain clearances as indicated on Drawings.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.7 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.

D. 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.

1.8 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 VALVES

A. Description: Valves, operator, actuator, handwheel, chainwheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and other accessories as required.

B. Valve to be suitable for intended service.

C. Valve size: Valve same size as adjoining pipe unless otherwise called out on drawings or in valve schedule.

D. Valve Ends: Compatible with adjacent piping system.

E. Operation:
   1. Open by turning counterclockwise; close by turning clockwise.
   2. Cast directional arrow on valve or actuator with OPEN and CLOSE cast on valve in appropriate location.

F. Valve Marking and Labeling:
   1. Marking: Comply with MSS SP-25.

2. Labeling: Use Valve Tag as specified in valve schedule.
3. Provide buried valves with valve boxes, covers, and extensions as specified in Section 33 11 13 - Site Water Utility Distribution Piping.

G. Valve Construction:
1. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.
   a. Use or reuse of components and materials without a traceable certification is prohibited.
2. Bronze and brass valve components and accessories that have surfaces in contact with water to be alloys containing less than 16 percent zinc and 2 percent aluminum.
   a. Approved alloys are of the following ASTM designations: B61, B62, B98/B98M (Alloy UNS No. C65100, C65500, or C66100), B139/B139M (Alloy UNS No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, B194, and B127.
   b. Stainless steel Alloy 18 8 may be substituted for bronze.
3. Valve materials in contact with or intended for drinking water service to meet the following requirements:
   a. Materials to comply with requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements.
   b. Coatings materials to be formulated from materials deemed acceptable to NSF/ANSI 61.
4. Supply certification product is certified as suitable for contact with drinking water by an accredited certification organization in accordance with NSF/ANSI 61. Provide certification for each valve type used for drinking water service.
5. Bodies: Rated for maximum temperature and pressure to which valve will be subjected as specified in valve Sections.
6. Bonnets:
   a. Screwed or flanged to body and of same material and pressure rating as body.
   b. Furnish glands, packing nuts, or yokes as specified in valve Sections.
7. Stems and Stem Guides:
   a. Materials and Seals: As specified in valve Sections.
   b. Bronze Valve Stems: According to ASTM B62 or B584.
   c. Space stem guides 10 feet o.c.
   d. Submerged Stem Guides: Type 304 stainless steel.
8. Nuts and Bolts: As specified in Section 05 50 00 - Metal Fabrications.

2.2 VALVE ACTUATORS

A. As specified in Section 40 05 57 – Actuators for Process Valves and Gates.

B. Size operators and actuators to operate valve for full range of pressures and velocities.

C. Factory mount operator, actuator, and accessories.

D. Motors: As specified in Section 26 20 00 – Low Voltage AC Induction Motors

2.3 INSULATION

A. As specified in Section 40 42 13 - Process Piping Insulation.

B. As indicated in Pipe Schedule.

2.4 FINISHES

A. Valve Lining and Coating: Comply with AWWA C550.

B. Exposed Valves: As specified in Section 09 90 00 - Painting and Coating.

C. Do not coat flange faces of valves unless otherwise specified.

D. Material in contact with potable water shall conform to NSF/ANSI 61.

E. Exposed safety isolation valves and lockout valves with handles, handwheels, or chain wheels shall be “safety yellow.”

F. Where epoxy lining and coating are specified, factory finishing shall be as follows:
   1. In accordance with AWWA C550.
   2. Either two-part liquid material or heat-activated (fusion) material except only heat-activated material if specified as “fusion” or “fusion bonded” epoxy.
   3. Minimum 7 mil dry film thickness except where limited by valve operating tolerances.

2.5 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Testing: Test valves according to manufacturer's standard testing protocol, including hydrostatic, seal, and performance testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for installation examination.

B. Verify that piping system is ready for valve installation.

3.2 INSTALLATION

A. General:
   1. Install valves, actuators, extensions, valve boxes, and accessories according to manufacturer instructions.
   2. Firmly support valves to avoid undue stresses on piping.
   3. Coat studs, bolts and nuts with anti-seizing lubricant.
   4. Clean field welds of slag and splatter to provide a smooth surface.
   5. Install valves with stems upright or horizontal, not inverted.

6. Install brass male adapters on each side of valves in copper-piped system and solder adapters to pipe.
7. Install 3/4-inch ball valves with cap for drains at main shutoff valves, low points of piping, bases of vertical risers, and equipment.
8. Install valves with clearance for installation of insulation and to allow access.
9. Provide access where valves and fittings are not accessible.
10. Comply with Division 40 - Process Interconnections for piping materials applying to various system types.
11. Install insulation as specified in Section 40 42 13 - Process Piping Insulation
12. Install insulation as indicated in pipe schedule.
13. Flange Ends:
    a. Flanged valve bolt holes shall straddle vertical centerline of pipe.
    b. Clean flanged faces, insert gasket and bolts, and tighten nuts progressively and uniformly.
14. Screwed Ends:
    a. Clean threads by wire brushing or swabbing.
    b. Apply joint compound.
15. PVC and CPVC Valves: Install using solvents approved for valve service conditions.
16. Extension Stem for Operator: Where depth of valve operating nut is 3 feet or greater below finish grade, furnish operating extension stem with 2-inch operating nut to bring operating nut to a point within 6 inches of finish grade.

B. Valve Applications:
1. Gate, Globe, and Ball Valves:
    a. Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above finished floor, unless otherwise shown.
    b. Install operating stem horizontal in horizontal runs of pipe having centerline elevations greater than 4 feet 6 inches above finish floor, unless otherwise shown.
2. Eccentric Plug Valves:
    a. Unless otherwise restricted or shown on Drawings, install valve as follows:
        1) Liquids with suspended solids service with horizontal flow: Install valve with stem in horizontal position with plug up when valve is open. Install valve with seat end upstream (flow to produce unseating pressure).
        2) Liquids with suspended solids service with vertical flow: Install valve with seat in highest portion of valve (seat up).
        3) Clean Liquids and Gas Service: Install valve with seat end downstream of higher pressure when valve is closed (higher pressure forces plug into seat).
3. Butterfly Valves:
    a. Unless otherwise restricted or shown on Drawings, install valve a minimum of 8 diameters downstream of a horizontal elbow or branch tee with shaft in horizontal position.
    b. For vertical elbow or branch tee immediately upstream of valve, install valve with shaft in vertical position.
    c. For horizontal elbow or branch tee immediately upstream of valve, install valve with shaft in horizontal position.
    d. When installed immediately downstream of swing check, install valve with shaft perpendicular to swing check shaft.
    e. For free inlet or discharge into basins and tanks, install valve with shaft in vertical position.

4. Check Valves:
    a. Install valve in accordance with manufacturer's instructions and provide required distance from immediate upstream fitting.
    b. Install valve in vertical flow (up) piping only for gas services.
    c. Install swing check valve with shaft in horizontal position.
    d. Install double disc swing check valve to be perpendicular to flow pattern when discs are open.
5. Solenoid Valves: Install in accordance with manufacturer's instructions.
6. Install line size ball valve and union upstream of each solenoid valve, in-line flow switch, or other in-line electrical device, excluding magnetic flowmeters, for isolation during maintenance.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and manufacturing.

B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. TESTS AND INSPECTION
1. Valve may be either tested while testing pipelines, or as a separate step.
2. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.
3. Inspect air and vacuum valves as pipe is being filled to verify venting and seating is fully functional.
4. Count and record number of turns to open and close valve; account for discrepancies with manufacturer's data.
5. Set, verify, and record set pressures for relief and regulating valves.
6. Automatic valves to be tested in conjunction with control system testing. Set opening and closing speeds, limit switches, as required or recommended by Engineer.
7. Test hydrostatic relief valve seating; record leakage. Adjust and retest to maximum leakage of 0.1 gpm per foot of seat periphery.

3.4 VALVE SCHEDULE

A. Valve Schedule: Shown in Plans

END OF SECTION

SECTION 40 05 57 - ACTUATORS FOR PROCESS VALVES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Manual actuators.
2. Electric motor actuators.
3. Pneumatic actuators.

B. Related Requirements:
1. Section 40 05 51 - Common Requirements for Process Valves: Common product requirements for valves for placement by this Section.
2. Section 26 20 00 - Low-Voltage AC Induction Motors.

1.2 REFERENCE STANDARDS

A. American Bearing Manufacturers Association:
1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. American Water Works Association:
1. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
2. AWWA C541 - Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates.
3. AWWA C542 - Electric Motor Actuators for Valves and Slide Gates.

C. NFPA:
1. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. In accordance with Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information for actuator with model number and size indicated.

C. Shop Drawings:
1. Indicate parts list, materials, sizes, position indicators, limit switches, actuator mounting, wiring diagrams, control system schematics on assembly drawings.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit special procedures and placement requirements.

F. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations and types of actuators.

1.5 QUALITY ASSURANCE

A. Valve Actuators in NEC Class I, Group D, Division 1 or 2 Hazardous Locations: Comply with NFPA 70.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' experience

1.7 DELIVERY, STORAGE, AND HANDLING

A. In accordance with 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.

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.

1.8 EXISTING CONDITIONS

A. Field Measurements:
1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.9 WARRANTY

A. Warranty on equipment and installation is one (1) year from Final Completion, in accordance with Article 6.19 of the General and Supplemental Conditions.

PART 2 - PRODUCTS

2.1 MANUAL ACTUATORS

A. General:
1. For AWWA valves, operator force not to exceed requirements of applicable valve standard. Provide gear reduction operator when force exceeds requirements.
2. For non-AWWA valves, operator force not to exceed applicable industry standard or 80 pounds, whichever is less, under operating condition, including initial breakaway. Provide gear reduction operator when force exceeds requirements.
3. Operator self-locking type or equipped with self-locking device.
4. Position indicator on quarter-turn valves.
5. Worm and gear operators one-piece design, worm-gears of gear bronze material. Worm of hardened alloy steel with thread ground and polished. Traveling nut type operator's threaded steel reach rod with internally threaded bronze or ductile iron nut.

B. Exposed Operator:
1. Galvanized and painted handwheel.
2. Cranks on gear type operator.
3. Chain wheel operator with tieback, extension stem, floor stand, and other accessories to permit operation from normal operation level.
4. Valve handles to take a padlock; handwheels a chain and padlock.

C. Buried Operator:
1. Buried service operators on valves larger than 2-1/2 inches shall have a 2-inch AWWA operating nut. Buried operators on valves 2 inches and smaller shall have cross handle for operation by forked key. Enclose moving parts of valve and operator in housing to prevent contact with the soil.
2. Buried service operators to be grease packed and gasketed to withstand submersion in water to 20 feet minimum.
3. Buried valves shall have extension stems, bonnets, and valve boxes.

2.2 Electric Operators, 120 Volts**;**

A. General:
1. Unit shall be low profile to reduce amount of required space and weigh 15 pounds or less.
2. Size to 1-1/2 times required operating torque. Motor stall torque not to exceed torque capacity of the valve.
3. Provide operator mounting bracket to mount operator to valve providing minimal torque to piping system when operating.

B. Operator Operation, General:
1. Suitable for full 90-degree rotation of quarter-turn valves.
2. Manually override handwheel.
3. Mechanical valve position indication.

C. Electronic Control:
1. Torque Limiting Switches: Two single pole, double throw mechanical switches. Switches operate at any point in valve travel.
2. Jammed-valve detection and protection.

3. Motor over-temperature detection and protection.
4. Travel limit switches, single pole double throw.

D. Open-Close (O/C) Service:
1. Duty cycle for intermittent ON-OFF operation shall be 25 percent.
2. Operator shall power to OPEN and power to CLOSE.
3. Local Indication and Control:
   a. Integral mechanical valve POSITION indication, 0 percent to 100 percent OPENED.
   b. Integral OPENED and CLOSED indication lights.
   c. Integral LOCAL-OFF-REMOTE (L-O-R).
   d. Integral OPEN maintained switch which causes the valve to stroke full OPENED, even if OPEN switch is released, while L-O-R switch is in LOCAL.
   e. Integral CLOSE maintained switch which causes valve to stroke full CLOSED, even if CLOSED switch is released, while L-O-R switch is in LOCAL.
4. Remote Indication and Control:
   a. Relay contact that closes when valve is capable of being controlled remotely (L-O-R switch in REMOTE) for connection to and monitoring by plant control system.
   b. Limit switch that closes when valve is fully OPENED for connection to and monitoring by plant control system.
   c. Limit switch that closes when valve is fully CLOSED for connection to and monitoring by plant control system.

E. Modulating (M) Service:
1. Operator rated for continuous duty with servo shall be rated for 100 percent modulating operation.
2. Operator shall modulate based on an externally applied 4 mA to 20 mA dc signal.
3. Operator shall be equipped with an electronic servo module for valve modulation.
   a. Module shall provide serial communications with provided cable for setup of valve operation.
4. Local Indication and Control:
   a. Integral mechanical valve POSITION indication, 0 percent to 100 percent OPENED.
   b. Integral OPENED and CLOSED indication lights.
   c. Integral LOCAL-OFF-REMOTE (L-O-R).
   d. Integral OPEN momentary switch which causes valve to stroke towards OPENED, as long as OPEN switch is held, while L-O-R switch is in LOCAL.
   e. Integral CLOSE momentary switch which causes valve to stroke towards CLOSED, as long as CLOSED switch is held, while L-O-R switch is in LOCAL.
   f. Position valve proportionally 0 to 100 percent OPEN with external 4 mA to 20 mA dc signal while in REMOTE.
5. Remote Indication and Control:
   a. Relay contact that closes when valve is capable of being controlled remotely (L-O-R switch in REMOTE) for connection to and monitoring by plant control system.
   b. Limit switch that closes when valve is fully OPENED for connection to and monitoring by plant control system.
   c. Limit switch that closes when valve is fully CLOSED for connection to and monitoring by plant control system.

d. Current Position Transmitter, 4 mA to 20 mA dc signal in proportion to 0 percent to 100 percent OPENED, with 0.5 percent accuracy and 0.5 percent repeatability, capable of driving a 750-ohm load, for connection to and monitoring by Plant Control System.

F. Control Features: Electric motor actuators with features as noted above, and in the Control Diagrams

G. Manufacturer and Product: Rotork;

2.3 Electric Motor Actuators, 480 Volts:

A. General:
1. Comply with latest version of AWWA C542.
2. Size to 1-1/2 times required operating torque. Motor stall torque not to exceed torque capacity of valve.
3. Controls integral with actuator and fully equipped as specified in AWWA C542.
4. Stem protection for rising stem valves.

B. Actuator Operation—General:
1. Suitable for full 90-degree rotation of quarter-turn valves or for use on multiturn valves, as applicable.
2. Manual override handwheel.
3. Valve position indication.
4. Operate from FULL CLOSED to FULL OPEN positions or the reverse in the number of seconds given in Electric Actuated Valve Schedule.

C. Open-Close(O/C)/Throttling(T) Service:
1. Size motors for one complete OPEN-CLOSE-OPEN cycle no less than once every 10 minutes.
2. Actuator suitable for throttling operation of valve at intermediate positions.
3. LOCAL-OFF-REMOTE Selector Switch, padlockable in each position:
a. Integral OPEN-STOP-CLOSE momentary pushbuttons with seal-in circuits to control valve in LOCAL position.
b. Remote OPEN-STOP-CLOSE momentary control dry contact inputs in REMOTE position. Integral seal-in circuits for remote OPEN and CLOSE commands; valve travel stops when remote STOP contact opens.
c. Auxiliary contact that closes in REMOTE position.
4. OPEN and CLOSED indicating lights.
5. Integral reversing motor starter with built-in overload protection.

D. Modulating (M) Service:
1. Size actuators for continuous modulating duty.
2. Feedback potentiometer, or equivalent, and integral electronic positioner/comparator circuit to maintain valve position.
3. HAND-OFF-AUTO (Local-Off-Remote) Selector Switch, padlockable in each position:
a. Integral OPEN-STOP-CLOSE momentary pushbuttons with seal-in circuits to control valve in HAND (Local) position.
b. 4 mA to 20 mA dc input signal to control valve in AUTO (Remote) position.
c. Auxiliary contact that closes in AUTO (Remote) position.

4. OPEN and CLOSED indicating lights.
5. Ac motor with solid state reversing starter or dc motor with solid state reversing controller, and built-in overload protection. Controller capable of 1,200 starts per hour.
6. Duty cycle limit timer and adjustable band width, or equivalent, to prevent actuator hunting.
7. Valve position output converter that generates isolated 4 mA to 20 mA dc signal in proportion to valve position and is capable of driving into loads of up to 500 ohms at 24 volts dc.

E. Limit Switch:
1. Single-pole, double-throw (SPDT) type, field adjustable, with contacts rated for 5 amps at 120 volts ac.
2. Each valve actuator to have a minimum of two auxiliary transfer contacts at end position, one for valve FULL OPEN and one for valve FULL CLOSED.
3. Housed in actuator control enclosure.

F. Control Features: Electric motor actuators with features as noted above, and as described in the Control Diagrams.

G. Manufacturers and Products:
1. Rotork Controls;
2. Flowserve Limitorque;
3. AUMA;

2.4 Pneumatic Actuators:

A. General:
1. Actuator complete with air sets, exhaust mufflers, speed controls, pilot solenoids, safety vented isolation valves, and accessories.
2. Suitable for full operation range of valve at air supply pressure indicated.
3. Position indication and stop limiting devices on all actuators.

B. Vane Style Actuator:
1. In compliance with AWWA C541.
2. Air supply of 80 psig
3. Pressure die-cast aluminum housing with corrosion resistant fusion bonded epoxy finish, stainless steel bolting, stainless steel adjustable end stops.
4. Electroless nickel-plated steel shaft and vane, single-component machined or cast part.
5. Dual-opposed polyurethane lip seals with stainless steel expander.
6. Double Acting:
   a. Complete with mounting hardware.
   b. Suitable for non-lubrication air.
7. Spring Return:
   a. Wound stainless steel spring type in separate housing.
   b. Attached to pneumatic actuator housing.
8. Geared Manual Override: Geared type with de-clutchable handwheel, torque rated for application.
9. Visual Indicator: High visibility, OPEN-CLOSED indication, color coded, chemical resistant, clear polycarbonate cover.

10. Manufacturers:
    a. Kinetrol.
    b. K-Tork.

C. Cylinder Actuator:
1. In compliance with AWWA C541.
2. Air supply pressure of 80 psig
3. Nonswivel type totally enclosed:
    a. Travel stops and position indicator.
    b. Factory lubricated and sealed requiring no additional lubrication.
4. Double Acting:
    a. Nonmetallic for operation on nonlubricated air.
    b. Handwheel override independent of cylinder.
5. Spring Return:
    a. Open, closed, or throttling, steel cylinder with air line lubricators. Nonlubricated air may be used if certified by manufacturer.
    b. Modulating: Nonmetallic for operation on nonlubricated air.
    c. Manual override manufacturer's standard.
6. Actuators used on quarter-turn valves to include a totally enclosed valve actuating mechanism. Actuating mechanism to be factory lubricated and sealed.
7. Manufacturers and Products:
    a. Rotork.
    b. DeZurik.

D. Diaphragm Actuator:
1. Spring return with steel or aluminum diaphragm case and spring barrel, steel spring and actuator stem, and fabric-reinforced neoprene diaphragm.
2. Actuators used on quarter-turn valves to include a totally enclosed valve actuating mechanism. Actuating mechanism to be factory lubricated and sealed.
3. Diaphragm actuators sized and configured for service indicated and air supply pressure of 35 psig.
4. Manufacturers and Products:
    a. Fisher Controls; Type 1051.

E. Accessories:
1. Air Set: Pressure regulator with internal relief, filter, outlet pressure gauge, and adjustable reduced pressure range as required by valve actuator.
    a. Aluminum body and handwheel.
    b. Safety vented lockout isolation valve.
    c. Gauge range 1-1/3 to 2 times maximum operating pressure.
    d. Manufacturers and Products:
        1) Fisher Controls; Type 67 AFR.
        2) Masoneilan; No. 77-4.
2. Air Exhaust Muffler:
    a. In the exhaust port of actuator pilot solenoid valves.
    b. Manufacturers and Products:
        1) Barry Wright Corp.;
        2) Allied Witan Co.;
3. Limit Switch:
    a. Single-pole, double-throw (SPDT) type, rated 10 amps at 120 volts ac.
    b. Housed in NEMA 4X enclosure.

c. Adjustable for OPEN and CLOSED valve positions.

4. Positioner:
   a. For modulating actuators, shall be pneumatic force balance instruments to control valve position as a function of input signal. Accomplish positive positioning of valve by a mechanical feedback connection from valve actuating mechanism. Position feedback through a characterized linear cam to allow adjustment of valve positioning and input signal. Positioner suitable for double acting or spring return actuator.
   b. Positioner to have zero and span adjustment and be field reversible for direct or reverse action.
   c. Gauges for supply and output pressure and for input signal pressure.
   d. Positioner for 3 psig to 15 psig pneumatic input signal or 4 mA to 20 mA dc input signal as indicated.
   e. Positioner for dc input signal with transducers shall convert electrical signal to appropriate pneumatic signal. Transducer integral with positioner or separate component. If separate, factory mount transducer on pneumatic operator. Line electric power not required for transducer.
   f. Corrosion-resistant enclosures for positioners and transducers to be splash-proof and moisture-proof with gasketed covers.
5. Pilot Solenoid Valve:
   a. Solenoid valve shall pilot control actuator in appropriate configuration for type of open-close actuator being controlled. Double acting actuator shall have four-way solenoid valve, and spring return actuator shall have three-way solenoid valve. Dual coil valve shall not change position unless one coil is energized while the other is de-energized.
   b. Pilot operated diaphragm type solenoid valve with brass body and resilient seat. Valve with minimum operating pressure differential no greater than 10 psig and maximum operating pressure differential no less than 150 psig. Internal parts corrosion-resistant. Solenoid valve to have Class F molded coils for operation on 120 volts ac, 60-Hz, unless otherwise indicated. Solenoid enclosure as defined in NEMA 250, Type 4X
   c. Manufacturers and Products:
      1) Asco Red Hat;
      2) C. A. Norgren Co.

F. Open-Close and Throttling Valve:
   1. Double Acting Cylinders: Four-way solenoid with dual coils.
   2. Spring Return Cylinders: Three-way solenoids, spring return.

G. Modulating Valve: Positioner with 4 mA to 20 mA input signal, unless otherwise indicated.

H. Control Features: Pneumatic actuators with features noted in the Pneumatic Actuated Valve Schedule.

2.5 ACCESSORIES

A. Tagging: 1-1/2-inch diameter heavy brass or stainless-steel tag attached with No. 16 solid brass or stainless-steel jack chain for each valve operator bearing valve tag number shown on Valve Schedule

B. Limit Switch:
   1. Factory installed NEMA 4X limit switch by actuator manufacturer.

C. T-Handled Operating Wrench:
   1. each galvanized operating wrenches, 4 feet long.
   2. Manufacturers and Products:
      a. Mueller; No. A-24610.
      b. Clow No.; F-2520.
   3. Each galvanized operating keys for cross handled valves.

D. Extension Bonnet for Valve Operator: Complete with enclosed stem, extension, support brackets, and accessories for valve and operator.
   1. Manufacturers and Products:
      a. Pratt;
      b. DeZurik;

E. Floor Stand:
   1. Nonrising, heavy pattern, indicating type.
   2. Complete with solid extension stem, coupling, handwheel, stem guide brackets, and yoke attachment. Stem length as required to connect valve operating nut and floor stand.
   3. Stem Guide: Space such that stem L/R ratio does not exceed 200.
   4. Anchor Bolts: Type 304 stainless steel.
   5. Manufacturers and Products:
      a. Clow; Figure F-5515.
      b. Mueller, Figure A-26426.

F. Floor Box:
   1. Plain type, for support of nonrising type stem.
   2. Complete with solid extension stem, operating nut, and stem guide brackets. Stem length as required to extend valve operating nut to within 3 inches of finish floor.
   3. Stem Guide: Space such that stem L/R ratio does not exceed 200.
   4. Anchor Bolts: Type 304 stainless steel.
   5. Manufacturers and Products:
      a. Neenah Foundry; R 7506.
      b. Clow; No. F5690.

G. Chain Wheel and Guide:
   1. Handwheel direct-mount type.
   2. Complete with chain.
   3. Galvanized or cadmium-plated.
   4. Manufacturers and Products:
      a. Clow Corp.; Figure F-5680.
      b. Walworth Co.; Figure 804.
      c. DeZurik Corp.; Series W or LWG.

H. Cast-Iron Valve Box: Designed for traffic loads, sliding type, with minimum of 5-1/4-inch ID shaft.
   1. Box: Cast iron with minimum depth of 9 inches.
   2. Lid: Cast iron, minimum depth 3 inches, nonlocking type
   3. Extensions: Cast iron, ABS, or PVC pipe.

4. Two-piece box and lid for valves 4 inches through 12 inches, three-piece box and lid for valves larger than 12 inches with base sized for valve.
5. Valve extension stem for valves with operating nuts 3 feet or greater below finish grade.
6. Manufacturers and Products:
   a. East Jordan Iron Works; Cast-Iron Valve Boxes.
   b. Bingham & Taylor; Cast-Iron Valve Boxes.

I. Concrete Valve Box: Designed for traffic loads, sliding type, with minimum of 10-inch ID shaft.
1. Box: High-density, reinforced concrete, minimum depth 12 inches, cast-iron ring seat.
2. Lid: Cast iron, minimum depth 3 inches
3. Extensions: ABS, PVC, or cast-iron pipe.
4. Manufacturers and Products:
   a. Christy Concrete Products; G Series.
   b. BES Concrete Products; G Series.

J. Indicator Post Assembly:
1. Cast or ductile iron post head, bell, and wrench with cast or ductile iron or steel barrel.
2. Plexiglas or equal protected window to indicate OPEN and CLOSED position.
3. Padlockable eye bolt for wrench.
4. Adjustable bury depth. Bury depth as required for valve installation.
5. UL Listed and FM Approved.
6. Manufacturers and Products:
   a. Clow; Style 2945.
   b. Mueller; A-20806.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that field dimensions are as indicated on Shop Drawings.

3.2 INSTALLATION

A. Solenoid Valves: Install in accordance with manufacturer’s instructions.

B. Extension Stem for Operator: Where depth of valve operating nut is 3 feet or greater below finish grade, furnish operating extension stem with 2-inch operating nut to bring operating nut to a point within 6 inches of finish grade.

C. Torque Tube: Where operator for quarter-turn valve is located on floor stand, furnish extension stem torque tube of a type properly sized for maximum torque capacity of valve.

D. Floor Box and Stem: Steel extension stem length shall locate operating nut in floor box.

E. Chain Wheel and Guide: Install chain wheel and guide assemblies or chain lever assemblies on manually operated valves over 6 feet 9 inches above finish floor. Install chain to within 3 feet of finish floor. Where chains hang in normally traveled areas, use appropriate “L” type tie-back anchors. Install chains to within operator horizontal reach of 2 feet 6 inches maximum, measured from normal operator standing location or station.

3.3 TESTS AND INSPECTION

A. Automatic valves to be tested in conjunction with control system testing. Set opening and closing speeds, limit switches, as required or recommended by Engineer.

3.4 MANUFACTURER’S SERVICES

A. Valve(s) and gate(s) operators as listed in schedules require manufacturer’s field services:

B. Manufacturer’s Representative: Present at Site for minimum person-days listed below, travel time excluded:
   1. 1 person-days for installation assistance and inspection.
   2. 1 person-days for functional and performance testing and completion of Manufacturer’s Certificate of Proper Installation.

C. See Section 01 60 00 - Product Requirements

3.5 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are part of this Specification.
   1. Electric Actuated Valve Schedule.

END OF SECTION

Electric Actuated Valve Schedule									
Tag Number	**Valve Type**	**Actuator Power Supply**	**Valve Size (inches)**	**Process Fluid**	**Maximum Operating Flow (cfs)**	**Maximum ΔP (psi)**	**Service**	**Travel Time (Seconds)**	**Control Feature Modifications/ Supplements**
BFV-401	Butterfly	120-volt, single-phase	10	Air	3,500	10	M	30	C, D, H, J
BFV-402	Butterfly	120-volt, single-phase	10	Air	3,500	10	M	30	C, D, H, J

Service: O/C = Open-Close, T = Throttling, M = Modulating

Control Feature Modifications/Supplements:

A = Actuator shall open valve upon loss of signal.

B = Actuator shall close valve upon loss of signal.

C = Actuator shall remain in last position upon loss of signal.

D = Local OPEN-CLOSE momentary pushbuttons that must be continuously depressed to initiate/maintain valve travel; travel stops when pushbutton is released or when end of travel limit is reached.

E = Remote OPEN-CLOSE maintained dry contacts; travel stops when remote contact opens, or when end of travel limit is reached.

F = Three 24-volt dc interposing relays for remote OPEN-STOP-CLOSE control. Relays powered externally, thereby permitting valve control from greater distances.

G = Motor and control enclosure(s) NEMA 250, Type 4 with 120-volt space heaters.

H = Motor and control enclosure(s) NEMA 250, Type 6 (IP 68) with 120-volt space heaters.

I = Motor and control enclosure(s) NEMA 250, Type 7 with 120-volt space heaters.

J = Valve position output converter that generates isolated 4 mA to 20 mA dc signal in proportion to valve position and is capable of driving into loads of up to 500 ohms at 24 volts dc.

K = 120-volt secondary control power transformer.

L = Externally operable power disconnect switch.

SECTION 40 05 59 - FABRICATED STAINLESS STEEL SLIDE GATES AND SLUICE GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fabricated Stainless Steel Slide Gates and Sluice Gates.

B. Related Sections:
   1. Division 00 – Procurement and Contracting Requirements
   2. Division 01 – General Requirements
   3. Section 09 90 00 – Painting and Coating
   4. Section 40 05 51 – Common Requirements for Process Valves

C. Gate Schedule:
   1. The Gate Schedule is shown in this Section, following “End of Section”.

1.2 REFERENCE STANDARDS

A. American Water Works Association (AWWA):
   1. American Water Works Association (AWWA):
      a. C561, Fabricated Stainless Steel Slide Gates.
      b. C501, AWWA Standard for Sluice Gates.
   2. National Sanitation Foundation International (NSF):
      a. 61, Drinking Water System Components - Health Effects.
   3. Society for Protective Coatings/NACE International (SSPC/NACE):
      a. SP 5/NACE No. 1, White Metal Blast Cleaning.

1.3 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Section 01 30 00 – Administrative Requirements.
   2. Product technical data including:
      a. Calculations that demonstrate compliance with the deflections, stress and factor of safety specified.
      b. Certified drawings and material specifications for all components.
      c. Test reports.

B. Operation and Maintenance Manuals:
   1. See Section 01 70 00 – Execution and Closeout Requirements.

C. Affidavit of Compliance: See AWWA C561 and AWWA C501.

1.5 QUALITY ASSURANCE

A. Perform Work according to ASME B31.9 for installation of piping systems and according to ASME BPVC-IX for welding materials and procedures.

B. Perform Work according to ASME B31.3 for installation of piping systems.

1.6 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.

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.

1.7 WARRANTY

A. Warranty on equipment and installation is one (1) year from Final Completion, in accordance with Article 6.19 of the General and Supplemental Conditions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Fontaine.
2. Golden Harvest
3. Hydro-Gate
4. Rodney Hunt
5. Whipps
6. Waterman

B. Submit request for substitution in accordance with Specification Section 01 25 00 - Substitution Procedures.

2.2 DESIGN REQUIREMENTS AND MATERIALS

A. General: Provide gates, stems, lifts and other appurtenances of size, type, material and construction shown on Drawings and as specified herein.

B. Comply with requirements of Section 01 60 00 – Product Requirements.

C. Gates: Meet all requirements of AWWA C561 as modified per this Section.

D. Maximum leakage rate: Per AWWA C561 or AWWA C501.

E. Materials:
   1. Materials subject to dezincification or dealuminization prohibited.
   2. "L" grades for all welded components.
   3. Thimble, frame, guides, slide, yoke and stem guides:
      a. Stainless steel, Type 304 and Type 304L.
   4. Gear housing:
      a. Cast iron, steel or ductile iron.
   5. Actuator pedestal:
      a. Stainless steel, Type 304.
   6. Rising stem thrust nuts:
      a. Stainless steel, Type 304.
   7. Stem couplings:
      a. Stainless steel, Type 304.
   8. Stem guide bushings:
      a. Cast or extruded UV stabilized UHMW-PE, or
      b. Stainless steel, Type 304.
   9. Stems:
      a. Stainless steel, Type 304.
   10. Self-adjusting Seals:
      a. UV stabilized UHMW-PE.
   11. Anchor bolts and fasteners: Stainless steel, Type 316.
   12. Flush-bottom sill retainer: Stainless steel, Type 304.
   13. Wedges and Pressure Pads: UV stabilized UHMW-PE, if required.

F. Fabrication: One-piece frames.
   1. One-piece frame: Conventional pedestal mounted.
   2. Flush bottom seals: Easily replaceable without disassembly of the gate.
   3. Side and top seals of gate: Replaceable without removing gate or without dewatering.

2.3 GATE OPERATORS AND LIFTS

A. General: Provide lifts in accordance with AWWA C561 or AWWA C501 or as modified in this Section.

B. Rising Stem: Provide clear butyrate plastic stem cover with Mylar open-close indicator.

C. Manual Operators:
   1. Equip lift mechanism with a pedestal, torque tube, or baseplate, machined and drilled for mounting the lift housing and ready for bolting to the operating floor, top wall mounting bracket, or gate yoke, as shown on Drawings or specified.

2. Centerline of crank or handwheel: Approximately 36 inches above operating floor (where operator will stand).

2.4 FABRICATION

A. Specified in AWWA C561 or AWWA C501.

B. Welded Stainless Steel: Passivated after fabrication.

2.5 SOURCE QUALITY CONTROL

A. Factory Test Reports:
1. Shop leakage tests.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Affix equipment tags on all Gates.

3.2 FIELD QUALITY CONTROL

A. Field Testing:
1. Leakage: Test gate under design seating head and adjust to maximum leakage specified.

B. Services of Manufacturer:
1. See Sections 01 40 00 - Quality Requirements and Section 01 70 00 - Execution and Closeout Requirements.
2. Provide the services of a manufacturer’s representative specifically trained in the installation, testing, and maintenance of equipment specified herein. Such services shall be provided by a representative who is a direct, full-time employee of the manufacturer.
3. Services of equipment manufacturer's representative shall include:
   a. Inspect equipment covered by this Section.
   b. Supervise adjustments and installation checks.
   c. Provide test equipment, tools, and instruments necessary to accomplish equipment testing.
   d. Inspect equipment, perform operational checks, and supervise acceptance testing.
   e. Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner.
   f. Instruct Owner on operation and maintenance of furnished equipment.
4. Services of manufacturer’s representative shall be provided for the amount of time specified below.
   a. Testing gates during Plant Functional Test: 6 hours.
   b. Instruct Owner on operation and maintenance: 2 hours.

3.3 SUPPLEMENTS

A. The Slide and Sluice Gate Schedule, following "End of Section" are part of this Specification.

END OF SECTION

SLIDE AND SLUICE GATE SCHEDULE

Gate Tag No.	Size WxH (in)	Design Head, (ft) [a]	Approx IE [g] (FT)	Opening Direction [b]	Type of Closure [c]	Type of Lift Mechanism [d]	Stem [e]	Wall Thimble Required [f]
SG-101-01	36x48	2.0'	750.76	Up Op	FB	Hdwl	R	No
SG-101-02	34x36	2.0'	750.76	Up Op	FB	Hdwl	R	No
SG-420-01	60x30	2.0'	768.00	Dn Op	W	Hdwl	R	No
SG-420-02	60x30	2.0'	768.00	Dn Op	W	Hdwl	R	No
SG-601-01	30x30	3.5'	759.50	Up Op	FM	Hdwl	R	No
SG-601-02	30x30	3.5'	759.50	Up Op	FM	Hdwl	R	No
SG-602	30x30	1.5'	762.00	Up Op	FM	Hdwl	R	No
SG-621	30x30	4.5'	760.00	Up Op	FM	Hdwl	R	No

Abbreviations:

[a] Design Head: Measured from surface of water to centerline of gate, in FT.
[b] Opening Direction: Dn Op = Downward Opening; Up Op = Upward Opening.
[c] Type of Closure: W = Weir Service; FB = Flush Bottom (Embedded); FM = Face Mounted.
[d] Type of Lift Mechanism: Ped = Pedestal; Elec = Electric; Hdwl = Handwheel; Hyd = Hydraulic, CH = Crank Handle, SQN = Square Nut.
[e] Rising or Nonrising Stem: R = Rising; NR = Nonrising.
[f] Thimble Required: Wall Thimble is required = YES; Wall Thimble is not required = No.
[g] IE = Invert Elevation (Reference Drawings).

SECTION 40 05 61 - GATE VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resilient-seated gate valves.
   2. Solid wedge, metal-seated gate valves.
   3. General duty gate valves smaller than 3 inches.
   4. Plastic gate valves.
   5. Knife gate valves

B. Related Requirements:
   1. Section 40 05 51 - Common Requirements for Process Valves: Basic materials and methods related to valves commonly used for process systems.

1.2 DEFINITIONS

A. CWP—Cold Working Pressure: Maximum rated nonshock pressure of valve at temperature range of minus 20 degrees F to 150 degrees F.

B. NRS—Nonrising Stem: Valve stem configuration in which threads are inside body and moves disc up and down stem when stem is turned (disc is threaded internally).

C. OS&Y—Outside Screw and Yoke: Valve configuration which has outside screw and yoke and rising stem (RS). A valve in which the operating screw is driven by a threaded nut that is built into the handle.

D. RS—Rising Stem: Valve stem configuration which allows stem to raise and lower moving disc with it.

E. SWP—Steam Working Pressure: Allowable working pressure of valve when used in steam service.

F. WOG—Water, Oil, Gas: Valve can be used for water, oil, or gas service.

1.3 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
   2. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
   3. AWWA C515, Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.

B. ASME International:
   1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
   3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.
   4. ASME B1.20.1 - Pipe Threads, General Purpose, Inch.

C. ASTM International:
   1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
   3. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
   4. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends.
   2. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.

1.4 SUBMITTALS

A. As specified in Section 40 05 51 - Common Requirements for Process Valves: Submittal requirements for compliance with this Section.

PART 2 - PRODUCTS

2.1 GENERAL

A. AWWA gate valves to be in full compliance with stated AWWA standard and the following requirements:
   1. Provide 2-inch operating nut and handwheel for AWWA gate valves 12 inches and smaller.
   2. Provide totally enclosed spur or bevel gear operator with indicator for AWWA gate valves 14 inches and larger.
   3. Provide Affidavit of Compliance per the applicable AWWA standard for AWWA gate valves.
   4. Mark AWWA gate valves with manufacturer’s name or mark, year of valve casting, valve size, and working water pressure.
   5. Repaired AWWA gate valves shall not be submitted or supplied.
   6. AWWA C509 and AWWA C515 valves may be substituted for each other.

2.2 RESILIENT-SEATED GATE VALVES

A. Resilient Seated Gate Valve 3 Inches to 12 Inches:
   1. Iron body, resilient seat, bronze stem and stem nut, ASME B16.1 Class 125 flanged ends, nonrising stem in accordance with AWWA C509, minimum design working water pressure 200 psig, full port, fusion-epoxy coated inside and outside per AWWA C550,
   2. Manufacturers and Products:
      a. M&H Valve; AWWA C509.
      b. U.S. Pipe; A-USPO.

B. Resilient Seated Gate Valve 3 Inches to 12 Inches, for Buried Service:
   1. Iron body, resilient seat, bronze stem and stem nut, mechanical joint ends, nonrising stem, in accordance with AWWA C509, 2-inch operating nut, minimum design working

water pressure 200 psig, full port, fusion epoxy coated inside and outside per AWWA C550

2. Manufacturers and Products:
   a. M&H Valve; AWWA C509.
   b. U.S. Pipe; A-USPO.

C. Resilient Seated Ductile Iron Gate Valve 3 Inches to 36 Inches:
1. Ductile iron body, resilient seat, bronze stem and stem nut, ASME B16.1 Class 125 flanged ends, nonrising stem, in accordance with AWWA C515, minimum design working water pressure 200 psig, full port, fusion epoxy coated inside and outside per AWWA C550.
2. Manufacturers and Products:
   a. American Flow Control; Series 2500.
   b. M&H; Style 7000 and C515 Large RW Valves.

D. Resilient Seated Ductile Iron Gate Valve 3 Inches to 36 Inches:
1. Ductile iron body, resilient seat, bronze stem and stem nut, mechanical joint ends, nonrising stem, in accordance with AWWA C515, minimum design working water pressure 200 psig, full port, fusion epoxy coated inside and outside per AWWA C550.
2. Manufacturers and Products:
   a. American Flow Control; Series 2500.
   b. M&H; Style 7000 and C515 Large RW Valves.

E. Resilient Seated Gate Valve, Flanged Ends 4 Inches to 12 Inches:
1. UL Listed and FM Approved, iron body, resilient seat, bronze mounted, ASME B16.1 Class 125 flanged ends, outside screw and yoke, handwheel operator, in accordance with AWWA C509, minimum design working water pressure 200 psig, full port, fusion-epoxy coated inside and outside per AWWA C550.
   a. Manufacturers and Products:
      1) Kennedy Valve; Ken-Seal II.
      2) M&H Valve; Style 4068.
      3) Mueller; R-2360.
2. UL Listed and FM Approved for fire protection, iron body, resilient seat, bronze mounted, mechanical joint ends, nonrising stem, 2-inch operating nut, in accordance with AWWA C509, design working water pressure 200 psig, full port, fusion-epoxy coated inside and outside per AWWA C550, NSF/ANSI 61 certified.
   a. Manufacturers and Products:
      1) Kennedy Valve; Ken-Seal II.
      2) M&H Valve; Style 4067.
      3) Mueller; P-2360.

2.3 SOLID WEDGE, METAL-SEATED GATE VALVES

A. Gate Valve 3 Inches to 48 Inches for Water Service:
1. AWWA C500, iron body, bronze mounted, flanged ends, double-disc gate, nonrising bronze stem, working water pressure 200 psi for 3 inches through 12 inches and 150 psi for 14 inches through 48 inches.
2. Manufacturers and Products:
3. M&H Valve Company; Style 67.

4. Clow Valve Company; AWWA C500.

B. Gate Valve 3 Inches to 48 Inches for Buried Water Service:
1. AWWA C500, iron body, bronze mounted, mechanical joint ends, double-disc gate, nonrising bronze stem, 2-inch operating nut, and O-ring sealed stuffing box, working water pressure of 200 psi for 3 inches through 12 inches and 150 psi for 14 inches through 48 inches.
2. Manufacturers and Products:
   a. M&H Valve Company; Style 67.
   b. Clow Valve Company; AWWA C500.

C. Gate Valve 16 Inches and Larger for Low Pressure Water Service:
1. Iron body, bronze mounted, flanged ends, double disc gate, nonrising bronze stem, rated for 50 psi, working water pressure, 125 psi ASME B16.1 drilling.
2. Manufacturer and Product: Ludlow-Rensselaer Valve Division of Patterson Industries, Inc.; List 11.

D. Gate Valve 4 Inches through 30 Inches for High Pressure Water Service:
1. Iron body, bronze mounted, flanged ends, double disc gate with nonrising bronze stem, rated 250 psi working water pressure.
2. Operator:
   a. 2 Inches to 14 Inches Valves: Handwheel.
   b. 14 Inches and Larger Valves: Spur gear
3. Manufacturer and Product: M&H; Style 871 02.

E. Gate Valve 4 Inches Through 30 Inches for Buried High Pressure Water Service:
1. Iron body, bronze mounted, mechanical joint ends, double disc gate, nonrising bronze stem, O-ring sealed stuffing box, 2-inch square wrench nut conforming to AWWA C500, rated 250 psi nonshock cold water.
2. Manufacturer and Product: M&H; Style 871.

F. Gate Valve 3/4 Inch to 2 Inches:
1. UL Listed and FM Approved, all bronze, solid wedge disc, outside screw and yoke, screwed ends rated 175 pound WOG minimum.
2. Manufacturer and Product: Kennedy; UL/FM.

G. Gate Valve 3 Inches to 12 Inches:
1. UL Listed, iron body, bronze-mounted, designed for fire protection service, rising stem, outside screw and yoke, ASME B16.1 flanged ends, rated 175 pound WOG.
2. Double disc type gate, bronze wedge pins, parallel seat, gate stem in bronze bushing through stuffing box.

H. Indicator Post Valve 3 Inches to 14 Inches:

I. UL Listed, iron body, bronze mounted, nonrising stem, rated 175 pound WOG, AWWA C111/A21.11 mechanical joint ends.
1. Double disc type gate, bronze wedge pins, parallel seat, gate stem sealed with double O-ring pressure and dirt seal.

2. Bolted flanged bonnet for mounting indicator post, indicator post to be locking type with an adjustable barrel and weather-sealed indicator window to display OPEN and SHUT positions.

2.4 GENERAL-DUTY GATE VALVES - SMALLER THAN 3 INCHES

A. Gate Valve 3 Inches and Smaller:
1. All-bronze, screwed bonnet, packed gland, single solid wedge gate, nonrising stem, Class 125 rated 200 psi CWP, complies with MSS SP-80 Type 1.
2. Manufacturers and Products:
   a. Crane; Figure 438, NPT threaded ends.
   b. Stockham; Figure B103, NPT threaded ends.
   c. Crane; Figure 1324, soldered ends.
   d. Stockham; Figure B104, soldered ends.

B. Gate Valve 3 Inches and Smaller:
1. All-bronze, screwed bonnet, packed gland, single solid wedge gate, rising stem, Class 125 rated 200 psi CWP, complies with MSS SP-80 Type 2.
2. Manufacturers and Products:
   a. Crane; Figure 428, NPT threaded ends.
   b. Stockham; Figure B-100, NPT threaded ends.
   c. Crane; Figure 1334, soldered ends.
   d. Stockham; Figure B-108, soldered ends.

C. Gate Valve 3 Inches and Smaller:
1. All-bronze, screwed bonnet, packed gland, NPT threaded ends, single solid wedge gate, nonrising stem, Class 150 rated 150 psi SWP/300 psi CWP, complies with MSS SP-80 Type 1.
2. Manufacturers and Products:
   a. Crane; Figure 437.
   b. Stockham; Figure B-128.

D. Gate Valve 3 Inches and Smaller:
1. All-bronze, screwed bonnet, packed gland, NPT threaded ends, single solid wedge gate, rising stem, Class 150 rated 150 psi SWP/300 psi CWP, complies with MSS SP-80 Type 2.
2. Manufacturers and Products:
   a. Crane; Figure 431.
   b. Stockham; Figure B122.

E. Gate Valve 3 Inches and Smaller:
1. All-bronze, screwed bonnet, packed gland, NPT threaded ends, single solid wedge gate, nonrising stem, stainless steel seat rings, Class 200 rated 200 psi SWP/400 psi CWP, complies with MSS SP-80 Type 1.
2. Manufacturers and Products:
   a. Crane; Figure 426.
   b. Stockham; Figure B-140.

F. Gate Valve 3 Inches and Smaller:
   1. All-bronze, screwed bonnet, packed gland, NPT threaded ends, single solid wedge gate, rising stem, Class 200 rated 200 psi SWP/400 psi CWP, complies with MSS SP-80 Type 2.
   2. Manufacturers and Products:
      a. Crane; Figure 424.
      b. Stockham; Figure B-132.

G. Gate Valve 2 Inches and Smaller:
   1. All-bronze, screwed bonnet, packed gland, NPT threaded ends, single solid wedge gate, nonrising stem, stainless steel seat rings, Class 300 rated 300 psi SWP/1,000 psi CWP, complies with MSS SP-80 Type 1.
   2. Manufacturers and Products:
      a. Crane; Figure 636E.
      b. Stockham; Figure B-147.

H. Gate Valve 2 Inches and Smaller:
   1. All-bronze, screwed bonnet, packed gland, NPT threaded ends, single solid wedge gate, rising stem, stainless steel seat rings, Class 300 rated 300 psi SWP/1,000 psi CWP, complies with MSS SP-80 Type 2.
   2. Manufacturers and Products:
      a. Crane; Figure 634E.
      b. Stockham; Figure B-145.

I. Gate Valve 2 Inches to 24 Inches:
   1. Iron body, bronze mounted, flanged ends, solid wedge gate, nonrising bronze stem, Class 125 rated 125 psi SWP, 200 psi CWP for 2 inches through 12 inches and 100 psi SWP, 150 psi CWP for 14 inches through 24 inches.
   2. Manufacturers and Products:
      a. Crane; Figure 461.
      b. Stockham; Figure G612.

J. Gate Valve 2 Inches to 24 Inches:
   1. Iron body, bronze mounted, flanged ends, solid wedge gate, outside screw and yoke, Class 125 rated 125 psi SWP, 200 psi CWP for 2 inches through 12 inches and 100 psi SWP, 150 psi CWP for 14 inches through 24 inches.
   2. Manufacturers and Products:
      a. Crane; Figure 465-1/2.
      b. Stockham; Figure G623.

2.5 KNIFE GATE VALVE 24 INCHES AND SMALLER

A. Bonnetless wafer body type, outside stem and yoke, rated for 150 psi cold water, ASME B16.1 flanged ends, self-cleaning, nonclogging, with round port, resilient neoprene seat, drip-tight shutoff.

B. Wetted metal parts and stem, Type 316 stainless steel, yoke sleeve bronze, gate finish ground both sides with a sharp knife edge.

C. Packing system leak-tight seal around gate, valve superstructure and yoke designed for full peripheral access to gland bolts when valve is equipped with manual or power actuator.

D. In compliance with MSS SP-81.

E. Manufacturers and Products:
1. DeZurik; Series L.
2. Rovang; Model L17.
3. ITT Fabri-Valve; Model C37.

2.6 KNIFE GATE VALVE 30 INCHES AND LARGER

A. Bonnetless wafer body type, outside stem and yoke, rated 50 psi CWP minimum, handwheel or floor stand operator as required, self-cleaning, nonclogging, with round port, resilient neoprene seat, drip-tight shutoff.

B. Wetted metal parts and stem Type 316 stainless steel, yoke sleeve bronze, gate finish ground both sides with a sharp knife edge.

C. Packing system leak-tight seal around gate, valve superstructure and yoke designed for full peripheral access to gland bolts when valve is equipped with manual or power actuator.

D. Manufacturers and Products:
1. DeZurik; Series KGC.
2. Tyco/Rovang; Model S20.
3. ITT Fabri-Valve; Figure F37R.

2.7 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. As specified in Section 40 05 51 - Common Requirements for Process Valves.

C. Testing: Test gate valves according to AWWA C509.

PART 3 - EXECUTION

3.1 As specified in Section 40 05 51 - Common Requirements for Process Valves: PART 3 EXECUTION requirements for compliance with this Section.

END OF SECTION

SECTION 40 05 62 - PLUG VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Eccentric plug valves.
   2. Non-lubricated plug valves.
   3. Gauge cock and corporation stop.

B. Related Requirements:
   1. Section 40 05 51 - Common Requirements for Process Valves: Basic materials and methods related to valves commonly used for process systems.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C517 - Resilient-Seated Cast-Iron Eccentric Plug Valves.

B. ASME International:
   1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
   3. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded.
   4. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.
   5. ASME B1.20.1 - Pipe Threads, General Purpose, Inch.

C. ASTM International:
   1. ASTM A536 - Standard Specification for Ductile Iron Castings.
   2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

1.3 SUBMITTALS

A. As specified in Section 40 05 51 - Common Requirements for Process Valves: Submittal requirements for compliance with this Section.

PART 2 - PRODUCTS

2.1 ECCENTRIC PLUG VALVES

A. Eccentric Plug Valve 2 Inches and Smaller:
   1. Nonlubricated type rated 175 psig CWP, drip-tight shutoff with pressure from either direction, cast-iron body, threaded ends, lever operator, cast-iron plug with round or rectangular port, plug coated with Buna-N, stem bearing lubricated stainless steel or bronze, stem seal multiple V-rings, or U-cups with O-rings of nitrile rubber.
   2. Manufacturers and Products:
      a. Pratt; Ballcentric.
      b. DeZurik; Style PEC.
      c. Milliken; Millcentric Series 603.

B. Eccentric Plug Valve 3 Inches to 12 Inches:
   1. Nonlubricated type rated 175 psig CWP, drip-tight shutoff with pressure from either direction, cast-iron body, exposed service flanged ends per ASME B16.1 or grooved ends in accordance with AWWA C606 for rigid joints, buried service mechanical joint ends, unless otherwise shown.
   2. Plug cast iron with round or rectangular port of no less than 80 percent of connecting pipe area and coated with Buna-N, seats welded nickel, stem bearings lubricated stainless steel or bronze, stem seal multiple V-rings, or U-cups with O-rings of nitrile rubber, grit seals on both upper and lower bearings.
   3. For buried service, provide external epoxy coating.
   4. Operators:
      a. 3-Inch to 4-Inch Valves: Wrench lever manual.
      b. 6-Inch to 12-Inch Valves: Totally enclosed, geared, manual operator with handwheel, 2-inch nut or chain wheel. Size operator for 1.5 times maximum operating shutoff pressure differential for direct and reverse pressure, whichever is higher. For buried service, provide completely sealed operator filled with heavy lubricant and 2-inch nut.
   5. Manufacturers and Products:
      a. Pratt; Ballcentric.
      b. DeZurik; Style PEC.
      c. Milliken; Millcentric Series 600.

C. Eccentric Plug Valve 14 Inches to 20 Inches:
   1. Nonlubricated type rated 150 psig CWP, drip-tight shutoff with pressure from either direction, cast-iron body, exposed service flanged ends per ASME B16.1 or grooved ends in accordance with AWWA C606 for rigid joints, buried service mechanical joints ends, unless otherwise shown, plug cast iron with round or rectangular port of no less than 80 percent of connecting pipe area and coated with Buna-N, seats welded nickel, stem bearings lubricated stainless steel or bronze, stem seal multiple V-rings or U-cups with O-rings of nitrile rubber, grit seals on both upper and lower bearings.
   2. Totally enclosed, geared, manual operator with handwheel, 2-inch nut or chain wheel. Size operator for 1.5 times maximum operating shutoff pressure differential for direct and reverse pressure, whichever is higher. For buried service, provide completely sealed operator filled with heavy lubricant and 2-inch nut.

3. For buried service, provide external epoxy coating.
4. Manufacturers and Products:
   a. Pratt; Ballcentric.
   b. DeZurik; Style PEC.
   c. Milliken; Millcentric Series 600.

D. Eccentric Plug Valve 24 Inches to 48 Inches:
1. Nonlubricated type rated 150 psig CWP, drip-tight shutoff with pressure from either direction, cast-iron body, exposed service flanged ends per ASME B16.1, buried service mechanical joints ends unless otherwise shown, plug cast iron rectangular port opening of no less than 70 percent of connecting pipe area and coated with Buna-N, seats welded nickel, stem bearings lubricated stainless steel or bronze, stem seal multiple V-rings or U-cups with O-rings of nitrile rubber, grit seals on both upper and lower bearings.
2. Totally enclosed, geared, manual operator with handwheel, 2-inch nut, or chain wheel. Size operator for 1.5 times maximum operating shutoff pressure differential for direct and reverse pressure, whichever is higher. For buried service, provide completely sealed operator filled with heavy lubricant.
3. For buried service, provide external epoxy coating.
4. Manufacturers and Products:
   a. Pratt; Ballcentric.
   b. DeZurik; Style PEC.
   c. Milliken; Millcentric Series 600.

E. Eccentric Plug Valve 3 Inches to 12 Inches for Digester Gas Service:
1. Nonlubricated type rated 175 psig working pressure, bubble-tight shutoff with gas pressure from one direction, body cast iron with flanged ends, plug cast iron with a rectangular port of no less than 70 percent of connecting pipe area and coated with Buna-N, seats welded nickel, stem bearing lubricated stainless steel, stem seal multiple V-rings or U-cups with O-rings of nitrile rubber.
2. Internal surfaces of valve body epoxy lined (except seat).
3. Operators:
   a. 3-Inch and 4-Inch Valves: Wrench lever manual.
   b. 6-Inch through 12-Inch Valves: Totally enclosed, geared, manual operator, with handwheel, 2-inch nut, or chain wheel.
4. Manufacturers and Products:
   a. Pratt; Ballcentric.
   b. DeZurik; Style PEC.
   c. Milliken; Millcentric Series 600.

2.2 NONLUBRICATED PLUG VALVES

A. Three-Way, Nonlubricated, Tapered Plug Valve 3 Inches to 16 Inches:
1. Cast-iron body with Buna-N-coated plug, multiple V-rings or U-cups with O-ring seals, lubricated stainless steel bearings, and nickel- or epoxy-coated seat, rated 125 psi CWP minimum, flanged to ASME B16.1.
2. Operator: Lever type.
3. Manufacturers and Products:
   a. DeZurik; Style PTW, Combination.
   b. Milliken; Millcentric Series 600.

B. Nonlubricated Plug Valve 2 Inches and Smaller:
   1. Ductile iron or carbon steel body, Type 316 stainless steel plug with straight-way rectangular ports, Teflon sleeves, screwed ends, wrench operator.
   2. Class: 150.
   3. Rating: 275 psi WOG.
   4. Manufacturers and Products:
      a. Duriron Co.; Figure No. G432.
      b. Tufline; Figure 066.

C. Nonlubricated Plug Valve 2-1/2 Inches to 14 Inches:
   1. Ductile iron or carbon steel body, Type 316 stainless steel plug with straight-way rectangular ports, Teflon sleeves, flanged ends.
   2. Class: 150.
   3. Rating: 275 psi WOG.
   4. Operator:
      a. 4 Inches and Smaller Valve: Wrench type.
      b. 6 Inches and Larger Valve: Enclosed gear type.
   5. Manufacturers and Products:
      a. Duriron Co.; Figure No. G411.
      b. Tufline; Figure 067.

2.3 GAUGE COCK AND CORPORATION STOP

A. Gauge Cock 1/8 Inch to 1/4 Inch:
   1. 1/4-inch bronze body, hexagon end pattern, tee head, male ends, rated 125-pound SWP.
   2. Manufacturer and Product: United Brass Works; Figure 973.

B. Corporation Stop 1/2 Inch to 2 Inches:
   1. AWWA C800 type, tapered threaded inlet, except when connecting to tapped fittings which require IPS tapered threads, outlet compression connection or IPS threads to suit connecting pipe, stops 1 inch and smaller rated 100 psi, larger stops rated 80 psi.
   2. Manufacturers and Products:
      a. Ford Meter Box Co.
      b. Mueller Co.

C. Buried Service Natural Gas Plug Valve 2 Inches and Smaller:
   1. UL Listed, iron body type, rated 125 psi, screwed ends, drilled key head for permanent pinned operating rod.
   2. Manufacturers and Products:
      a. DeZurik; Figure 425.
      b. Mueller; (gas) curb stop H-11104.

D. Combination Balancing and Shutoff Valve 2-1/2 Inches and Smaller for Heating, Chilled, and Cooling Water Service:
   1. Nonlubricated plug valve, cast-iron body, NPT threaded ends, cast-iron plug with Chloro-Isobutane-Isoprene resilient plug facing, PTFE packing, dual stainless steel bearings, PTFE thrust seal, adjustable memory stop, rated 175 psi CWP, lever operator, upstream and downstream 1/8-inch flow taps with air valve fittings and sealing caps.
   2. Manufacturer and Product: DeZurik; Style PEC.

E. Combination Balancing and Shutoff Valve 3 Inches to 24 Inches for Heating, Chilled, and Cooling Water Service:
   1. Nonlubricated plug valve, cast-iron body, ASME B16.1 Class 125 flanged ends, cast-iron plug with Chloro-Isobutane-Isoprene resilient plug facing, PTFE packing, dual stainless steel bearings, PTFE thrust seal, adjustable memory stop, rated 150 psi CWP minimum, lever operator for 3-inch and 4-inch valves, totally enclosed and sealed heavy-duty gear operator for 6-inch and larger valves, upstream and downstream 1/8-inch flow taps with air valve fittings and sealing caps.
   2. Manufacturer and Product: DeZurik; Style PEC.

2.4 SOURCE QUALITY CONTROL

A. Section 01 60 00 – Product Requirements: Requirements for testing, inspection, and analysis.

B. As specified in Section 40 05 51 - Common Requirements for Process Valves.

C. Testing: Test plug valves according to AWWA C517.

PART 3 - EXECUTION

3.1 As Specified in Section 40 05 51 - Common Requirements for Process Valves**:** PART 3 – EXECUTION, REQUIREMENTS for compliance with this section.

END OF SECTION

SECTION 40 05 63

BALL VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rubber-seated ball valves.
2. Plastic ball valves.

B. Related Requirements:
1. Section 40 05 51 - Common Requirements for Process Valves: Basic materials and methods related to valves commonly used for process systems.

1.2 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA C507 - Ball Valves, 6 In. Through 60 In. (150 mm Through 1,500 mm).

B. ASME International:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
3. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded.
4. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.
5. ASME B1.20.1 - Pipe Threads, General Purpose, Inch.

C. ASTM International:

1. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
2. ASTM D3222 - Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
3. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

A. As specified in Section 40 05 51 - Common Requirements for Process Valves: Submittal requirements for compliance with this Section.

PART 2 - PRODUCTS

2.1 RUBBER-SEATED BALL VALVES

A. Ball Valve 3 Inches and Smaller for General Water and Air Service:

1. Two-piece, standard port, NPT threaded or soldered ends, bronze body and end piece, hard chrome-plated solid bronze or brass ball, RTFE seats and packing, blowout-proof stem, adjustable packing gland, zinc-coated steel hand lever operator with vinyl grip, rated 600-pound WOG, 150-pound SWP, complies with MSS SP-110.
2. Manufacturers and Products:
   a. Threaded:
      1) Conbraco Apollo; 70-100.
      2) Nibco; T-580-70.
   b. Soldered:
      1) Conbraco Apollo; 70-200.
   c. Nibco; S-580-70.

B. Actuator Ready Ball Valve 2 Inches and Smaller for General Water and Air Service:

1. Two-piece, standard port, NPT threaded ends, bronze body and end piece, actuator mounting pad, Type 316 stainless steel ball and stem, vented ball, reinforced PTFE seats and seals, adjustable packing nut, blowout-proof stem, rated 600-pound WOG, 150-pound SWP, complies with MSS SP-110.
2. Manufacturers and Products:
   a. Conbraco Apollo; 71-140.
   b. Milwaukee; 20BSOR-02.

C. Ball Valve 2 Inches and Smaller for Equipment Air System Shutoff:

1. Two-piece, NPT threaded ends, bronze body and end piece, hard chrome-plated solid bronze or brass ball, RTFE seats and packing, blowout-proof stem, adjustable packing gland, 125 psig rated, safety exhaust port to exhaust downstream side when valve is in closed position, zinc-coated steel locking handle with vinyl grip.
2. Meets OSHA Regulation 29 CFR Part 1910.147 requirements.
3. Manufacturers and Products:
   a. Conbraco Apollo; 75-100-41.
   b. Nibco; T-580-70-SV/T-585-70-SV.

D. Ball Valve 2 Inches and Smaller for General Water and Air Service:

1. Three-piece, full port, NPT threaded ends, bronze body and end pieces, hard chrome plated solid bronze or brass ball, RTFE seats and packing, blowout-proof stem, zinc-plated steel hand lever operator with vinyl grip, rated 600-pound WOG, 150 psi SWP, complies with MSS SP-110.
2. Manufacturers and Products:
   a. Threaded Ends:
      1) Conbraco Apollo; 82-100.
      2) Nibco; T-595-Y.
      3) Stockham; T-395 Series.

b. Solder Ends:
   1) Conbraco Apollo; 82-200.
   2) Nibco; S-595-Y.
   3) Stockham; S-395 Series.

E. Ball Valve 2 Inches and Smaller for LP Gas Service:

1. Two-piece bronze or forged brass body and end piece, NPT threaded ends, hard chrome-plated solid brass ball, RTFE seats and seal, blowout-proof stem, zinc-plated hand lever operator with vinyl grip, UL Listed Guide YSDT for LP Gas, 600 WOG.
2. Manufacturers and Products:
   a. Conbraco Apollo; 80-100.
   b. Nibco; T-585-70-UL/T-580-70-UL.

F. Stainless Steel Ball Valve 2 Inches and Smaller:

1. Two-piece, full port, ASTM A276 GR 316 or ASTM A351/A351M GR CF8M stainless steel body and end piece, NPT threaded ends, ASTM A276 Type 316 stainless steel ball, reinforced PTFE seats, seals, and packing, adjustable packing gland, blowout proof stainless steel stem, stainless steel lever operator with vinyl grip, rated 1,000 psig CWP, complies with MSS SP-110.
2. Manufacturers and Products:
   a. Conbraco Apollo; 76F-100 Series.
   b. Nibco; T-585-S6-R-66-LL.

G. Stainless Steel Ball Valve 2 Inches and Smaller:

1. Three-piece, full port, ASTM A276 GR 316 or ASTM A351/A351M GR CF8M stainless steel body and end pieces, Type 316 stainless steel ball, NPT threaded ends, reinforced PTFE seats, seals, and packing, adjustable packing gland, blowout-proof stainless steel stem, stainless steel lever operator with vinyl grip, rated 800 psig to 1,000 psig CWP, complies with MSS SP-110.
2. Manufacturers and Products:
   a. Conbraco Apollo; 86R-100/86-500 Series.
   b. Nibco; T-595-S6-R-66-LL.

H. Stainless Steel Ball Valve 2 Inches and Smaller:
1. Two-piece, standard port, NPT threaded ends, ASTM A351/A351M GR CF8M stainless steel body and end pieces, actuator mounting pad, Type 316 stainless steel ball and stem, vented ball, reinforced PTFE seats and seals, adjustable packing nut, blowout-proof stem, rated 1,500 psig WOG minimum, 150 psi SWP, complies with MSS SP-110.
2. Manufacturers and Products:
   a. Conbraco Apollo; 76-100.
   b. Nibco; T-580-S6-R-66-LL.
   c. Milwaukee; 20SSOR-02.

I. Instrument Air Shutoff Valve 1/8 Inch to 3/4 Inch:

1. Brass body ball valve, nylon handle, tube fitting ends, PTFE seats and seals, panel nut, rated 1,500 psi minimum.

2. Manufacturers and Products:
   a. Swagelok; 40 Series.
   b. Parker Hannifin; B Series.

J. Ball Valve for Chlorine Liquid and Gas:

1. 600-pound WOG, carbon steel body, monel ball and stem, reinforced Teflon seat, Teflon seals, double stem seal, lever operator, screwed ends, nonlubricated, and comply with the requirements of Chlorine Institute Pamphlet 6.
2. Manufacturer and Product: ITT Camtite.

K. Ball Valve 1 Inch and Smaller for In-Door Low Pressure Gas Service:

1. Two-piece bronze or forged brass body and end piece, NPT threaded ends, hard chrome plated brass ball, PTFE seats and packing, yellow or red lever handle, rated pressure to 5 psi.
2. Fully comply with AGA 3 or ASME B16.44, ANSI Z21.15/CSA 9.1, and CR91-002 for manually operated valves.
3. Manufacturers and Products:
   a. Conbraco Apollo; Series GB-10.
   b. Nibco; GB-10.

L. Ball Valve 2 Inches and Smaller for In-Door Main Burner Low Pressure Gas Service:

1. Two-piece bronze or forged brass body and end piece, NPT threaded ends, hard chrome plated brass ball, PTFE seats and packing, plated steel lever handle with yellow vinyl grip, rated pressure to 5 psi, with cast-in pilot tap and plug.
2. CSA approved and in full compliance with AGA 3, ANSI Z21.15/CSA 9.1, and CR91-002for manually operated valves.
3. Manufacturers and Products: Conbraco Apollo; Series GB-50 Series.

M. Vee-Ball Valve 1 Inch to 16 Inches:

1. ASME B16.1 Class 150-pound flanged ends, carbon steel body, heat treated nickel- or hard chromium-plated Type 317 stainless steel ball, splined-type, 17-4 PH stainless steel shafts, reinforced PTFE flow-ring seal, reinforced PTFE with stainless steel or Hastalloy sleeve bearings, and PTFE V-ring packing. Valve to have 300:1 rangeability and equal percentage characteristic.
2. Manufacturers and Products:
   a. Fisher Controls: Design V150.
   b. DeZurik: VPB V-Port Ball Valve.
3. Finishes: As specified in Section 40 05 51 - Common Requirements for Process Valves.

2.2 PLASTIC BALL VALVES

A. PVC Ball Valve 2 Inches and Smaller:

1. Rated 150 psi at 73 degrees F, with ASTM D1784, Type I, Grade 1 polyvinyl chloride body, ball, and stem, end entry, double union design, solvent-weld socket ends, elastomer seat, Viton or Teflon O-ring stem seals, to block flow in both directions.

2. Manufacturers and Products:
   a. Nibco; Chemtrol Tru-Bloc.
   b. ASAHI/America; Type 21.
   c. Spears; True Union.

B. PVC Ball Valve 3 Inches and 4 Inches:

1. Rated 150 psi at 73 degrees F, with ASTM D1784 Type I, Grade 1 PVC full port body, Teflon seat, Viton O-ring stem, face and carrier seals, end entry design with dual union, solvent-weld socket ends, or single union ball valve with flanged ends drilled to ASME B16.1.
2. Manufacturers and Products:
   a. Nibco; Chemtrol Tru-Bloc.
   b. ASAHI/America; Type 21.

C. CPVC Ball Valve 2 Inches and Smaller:

1. Rated 150 psi at 100 degrees F, 80 psi at 140 degrees, with ASTM D1784, Type IV, Grade 1 chlorinated polyvinyl chloride (CPVC) body, ball, and stem, end entry, double union design, with solvent-weld socket ends or single union ball with flanged ends drilled to ASME B16.1, replaceable Teflon seat, Viton or Teflon O-ring stem seals, to block flow in both directions.
2. Manufacturers and Products:
   a. Nibco; Chemtrol Tru-Bloc.
   b. ASAHI/America; Type 21.
   c. Spears; True Union.

2.3 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. As specified in Section 40 05 51 - Common Requirements for Process Valves.

C. Testing: Test ball valves according to AWWA C507.

PART 3 - EXECUTION

3.1 As specified in Section 40 05 51 - Common Requirements for Process Valves: PART 3 – EXECUTION requirements for compliance with this Section.

END OF SECTION

SECTION 40 05 64 - BUTTERFLY VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rubber-seated butterfly valves.
   2. Plastic butterfly valves.

B. Related Requirements:
   1. Section 40 05 51 - Common Requirements for Process Valves: Basic materials and methods related to valves commonly used for process systems.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C504 - Rubber-Seated Butterfly Valves.

B. ASME International:
   1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
   3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

C. ASTM International:
   1. ASTM A536 - Standard Specification for Ductile Iron Castings.
   2. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
   3. ASTM D3222 - Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
   4. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

1.3 SUBMITTALS

A. As specified in Section 40 05 51 - Common Requirements for Process Valves: Submittal requirements for compliance with this Section.

PART 2 - PRODUCTS

2.1 GENERAL

A. In full compliance with AWWA C504 and following requirements:
   1. Suitable for throttling operations and infrequent operation after periods of inactivity.
   2. Elastomer seats which are bonded or vulcanized to the body shall have adhesive integrity of bond between seat and body assured by testing, with minimum 75-pound pull in accordance with ASTM D429, Method B.
   3. Bubble-tight with rated pressure applied from either side. Test valves with pressure applied in both directions.

4. No travel stops for disc on interior of body.
5. Self-adjusting V-type or O-ring shaft seals.
6. Isolate metal-to-metal thrust bearing surfaces from flowstream.
7. Provide traveling nut or worm gear actuator with handwheel. Valve actuators to meet the requirements of AWWA C504.
8. Buried service operators shall withstand 450 foot-pounds of input torque at fully open and fully closed positions.
9. Provide linings and coatings per AWWA, unless otherwise indicated on Drawings or specified herein.
10. Valves to be in full compliance with NSF/ANSI 61.

B. Non-AWWA butterfly valves to meet the following actuator requirements:
1. For above ground installations, provide handle and notch plate for valves 6 inches and smaller and heavy-duty, totally enclosed gearbox type operators with handwheel, position indicator and travel stops for valves 8 inches and larger, unless otherwise indicated on Drawings or specified herein.

2.2 RUBBER-SEATED BUTTERFLY VALVES

A. Butterfly Valve Water Works Service 3 Inches to 72 Inches:
1. AWWA C504, Class 150B.
2. Short body type, flanged ends.
3. Cast-iron body, cast or ductile iron disc, Type 304 stainless steel shafts, Buna-N rubber seat, and stainless-steel seating surface.
4. Provide epoxy lining and coating] in compliance with AWWA C550.
5. Manufacturers and Products:
   a. Pratt; Model 2FII or Triton XR-70.
   b. DeZurik; AWWA Valve.

B. Butterfly Valve Water Works Service 30 Inches to 72 Inches:
1. AWWA C504, Class B.
2. Short body type, flanged ends.
3. Cast-iron body, ductile iron disc with Type 316 stainless steel seating edge, Type 304 stainless steel shafts, Buna-N rubber seat
4. Provide epoxy lining and coating in compliance with AWWA C550.
5. Manufacturers and Products:
   a. Pratt; Model Triton XR-70.
   b. DeZurik; AWWA Valve.

C. Butterfly Valve General Service 3 Inches to 20 Inches:
1. AWWA C504, Class 150B.
2. Wafer style type.
3. Buna-N rubber seat.

D. Butterfly Valve General Service 4 Inches to 48 Inches:
1. AWWA C504, Class 150B.
2. Mechanical joint end type.
3. Cast-iron body, cast or ductile iron disc, Type 304 stainless steel shafts, Buna-N rubber seat, and stainless-steel seating surface.
4. Provide epoxy lining and coating in compliance with AWWA C550.

5. Manufacturers and Products:
   a. Pratt; Groundhog.
   b. DeZurik; Buried AWWA Valve.

E. Butterfly Valve High Pressure Service 4 Inches to 48 Inches:
1. AWWA C504, Class 250B.
2. Short body type, Class 125 flanged ends.
3. Cast or ductile iron body, cast or ductile iron disc with Type 316 stainless steel disc edge, ASTM A564/A564M Type 630 Condition H-1100/1150 or Type 316 stainless steel shaft, Buna-N rubber seat bonded or molded in body only, self-adjusting V-type multi-ring seals.
4. Provide epoxy lining and coating in compliance with AWWA C550.
5. Manufacturers and Products:
   a. Pratt; Triton HP-250.
   b. DeZurik; AWWA Flanged Class 250.
   c. Mueller; Lineseal XP Class 250.

F. Butterfly Valve High Pressure Service 4 Inches to 48 Inches:
1. AWWA C504, Class 250B.
2. Mechanical joint ends.
3. Cast or ductile iron body, cast or ductile iron disc with Type 316 stainless steel disc edge, ASTM A564/A564M Type 630 Condition H-1100/1150 or Type 316 stainless steel shaft, Buna-N rubber seat bonded or molded in body only, self-adjusting V-type multi-ring seals.
4. Provide epoxy lining and coating in compliance with AWWA C550.
5. Manufacturers and Products:
   a. Pratt; Triton HP-250.
   b. DeZurik; AWWA Mechanical Joint Class 250.
   c. Mueller; Lineseal XP250.

G. Lug Style Butterfly Valve, Resilient Seated, 2 Inches to 20 Inches for Low Pressure Process Air Service:
1. Lug style cast-iron body, aluminum bronze discs, Type 316 stainless steel one-piece stem, self-lubricating sleeve type bushings, EPDM replaceable resilient seat suitable for operating temperatures up to 250 degrees F, 150 psi working pressure rating, bubble-tight at 50 psi differential pressure, valve body to fit between ASME B16.1 Class 125/150 flanges.
2. Manufacturers and Products:
   a. Bray Controls; Series 31.
   b. Tyco/Keystone; Model AR2.

H. Flanged Style Butterfly Valve, Resilient Seated, 24 Inches to 48 Inches for Low Pressure Process Air Service:
1. Flanged style cast-iron body, aluminum bronze discs, Type 304 stainless steel one-piece stem, self-lubricating bronze sleeve type bearing, EPDM replaceable resilient seat suitable for operating temperatures up to 250 degrees F, 150 psi working pressure, rating, bubble-tight at 50 psi differential pressure, externally adjustable bronze packing gland with Buna-N packing, valve body to fit between ASME B16.1 Class 125/150 flanges.
2. Manufacturers and Products:
   a. Bray Controls; Series 35.

b. Tyco/Keystone; Figure 106.

I. Lug Butterfly Valve 2 Inches to 20 Inches for Digester Gas:
1. Lug style, two-piece cast-iron body, one-piece Type 316 stainless steel thin-profile disc and stem, heavy-duty stem bushing, NBR stem seal, FKM (Viton) replaceable resilient seat, 50 psi pressure bi-directional bubble-tight rating, suitable for temperatures up to 250 degrees F, valve body to fit between ASME B16.1 Class 125/150 flanges. Supply reduced disc diameter, if available.
2. Manufacturers and Products:
a. Bray Controls; Model 21.
b. Tyco/Keystone; Model 920.

J. Butterfly Valve 2 Inches to 20 Inches:
1. Wafer style, cast iron body, Type 316 stainless steel disc, Type 316 or Type 18-8 stainless steel one-piece stem, Buna-N replaceable resilient seat, heavy-duty self-lubricating sleeve type bushings, NBR stem seal, 150 psi working pressure rating, valve body to fit between ASME B16.1 Class 125/150 flanges.
2. Manufacturers and Products:
a. Bray Controls; Series 30/31.
b. Tyco/Keystone; Model AR1/AR2.
c. Crane/Centerline; Series 200.

K. High Performance Butterfly Valve 2 Inches to 36 Inches:
1. ASME B16.1 Class 150 wafer style, high performance type, carbon steel body, Type 316 stainless steel single or double offset disc, Type 316 stainless steel shaft and taper pins, Buna-N seat, PTFE stem packing, stainless steel with RTFE thrust washer.
2. Manufacturers and Products:
a. Tyco/Keystone; K-Lok Series.
b. DeZurik; BHP Series.

2.3 Butterfly Valve 4 Inches to 20 Inches for Fire Protection Service:

A. UL Listed and FM Approved, wafer style, AWWA C504 Class 150B valve with cast-iron body, aluminum-bronze disc, stainless steel stem, EPDM seat, geared operator with highly visible position indicator and detachable crank handle.

B. For buried service, provide post indicating assembly with detachable crank handle.

C. Manufacturer and Product: Pratt; Model IBV

2.4 PLASTIC BUTTERFLY VALVES

A. Solid Polyvinyl Chloride Butterfly Valve 1-1/2 Inches to 8 Inches:
1. Wafer body type, pressure rated 150 psi at 70 degrees F CWP, solid ASTM D1784, Type I, Grade 1, PVC body and contoured PVC or polypropylene valve disc, stainless steel valve stem, Viton seat, lever operator.
2. Manufacturers and Products:
a. ASAHI/America; Type 57P
b. Spears.

2.5 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. As specified in Section 40 05 51 - Common Requirements for Process Valves.

C. Testing: Test butterfly valves according to AWWA C504.

PART 3 - EXECUTION

3.1 As specified in Section 40 05 51 - Common Requirements for Process Valves: PART 3- EXECUTION requirements for compliance with this Section.

END OF SECTION

SECTION 40 05 65 - VALVES FOR PUMP CONTROL AND CHECK SERVICE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Swing check valves
   2. Slanting disc check valves
   3. Silent check valves
   4. Ball check valves
   5. Flap type check valves
   6. Hydraulically operated pump control valves

B. Related Requirements:
   1. Section 09 90 00 - Painting and Coating: Coating and touchup of shop-primed surfaces with primer.
   2. Section 40 05 51 - Common Requirements for Process Valves: Basic materials and methods related to valves commonly used for process systems.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.

B. ASME International:
   1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   2. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded.
   3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

C. ASTM International:
   1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   2. ASTM A536 - Standard Specification for Ductile Iron Castings.
   3. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
   4. ASTM B148 - Standard Specification for Aluminum-Bronze Sand Castings.

D. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

E. SSPC - The Society for Protective Coatings:
   1. SSPC SP 6 - Commercial Blast Cleaning.

1.3 SUBMITTALS

A. As specified in Section 40 05 51 - Common Requirements for Process Valves: Submittal requirements for compliance with this Section.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, and centerline elevations.

1.5 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

1.6 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.

D. Protection:
1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Protect valves and appurtenances by storing off ground.
3. Provide additional protection according to manufacturer instructions.

1.7 EXISTING CONDITIONS

A. Field Measurements:
1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SWING CHECK VALVES

A. Check Valve 2 Inches and Smaller:
1. All bronze, threaded cap, threaded or soldered ends, swing type replaceable bronze disc, rated 125-pound SWP, 200-pound WOG.
2. Manufacturers and Products:
a. Stockham; Figure B-319, threaded ends.
b. Milwaukee; Figure 509, threaded ends.
c. Stockham; Figure B-309, soldered ends.
d. Milwaukee; Figure 1509, soldered ends.

B. Check Valve 2 Inches and Smaller:
1. All bronze, threaded cap, threaded ends, swing type replaceable Teflon disc and bronze disc holder, rated 150-pound SWP, 300-pound WOG.
2. Manufacturers and Products:

a. Walworth; Figure 3412.
b. Milwaukee; Figure 510.

C. Check Valve 2-1/2 Inches to 12 Inches:
1. Flanged end, cast-iron body, bronze mounted swing type, solid bronze or cast-iron disc, bronze seat ring, rated 125-pound SWG, 200-pound WOG.
2. Manufacturers and Products:
a. Stockham G-931; List 37, Clearway check valve.
b. Crane Co.; Cat. No. 373.

D. Check Valve 2 Inches to 12 Inches:
1. Flanged end, cast-iron body, bronze mounted swing type, solid bronze or cast-iron disc, bronze seat ring, outside lever and weight, rated 125-pound SWP, 200-pound WOG.
2. Manufacturers and Products:
a. Stockham; G-931.
b. Crane Co.; Cat. No. 383.

E. Swing Check Valve 2 Inches to 24 Inches:
1. AWWA C508, 125-pound flanged ends, cast-iron body, bronze body seat, bronze mounted cast-iron clapper with bronze seat, stainless steel hinge shaft.
2. Valves, 2 inches through 12 inches rated 175-pound WWP and 14 inches through 24 inches rated 150-pound WWP. Valves to be fitted with adjustable outside lever and weight. Increasing-pattern body valve may be used where increased outlet piping size is shown.
3. Manufacturers and Products:
a. M&H Valve; Style 59, 159, or 259.
b. Mueller Co.; No. A-2600 Series.

F. Swing Check Valve 2-1/2 Inches to 12 Inches for Fire Protection Service:
1. UL Listed, FM Approved, iron body, bronze-mounted, rated 175 pounds WOG, self-adjusting bronze disc, ends ASME B16.1 flanged, with a 1-inch NPT tapped and plugged boss.
2. Manufacturers and Products:
a. Kennedy; Figure 126.
b. Mueller; A-2120-6.

G. Wafer Style Check Valve 2 Inches to 36 Inches:
1. Wafer style, swing check, one-piece body design, full resilient seal in machined body groove. Cast-iron body, ASME B16.1 Class 125 rating, Type 316 stainless steel disc, Type 316 stainless steel spring and other internals, Buna-N seal, outside lever and weight assembly, external and internal epoxy coating.
2. Manufacturers and Products:
a. Tyco; Prince Figure 800 Series.
b. Crane; Uni-Chek II.

H. Double Disc Swing Check Valve 2 Inches to 48 Inches:
1. Wafer style, spring loaded, cast-iron body, aluminum-bronze or ductile iron discs, Buna-N resilient seats, and Type 316 stainless steel spring, hinge pin, and stop pin.

2. Valves 2 inches through 12 inches rated 200 psi non-shock working pressure and valves 14 inches through 48 inches rated 150 psi non-shock working pressure.
3. Manufacturers and Products:
   a. APCO; Series 9000.
   b. Val-Matic; Dual Disc.
   c. Crane/Stockham; WG-970.
   d. Tyco; Gulf MB Series.

I. Wet Pipe Alarm Valve:
1. Valve and Trim:
   a. UL Listed and FM Approved as a complete unit, rated 175 psi working pressure, 125-pound ASME B16.1 flanged inlet and C: outlet.
   b. Supplied with full trim for position as shown on Drawings including, but not necessarily limited to, water pressure gauges (with test valves), alarm test valve, mechanical sprinkler alarm bell connection (with strainer), pressure switch for electric alarm signal, retarding chamber, alarm and retard chamber drains, and main drain.
   c. Provide with additional valves, piping, and fittings as required for complete and fully functioning arrangement.
2. Manufacturers and Products:
   a. Reliable Automatic Sprinkler Co., Inc.; Model E Alarm Valve.
   b. Tyco/Central; Model L/W.

J. Check Valve 2 Inches and Smaller for Fuel Oil Service:
1. Forged steel, lift-check type integral seat, stainless steel disc, screwed ends, rated 800 psi at 850 degrees F.
2. Manufacturers and Products:
   a. Smith; C80.
   b. R-P&C; F90.

2.2 SLANTING (TILTING) DISC CHECK VALVES

A. Slanting Disc Check Valve 2 Inches to 60 Inches:
1. Slanting or tilting disc design, off-center pivot, body ductile iron two-piece design, bronze seat on 55 degree angle, disc bronze or ductile iron, pivot pin and bushing Type 304 stainless steel, Class 125, 150 psi rating, Class 125 flange drilling, valve disc position indicator.
2. Manufacturers and Products:
   a. APCO; Series 800.
   b. Val-Matic; Series 9800.

B. Slanting Disc Check Valve 2 Inches to 60 Inches:
1. Slanting or tilting disc design, off-center pivot, body ductile iron two-piece design, bronze seat on 55 degree angle, disc bronze or ductile iron, pivot pin and bushing Type 304 stainless steel, Class 250, 300 psi rating, Class 250 flange drilling, flat face, valve disc position indicator.
2. Manufacturers and Products:
   a. APCO; Series 800.
   b. Val-Matic; Series 9700.

C. Slanting Disc Check Valve 2 Inches to 36 Inches:
   1. Off-center pivoting disc design, wafer style, cast-iron body, ductile iron discs, Type 316 stainless steel pivot pin, spring pin, and bushing, Buna-N disc seal, Type 316 stainless steel or Monel spring, Class 125.
   2. Manufacturers and Products: Daniel Flow Products; Chexter 1600 Series, Type D.

2.3 SILENT CHECK VALVES

A. Silent Check Valve 2 Inches to 10 Inches:
   1. Wafer style, iron body, center guided valve, bronze trim, Buna-N seat, stainless steel springs, rated 150-pound WOG.
   2. Manufacturers and Products:
      a. Mueller; Steam Specialty 91AP.
      b. APCO; Series 300.

B. Silent Check Valve 3 Inches to 24 Inches:
   1. Globe style, center guided, 125-pound flanges, cast-iron body, bronze trim, stainless steel spring. Valves to be FM Approved in sizes up to and including 12 inches.
   2. Manufacturers and Products:
      a. APCO; Series 600.
      b. Val-Matic; 1800 Series.
      c. Cla-Val; Series 581.

C. Silent Check Valve 4 Inches to 12 Inches for Fire Protection Service:
   1. UL Listed or FM Approved, center-guided globe style valve with ASME B16.1, Class 125 flanges, iron body, bronze trim, stainless steel spring, rated 175-pound nonshock, CWP.
   2. Manufacturers and Products:
      a. Mueller; Steam Specialty.
      b. APCO

D. Check Valve 2 Inches and Smaller for Heating, Chilled, and Cooling Service:
   1. All-bronze type silent check valve, screwed ends, rated 200-pound WOG.
   2. Manufacturers and Products:
      a. Mueller; Steam Specialty No. 203-BP.
      b. Metraflex.

2.4 BALL CHECK VALVES

A. PVC Ball Check Valve 4 Inches and Smaller:
   1. ASTM D1784, Type I, Grade 1 polyvinyl chloride body, dual union socket weld ends, rated 150 psi at 73 degrees F, and Viton seat and seal.
   2. Manufacturers and Products:
      a. Nibco; Chemtrol Tru Union.
      b. ASAHI/America.
      c. Spears; True Union.

B. CPVC Ball Check Valve 4 Inches and Smaller:
   1. ASTM D1784 Cell Class 23477B CPVC body, single or dual union socket weld ends, rated 150 psi at 73 degrees F, 110 psi at 140 degrees F, Viton seat and seal.
   2. Manufacturers and Products:
      a. Nibco; Chemtrol Tru Union.
      b. ASAHI/America.
      c. Spears; True Union.

C. Ball Check Valve 3 Inches and Larger:
   1. Flanged end, iron body valve with cleanout and floating type hollow steel ball, vulcanized nitrile rubber exterior, flanges ASME B16.1, Class 125, rated 150-pound working pressure, suitable for vertical up or horizontal flow.
   2. Manufacturers and Products:
      a. FLYGT Corp;
      b. Flomatic Corp.;
      c. Golden Anderson;

2.5 FLAP TYPE CHECK VALVES

A. Rubber Flapper Check Valve 2 Inches to 24 Inches:
   1. Iron body, ASME B16.1, Class 125 flanges, steel-reinforced Buna-N flapper raised seating ring, rated 150-pound CWP.
   2. Manufacturers and Products:
      a. APCO; Series 100.
      b. Val-Matic; “Swingflex.”

B. Flap Gate 6 Inches to 96 Inches:
   1. Cast-iron body and cover, bronze-mounted, flanged frame type, dual pivot-point hinge arms, hinge arms bronze, hinge pins Type 304 stainless steel, seat bronze and impacted into grooves in body and cover flap, lubrication fittings for each pivot, upper and lower pivot adjustment.
   2. Manufacturers and Products:
      a. Rodney Hunt Co.; Series FV-AC or FV-AR.
      b. Hydro Gate; Model 50C or 50.

C. Flap Valve 4 Inches to 30 Inches:
   1. Flange style frame, cast-iron body, bronze seats on body and cover, bronze hinge pins.
   2. Manufacturers and Products:
      a. M&H Valve; Style 47-02.
      b. Clow Valve; No. F-3012.

D. Check Valve 1 Inch to 48 Inches:
   1. Elastomer type flanged or slip-on as shown on Drawings, round entry area to match pipe, contoured duckbilled shaped exit, flat bottom and off-set bill design, curved bill for 18 inches and larger, valve open with approximately 2 inches of line pressure and return to CLOSED position under zero flow condition, rated for 50 psi minimum operating pressure; flanges steel backing flange type, drilled to ASME B16.1, Class 125, plain-end valve attached with two Type 316 stainless steel adjustable bands, elastomer nylon-reinforced neoprene

2. Manufacturer and Product: Red Valve Co.; Tideflex Check Valve Series TF-1 or 35-1.

2.6 HYDRAULICALLY OPERATED PUMP CONTROL VALVES

A. Dual Chamber Booster Pump Control Valve 2-1/2 Inches to 16 Inches:
   1. Hydraulically operated, diaphragm actuated, pilot controlled globe valve with ductile iron body, ASME B16.1 Class 150 flanged ends, rated 250 psi, bronze or stainless steel trim, stainless steel stem, externally mounted strainer with cock. FDA approved fusion bonded epoxy lining and coating installed in accordance with AWWA C550.
   2. Manufacturers and Products:
      a. Cla-Val; Model 60-11.
      b. Singer; Model 106-BPC.

B. Dual Chamber Deep Well Pump Control Valve 2-1/2 Inches to 16 Inches:
   1. Hydraulically operated, diaphragm actuated, solenoid controlled globe valve with ductile iron body, ASME B16.1 Class 150 flanged ends, rated 250 psi, bronze or stainless steel trim, stainless steel stem, and externally mounted strainer with cock.
   2. FDA approved fusion bonded epoxy lining and coating installed in accordance with AWWA C550.Manufacturers and Products:
      a. Cla-Val; Model 61-02.
      b. Singer; Model 106-DW.

PART 3 - EXECUTION

3.1 As specified in Section 40 05 51 - Common Requirements for Process Valves: PART 3 EXECUTION requirements for compliance with this Section.

END OF SECTION

SECTION 40 05 67 – SPECIALIZED PRESSURE AND FLOW-CONTROL VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pressure-reducing valves.
2. Pressure-sustaining valves.
3. Pressure relief valves.
4. Plastic pressure regulating valves.
5. Backflow prevention valves

B. Related Requirements:
1. Section 40 05 51 - Common Requirements for Process Valves: Basic materials and methods related to valves commonly used for process systems.

1.2 REFERENCE STANDARDS

A. ASME International:
1. ASME B1.20.1 - Pipe Threads, General Purpose (Inch.
2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
3. ASME B16.24 - Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.
4. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300.

B. ASTM International:
1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
2. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
3. ASTM A536 - Standard Specification for Ductile Iron Castings.
4. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

C. American Water Works Association:
1. C510, Double Check Valve Backflow Prevention Assembly.
2. C511, Reduced-Pressure Principle Backflow Prevention Assembly.
3. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.

D. NSF International:
1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 SUBMITTALS

A. As specified in Section 40 05 51 - Common Requirements for Process Valves: Submittal requirements for compliance with this Section.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of pressure-regulating valves.

1.5 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.

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.

1.6 EXISTING CONDITIONS

A. Field Measurements:
1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PRESSURE-REDUCING VALVES

A. Pressure-Reducing Valve 2-1/2 Inches and Smaller:
1. Direct diaphragm operated, spring controlled, bronze body, NPT threaded ends, 200-psig rated minimum.
2. Size/Rating: As shown in Valve Schedule.
3. Manufacturers and Products:
a. Fisher; Type 75A.
b. Watts; Series 223.

B. Pressure-Reducing Valve 2 Inches and Smaller:
1. Direct diaphragm, spring controlled, cast-iron body, spring case, seat and diaphragm, stainless steel valve stem, NPT threaded ends, 250-psig rated.
2. Size/Rating: As shown in Valve Schedule.
3. Manufacturer and Product: Fisher; 95 Series.

C. Pressure-Reducing Valve 1-1/2 Inches to 2 Inches:
1. Direct diaphragm, spring controlled, cast-iron body, aluminum diaphragm and spring case, nitrile disc/diaphragm/O-rings, internal relief, NPT threaded ends, 125-psig rated.

2. Size/Rating: As shown in Valve Schedule.
3. Manufacturer and Product: Fisher; S200 Series.

D. Pressure-Reducing Valve 3 Inches and Larger:
1. Hydraulically operated, diaphragm actuated, pilot-controlled globe valve, ductile iron body, ASME B16.1 Class 150 flanged ends, rated 250 psi, bronze or stainless steel trim, stainless steel stem, externally mounted strainers with cocks, maintains a constant downstream pressure regardless of fluctuations in flow or upstream pressure.
2. Size/Rating: As shown in Valve Schedule.
3. Manufacturers and Products:
a. Cla-Val; 90-01 Series.
b. Singer; Model 206PR.

2.2 PRESSURE-SUSTAINING VALVES

A. Pressure-Reducing/Back-Pressure Sustaining Valve 3 Inches and Larger:
Hydraulically operated, diaphragm actuated, pilot controlled globe valve, ductile iron body, ASME B16.1 Class 150 flanged ends, rated 250 psi, bronze or stainless steel trim, stainless steel stem, externally mounted strainers with cocks, maintains a constant downstream pressure while maintaining a minimum upstream pressure.

B. FDA approved fusion bonded epoxy lining and coating installed in accordance with AWWA C550.

C. Manufacturers and Products:
1. Cla-Val; 92-01 Series.
2. Singer; Model 206PR-R.

2.3 PRESSURE RELIEF VALVES

A. Pressure-Relief Valve 2 Inches and Smaller:
1. Direct diaphragm, spring controlled**,** cast-iron body, spring case, neoprene diaphragm, stainless steel valve stem, NPT threaded ends, 200 psi rated.
2. Opens when upstream pressure reaches a maximum set point.
3. Size/Rating: As shown in Valve Schedule.
4. Manufacturer and Product: Fisher; 98 Series.

B. Pressure-Relief Valve 3 Inches and Larger:
1. Hydraulically operated, diaphragm actuated, pilot-controlled globe valve, ductile iron body, ASME B16.1 Class 150 flanged ends, rated 250 psi, bronze or stainless-steel trim, stainless steel stem, externally mounted strainers with cocks, to open when upstream pressure reaches a maximum set point.
2. FDA approved fusion bonded epoxy lining and coating installed in accordance with AWWA C550.
3. Size/Rating: As shown in Valve Schedule.
4. Manufacturers and Products:
a. Cla-Val; 50-01**.**
b. Singer; Model 206-RPS.

2.4 PLASTIC REGULATING VALVES

A. PVC Pressure Relief, By-Pass Relief, Back-Pressure Regulator, Back-Pressure, Anti-Siphon Valve 1/2 Inch to 2 Inches:
   1. Direct acting diaphragm, spring controlled, in-line pattern, NPT threaded inlet and outlet, 150 psi design pressure.
   2. PVC body, Teflon or Viton diaphragm, PVC or Teflon piston, high-density polyethylene or stainless-steel adjusting bolt and locknut, stainless steel or coated steel spring, stainless steel fasteners.
   3. Designed to open when upstream pressure reaches setpoint; set pressure adjustable from 10 psi to 100 psi, minimum. Factory set pressure setting at 25 psi for back-pressure and anti-siphon valves, 10 psi for pressure relief valves, 100] psi for bypass relief valves, and 50 psi for back-pressure regulator valves**.**
   4. Manufacturers and Products:
      a. Plast-O-Matic; Series RVDT.
      b. Griffco; Series BPV.
      c. Primary Fluid Systems; TOP Valve.

B. PVC Pressure Regulating Valve, 1/2 Inch to 1-1/2 Inches:
   1. Diaphragm operated assembly, spring controlled, in-line pattern, NPT threaded inlet and outlet, 150 psi design pressure.
   2. PVC body, Viton seals and diaphragm, coated stainless steel spring, stainless steel adjusting bolt, locknut, and fasteners.
   3. Designed to regulate downstream pressure closing when pressure reaches setpoint; set pressure adjustable from 5 psi to 50 psi.
   4. Manufacturers and Products:
      a. Plast-O-Matic, Series PR.
      b. Hayward; Pressure Regulator.

C. Automatic Degassing Valve, 1/2 Inch to 3/4 Inch:
   1. PVC or CPVC construction with Viton seals, NPT threaded inlet and outlet, float designed to automatically vent gases, 100 psi design pressure.
   2. Manufacturers and Products:
      a. Plast-O-Matic; Series DGV.
      b. Primary Fluid Systems, Inc.; Accu-Vent.

2.5 BACKFLOW PREVENTION VALVES

A. Double Check Valve Backflow Prevention Assembly 3/4 Inch to 10 Inches:
   1. Two resilient seated check valves, two non-rising stem resilient-seated isolation valves, test cocks, in accordance with AWWA C510, rated 175 psi maximum working pressure, meets requirements of USC Foundation for Cross-Connection Control and Hydraulic Research.
   2. Manufacturers and Products:
      a. FEBCO; Model 850S or LF850L.
      b. Danfoss Flomatic; Model DCVE/DCV.
      c. Watts; Series 007/709.

B. Reduced-Pressure Principle Backflow Prevention Assembly 3/4 Inch to 10 Inches:
   1. Two resilient seated check valves with an independent relief valve between the valves, two non-rising stem resilient-seated isolation valves, test cocks, in accordance with AWWA C511, rated 175 psi maximum working pressure, meets requirements of USC Foundation For Cross-Connection Control and Hydraulic Research.
   2. Manufacturers and Products:
      a. FEBCO; Model 860S or LF860L.
      b. Danfoss Flomatic; Model RPZE/RPZ.
      c. Watts; Series 009/909.

PART 3 - EXECUTION

3.1 As specified in Section 40 05 51 - Common Requirements for Process Valves: PART 3 EXECUTION requirements for compliance with this Section.

END OF SECTION

SECTION 40 05 78 - AIR RELEASE VALVES FOR WATER AND WASTEWATER SERVICE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Air and vacuum release valves for water service.
   2. Air and vacuum release valves for wastewater service.

B. Related Requirements:
   1. Section 09 90 00 - Painting and Coating: Preparing, priming, and painting surfaces, including field-applied and equipment finishing.
   2. Section 40 05 07 - Hangers and Supports for Process Piping: Anchors and supports.
   3. Section 40 05 51 - Common Requirements for Process Valves: Typical product and installation requirements for valves specified in this Section.
   4. Section 40 42 13 - Process Piping Insulation: Insulation applied to process piping systems.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C512 - Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.

B. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 SUBMITTALS

A. As specified in Section 40 05 51 - Common Requirements for Process Valves: Submittal requirements for compliance with this Section.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of air release valves.

1.5 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.

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.

1.6 EXISTING CONDITIONS

A. Field Measurements:
1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 AIR AND VACUUM RELEASE VALVES FOR WATER SERVICE

A. Air and Vacuum Valve 1/2 Inch to 16 Inches:
1. 1/2-inch through 3-inch NPT inlets and outlets, 4-inch and larger ASME B16.1 Class 125 flanged inlet with plain outlet and protective hood.
2. Rated 150 psi working pressure, cast-iron or ductile iron body and cover, stainless steel float and trim, built and tested to AWWA C512.
3. Manufacturers and Products:
a. APCO Valve and Primer Corp.; Series 140 or 150.
b. Val-Matic Valve; Series 100.

B. Air and Vacuum Valve 4 Inches to 16 Inches with Anti-Slam Device:
1. Equipped with anti-slam device to throttle flow of water into air valve. Design anti-slam device to permit full, unrestricted flow of air into and out of air valve but reduce flow area for water to approximately 10 percent.
2. Rated 150 psi working pressure, cast-iron or ductile iron body and cover, stainless steel float and trim, built and tested to AWWA C512, ASME B16.1 Class 125 flanged inlet and plain outlet with protective hood.
3. Manufacturers and Products:
a. APCO Valve and Primer Corp.; Series 1900.
b. Val-Matic Valve; Series 1200/100.

C. Air and Vacuum Valve 1/2 Inch to 16 Inches for Vertical Turbine Service:
1. Equip 1/2 inch through 3 inches with stainless steel diffuser screen to break up solid water column before coming in contact with float, manufacturer’s standard double acting throttling device in outlet for throttling, NPT threaded inlet and outlet.
2. Equip 4 inches and larger with anti-slam device to throttle flow of water into air valve. Design anti-slam device to permit full, unrestricted flow of air into and out of air valve, but reduce flow area for water to approximately 10 percent. ASME B16.1 Class 125 flanged inlet and NPT threaded outlet.
3. Rated 150 psi working pressure, cast-iron or ductile iron body and cover, stainless steel float and trim, built and tested to AWWA C512.
4. Manufacturers and Products:
a. APCO Valve and Primer Corp.; Series 141DAT to 146DAT or Series 1904 to 1916.

b. Val-Matic Valve; Series 100WS to 116WS.

D. Air Release Valve 1/2 Inch to 2 Inches:
1. Suitable for water service, automatically exhaust small amounts of entrained air that accumulates in a system. In CLOSED position, seat against resilient seat to prevent water leakage.
2. Rated 150 psi working pressure, cast-iron or ductile iron body and cover, stainless steel float and trim, NPT threaded inlet and outlet, built and tested to AWWA C512.
3. Manufacturers and Products:
a. APCO Valve and Primer Corp.; Series 50, 200, and 200A.
b. Val-Matic Valve; Series 15A to 45.6.

E. Air Release Valve 1/2 Inch to 1 Inch:
1. Suitable for water service, automatically exhaust small amounts of entrained air that accumulates in system. In CLOSED position, seat against resilient seat to prevent water leakage.
2. Rated 230-psi working pressure, reinforced nylon body, foamed polypropylene float, EPDM rolling seal, Buna-N O-ring, NPT threaded inlet.
3. Manufacturer and Product: ARI Valves; S-050.

F. Combination Air Release Valve 1 Inch to 16 Inches:
1. Suitable for water service, combines operating features of air and vacuum valve and air release valve. Air and vacuum portion to automatically exhaust air during filling of system and allow air to re-enter during draining or when vacuum occurs. Air release portion to automatically exhaust entrained air that accumulates in system.
2. Valve single body or dual body, air release valve mounted on air and vacuum valve, isolation valve mounted between the dual valves. 1-inch through 3-inch valves with NPT threaded inlet and outlet, 4-inch and larger valves with ASME B16.1 Class 125 flanged inlet and cover outlet.
3. Rated 150 psi working pressure, cast-iron or ductile iron body and cover, stainless steel float and trim, built and tested to AWWA C512.
4. Manufacturers and Products:
a. APCO Valve and Primer Corp.; Series 143C to 147C or 1804 to 1816.
b. Val-Matic Valve; Series 201C to 203C or 104/22 to 116/38.

G. Rolling Seal Combination Air Valve 3/4 Inch to 2 Inches:
1. Designed for water service and uses rolling seal to allow smaller and larger amounts of air to automatically exhaust under pressure and air to enter when vacuum occurs in a single valve body.
2. Reinforced nylon body with polypropylene discharge elbow, NPT inlet, 230 psi working pressure.
3. Foamed polypropylene float, EPDM rubber rolling seal mechanism with reinforced nylon plug, plug cover, and clamping stem, Buna-N O-ring.
4. Manufacturer and Product: ARI Valves; D-040 or D-040-C.

H. Rolling Seal Combination Air Valve 2 Inches to 8 Inches:
1. Suitable for water service, combines operating features of air and vacuum valve and air release valve. Air and vacuum portion to automatically exhaust air at a high rate during filling of system and allow air to re-enter during draining or when vacuum occurs. Air

release portion to automatically exhaust entrained air that accumulates in system. Air release uses rolling seal mechanism.
2. High flow air/vacuum valve, cast-iron body with stainless steel float and seat, EPDM seal, ASME B16.1 Class 125 flanged inlet, 230-psi working pressure.
3. Air release valve with foamed polypropylene float, EPDM rubber rolling seal mechanism with reinforced nylon plug, plug cover, and clamping stem, Buna-N O-ring.
4. Manufacturer and Product: ARI Valves; D-060-C HF.

2.2 AIR AND VACUUM RELEASE VALVES FOR WASTEWATER SERVICE

A. Sewage Air and Vacuum Valve 2 Inches to 14 Inches:
1. Suitable for sewage service; automatically exhausts air during system filling and allows air to re-enter during draining or when vacuum occurs.
2. Rated working pressure of 150 psi, 1-inch through 3-inch valves with NPT threaded inlet and outlet, 4-inch and larger valves with ASME B16.1 Class 125 flanged inlet and threaded cover outlet, built and tested to AWWA C512.
3. Materials: Cast-iron or ductile iron body and cover, concave or skirted stainless steel float and trim, Buna-N seat.
4. Manufacturers and Products:
   a. APCO Valve and Primer Corp.; Series 401 SAVV to 414 SAVV.
   b. Val-Matic Valve; Series 301 to 306.

B. Sewage Air Release Valve 2 Inches to 4 Inches:
1. Suitable for sewage service; automatically exhausts entrained air that accumulates in a system.
2. Rated working pressure of 150 psi, built and tested to AWWA C512.
3. Materials: Cast-iron or ductile iron body and cover with NPT threaded inlet and 1-inch NPT threaded outlet, concave or skirted stainless steel float and trim; Buna-N resilient seat.
4. Manufacturers and Products:
   a. APCO Valve and Primer Corp.; Series 400 SARV or 450 SARV.
   b. Val-Matic Valve; Series 48 or 49.

C. Sewage Combination Air Valve 2 Inches to 6 Inches:
1. Suitable for sewage service; combines operating functions of air and vacuum valve and an air release valve. Air and vacuum portion shall automatically exhaust air during filling of a system and allow air to re-enter during draining or when a vacuum occurs. Air release portion to automatically exhaust entrained air that accumulates in system. Single body unit with air and vacuum valve and an air release valve in a single housing.
2. Rated working pressure of 150 psi; built and tested to AWWA C512.
3. Materials: Cast-iron or ductile iron body and covers, NTP threaded inlet and outlet, with concave or skirted stainless steel float and trim.
4. Manufacturers and Products:
   a. APCO Valve and Primer Corp.; Series 440 SCAV.
   b. Val-Matic Valve; Series 800.

D. Sewage Combination Air and Vacuum Valve 6 Inches to 14 Inches:
1. Suitable for sewage service; combines operating functions of air and vacuum valve and an air release valve using separate valves connected together. Air and vacuum valve shall automatically exhaust large quantities of air during system filling and allow air to re-enter

during draining or when a vacuum occurs. Air release valve to automatically exhaust small quantities of entrained air that accumulates in system.

2. Rated working pressure of 150 psi.
3. Materials: Cast-Iron or Ductile Iron Body:
   a. Air and Vacuum Valve:
      1) Upper and lower concave or skirted stainless steel float and trim.
      2) Inlet Flanges: ASME B16.1 Class 125 pound.
      3) Outlet: Flanged
      4) Seat: Buna-N.
   b. Air Release Valve: 2-inch NPT threaded inlet and 1/2-inch NPT threaded outlet; Buna-N seat.
4. Provide with all-bronze blow-off and flushing gate valves for each valve, all-bronze isolation gate valve between air and vacuum valve and air release valve; 5-foot rubber hose with quick disconnect couplings.
5. Provide with inlet butterfly isolation valve.
6. Manufacturer and Product: APCO Valve and Primer Corp.; Series 400C.

E. Sewage Rolling Seal Combination Air Valve 2 Inches to 8 Inches:
1. Designed for sewage service, uses rolling seal to allow smaller and larger amounts of air to automatically exhaust under pressure and air to enter when a vacuum occurs in a single valve body. Body designed to allow sewage solids to flow out of valve.
2. Stainless steel funnel shaped body with ASME B16.1 Class 150 flanged inlet and access flanges, reinforced nylon combination air and vacuum valve assembly and polypropylene discharge elbow, 250-psi working pressure, all-bronze drain/flush valve, flushing connection.
3. Foamed polypropylene float, EPDM rubber rolling seal mechanism with reinforced nylon plug, plug cover, and clamping stem, Buna-N O-ring.
4. Manufacturer and Product: ARI Valves; D-020.

2.3 FINISHES

A. Prepare piping appurtenances for field finishes as specified in Section 09 90 00 - Painting and Coating.

PART 3 - EXECUTION

3.1 As specified in Section 40 05 51 - Common Requirements for Process Valves: PART 3 – EXECUTION requirements for compliance with this Section.

END OF SECTION

SECTION 40 05 81 – HYDRANTS, HOSE BIBS, AND OTHER MISCELLANEOUS VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Hydrants
2. Hose Valves
3. Diaphragm Valves
4. Pinch Valves
5. Telescoping Valves
6. Mud Valves
7. Hydrostatic Pressure Relief Valves
8. Sampling Valves
9. Solenoid Valves

B. Related Requirements:
1. Section 40 05 51 – Common Requirements for Process Valves.

1.2 REFERENCE STANDARDS

A. American Water Works Association (AWWA):
1. C550, Protective Interior Coatings for Valves and Hydrants.

B. NSF International:
1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. As specified in Section 40 05 51 - Common Requirements for Process Valves: Submittal requirements for compliance with this Section.

PART 2 - PRODUCTS

2.1 NON-FREEZE YARD HYDRANTS

A. Description:
1. Type: Non-freeze.
2. Closure Valve: Free-floating, compression type.
3. Barrel: Automatic drain after use.
4. Stem: Nourishing.
5. Main Valve: 1-1/2 inches.
6. Lubrication: Furnish access hole in operating nut.

B. Materials:
   1. Body: Galvanized steel
   2. Head: Cast iron
   3. Outlets: Brass
   4. Main Valve: Bronze
   5. Drain Valve: Bronze
   6. Operating Rod: Stainless steel

C. Operation:
   1. Cam-type, cast-iron lever control.
   2. Drain Valve: Actuated when main valve is in CLOSED position.

D. Connections:
   1. Hose Connection: One each, ¾-inch hose connections.
   2. Drain Port: 1/8-inch.
   3. Inlet:
      a. Size: 1- inch.
      b. Type: Threaded.

E. Accessories:
   1. Operating handle lock.

F. Manufacturers: Woodford Iowa Model Y1

2.2 HOSE BIBS

A. Globe Valves:
   1. Globe Valve 3 Inches and Smaller:
      a. All-bronze, union bonnet, packed gland, inside screw, rising stem, TFE disc, Class 150 rated 150 psi SWP/300 psi CWP, complies with MSS SP-80 Type 2.
      b. Manufacturers and Products:
         1) Stockham; Figure B-22T, NPT threaded end.
         2) Crane Co.; Figure 7TF, NPT threaded end.
         3) Milwaukee; Model 1590T, soldered ends.
         4) NIBCO; Figure S-235-Y, soldered ends.
   2. Angle Pattern Valve 2 Inches and Smaller:
      a. All-bronze, NPT threaded ends, union bonnet, packed gland, inside screw, rising stem, TFE disc, Class 150 rated 150 psi SWP/300 psi CWP, complies with MSS SP-80 Type 2.
      b. Manufacturers and Products:
         1) Stockham; Figure B-222T.
         2) Crane Co.; Figure 17TF.
   3. Globe Valve 3 Inches and Smaller:
      a. All-bronze, union bonnet, packed gland, inside screw, rising stem, replaceable stainless steel tapered plug type disc and seat ring, Class 200 rated 200 psi SWP/400 psi CWP, complies with MSS SP-80 Type 3.
      b. Manufacturers and Products:

1) Stockham; Figure B-62, NPT threaded end.
2) Crane Co.; Figure 212P, NPT threaded end.

4. Globe Valve 2 Inches and Smaller:
   a. All-bronze, NPT threaded ends, union bonnet, packed gland, inside screw, rising stem, replaceable stainless steel tapered plug type disc and seat ring, Class 300 rated 300 psi SWP/1,000 psi CWP, complies with MSS SP-80 Type 3.
   b. Manufacturers and Products:
      1) Crane; Figure 382P.
      2) Stockham; Figure B-74.
5. Angle Pattern Valve 2 Inches and Smaller:
   a. All-bronze, NPT threaded ends, union bonnet, packed gland, inside screw, rising stem, replaceable stainless steel tapered plug type disc and seat ring, Class 300 rated 300 psi SWP/1,000 psi CWP, complies with MSS SP-80 Type 3.
   b. Manufacturers and Products:
      1) Stockham; Figure B-274.
      2) Crane; Figure 384P.
6. Needle Disc Type Globe Valve 1/8 Inch to 3/4 Inch:
   a. All-bronze, threaded bonnet, packed gland, rising stem, bronze body and stem, Class 200 rated 200 psi SWP/400 psi CWP, complies with MSS SP-80.
   b. Manufacturers and Products:
      1) Crane Cat.; No. 88.
      2) Stockham; B-64.
7. Needle Disc Type Globe Valve 1/8 Inch to 3/4 Inch:
   a. All-bronze, threaded bonnet, packed gland, rising stem, bronze body and stem, Class 200 rated 200 psi SWP/400 psi CWP, complies with MSS SP-80.
   b. Manufacturers and Products:
      1) Crane Cat.; No. 89.
      2) Stockham; B-264.
8. Globe Valve 2 Inches to 10 Inches:
   a. Iron body, bronze mounted, flanged ends, bronze seat, outside screw and yoke, bolted bonnet, Class 125 rated 125 psi SWP/200 psi CWP, complies with MSS SP-85 Type 1.
   b. Manufacturers and Products:
      1) Stockham; G-512.
      2) Crane; Figure 351.
9. Angle Type Hose Valve 1/2 Inch to 3/4 Inch:
   a. Bronze or manufacturer's standard brass, angle sillcock type body, threaded or solder inlet as applicable, pressure rating 125 psi cold water.
   b. Manufacturer and Product: Nibco; QTX Series.
10. Angle Type Hose Valve 3/4 Inch:

a. 3/4-inch NPT female inlet, 3/4-inch male hose thread outlet, heavy rough brass body rated 125 psi, lockshield bonnet, removable handle, atmospheric vacuum breaker conforming to ASSE 1011 and IAPMO code.
b. Manufacturers and Products:
1) Acorn; 8126, surface pipe mount valve, bent nose without flange.
2) Acorn; 8121, surface mount through wall valve, bent nose with flange.
3) Acorn; 8131, pipe and pedestal mounted valve located above 6 inches, straightnose.
4) Acorn; 8136, pedestal mounted valve located lower than 6 inches, inverted nose.

11. Globe Style Hose Valve 1 Inch to 3 Inches:
a. All-bronze, NPT threaded ends, inside screw-type rising stem, TFE disc, cast brass male NPT by male NHT adapter with hexagonal center wrench nut**,** complies with MSS SP-80, rated 300 WOG.
b. Manufacturers and Products:
1) Stockham; Figure B-22T.
2) Crane Co.; Cat. No. 7TF.
3) Nibco; Figure T-235-Y.

12. Angle Pattern Hose Valve 1 Inch to 2 Inches:
a. All-bronze, NPT threaded ends, inside screw-type rising stem, TFE disc, cast brass male NPT by male NHT adapter with hexagonal center wrench nut**,** complies with MSS SP-80, rated 300 WOG.
b. Manufacturers and Products:
1) Stockham; Figure B-222T.
2) Crane Co.; Cat. No. 17TF.
3) Nibco; Figure T-335-Y.

2.3 DIAPHRAGM VALVES

A. Diaphragm Valve 1/2 Inch to 12 Inches:
1. Straight-through type**,** polypropylene-lined cast-iron body, ASME B16.1 flanged ends, manual operator indicating, rising stem type with handwheel, neoprene diaphragm, in accordance with MSS SP-88, Category B.
2. Manufacturers and Products:
a. ITT Engineered Valves;
b. Saunders Valve, Inc.;

B. Diaphragm Valve, 1/2 Inch to 4 Inches:
1. Weir type with PVC Type 1, Grade 1, handwheel operator, position indicator, adjustable travel stop, clear molded acrylic stem cap.
2. Manufacturers and Products:
a. ASAHI/AMERICA; Diaphragm Valve Type 14.
b. ITT Engineered Valves; Dia-Flo.
c. Saunders Valve; Diaphragm Valve.

2.4 PINCH VALVES

A. Pinch Valve 1 Inch to 12 Inches:
   1. Cast-iron fully enclosed body, epoxy lined and coated, ASME B16.1 Class 125 flanged ends, one-piece molded Buna-N elastomer tube, full-port design, 90 psi minimum working pressure, double-acting upper and lower pinch bars that close on centerline, stainless steel stem, handwheel operator, position indicator, geared operator for valves 6 inches and larger.
   2. Manufacturers and Products:
      a. Red Valve Co.; Series 75.
      b. RF Technologies, Inc.; RF Valve.

2.5 TELESCOPING VALVES

A. Telescoping Scum Collection Valve:
   1. Rack and pinion type with offset floor stand and cast-iron offset floor stem incorporating rack guides, pinion, and handwheel supports. Rack and pinion and connecting rods Type 304 stainless steel, slip pipe brass with flat weir-crest skimming funnel, cast-iron pipe companion flange, O-ring seal and gasket for connection to discharge pipe. Skimming funnel minimum top diameter of 8 inches.
   2. Valve, 4 inches nominal and continuously adjustable from a high point of 1.5 feet below bottom of floor stand to a low point 5.50 feet below bottom of floor stand.
   3. Anchor Bolts: Type 316 stainless steel.
   4. Manufacturers and Products:
      a. Troy Valve.; Safety Lock Telescoping Valve
      b. Trumbull Manufacturing

2.6 MUD VALVES

A. Mud Valve 4 Inches to 24 Inches:
   1. Cast-iron frame, yoke, and gate; heavy-duty 125-pound flange style, bronze seat, Buna-N seal, nonrising stem**,** bronze stem and stem nut, 2-inch square operating nut, Type 304 stainless steel extension stem; stem guides spaced for L/R of 200 maximum**.**
   2. Manufacturers:
      a. Troy Valve.
      b. Trumbull Manufacturing, Inc.
      c. Clow Valve Company.

B. Cast Stainless Steel Mud Valve 4 Inches to 20 Inches:
   1. Heavy-duty CF8M stainless steel yoke, flange, guides, and gate; SBR rubber seat mechanically retained with Type 316 stainless steel fasteners**,** nonrising stem. Stainless steel casting to be passivated per ASTM A380. Type 316 stainless steel one-piece stem with integral thrust collar and coated with antigalling compound.
   2. Stem extension one-piece Type 316 stainless steel, 2-inch operating nut, floor box with position indicator**.** Stem guides Type 316 stainless steel with bronze bushings for L/R of 200 maximum. Cast top and bottom stem couplings Type 316 stainless steel.
   3. Manufacturers:
      a. Troy Valve.
      b. Trumbull Industries, Inc.

2.7 HYDROSTATIC PRESSURE RELIEF VALVES

A. Hydrostatic Pressure Relief Valve, Floor Type 4 Inches:
   1. Floor type, cast-iron body, grate, and cover, removable cover and strainer, body with integral seep ring, body length as shown on Drawings, neoprene rubber cover seat, epoxy body seat.
   2. Manufacturers and Products:
      a. M&H Valve; Style 147, F-1493.
      b. Clow Valve; Figure F-1493.

B. Hydrostatic Pressure Relief Valve, Wall Type 4 Inches:
   1. Wall type, flange style frame, cast-iron body and cover, bronze seat body, resilient rubber seat on cover, bronze hinge pins, cast-iron wall pipe with integral seep ring and strainer, length as shown on Drawings.
   2. Manufacturers and Products:
      a. M&H Valve; Style 147, F-1494/F-1496.
      b. Clow Valve; Figure F-1494/F-1496.

2.8 SAMPLING VALVES

1. Type 316 stainless steel wetted parts, hand operated iron crank, piston to extend to inner surface of vessel or pipe, sealed by two compressible replaceable Teflon rings, one above discharge port and other below discharge port, 3/4-inch NPT inlet and 3/4-inch NPT outlet**.**
2. Manufacturers and Products:
   a. Strahman Valves, Inc.; Piston Type Sampling Valve.
   b. Fetterolf Corporation; Rod-Seal Sampling Valve.

2.9 SOLENOID VALVES

A. Solenoid Valve 1/4 Inch to 2 Inches:
   1. Two-way internal pilot operated diaphragm type, brass body, resilient seat suitable for air or water, solenoid coil molded epoxy, NEMA insulation Class F, 120 volts ac, 60-Hz, unless otherwise indicated. Solenoid enclosure NEMA 250, Type 4 unless otherwise indicated. Size and normal position (when de-energized) as indicated on_____.
   2. Minimum operating pressure differential no greater than 5 psig, maximum operating pressure differential not less than 125 psig.
   3. Manufacturers and Products:
      a. ASCO;
      b. Skinner;

PART 3 - EXECUTION

3.1 As specified in Section 40 05 51 - Common Requirements for Process Valves: PART 3- EXECUTION requirements for compliance with this Section.

END OF SECTION

SECTION 40 41 13.13 - PROCESS PIPING ELECTRICAL RESISTANCE HEAT TRACING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Electrical heating tape
2. Connection system
3. Securing tape
4. Pipe mounted thermostat
5. Ambient thermostat

1.2 DEFINITIONS

A. Self-Regulating Index (SRI): The rate of change of power output in Watts per degree F, as measured between the temperatures of 50 and 100 degrees F.

1.3 REFERENCE STANDARDS

A. ASTM International:
1. ASTM B193 - Standard Test Method for Resistivity of Electrical Conductor Materials.
2. ASTM D2633 - Standard Test Methods for Thermoplastic Insulations and Jackets for Wire and Cable.

B. FM Global:
1. FM Approval Guide.

C. Institute of Electrical and Electronics engineers, Inc (IEEE): 515, Testing, Design, Installation and Maintenance of Electrical Resistance Heat Tracing for Industrial Applications.

D. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NFPA:
1. NFPA 70 - National Electrical Code (NEC).

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information for system materials and component equipment, including thermal properties, electrical characteristics, and connection requirements.

C. Shop Drawings:
1. Indicate system materials and component equipment.
2. Submit wiring and control diagrams, installation and anchoring requirements, fasteners, and other details.

3. Plastic Pipe Installations: Output adjustment factors for heating tape for the services indicated.
4. Pipe heat loss calculations for each pipe size to be heat traced.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping and appurtenances receiving heat tracing, and locations of source power and controls.

1.6 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.

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.

1.7 EXISTING CONDITIONS

A. Field Measurements:
1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SYSTEM DESIGN REQUIREMENTS

Nominal Pipe Size (In)	50 Degree Column Heat Trace Minimum Capacity (Watts/Ft)	75 Degree Column Heat Trace Minimum Capacity (Watts/Ft)	100 Degree Column Heat Trace Minimum Capacity (Watts/Ft)	Capacity
1/4	1.9	2.9	3.9	
1/2	2.5	3.9	5.2	
3/4	2.9	4.5	6.1	
1	2.2	3.4	4.5	
1-1/4	2.5	3.9	5.2	
1-1/2	2.8	4.3	5.8	
2	3.2	5.0	6.8	

2-1/2	3.8	5.8	7.8
3	4.4	6.8	9.1
3-1/2	3.6	5.5	7.4
4	3.9	6.0	8.1
6	5.3	8.2	11.1
8	6.7	10.3	13.9
10	8.1	12.5	16.8
12	7.3	11.3	15.2
14	7.9	12.2	16.5
16	8.9	13.8	18.6
18	8.2	12.6	17.0
20	9.0	13.9	18.7
24	10.6	16.3	22.0

A. Design Heating Load:
   1. Heating load to be calculated based upon a 50-degree F delta, 20 mph wind if pipes are located outdoors, insulation as specified in Section 40 42 13, Process Piping Insulation, pipe as specified in Section 40 05 10, Common Requirements for Process Piping, and shall include a 10 percent safety factor.
   2. Heat loss calculations shall be based on IEEE 515, Equation 1, Page 19.

2.2 ELECTRICAL HEATING TAPE

A. Cable: Self-limiting, parallel circuit construction consisting of continuous inner core of variable resistance conductive heating material between two parallel copper bus wires. Provide tinned copper braid for PVC, FRP, and stainless steel pipe applications.

B. UL Listing: Listed as self-limiting pipe tracing material for pipe freeze protection application in ordinary conditions.

C. Maximum Maintenance Temperature: 150 degrees F (65 degrees C).

D. Maximum Intermittent Temperature: 185 degrees F (85 degrees C).

E. Service Voltage: As indicated by branch circuits provided for heat tracing on the Drawings.

F. Manufacturers and Products:
   1. Raychem; BTV-CR.
   2. Thermon; BSX.
   3. Nelson; CL1-J1 or L1-J1.

2.3 CONNECTION SYSTEM

A. Rating: NEMA 250, Type 4 and Factory Mutual approved.

B. Operating Monitor Light: Furnish with each circuit power connection kit to indicate when heat tracing is energized.

C. Manufacturers and Products:
   1. Power Connection Kit:
      a. Raychem; JBS-100.
      b. Thermon; PCA-1-SR or DP-L.
      c. Nelson; PLT-BC.
   2. Splice Kit:
      a. Raychem; S-150.
      b. Thermon; PCS-1-SR.
      c. Nelson; PLT-BS.
   3. Tee Kit:
      a. Raychem; T-100.
      b. Thermon; DS-S.
      c. Nelson; PLT-BY.
   4. End Seal Kit:
      a. Raychem; E-150.
      b. Thermon; DE-S.
      c. Nelson; LT-ME.
   5. Lighted End Seal Kit:
      a. Raychem; E-100-L.
      b. Thermon; DLS.
      c. Nelson; LT-L.

2.4 SECURING TAPE

A. Plastic Piping Systems:
   1. Type: Aluminum foil coated adhesive tape.
   2. Manufacturers and Products:
      a. Raychem; AT-180.
      b. Thermon; AL-20P.
      c. Nelson; AT-50.

B. Metallic Piping Systems:
   1. Type: Glass or polyester cloth pressure sensitive tape.
   2. Manufacturers and Products:
      a. Raychem; GS54 or GT66.
      b. Thermon; PF-1.
      c. Nelson; GT-6 or GT-60.

2.5 PIPE MOUNTED THERMOSTAT

A. Type: Fixed, nonadjustable, set at 40 degrees F.

B. Sensor: Fluid-filled with 3-foot capillary.

C. Enclosure: Glass-filled nylon, NEMA 250, Type 4X weatherproof with gasketed lid.

D. Switch: SP-ST, UL listed, rated 22 amps, 120 to 240V ac.

E. Manufacturers and Products:
   1. Raychem; DigiTrace Model AMC-F5.

2. Thermon; E4X-1.
3. Raychem; DigiTrace Model E507S-LS for hazardous areas.
4. Thermon; E7-25325 for hazardous areas.

2.6 AMBIENT THERMOSTAT

A. Type: Adjustable setting (15 to 140 degrees F).

B. Sensor: Fluid-filled probe.

C. Enclosure: Epoxy-coated NEMA 250, Type 4X aluminum enclosure with exposed hardware of stainless steel.

D. Switch: SP-DT, UL or FM listed, rated 22 amps, 125 to 250V ac.

E. Manufacturers and Products:
1. Raychem; DigiTrace Model AMC-1A.
2. Thermon; B4X-15140.
3. Raychem; DigiTrace Model AMC-1H for hazardous areas.
4. Thermon; B7-15140 for hazardous areas.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install in accordance with the manufacturer's instructions and recommended practices.
2. Provide insulation as specified in Section 40 42 13, Process Piping Insulation, over all pipe heat tracing.
3. Ground metallic structures or materials used for support of heating cable or on which it is installed in accordance with applicable codes.
4. Wiring between power connection points of heat tracing cable branch lines shall be provided by heat tracing system supplier.
5. Provide end of circuit pilot lights on heat tracing circuits for buried piping.

B. Electrical Heating Tape:
1. Determine required length of electrical heating tape by considering length of circuit, number and type of fittings and fixtures, design heating load, and heating tape output.
2. Where design heating load exceeds heating tape capacity, install by spiraling.
3. Derate heating tape capacity when installed on plastic piping.
4. Install additional heating tape at bolted flanges, valves, pipe supports, and other fittings and fixtures as recommended by supplier, but not less than the following:

C. Heat Tracing Circuits: Limit individual lengths of heat tracing circuits such that maximum single circuit capacity is 20 amps when starting the circuit at 35 degrees F. Provide multiple 20-amp circuits as required at individual heat tracing locations.

D. Thermostats:
1. Install in accordance with manufacturer's instructions and as approved by Engineer.
2. For each group of heat traced circuit, install one ambient thermostat.

3.2 FIELD QUALITY CONTROL

A. Test each circuit with 500-volt insulation tester between circuit and ground with neutrals isolated from ground.
   1. Insulation Resistance: Minimum 1,000 megohms per 1,000 feet.

END OF SECTION

SECTION 40 42 13 - PROCESS PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Process piping insulation.
2. Jacketing.
3. Accessories.

1.2 REFERENCE STANDARDS

A. ASTM International:
1. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
5. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
6. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
7. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
8. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
9. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
10. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
11. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
12. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.
13. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
14. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
15. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
16. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
17. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
18. C1729, Standard Specification for Aluminum Jacketing for Insulation.
19. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.

20. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
21. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit product description, thermal characteristics, list of materials, and thickness for each service and location.

C. Samples: Submit one sample of representative size, illustrating each insulation type.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on-Site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Inspection: Accept insulation on-Site in manufacturer's packaging. Inspect for damage.

D. Store insulation according to manufacturer's instructions.

E. Protect insulation from weather and construction traffic, dirt, water, chemicals, and damage by storing in original wrapping.

1.5 EXISTING CONDITIONS

A. Field Measurements:
1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PIPE INSULATION

A. Type P-1: Fiberglass:
1. Material: UL rated, preformed, sectional bonded fiberglass per ASTM C585 with factory applied, Kraft paper with aluminum foil vapor barrier jacket with pressure-sensitive, self-sealing lap.
2. Insulation Temperature Rating: Zero to 850 degrees F.
3. Conductivity in accordance with ASHRAE 90.1 and maximum numerical value of 0.23 Btu in./hr square foot degrees F at 75 degrees F.
4. Jacketing per ASTM C1136 with minimum water vapor transmission for jacket of 0.02 perm-inch per ASTM E96/E96M. Furnish with no jacket if field finish system specified.

5. Joints: Matching pressure-sensitive butt strips for sealing circumferential joints.
6. Flame Spread Rating: Less than 25 per ASTM E84.
7. Smoke Developed Index: Less than 50 per ASTM E84.
8. Manufacturers and Products:
    a. Owens Corning Fiberglass; ASJ/SSL II.
    b. John Manville; Micro-Lok with Jacket.

A. Type P-2 Foamglass:
1. Material: Cellular glass per ASTM C552.
2. Nominal Density: 7.5 pcf.
3. Compressive Strength: 90 psi per ASTM C165.
4. Temperature Rating: Minus 290 degrees F to 900 degrees F.
5. Conductivity in accordance with ASHRAE 90.1 and maximum numerical value of 0.29 Btu in./hr square foot degrees F.
6. Minimum water vapor transmission for insulation of 0.00 perm-inch per ASTM E96/E96M.
7. Joints: Matching pressure-sensitive butt strips for sealing circumferential joints.
8. Flame Spread Rating: 0 per ASTM E84.
9. Smoke Developed Index: 0 per ASTM E84.
10. Follow manufacturer's recommendation, based upon temperature of piping to be insulated.
11. Manufacturer and Product: Pittsburgh Corning; Foamglas One.

A. Type P-3 Elastomeric:
1. Material: Flexible elastomeric pipe insulation, closed-cell structure in accordance with ASTM C534/C534M.
2. Temperature Rating: Minus 297 degrees F to 220 degrees F.
3. Nominal Density: 3 pcf to 6 pcf.
4. Conductivity in accordance with ASHRAE 90.1 and maximum numerical value of 0.25 Btu in./hr square foot degrees F at 75 degrees F per ASTM C177 or ASTM C518.
5. Maximum water vapor transmission of 0.06 perm inch per ASTM E96/E96M, Procedure A.
6. Joints: Manufacturer's adhesive.
7. Flame Spread Rating: Less than 25 per ASTM E84.
8. Smoke Developed Index: Less than 50 per ASTM E84.
9. Manufacturers and Products:
    a. Nomaco; K Flex.
    b. Armacell; AP Armaflex.

B. Type P-4: Noncombustible mineral fiber
1. Comply with ASTM C547, Type I or II.
2. Thermal Conductivity: 0.23 Btu-in./h-ft.-deg. F at 75 degrees F.
3. Maximum Service Temperature: 1,200 degrees F.
4. Canvas Jacket:
    a. Description: Plain-weave cotton fabric treated with fire-retardant lagging adhesive.
    b. UL listed.
    c. Weight: 6 oz./sq. yd.

C. Type P-5: Polyisocyanurate foam insulation, formed into shapes for use as pipe insulation.
1. Comply with ASTM C591, Type IV.

2. Density: 2 pcf.
3. Thermal Conductivity: 180-day aged value of 0.19 Btu-in./h-ft.-deg. F at 75 degrees F.
4. Operating Temperature Range: Minus 297 to 300 degrees F.
5. Vapor Barrier Jacket:
   a. Comply with ASTM C1136, Type I.
   b. Factory-Applied Film Thickness: 4 mils.
   c. Water Vapor Permeance: 0.02 perms.

D. Type P-6: Extruded polystyrene insulation
1. Description: Formed into shapes for use as pipe insulation.
2. Comply with ASTM C578, Type XIII.
3. Thermal Conductivity: 180-day aged value of 0.259 Btu-in./h-ft.-deg. F at 75 degrees F.
4. Operating Temperature Range: Minus 297 to 165 degrees F.
5. Vapor Barrier Jacket:
   a. Comply with ASTM C1136, Type I.
   b. Factory-Applied Film Thickness: 4 mils.
   c. Water Vapor Permeance: 0.02 perms.

E. Type P-7: Rigid molded hydrous calcium silicate
1. Description:
   a. Color: White.
   b. Asbestos free.
2. Comply with ASTM C533, Type I.
3. Thermal Conductivity: 0.45 Btu-in./h-ft.-deg. F at 200 degrees F.
4. Operating Temperature Range: 140 to 1,200 degrees F.

2.2 INSULATION AT PIPE HANGERS AND SUPPORTS

A. Refer to Section 40 05 07 - Hangers and Supports For Process Piping.

B. Copper, Ductile Iron, and Nonmetallic Pipe: High-density insert, thickness equal to adjoining insulation of Type 3 or other rigid insulation or manufactured pre-insulated pipe hanger and insulation shield. Extend insert beyond shield.

C. Steel Pipe: Insulation saddle or high-density insert, thickness equal to adjoining insulation of Type 3 or other rigid insulation or manufactured pre-insulated pipe hanger and insulation shield at support location. Extend insert beyond shield.

2.3 PIPE INSULATION JACKETS

A. Type J1Vapor-Retarder Jacket:
1. Description: White kraft paper with glass-fiber yarn, bonded to aluminized film.
2. Water Vapor Permeance:
   a. ASTM E96.
   b. 0.02 perms.

B. Type J2 PVC Plastic Pipe Jacket:
1. Polyvinyl chloride (PVC) jacketing, minimum 20 mils indoors and 30 mils outdoors, for straight run piping and fitting locations, temperatures to 140 degrees F.

2. Color: PVC jacketing shall be color coded to match colors listed in pipe schedule where suitable matching colors are available. If no suitable colors are available jacketing shall be white.
3. Flame Spread Rating: 25 per ASTM E84.
4. Smoke Developed Index: 50 per ASTM E84.
5. Manufacturers and Products:
   a. Knauf Insulation; Proto 1000.
   b. Johns Manville; Zeston 2000 or 300.
   c. Speedline; 25/50 Smoke-Safe.

C. Type J3 - Paint:
1. Type P3 Insulation: Acrylic latex paint, white, and suitable for outdoor use.
   a. Manufacturer and Product: Armacell; WB Armaflex finish.
2. Type P1 Insulation: In accordance with Section 09 90 00, Painting and Coating.

D. Type J4—Aluminum:
1. Aluminum Roll Jacketing: For straight run piping, wrought aluminum Alloy 3003, 5005, 1100, or 3105 to ASTM B209 with H-14 temper, in accordance with ASTM C1729, minimum 0.016-inch thickness, with smooth mill finish.
2. Vapor Barrier: Provide factory applied vapor barrier, heat and pressure bonded to inner surface of aluminum jacketing.
3. Fitting Covers: Material as for aluminum roll jacketing, premolded, one or two piece covers, which includes elbows, tee/valves, end caps, mechanical line couplings, and specialty fittings.
4. Metal Jacket Bands:
   a. Width: 3/8 inch.
   b. Thickness and Material: 0.015 inch, aluminum.
5. Manufacturers:
   a. RPR Products; Insul-Mate.
   b. ITW, Pabco-Childers.

E. Type J5 - Foamglass Jacketing:
1. Type P2 Insulation—Buried and Up to 1 Foot Above Grade: 70-mil bituminous resin with woven, glass fabric, aluminum foil layer, and plastic film coating, self-sealing manual pressure seals; Pittsburgh Corning Pittwrap SS.
2. TypeP2 Insulation—Greater that 1 Foot Above Grade: 30-mil modified bituminous membrane with self-sealing manual pressure seals; Pittsburgh Corning Pittwrap CW30.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor-Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2-Inch Diameter and Smaller:
1. Description: Galvanized-steel insulation protection shield.
2. Comply with MSS SP-69, Type 40.
3. Length: Based on pipe size and insulation thickness.

D. Piping 2-Inch Diameter and Larger:

1. Description: Polyurethane insert with aluminum single-piece construction and self-adhesive closure.
2. Thickness: Match pipe insulation.

E. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.

F. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: Comply with ASTM C449.

G. Insulating Cement:
1. Comply with ASTM C195.
2. Hydraulic setting on mineral wool.

H. Adhesives: Compatible with insulation.

PART 3 - EXECUTION

3.1 APPLICATION

A. General:
1. Insulate valve bodies, flanges, and pipe couplings.
2. Insulate and vapor seal hangers, supports, anchors, and other piping appurtenances that are secured directly to cold surfaces.
3. Do not insulate flexible pipe couplings and expansion joints.
4. Service and Insulation Thickness: Refer to Supplement Service and Insulation Thickness table following “End of Section” and to Piping Schedule in Section 400510 Common Requirements For Process Piping.

3.2 INSTALLATION

A. General:
1. Install in accordance with manufacturer’s instructions and as specified herein.
2. Install after piping system has been pressure tested and leaks corrected.
3. Install over clean dry surfaces.
4. Use insulating cements, lagging adhesives, and weatherproof mastics recommended by insulation manufacturer.
5. Do not allow insulation to cover nameplates or code inspection stamps.
6. Run insulation or insulation inserts continuously through pipe hangers and supports, wall openings, ceiling openings, and pipe sleeves, unless otherwise shown.
7. Install removable insulation sections on devices that require access for maintenance of equipment or removal, such as unions and strainer end plates.
8. Personnel Protection: Install on pipes from floor to 8 feet high. Install on pipes within 4 feet of platforms and to 8 feet high above platforms.

B. Connection to Existing Piping: Cut back existing insulation to remove portion damaged by piping revisions. Install new insulation.

C. Cold Surfaces: Provide continuous vapor seal on insulation on cold surfaces where vapor barrier jackets are used.

D. Placement:
   1. Insulate valves and fittings with sleeved or cut pieces of same material.
   2. Seal and tape joints.

E. Heat Traced Piping: Apply insulation after heat-tracing work is completed and inspected.

F. Roof Drains: Insulate vertical drops from roof drains to horizontal pipe, exposed and concealed horizontal piping, and 2 feet down on vertical risers from horizontal pipe.

G. Roof Drain and Overflow Drain Sumps: Insulate entire sumps.

H. Vapor Barrier:
   1. Provide continuous vapor barrier at joints between rigid insulation and pipe insulation.
   2. Install vapor barrier jackets with pipe hangers and supports outside jacket.
   3. Do not use staples and screws to secure vapor sealed system components.

I. Aluminum Jacket:
   1. Use continuous friction type joint to hold jacket in place, providing positive weatherproof seal over entire length of jacket.
   2. Secure circumferential joints with preformed snap straps containing weatherproof sealant.
   3. On exterior piping, apply coating over insulation and vapor barrier to prevent damage when aluminum fitting covers are installed.
   4. Do not use screws or rivets to fasten fitting covers.
   5. Install removable prefabricated aluminum covers on exterior flanges and unions.
   6. Caulk and seal exterior joints to make watertight.

3.3 FIELD FINISHING

A. Apply coating of insulating cement where needed to obtain smooth and continuous appearance.

B. Where pipe labels or banding are specified, apply to finished insulation, not to pipe.

C. Painting Piping Insulation (Exposed to View):
   1. Aluminum or color-coded PVC jacketing does not require painting.
   2. If insulated piping system is indicated to be painted in Section 40 05 10 - Common Requirements for Process Piping, piping shall receive the following:
      a. Prime coat in accordance with Section 09 90 00 - Painting and Coating.
      b. Finished insulation (and not pipe) shall be painted in accordance with Section 09 90 00 - Painting and Coating.

END OF SECTION

SECTION 40 61 00 - PLANT SCADA SYSTEM

PART 1: GENERAL

1.1 SCOPE

A. This specification describes the new Wastewater SCADA system to be installed in the expanded City of Gatesville WWTP.

B. The work shall be as specified herein and shown on the plans.

C. The approved SCADA Integrator for this project is Dedicated Controls, contact David Bounds at Dedicated Controls, LLC (972-736-2880), email david@dedicatedcontrols.com.

1.2 WORK INCLUDED

A. The work shall include the following:

1. Furnish and install a Master Terminal Unit (MTU) in the Main Control Panel (MCP) located in the Electrical Room adjacent to the Blowers and a Master Station Computer (HMI) located in the Administration Building. Include the following:

    a. Personal Computer.
    b. External hard drive backup.
    c. Display monitor.
    d. Printer
    e. SCADA System software.
    f. All database entry. All programming including the master station HMI displays, trends, logs, graphics, etc.
    g. All software including development software, application software and operating software.
    h. All programming required at the MTU.
    i. RTU’s in MCC #2, MCC#4 and the Bar Screen Control Panel.
    j. Fiber Optic Network system with switches to connect the RTU’s and the vendor supplied panels with the MTU.
    k. Note that the vendor supplying the corresponding panel will provide the programming required for that panel to communicate on the network.

2. Shop testing, field installation and field testing.

3. Startup and overall system test.

4. All additional materials, services and labor required, that is not listed above, to provide a satisfactory operating system meeting the requirements of this and related Specifications and the drawings.

1.3 RELATED SPECIFICATIONS

A. Related Specifications include, among others, the following:

1. Division 0 – Bidding Requirements, Contract Forms and Conditions of the Contract
2. Division 1 – General Requirements
3. Section 01 33 00 – Submittal Procedures
4. Section 01 70 00 – Execution and Closeout Requirements
5. Section 26 01 00 – Electrical General Requirements
6. Section 26 05 26 – Grounding
7. ~~Section 40 80 00 – Testing Instrumentation and Controls~~
8. ~~Section 40 67 00 – Control Panels~~

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1.4 QUALITY ASSURANCE

A. Referenced Standards. All equipment furnished under this Specification shall conform in all respects to current applicable federal, state and local rules and regulations and all current applicable standards, codes and testing procedures of the following organizations:

1. Instrument Society of America (ISA)
2. National Electrical Code (NEC)
3. National Electrical Manufacturers Association (NEMA)
4. Scientific Apparatus Makers Association (SAMA)
5. Underwriters Laboratories, Inc. (UL)

B. Where a conflict exists between any of the applicable rules, regulations, codes, standards, procedures, or this Specification, the more stringent requirements shall apply.

C. The major components of the system shall be as specified in this section and in the related Specifications listed above. Substitutes will not be accepted without the express written consent of the Engineer.

D. Standardization: Like parts are to be interchangeable. All equipment of a common type is to be the product of a single manufacturer.

E. System Coordination: Contractor shall review applications shown on the Drawings to assure proper selection, application and programming of equipment.

F. IC Contractor: The system shall be furnished and installed by a Contractor with a minimum of 5 consecutive years installing similar projects of the same size and scope as this project. Contractors not meeting this requirement will not be considered as qualified for this project.

1.5 Factory Testing

A. Prior to shipment, completely test the system hardware and software to prove out the functional integrity of the system and all of its components. Hardware tests are to be in accordance with Instrument Society of America, RP55.1, paragraphs 3 and 5 insofar as they apply.

B. Submit information on testing procedures for review and comment by the Engineer at least one (1) month in advance of scheduled test date. Include a schedule indicating the date of each test and the anticipated duration.

C. Provide the Owner at least fourteen (14) days written notice before any scheduled test.

D. Test input/output devices to verify operability and basic calibration.

E. Test all processing equipment to verify proper operation of the equipment as stand-alone units. Include AC/DC power checks, power fail/restart test, diagnostic checks and functional capability.

F. Verify proper functioning of data communications between units.

G. Perform an integrated system test with all equipment connected to verify that all processing equipment performs properly as an integrated system.

H. Demonstrate all system software utility and security programs to illustrate the various functions and capabilities.

I. Simulate all analog and discrete input/output count to show that the applications software associated with those points performs the functions intended.

J. Demonstrate software features to illustrate program generation, operation and display of application software to show that the applications software operating system commands and process monitoring, display and report features. Include display and generation of library, group, individual block, point summary, current alarm, graphic, historical trend, faceplate, live trend and all periodic reports.

K. Any tests which fail to the point where they have to be rescheduled at a later date must be retested at no additional expense to the Owner; and the costs for two Owner personnel to witness the retesting must be borne by the manufacturer.

L. Field Testing shall comply with Section 16951.

1.6 SUBMITTALS

A. The following Drawings shall be submitted per Sections 01 33 00 and 26 01 00 and sections referenced therein for approval before commencement of manufacture of the items mentioned thereon. Submit any additional shop drawings necessary for comprehension and review of intended work.

1. Block diagram showing arrangement of the system including the existing system components.
2. Outline dimensions of equipment.
3. Functional drawing showing the overall operation of the equipment.
4. Details of terminals and terminal blocks.
5. Complete data highway map. The highway map shall include all system interconnection details. It shall include all hardware details of the data highway and the equipment tied to it.

6. A complete list of all hardware supplied with this Contract. List shall be tabulation according to tag number, supplier ID, manufacturer, model number, and hardware revision, quantity, etc.
7. Configuration drawings:
   a. Reflect all control logic required by the Contract Documents.
   b. Each function block with a tag descriptor shall include respective tag descriptor and associated functional description identified next to the function block.
8. Power consumption breakdown for all electrical devices (actual loading, not maximum capabilities).
9. Catalog cut sheets and data sheets.
10. Schematic ladder diagrams.
11. Field interconnection wiring diagrams showing all I/O connections to field devices.
12. Listing of all I/O points.
13. Detailed information on all software.
14. A minimum of five (5) typical graphic screens.

B. Submit Operation and Maintenance (O&M) manuals per the requirements of Sections 01 77 00 and 26 01 00 and sections referenced therein. Include the following:

1. Certified copies of all shop drawings.
2. Complete detailed drawings of all systems with each component tagged with tag number corresponding to a complete parts list.
3. Complete description of system operation.
4. Complete description of equipment operation instructions.
5. Complete description of operator's preventive maintenance instructions.
6. Troubleshooting instructions.
7. Complete listing of repair parts by number and/or model number.
8. External and internal wiring diagrams, cable and plug diagrams, and internal panel and console wiring diagrams.
9. Manuals to explain in clear and precise language the normal operating procedures, significance of alarms malfunction analysis, emergency procedures in the event of malfunctions, operational safety features, and other descriptions as required to fully familiarize the plant operators with systems' capabilities.
10. System test plans and procedures.
11. Simple English language instructions on how to operate the system through the Operator's CRT Keyboard.

C. Programming Documentation.

1. Deliver one (1) copy on disk of the programming documentation to the Owner within 30 days of the final acceptance date, at which time all programs are to be debugged and fully operational.
2. Include the following as a minimum:
   a. General description of the program including input and output message formats.
   b. Program logic.
   c. Nondependent and dependent flow charts.
   d. Assembled listing of all supplied software programs.
   e. Memory maps for CPU's internal storage and for memory storage units.

f. Glossary listing all variables used in the coding.
g. Table of mathematical formula used in the coding.
h. Coding techniques and decision tables, including decision strategy for priority level program security.
i. Source records.
j. Computer manufacturer's user manuals.
k. Complete instructions on how a program is used including execution procedures and system software dependency.
l. Source code and listing for all applications software, data base and other configuration data supplied.
m. English language explanation of each programming statement, programming statement, programming loop and subroutine calls.

D. Configuration Data.

1. Furnish one (1) disk copy of configuration data describing how the final system is configured.
2. Include the following as a minimum:
   a. Point data base showing all parameters of all points including I/O, internal points and calculations.
   b. Controller configurations including software, points, control modules, space I/O and memory.
   c. System memory allocation.
   d. Historical data configuration.
   e. Lab and maintenance data configuration.
   f. Display organization and configuration.

E. Users' List. The Owner is to be placed on the users' mailing list to receive update information on hardware and software and revisions to documentation. This service is to be free of charge to the Owner through the end of the maintenance contract period.

1.7 PROJECT/SITE CONDITIONS

A. All system equipment located shall be capable of operation in the following environment:

1. Ambient temperature: 50 to 104 DegF.
2. Humidity: 20 to 80 percent.
3. Atmospheric pressure: 29.92 to 20.72 IN HG.
4. Enclosure rating: NEMA 12.

1.8 WARRANTY

A. The Contractor shall guarantee that the system additions (both hardware and software) shall have availability in excess of 99.8 percent for a period of 12 months. This period shall commence after site acceptance tests have been found satisfactory.

B. The design goal for the mean-time-to-repair of any component, through use of maintenance diagnostic aids, procedures, and trained personnel shall be to achieve less than 1 HR during the first year of operation.

PART 2: PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. See individual Specification sections for acceptable manufacturers that are not specified herein.

2.2 EQUIPMENT

A. General:

1. All components shall be industrial process type. Where Contractor cannot furnish equipment to perform the function as specified, equipment may be substituted subject to prior written approval by the Owner.
2. System shall implement fully bumpless, balanceless transfer between automatic and manual control.

All control hardware (power supplies, operator consoles, field termination panels) shall be sized to include 25 percent spare space, power, memory, and terminations.

B. A Personal Computer Workstation shall be provided and installed in the Office at the Administration Building. The PC shall serve to provide an HMI for the SCADA System functions, including:

1. The HMI shall serve all SCADA functions for the remote sites and provide a graphical user interface (GUI) developed via the specified HMI software.
2. Peripherals: PC shall include Dual Monitors, Keyboard, Mouse, Printer, UPS and Business Productivity Software. The OIT shall be Dell Precision Workstations T5810 (or successor equivalent) with the following minimum specifications for each of one (1) PC:
   a. Processor: Intel® Xeon® Processor E5-1603 (Four Core 2.80GHz,10M)
   b. Operating System: Genuine Windows® 10 Professional, SP1, 64-bit
   c. Warranty: 3 Year Pro Support for End Users and 3 Year NBD 7x24 Onsite Service after Remote Diagnosis
   d. Video Card: 1GB AMD FirePro V4900, Three Monitor, 2 DP & 1 DVI
   e. Memory: 8GB, DDR3 UDIMM Memory, 1600MHz, Non-ECC (4 DIMMS)
   f. Optical Drive: 16X DVD+/-RW and 8X DVD
   g. Raid Configuration: None
   h. Hard Drive 1: 1TB, 7200 RPM, 3.5” SATA 6Gb/s, Hard Drive
   i. Network Adapter: Intel X520-T2, 10GbE NIC, Dual Port
   j. Monitor: Dell 22 inch Professional P2212H Widescreen, Adjustable Stand, VGA/DVI
   k. Speakers: AC511 Sound Bar for Select Dell Flat Panel LCD Monitors
   l. Keyboard: USB Entry Quiet key, No Hot Keys
   m. Mouse: Dell USB Optical Mouse with scroll, All Black Design w/mouse pad
   n. Printer: One (1) Dell Color Laser Printer, 3 yr Ltd. Warranty- Advance Exchange,
   o. UPS for PC: APC Back-UPS RS 750VA with Phone, Coax & Network Protection w/LCD
   p. Productivity software for each PC shall be Microsoft® Office Latest Business Edition and Adobe Acrobat DC STD.

C. Control Panels shall comply with Section 40 67 00. Panels shall be provided with an Operator Interface Display (OID) on the door. The OID shall have the following features:

1. The OID shall allow the Operator to view and modify system variables within the PLC.

2. Operator Interface shall be Maples Systems HM5121T, 12.1" touchscreen with the following features:

a. Bright 65,536 (16 bit) color TFT display.
b. Built-in Ethernet, serial, USB and compact flash ports.
c. Support for Allen-Bradley, Ethernet I/P and Modbus TCP/IP.
d. Up to four protocols simultaneously.
e. True Type fonts and international characters.
f. Data logging and data sampling.
g. Online/offline simulation.
h. Alarm and recipe management.
i. Animation and popup windows.
j. 2 year warranty.
k. 2" depth

3. Specifications

a. 200 MHz, 332 bit CPU
b. 32 MB Flash memory, 64 MB DRAM
c. 20 bit stereo audio sound
d. 800X600 resolution
e. 200:1 contrast ratio
f. 300 cd/sqm brightness
g. 1000 record data logging/sampling capacity
h. 6 levels of security, 3 passwords per level
i. 8 channel trending
j. Panel mounting bezel.

2.3 SOFTWARE - Supervisory Control and Data Acquisition (SCADA) Software

A. GENERAL REQUIREMENTS

1. SCADA software shall be commercially available off-the shelf and shall be non-proprietary, such that independent systems integrators are able to provide configuration and maintenance services as required.

2. Software shall be Client/Server architecture. No Microsoft Client Access Licenses (CAL) or Terminal Services shall be required for full installation (thick) or browser-based (thin) clients.

3. Software shall offer options for unlimited, concurrent Thin Client connections for connectivity of common mobile device operating systems.

4. Software shall support running as a Microsoft Windows® service.

5. Software shall support running in a virtualized server environment.

6. Software shall support installation on a Storage Area Network (SAN) or Network-Attached Storage (NAS).

7. Software licenses shall be upgradable for an annual fee such that the client is able to download and install the current version of the product.
8. Software shall be tag-based and have an integrated development environment for creation of all aspects of the application.
9. Software shall be compatible with commercially available, off-the shelf PC hardware running Microsoft Windows client and server operating systems currently available at the time of installation.
10. Software shall not require dedicated server-level PC hardware for any individual system components.
11. Software shall support any computer running a thick copy of the software performing as both an application server and a user interface. Software shall support automatic server failover to an unlimited number of servers.
12. Software shall include the following integrated components available as standard components or for an optional add-on price. These components shall not require 3rd party software. However, the system shall allow 3rd party components to be used if required.

    I. Online application development environment with version control.
    II. I/O drivers for a wide selection of communication protocols.
    III. Alarms management and alarms/events history.
    IV. Fully-integrated historian.
    V. Real-time and historical data trending and tabular views.
    VI. Report generation.
    VII. Security management.
    VIII. Unlimited operator logbooks.
    IX. Support for networked applications.
    X. Support for server redundancy.
    XI. An object-oriented scripting language with debugging tools.
    XII. Browser-based thin clients for PCs and Mobile devices.
    XIII. Alarm notification to off-site operators (email, text message and voice.)
    XIV. Interfaces for 3rd party software programs to access data (real-time and historical) and alarms via ODBC, OPC, SNMP, or SQL.

13. Software shall automatically compensate for deploying the same application simultaneously on a variety of monitor resolutions, while maintaining the aspect ratios of all displays.
14. Software shall protect against file corruption in the event of an unexpected loss of power or hardware failure. Software shall support an automatic, orderly shutdown when power levels drop to a user defined setpoint.
15. Software shall support automatic startup upon computer restart, to full operation without user intervention.
16. Software shall provide a mechanism to backup and restore the entire application configuration.

17. Software shall include an integrated security system supporting an unlimited number of user accounts, roles and privileges. System users with appropriate account privileges shall be capable of changing the application configuration without requiring the software supplier's assistance. No lockout mechanisms or passwords shall be withheld from the final customer.
18. Integrated software help manuals shall be provided to assist operators and maintenance personnel with operational and configuration tasks.

B. SERVER REDUNDANCY AND LOAD BALANCING

1. Redundancy
    a. A minimum of three levels of redundancy for all application services shall be supported. Software shall support automatic failover from primary server to backup server(s). No manual intervention shall be required. This functionality shall be supported in both standard and virtual server environments.
    b. Software must not require each redundant server to use a second network card to monitor the availability status of the primary server.
    c. All servers shall be aware of which server is in control of each software process. No two servers shall perform the same function at the same time (e.g. I/O communications to a specific device, incrementing a totalizer.)
2. Load balancing
    a. Software shall support the assignment of specific services (e.g. alarms management, alarm notification) to specific computers.
    b. Software shall support distribution of historical data storage to an unlimited number of computers.
    c. Software shall support management of alarm and event history separately from I/O process history.
    d. Software shall allow each workstation to hold a complete and automatically synchronized copy of alarm and event history so that alarms can be managed locally on any workstation in the event that the workstation's connection to the rest of the network is lost.
    e. Software shall automatically redirect incoming thin client connections to the server with the lowest number of active thin client connections.
    f. Software shall support redundant networks and shall be able to use these for load distribution when both are available.

C. THIN (BROWSER-BASED) CLIENTS

1. Software shall offer an optional zero-footprint thin client for use with HTML5-compatible browsers running on operating system variants, including:
    a. Windows
    b. Linux
    I. Apple
    II. Android

2. Server for thin clients shall be an integral feature of the SCADA software. Use of the thin client shall not require a 3rd party Internet server software (e.g. Microsoft IIS, Apache).
3. System shall support two levels of server redundancy for thin client connectivity, with automatic failover and client load sharing.
4. System shall support cyber security measures including Firewalls, Virtual Private Networks (VPN) and Secure Socket Layer (SSL.)
5. Thin client connections shall be concurrent. Tools shall be provided to monitor client connectivity and to disconnect users or switch them to alternate servers on demand.
6. The thin client shall share the same security accounts as the rest of the SCADA Software. A separate privilege shall be required for browser client access. Revocation of this privilege will immediately terminate the user's client connection.
7. Thin Client displays shall be generated automatically, requiring no additional configuration.
8. On-line configuration changes shall be deployed immediately to all thin client interfaces without requiring the client interface to be restarted or refreshed.
9. The Thin Client user interface shall be offered in two variants, the choice of which to use being user-selectable.
    a. Graphical (preferred for large user interfaces) – A user experience mirroring (graphically and operationally) that of the Thick Client.
    b. Text-based (preferred for mobile phone interfaces) – Simplified lists of monitored values, with support for control actions, alarms management, trending and mapped asset view.

D. HISTORIAN

1. Historian shall support logging of all the SCADA system data, including real-time, historical, transactions, alarms and events, regardless of the number of tags in the system. For example, a 25,000 tag system shall support historical data storage for 25,000 tags, plus alarms and events.
2. Software shall include an integrated Historian and historical data storage at no additional cost, but may optionally use Microsoft SQL as the database.
3. The Historian and its historical data storage shall not require dedicated server computers; however, dedicated servers may be used if preferred by the customer.
4. Historian shall be capable of logging up to 4,000 values per second.
5. A synchronization scheme shall be included such that a copy of all historical data storage resides on all designated computers. Data shall be synchronized in real-time.
6. Any historical database that has been offline must be automatically resynchronized with the historian holding the most recent data. Software shall be capable of synchronizing 100,000+ values per second between databases. This process shall occur in parallel with runtime SCADA processes and shall be designed to minimize interference.

7. Distributed Historian architecture shall be supported. For example, two plants (A and B) may be responsible for historical storage for locally collected data, while a central facility (C) may be responsible for redundant historical storage for both A's and B's data. This architecture shall be scalable to support the addition of future plants.
8. Historian shall support SQL queries of logged historical data. Queries of historical data may be for raw data or summary (value at beginning, average, max, min, delta) over a period.

E. Transaction Data

1. System shall provide a means to reliably collect and log (to historical data storage) transaction data from a field device. Transaction data is defined as a data set of related values stored with the same timestamp.
2. The transaction data capture process must include error checking.

F. Historical Data Display (trend plots and tabular)

1. Software shall display historical and real-time data in both plot and tabular format.
2. Software shall allow users to generate ad-hoc plots of historical data by clicking on each of the values to be trended. Selected groups shall be recordable for future recall.
3. Software shall support ad-hoc and preconfigured trend plots of real-time and historical data as integrated elements of graphical process displays. Historical and real-time plotted values shall be shown in a continuous, uninterrupted, scrolling fashion. The display shall support:
    a. An unlimited number of pens (i.e. tag values), including both analog and digital values. Name and description of each tag shall be provided.
    b. Analog pens as either layered or as stacked individual plots.
    c. Time frame selectable from one second to five years.
    d. Scaling for each pen as high/low values or graduated divisions.
    e. Value of each tag at the date/time of the mouse location.
    f. Statistical data, including average, minimum and maximum values, for each plot.
    g. Annotating trends
    h. Stop/pause scrolling.
    i. Zoom in/out on the time (x) and value (y) axis.
    j. Pan/Scroll along the time axis or select a particular date to display.
    k. Move analog tag plots vertically (in the value (y) axis), either individually or as a group.
    l. Print displayed plot data.
    m. Annotate a particular point in time on the plot.

n. Display alarm setpoints that are associated with the tag(s) as continuous marker lines across the plot.

o. Export plotted data to comma separated value (.csv) file or directly to a database, for use by 3rd party data analysis software.

p. Display plot data on a dedicated page, or as a component of a process display page.

q. Allow configuration of the plot display characteristics.

r. For tabular data, means shall be provided for the following;

s. An unlimited number of pens (i.e. tag values), including both analog and digital values. Name and description of each tag shall be provided.

t. Time frame selectable from one second to five years.

u. Stop/pause scrolling.

v. Show raw data.

w. Show summary data for a duration sampled at consistent periods (e.g. average, minimum or maximum value every 15 min for past 8 hrs).

x. Export plotted data to comma separated value (.csv) file or directly to a database, for use by 3rd party data analysis software.

G. Alarms and Events Management

1. Software shall include alarms and events management tools consist with implementation of the ANSI/ISA 18.2-2009 Management of Alarm Systems for the Process Industries standard.

2. Software shall include a predefined alarms and events management interface. The interface shall provide the following operational tools.

a. Lists of Current, Unacknowledged, Disabled, Active, Configured Historical and Shelved alarms and events.

b. Tools for searching and filtering lists.

c. Add a blog-style note to any alarm.

d. Day and night view toggle.

e. Acknowledgement of individual alarms or all visible alarms.

f. Option to require confirmation before acknowledging all alarms in the list.

g. Option to require that a note be created when alarms are acknowledged.

h. Font size adjustment for visually impaired users.

i. Representation of alarm priorities using shape, color and numeric priority level for enhanced operational awareness.

j. Option to plot data associated with an alarm.

k. Option to open a process display where the alarm is currently shown.

l. Option to have a relevant process display open automatically if there is no operator action for a defined period of time following the triggering of that alarm.

m. Alarm mute and silence.

n. Alarm shelving options for a defined period or indefinitely. Shelved alarms shall still be recorded to the alarms history but shall not annunciate or require acknowledgement.

o. Option to include or exclude shelved alarms in the list of Current, Unacknowledged, and Active alarms. Shelved alarms to be visible at all times in lists of Historical alarms and events, Configured alarms and Shelved alarms.

3. Alarm acknowledgement shall immediately be propagated to all networked stations.

4. A full redundant copy of alarm and event history shall be stored on every workstation, allowing that workstation to continue to process local alarms in the event that it becomes isolated from the network. History to be automatically synchronized when the workstation is reconnected to other servers.

5. Software shall allow alarms to be associated with functional areas, such that a user only has to deal with alarms in his/her functional area(s).

6. Alarm occurrence, acknowledgement, clear, disable and shelve actions shall be recorded.

7. Alarm disabling to be provided only as a configuration option, not as an operational action.

8. Software shall provide user-configurable settings for dead band on analog alarms and delay on analog and digital alarms.

9. Alarms and events records shall include:

a. Time/Date stamp.

b. The name and description of the alarm tag.

c. Priority.

d. Status of Alarm (i.e. Active, Acknowledged, Cleared). Alarm Acknowledgement records shall include the name of the user who acknowledged the alarm.

e. The value of the associated tag at the time of alarm occurrence.

f. The value of the alarm set point at the time of alarm occurrence.

10. Software shall support an unlimited number of alarm priorities and shall allow unique annunciation sounds, shapes, and colors for each.

11. Alarm annunciation shall be configurable to use alarm tones, text to speech descriptions, sound files or popup displays.

12. Users must be notified, both visibly and audibly, of the occurrence of an alarm, regardless which display is presently being viewed.

H. ALARM SYSTEM AUDITING AND REPORTING

1. Software shall support printing of alarms/events created over a range of dates/times.
2. Software shall provide a means to identify frequently occurring alarms (e.g. nuisance alarms.
3. Software shall provide a means to identify and analyze alarm flood conditions.
4. Software shall provide a summary of alarm percentages by priority, for comparison with generally accepted percentages as defined in the ANSI/ISA 18.2-2009 Management of Alarm Systems for the Process Industries standard.

I. ALARM NOTIFICATION SYSTEM (FOR REMOTE USERS)

1. The Alarm Notification System shall support alarm notification via dial-out over voice modem (using text-to-speech), VoIP (either direct or via POTS to VoIP converter) SMS text message, email and alphanumeric pager. Alarm acknowledgement shall be supported during voice calls and via email and text message.
2. The Alarm Notification System shall allow status retrieval and alarm acknowledgement via dial-in over voice modem (using text-to-speech.)
3. The Alarm Notification System shall be an integrated feature of the SCADA systems and shall not require a separate tag database and security system.
4. Email messages shall support outgoing mail with transport layer security (e.g. Gmail, Yahoo Mail, or corporate email server.)
5. The Alarm Notification System shall be capable of annunciating alarms to rosters of users with up to 30 contacts per roster. An unlimited number of rosters shall be supported. The system shall support associating rosters with functional areas, such that alarms in these functional areas will activate notification to the appropriate contacts.

J. SITE LISTS AND MAPPING

1. Software shall allow for the creation of "sites" which are collections of I/O tags, with an optional location that can be represented using Latitude and longitude coordinates.
2. Sites shall be user-definable to store and provide a configuration interface for any user-specified data.
3. Sites shall be user-configurable to control whether and how they are to be displayed in Site Lists.
4. Sites shall be user-configurable to control whether they will open a pre-defined screen showing the associated collection of I/O tag data, or open a user-selected display screen.
5. Software shall support common online mapping services (e.g. MapQuest, OSM, Google Maps) with zoom and pan features such that remote assets can be automatically mapped based on latitude and longitude coordinates.
6. Software shall include an integrated map display, wherein sites can be displayed at their latitude and longitude coordinates.
7. Software shall allow for user creation and selection of the icons used to represent sites on the map.

8. Software shall allow users to navigate the map including zoom and pan features.
9. Icons used to represent sites on the map shall be capable of displaying information about the site including current connection status and presence or absence of active alarms within the site.
10. Icons used to represent sites on the map shall include a built-in navigational link to either an automatically-generated page displaying all I/O tags within the site, or to a user-selected page.
11. Software shall provide a means to define and display pipes or other connections between sites.
12. Pipes or other connections between sites shall be user-configurable to include any relevant information about the connection.

K. SECURITY MANAGEMENT

1. Software shall include a security system with privilege and role-based user accounts. Level-based access shall not be acceptable.
2. Security system shall support an unlimited number of user accounts and roles. System shall allow creation of an unlimited number of additional security privileges where necessary.
3. User passwords must be configurable to require a minimum length, contain a combination of letters, numbers and special characters, and expire after a pre-set period. User passwords shall be stored in an encrypted format.
4. System shall allow changes to user accounts, roles and privileges while the application is running. Changes shall become effective immediately.
5. User logon and logout activity shall be recorded in the application event log. Disabling accounts after X failed attempts within Y seconds shall be supported where X and Y are configurable options.
6. System shall provide a mechanism to limit client access to specific IP addresses.
7. System shall support authentication of user accounts via a Windows domain and authorizing SCADA user roles from domain security groups.
8. System shall support the use of proximity cards/readers.
9. The integrated version control system shall allow the option of including or excluding security-related changes if returning the application to an earlier configuration state.

L. REPORT GENERATION

1. Authenticated operators shall, in the runtime environment, be able to produce reports including any analog, digital or calculated tag data from the historical database.
2. Data format options shall be as follows:
    a. To screen.
    b. To a comma separated value (.csv) file.
    c. To a text file.

d. To an ODBC-compliant database.

e. To any direct-connected or networked printer.

f. To a 3rd party software (e.g. Microsoft Excel) template for advanced data analysis and formatting.

g. To e-mail, if an external email server is provided.

3. Reports may be created for one-time use or saved for reuse.

M. The following reports should be included:

1. Analog Summary Report
2. Daily Snapshot Report
3. Daily Total Report
4. Derived Flow Report
5. Detail Report
6. Driver Communication Error Detail Report
7. Driver Communication Summary Report
8. Hourly Snapshot Report
9. Hourly Total Report
10. Rainfall Report
11. Pump Activity Report
12. Pump Discrepancy Report
13. Standard (raw data) Report
14. Report generation shall be invoked either on demand, by a monitored event, or on a scheduled basis.
15. For reports that are created on a scheduled basis, a mechanism shall be provided to allow operators to re-create the last scheduled report.
16. All regulatory reporting requirements shall be electronically logged at intervals required by law, trended on a time/value chart, and reported to a Microsoft Excel spreadsheet properly formatted to meet Texas Commission on Environmental Quality (TCEQ) requirements to reflect the required reporting time intervals.
17. XL Reporter shall be furnished for reporting software.

B. ELECTRONIC OPERATOR NOTEBOOKS

1. System shall support operator logbooks for recording ad-hoc notes or predefined notes as threads, in that notes can have associated comments.
2. Notebooks shall be searchable by keyword, user account and time/date.
3. Notebooks shall be color-coded for easy identification.
4. System shall support creation of an unlimited number of notebooks for association with system elements, such as equipment and trended pen groups.

5. All notes shall be encrypted and include the name of the user's account and the time/date of creation. All notes entered into the notebook shall be immediately viewable from all clients and servers.
6. System shall not allow editing or deleting notes once created, to prevent tampering.
7. System shall support the addition of comments to existing notes.
8. System shall support the option of requiring operator authentication as part of the note creation process.
9. System shall support printing of notes by range of dates/times.
10. System shall support the export of notes for a selected range of dates, to a format that can be easily viewed / printed from any workstation without the need for a (HTML)

C. INTEGRATED DEVELOPMENT ENVIRONMENT

1. An intuitive graphical development environment with drag and drop tools shall be used for configuration of application displays. A ribbon bar along the top of the display, as common to Microsoft office tools, is preferred.
2. Displays shall support zoom and pan actions.
3. A large library of static and animated graphics shall be provided with the software. Software shall support dragging and dropping additional graphics into the library.
4. Standard features shall be included for the following;
    a. Analog and digital inputs and outputs.
    b. Retentive counters. Values will persist if power is lost and subsequently restored or if failing over to a backup server.
    c. Retentive totalizers. Values will persist if power is lost and subsequently restored or if failing over to a backup server.
    d. Historical calculations (e.g. average flow over last hour.)
    e. Software shall include pre-built displays for standard user interfaces. The following pre-built displays shall be provided as a minimum:
    f. Alarm display that can be filtered by name and includes current, unacknowledged, disabled, shelved and history.
    g. Trending and tabular viewing of historical data.
    h. Report creator.
    i. Operator notebook.
    j. Site map.
    k. Site list.
5. Software shall allow calculations to be associated with each graphic object to facilitate movement, visibility, sizing and rotation.

6. Software shall allow multiple objects to be saved as a template graphic. The following template capabilities shall be supported;
    a. A template may be associated with a tag structure.
    b. Each new instance of the template will inherit the properties of the template, such that changes to the template will automatically update all instances created from it.
    c. The template may have any number of parameters, including tags and text values, which can be used to animate objects within the template. Each new object created from the template may include different parameters.
7. Templates may be imported from other projects.
8. Copy/paste/rename/delete for any template.
9. Ungrouping of any instance of the template.
10. Software shall support the creation of template displays. The following capabilities shall be supported;
    a. A template display may be associated with a tag structure.
    b. Each new instance of the template will inherit the properties of the template, such that changes to the template will automatically update all instances created from it.
    c. The template may have any number of parameters, including tags and text values, which can be used to animate objects within the template. Each new object created from the template may include different parameters.
11. Templates may be imported from other projects.
12. Copy/paste/rename/delete for any template.
13. There shall be no limit to the number of animated graphics that can be used to represent the same tag value.
14. Software shall support background bitmaps on graphical pages.
15. Users shall be able to select all or a subset of the graphics on any display and see a list of the associated tags. The list of tags shall be modifiable individually or using search and replace tools.

D. I/O Drivers (Field Device Communications)
    1. Software shall support an unlimited number of field devices and different I/O drivers in the same application.
    2. Software shall include support for communications over Serial port and TCP/IP.
    3. Software shall include, at no additional cost, I/O drivers for:
        a. Protocols - Ethernet/IP (CIP), Allen Bradley DF1, Modbus
        b. Manufacturers - Rockwell/Allen Bradley, Control Microsystems, Siemens, Square D.
    4. Software shall support the development of additional I/O drivers where necessary.
    5. Software shall support multiple communications protocols over a single communications port.

6. I/O drivers shall support redundant failover to one of more server computers. Software shall support redundant physical links to any field device, such as primary connectivity via Ethernet and redundant connectivity via serial port. Redundant links shall support similar or different protocols.
7. Software shall provide tools for polling telemetry devices (e.g. RTUs) directly. Software shall allow real-time tuning of each device's polling frequency without interrupting the polling cycle or restarting the application. To optimize I/O communications for telemetry applications, the polling order shall be configurable and polling shall be asynchronous (if permitted by the remote telemetry unit.)
8. Software shall be capable of pooling modems connected to one or more servers, for use in I/O communications.
9. Tools shall include methods for monitoring communication statistics and reporting errors for each I/O driver. Software shall support radio diagnostics monitoring for radio modems (e.g. Dataradio/Calamp, MDS.)
10. Software shall support writing to multiple output tags via a single write request. This shall allow writing a set of default values to a set group of field device registers.
11. Software shall support rewriting the last written value to an output.

E. Tag Database

1. A browser shall be provided for tag creation, modification and deletion. The tag browser shall include a summary of all tags' current addresses and values.
2. A tag export/import utility shall be provided to allow bulk tag changes using Microsoft Office tools.
3. Software shall support the creation of template tag structures to represent a typical piece of equipment (e.g. a pump, an engine.)
4. Tag configuration shall support the use of expressions that can set configuration parameters based on developer-defined rules.
5. Template tag structures shall be copied and pasted to create any number of equipment instances having similar structures, but differing configuration.

F. Configuration Management

1. Software shall be capable of on-line configuration. That is, changes to most aspects of the application (e.g. tags, displays, calculations, reports, trends, server lists) can be deployed in real-time without recompiling or restarting the application or restarting computers.
2. Software shall be capable of offline configuration, such that changes to most aspects of the application can be imported and deployed without recompiling or restarting the application or restarting computers.
3. Software shall be capable of testing configuration changes to tags and displays in the runtime environment before changes are deployed.

4. Users shall be able to deploy a set of changes either automatically or manually, with the option to select and deploy specific changes.
5. Software shall allow multiple users to configure an application simultaneously.
6. Any shut down client shall automatically download newly deployed changes from the server when the client is restarted.
7. All application servers and clients shall automatically synchronize with the primary application server. No manual file duplication shall be required.

G. Application Version Control

1. The software shall have an integrated version control system that automatically logs application configuration changes to an encrypted repository. Versions shall be auto-numbered. No manual changes to the repository shall be permitted.
2. A chronologically ordered summary of versions shall display the time and date when the version was created, the user who created the version and any comments entered by the user when deploying the version.
3. It shall be possible to determine which version is currently deployed on each client and server station.
4. The version history shall allow review of all changes applied within each version.
5. The version control system shall allow the following version management methods.
    a. Switch (aka rollback) to a previous version of the application.
    b. Reverse changes applied during a specific version.
    c. Merge changes made local to a specific workstation.
    d. Option to include or exclude security changes made between the current revision and the target revision when switching.

H. Information Technology (IT) Tools

1. Software shall include server-to-server and server-to-client IP link monitoring for the SCADA network. Link failure shall generate an alarm.
2. Software shall include tools for monitoring of historical data storage.
3. Software shall include tools for monitoring of any modems and SMS appliances used for sending alarm notifications to remote operators.
4. Software shall include an SNMP Agent option for integrating with Network Monitoring Software.
5. Software shall include tools to monitor computer resources (e.g. CPU, virtual memory, drive space) with the ability to generate an alarm on an out of range condition.

I. Product Upgrades, Support and Training

1. Software must have a history of allowing applications that have been deployed on current technology (operating systems and PC hardware) to be upgradable to new technology with minimal change to the application.

2. Software must have a history of allowing applications that have been deployed on one version of the product to be upgradable to a new version with minimal change to the application.

3. Software manufacturer shall offer product support via phone, email, user forum and remote access methods (e.g. Remote Desktop.)

4. Software training shall be available from the manufacturer via classroom courses and self-directed study (e.g. workbooks and tutorials online.)

J. SCADA Software License Requirements

1. 1000 Tag Capacity

2. Runtime and development license for one computer.

3. Alarm notification via SMS, email and phone.

4. Five (5) concurrent Thin Client connections.

K. MANUFACTURER

1. The software shall be manufactured by VT SCADA, latest version. Software manufactured by Allen Bradley, Wonderware and Ignition shall be accepted as long as it meets the requirements of these specifications.

2.4 DATA BASE CONFIGURATION AND PROGRAMMING

A. The Contractor is to provide all data base configuration and programming necessary for a turnkey operation so that the Owner has to do no additional work to begin operation of the system:

B. This work includes actually programming the local PLC's; constructing all of the screen graphics; entering the data base points; constructing all overview; group and loop displays; constructing alarm displays; constructing trend plots and other displays; and all other application system programming necessary for a completely functional system

C. Provide three (3) hard copies and one electronic copy of the entire data base configuration and programming.

2.5 COLOR GRAPHICS DISPLAY DEVELOPMENT

A. All monitored parameters shall be represented both graphically and digitally (numerically).

B. Graphics shall be pictorially illustrative of the actual device or component.

C. All screen layouts shall be logical and consistent with the general system layout.

D. Each screen and sub screen shall be consistent from one screen to the next.

E. Each component on the screen shall have a three-dimensional representation of each device.

F. Appropriate devices should be represented with motion and color changes when operating.

G. All graphics shall be represented by industry conventional color schemes.

H. A main overview screen shall schematically represent the overall system at a single glance.

I. All monitored parameters and respective values shall be represented on the main overview screen.

J. Each site shall be represented on a sub-screen accessed from a drill-down menu from main screen.

K. Each monitored device shall have operator intervention of its local control by point-and-click changes.

L. Alarm and value adjustment points shall be numeric keypads and value fields for level control, etc.

M. Control adjustments shall be graphical HOA switches to provide remote control of all motors/valves.

N. Trend charts shall be created for all specified parameters exhibiting its value over time.

O. All logged data shall be archived indefinitely to either local hard drives or back-up systems.

P. All alarms shall be pop-up flashing devices with respective audible enunciation via speakers.

Q. The graphical Interface shall be fully interactive as specified.

R. The graphical interface shall employ the full characteristics of graphical capabilities to provide for three-dimensional schematic layouts, as well as P&ID characterizations.

S. A minimum of three levels of security access to operational changes will be required.

T. Screen shots of existing displays are attached to these specifications. The Contractor shall develop the new displays to be a similar as possible to the existing.

U. In addition to these graphic displays, provide the services of a qualified representative on-site for a period of one week (40 hours), to develop additional custom displays.

V. Displays are to be developed from the input of operating personnel, and are to begin after on-site training has been accomplished.

W. The bid shall include the hourly rate and per diem to be paid for additional days as required for on-site development of graphics.

PART 3: EXECUTION

3.1 INSTALLATION

A. Provide installation of the control system, peripherals, grounding system and equipment as specified herein and in related Contract Documents.

B. Provide competent technical personnel who have been regularly employed by the Contractor to supervise the entire installation of the control system including unloading, assembly of equipment, installation, storage and handling, and inspection of the completed installation.

C. Verify to the Owner's satisfaction that the SCADA system is operating as specified in the Contract Documents.

D. Provide competent technical personnel who have been regularly employed by the Contractor to provide services to start up the SCADA system including interfacing controls provided by others and specified herein.

E. Provide engineering as necessary for required documentation.

3.2 FIELD QUALITY CONTROL

A. The Contractor shall load the entire process data base into the SCADA system. Data base information shall include the system I/O data, all modulation and sequential control algorithms, system calculated points and all their relevant information required to form complete and effective data base structure**.** The Engineer will provide the Contractor with data base information via instrument specifications, loop and logic diagrams, equipment Contractor drawings or logic drawings provided by equipment Contractors.

B. Maintain and submit an accurate daily or weekly log of all commissioning functions. All commissioning functions may be witnessed by the Owner's representative. All reports shall be cosigned by the Contractor and the Owner's representative if witnessed.

C. Provide verification of system assembly, power, ground, and I/O tests.

D. Verify existence and measure adequacy of all system grounds:

1. AC safety ground.
2. Lightning ground.
3. DC master reference ground.
4. Data highway ground.
5. System ground (separate from DC references).
6. Remote equipment grounds.

E. The acceptance test at site shall consist of a live system test. The Contractor shall demonstrate that the system can operate continuously for a period of 14 days without the software or hardware malfunctioning. In the event of software or hardware malfunction, the system test shall be restarted. The guarantee period of 12 months shall be effective once the system test has been completed to the Owner's satisfaction. If during the final field acceptance test any part of the system does not meet the specifications or the figures and tolerance stated in the Contract Documents, then the Contractor shall replace, repair, modify, adjust, or add hardware and software as is necessary to correct the deficiencies.

F. At the completion of the work, submit a certification that all control systems have been commissioned and are in operating condition in accordance with the Contract Drawings, Specifications, and all Contract Documents.

3.3 TRAINING

A. General

1. Provide five (5) days of onsite training and indoctrination for operation and maintenance, and supervisory personnel at times acceptable to the Owner.

2. All training is to be conducted during normal eight (8) hour working days.

3. All materials, manuals and additional computers and ancillary equipment shall be made available by the Contractor at each training session.

END OF SECTION

SECTION 40 61 13 - PROCESS CONTROL SYSTEMS GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Throughout Division 40 Instrumentation/IT System, the term "System Integrator" (SI) refers to the instrumentation system integrator for the Gatesville Stillhouse WWTF Upgrade and Expansion Project. The System Integrator, with the qualifications specified herein, is to perform all work necessary to select, furnish, configure, customize, debug, install, connect, calibrate, and place into operation for the following systems all hardware specified within the related Division.
   1. Section 40 75 00 – Process Liquid Analytical Measurement

B. The term "System Integrator" or "SI" refers to the Contractor Engineer who will provide SCADA system programming and configuration engineering services for the PLCs and the SCADA HMI system.

C. The term "Engineer" refers to the engineering designers who developed this project's instrumentation system construction plan.

D. The Contractor shall coordinate with the Owner, Engineer, and System Integrator for all required scheduling, workshop administration, installation, testing, startup, and training services.

E. Items specifically excluded from the Contractor's scope of work, but included within the System Integrator's scope of work, include the following, except where it is specified that an Equipment Vendor will provide:
   1. All Programmable Logic Controller (PLC) programming, testing of PLC logic, and startup and training activities associated with the PLC applications.
   2. All Human Machine Interface (HMI) graphics development, HMI software configuration, database development, report development, historical database development, related software applications, and startup and training activities associated with the configured SCADA system.

F. The PLC program of the Equipment Vendor provided PLCs installed in the control panels shall be provided by the Equipment Vendor.

G. The System Integrator with the Contractor scope of work includes, but is not limited to, the following items:
   1. Furnish, install, test, and place into operation for all instruments, PLCs, and PLC panels, the SCADA system network equipment including cellular network hardware and configuration, network switches and routers, network cables and connectors, network racks, SCADA computers and servers, SCADA monitors, and all SCADA software.
   2. Fabricate, assemble, install, and place in proper operating condition, equipment that is in full compliance with detail drawings, specifications, engineering data, instructions, and recommendations by the equipment manufacturers and as approved by the Engineer.

3. Make wiring terminations for all field-mounted instruments furnished and mounted under other Divisions, including process instrumentation primary elements, transmitters, local indicators, and control panels. Install all vendor-furnished cables specified under other Divisions.
4. Integrate, configure, and program the test, startup, training, and other software configuration including but not limited to cellular network communication, network switches and device configuration, and network security configuration as defined in Specification 40 61 00 – Plant SCADA System.
5. Include all auxiliary and accessory devices necessary for system operation or performance that interface with existing equipment or equipment provided by other suppliers under other sections of these specifications, whether or not they are shown on the Drawings. These devices include, but are not limited to, transducers, current isolators, and signal conditioners, interposing relays and protocol or media converters.
6. Provide and configure the cellular network for all provided cellular gateways. Coordinate with the System Integrator for the network configuration and tests.
7. Finish and provide an Early Development System (EDS) to the System Integrator.
8. System Integrator and Contractor shall coordinate and schedule all required installation, testing and startup services with the Owner and Engineer.
9. Provide all submittals, Owner Manuals, and equipment trainings.

1.2 RELATED WORK

A. Where references are made in the Related Work paragraph in each specification section, referring to other sections and other Divisions of the specifications, the Contractor shall provide such information or work as may be required in those references, and include such information or work as may be specified.

B. Provide all Process Controls work related to Process and Mechanical Divisions equipment that is shown on the Instrumentation Drawings under Division 40 sections.

C. Furnish all Process Controls equipment and work under any Division of the specifications in full compliance with the requirements of Division 40 sections.

D. Related Specification Sections
1. Section 40 61 96 - Process Control Descriptions
2. Section 40 61 00 - Plant SCADA System
3. Section 27 13 23 - Fiber Optic Cable
4. Section 26 05 29 - Panels and Supports
5. Section 40 70 02.1 - Process Instrument Schedule
6. Section 40 70 01.2 - Support Instrument Hardware
7. Section 40 75 00 - Process Liquid Analytical Measurement

1.3 SUBMITTALS

A. General
1. Refer to Division 1 for general project submittal requirements.
2. Refer to all other Division 40 for additional specific submittal requirements.

3. Shop drawings shall be submitted as detailed herein. Shop drawings shall demonstrate that the equipment and services to be furnished comply with the provisions of these specifications and shall provide a complete record of the equipment as manufactured, delivered, installed, and placed into service.
4. Submittals shall be complete and shall give equipment specifications, details of connections, wiring, ranges, installation requirements, and specific dimensions. Submittals consisting of only general sales literature shall not be acceptable.
5. Submittals shall be bound in separate three-ring binders, with an index and sectional dividers, and with all included drawings reduced to a maximum size of 11-inches by 17-inches, then folded to 8.5-inches by 11-inches for inclusion inside the binder. Maximum binder thickness shall be 3 inches.
6. The shop drawings title block shall include, as a minimum, the Contractor's registered business name and address, Owner and project name, drawing name, revision level, and shall identify personnel responsible for the content of the drawing.
7. Incomplete submittals not complying with the submittal requirements outlined in this Section will be returned without review.
8. In each submission, include the applicable specification section noted with the Contractor's indication of compliance with each requirement.
9. Unless discussed with and approved by the Engineer prior to submission, partial submittals are not acceptable and will be returned un-reviewed.
10. Any reproduction of the Contract Documents or portions thereof, and presentation of these as submittal content to the Owner and Engineer is not acceptable unless it is for indicating compliance with specification requirements and is clearly marked as such.
11. The design intent for the Process Instrumentation and Control Systems work as specified in the Division 40 specifications sections is for all requirements to be fulfilled in their entirety by the Contractor. Submittals with notes indicating that required items or work are being furnished "by others" are not acceptable and will be returned un-reviewed. Unless discussed with and approved by the Engineer prior to submission, any deviations in this regard are not acceptable. Approval of all deviations from the Contract Documents is at the discretion of the Owner and/or Engineer.
12. Include project-specific tagging and descriptions as shown in the Contract Documents as well as quantities for all devices and systems being provided to facilitate the Owner's and the Engineer's cross-referencing with requirements and verification of completeness.
13. Separate submittals as listed in Table 1 below shall be made.

Table 1 Required Submittals

Item Number	Submittal Title	Submittal Number	Governing Specifications
1	Project Plan, Schedule, and Deviation List	40 61 00-01	40 61 00
2	Hardware and Software Packages	40 61 00-02	40 61 00, 40 70 03, 40 75 00, 40 61 13, 40 61 96.1
3	Early Development System (EDS)	40 61 00-03	40 61 00, 40 61 96.1, 40 61 13, 40 70 03, 40 75 00, 40 70 02.1
4	Input/Output (I/O) List	40 61 00-04	40 61 00, 40 61 96.1

5	Process Instruments	40 70 02.1-01	40 70 02.1, 40 70 03, 40 75 00
6	Panel Layout Drawings, Wiring Diagrams and Loop Wiring Diagrams	40 61 00-05	40 61 00, 40 70 02.1, 40 75 00
7	Testing Plan	40 61 21-01	40 61 13, 40 61 21
8	Training Plan	40 61 26-01	40 61 13, 40 61 26
9	Spares, Expendables, and Test Equipment.	40 61 13-01	40 61 13, 40 71 00, 40 72 00, 40 73 00, 40 75 00, 40 66 01, 40 67 00, 40 78 00, 40 63 43, 40 66 00
10	Final System Documentation	Per O&M Submittal Numbering Convention	Division 01, 40 61 13
11	Fiber Optic Cabling and Equipment	27 13 23-01	27 13 23

14. All submittals must include a digital copy in PDF or other readily reviewable format.

B. Project Plan, Schedule and Deviation List Submittal
   1. Submit, within 45 days following the Contractor's receipt of Notice to Proceed, a Project Plan, Schedule and Deviation List Submittal. The Project Plan, Schedule and Deviation List Submittal shall be submitted and favorably approved before any additional submittals will be accepted and prior to scheduling of the first contractor coordination meeting.
   2. The Project Plan, Schedule and Deviation List Submittal shall, as a minimum, contain the following:
      a. Overview of the Process Control System, clearly describing the Contractor's understanding of the project work and interfaces to other systems; and including a preliminary control system network architecture drawing and proposed project work schedule detailing all of the Contractor's work activities.
      b. Approach to work clearly describing how the Contractor intends to execute the work, including detailed discussion of switchover, startup, replacement of existing equipment with new, and other tasks as required by these specifications as applicable.
      c. Preliminary PLC hardware submittal information shall be included solely for determining compliance with the requirements of the Contract Documents prior to beginning development of application programming. Review and approval of software and hardware systems as part of this Project Plan stage shall not relieve the Contractor 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 shall not be permitted without prior Engineer approval.

d. Details of personnel assigned to the project and organizational structure including the Contractor's project manager, project Engineer, and lead project technicians. Include resumes of each key individual and specify in writing their commitment to this project.
e. Preliminary coordination meeting agendas as specified herein.
f. Preliminary training plan
g. Samples of shop drawings to be submitted in conformance with the requirements of the Specifications shall be submitted. At a minimum include samples of panel fabrication drawings, loop, and I/O wiring diagrams.

3. Exceptions to the Specifications or Drawings shall be clearly defined in a separate 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. The acceptability of any device or methodology submitted as an "equal' or "exception" to the specifications shall be at the sole discretion of the Engineer. If no exceptions are taken to the Specifications or Drawings, the Contractor shall make a statement indicating so. If there is no statement included by the Contractor, it shall be interpreted by the Engineer to mean that no exceptions are taken.
4. Project Schedule shall be prepared and submitted using Microsoft Project or similar software in conformance with Section 01 32 16 – Construction Progress Schedule. The schedule shall be prepared in Gantt chart format clearly showing task linkages for all tasks and identifying critical path elements. The Contractor's schedule shall be based on and coordinated with the General Contractor's and System Integrator's schedules and must meet all field installation, testing, and startup milestones in those schedules.
5. The Contractor's schedule shall illustrate all major project milestones including the following:
   a. Schedule for all subsequent project submittals. Include in the time allotment the time required for the General Contractor submittal preparation, Engineer's review, and a minimum of two complete review cycles.
   b. Proposed dates for all required project Coordination Meetings and workshops
   c. Hardware purchasing, fabrication, and assembly (following approval of related submittals)
   d. Software purchasing and configuration (following approval of related submittals)
   e. Shipment of all instrumentation and control system equipment
   f. Installation of all instrumentation and control system equipment
   g. Duration and dates for all required testing activities. Testing schedule shall include submittal of test procedures a minimum of 30 days prior to commencement of testing. Schedule shall also include submittal of completed documentation of testing activities for review and approval by the Engineer prior to equipment shipment, startup, or subsequent project work.
   h. The Contractor shall arrange the schedule to accommodate the requirements of the System Integrator to develop, test and troubleshoot on the PLC and HMI application and systems. The timing of these coordination efforts shall be jointly determined by the System Integrator and Contractor; however, the Contractor shall include all necessary costs to accommodate the minimum time slots in their overall project schedule. All time allotments shall exclude any legal holidays, or days lost due to delays caused by the General Contractor or the Contractor.
   i. Include a schedule for system cutover, startup, and/or placing in service for each major system. At a minimum, include the schedule for each process controller modified or provided under this Contract.

j. Schedule for all training including submittal and approval of O&M manuals, factory training, and field training.

C. Hardware and Software Packages Submittal
1. For each major hardware component shown on the Network Architecture Diagrams in the Contract Documents, submit a cover page that lists, at a minimum, date, specification number, product name, manufacturer, model number, location(s), quantities and power required. Preferred format for the cover page is ISA S20, general data sheet; however, other formats will be acceptable provided they contain all required information.
2. Catalog cuts for supplied Programmable Logic Controller (PLC), process controller equipment, including central processing units, memory, input modules, output modules, modems, network interface modules, mounting racks, and power supplies. Submit descriptive literature for each hardware component that fully describes the units being provided. Any deviation of the hardware systems from the preliminary hardware submittal included in the Project Plan shall be described in detail.
3. Catalog cuts for power supplies, and all other network hardware being provided. Submit descriptive literature for each hardware component, which fully describes the units being provided.
4. Complete Network Architecture Diagram showing the interconnections between major network hardware components including control centers, panels, power supplies, consoles, computer and peripheral devices, networking equipment, processors, I/O modules, local operator interfaces, and like equipment. This network diagram shall not be a copy of the Contract Documents or any portion thereof; rather, it shall be fully-detailed and shall depict all required cables, media type between components, network protocol used at each network level, details on connection requirements such as cable pin-outs, port numbers, and rack slot numbers. The intent of this specification requirement is for the Contractor to develop a new diagram that is complete in every aspect to allow purchase of all required equipment by part number, and to allow a qualified technician to interconnect all equipment without needing to refer to additional manuals or literature. Minimum sheet size shall be 11" x 17"; using multiple sheets is acceptable.
5. Submit details of field instrument, power monitoring, and field device digital networks. Submittal shall include details of the field device digital networks technology including type, power requirements, wiring requirements, configuration details, device addressing, and interface to the process control system. Include separate details of the field device digital network configuration(s) for each field level digital network and sub-network.
6. Submit details for all software packages to be furnished, including specification number, product name, manufacturer, product number, license versions and quantities.

D. Early Development System (EDS) Submittal
1. As soon as possible following approval of the Project Plan, Schedule and Deviation List, Hardware and Software Packages Submittals, and the first Contractor Coordination Meeting, submit to the Engineer an EDS Submittal for review and approval.
2. The submittal shall include a complete list of the equipment, devices, accessories, cables, software, etc., that shall be provided with the EDS as specified herein.

E. Input/Output (I/O) List Submittal
1. Joint efforts with the System Integrator and the Contractor shall develop and submit the system I/O list that includes all I/O identified in the project drawing P&IDs. Submittal shall

be a complete system I/O list for all equipment connected to the control system under this Contract.

2. The I/O list shall be submitted in both a Microsoft Excel readable electronic file format.
3. The I/O list shall reflect all active and spare I/O points. Add points to accommodate spare I/O.
4. The I/O list shall be arranged such that each control panel has a dedicated worksheet. At a minimum, I/O worksheet tables shall include the following information:
   a. TAG NUMBER(S): 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. LOGICAL POINT ADDRESS: Leave this field blank for use by the System Integrator. The Contractor shall coordinate the completion of the LOGICAL POINT ADDRESS field with the System Integrator.
   f. I/O TYPE: use DO - Discrete Output, DI - Discrete Input, AO - Analog Output, AI - Analog Input, PI - Pulse Input, or PO – Pulse Output.
   g. 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 is "1."
   h. ENGINEERING UNITS: The engineering units associated with the Analog I/O.
   i. ALARM LIMITS: Include alarm limits based on the control descriptions and the Drawings.
   j. 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.
5. The I/O list shall be sorted in order by:
   a. Physical location
   b. Device Tag
   c. I/O Type
   d. Description
   e. Loop Number
6. Once the I/O List is approved, the PLC I/O addresses may not be modified without approval by the Engineer and the System Integrator.
7. Where multiple mechanical components are provided for process redundancy, their field connections to I/O modules shall be arranged such that the failure of a single I/O module will not disable all mechanical components of the redundant system. This applies to all I/O types.

F. Process Instruments Submittal
   1. Submit complete documentation of all field instruments using ISA-S20 data sheet formats. Submit a complete Bill of Materials (BOM) listing all instrumentation equipment using project identification, such as tags and descriptions as shown in the Contract Documents.
   2. Submit separate data sheets for each instrument including:
      a. Plant Equipment Number and ISA tag number per the Drawings

b. Product (item) name used herein and on the Contract Drawings
c. Manufacturer's complete model number
d. Location of the device
e. Input - output characteristics
f. Range, size, and gradations in engineering units
g. Physical size with dimensions, enclosure NEMA classification and mounting details in sufficient detail to determine compliance with the requirements of the Contract Documents
h. Materials of construction for enclosure and wetted parts
i. Instrument or control device sizing calculations where applicable
j. Certified calibration data for all flow metering devices
k. Two-wire or four-wire device type, as applicable

3. Submit index and data sheets in electronic format as well as hard copies on 8 1/2" x 11" formats. Electronic format shall be in Microsoft Excel, Microsoft Word, or PDF.

G. Panel Layout Drawings, Wiring Diagrams and Loop Wiring Diagrams Submittal
1. Where direct hardwired interfaces exist between the Contractor control panels and vendor provided control panels furnished under other Divisions, the General Contractor shall provide to the Contractor the approved shop drawings and submittals for the Contractor 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.
2. These drawings will be included in the Final Documentation submittal. Leaving this information blank on the Final Documentation drawings is not acceptable.
3. Include a complete Bill of Materials for each individual control panel being furnished.
4. Include manufacturer literature for each item in the Bill of Materials with all required markings indicating exactly what versions, options, etc. are being proposed and indicate compliance with specification requirements. Manufacturer literature for common components need only be included once for the first panel in the submittal, with references to this literature included as applicable thereafter in submittal.
5. Panel Layout Drawings: Drawings shall be furnished for all panels, consoles, and equipment enclosures 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" x 17" minimum in size. As a minimum, the panel drawings shall include the following:
a. Interior and exterior panel elevation drawings to scale
b. Nameplate schedule
c. Conduit access locations
d. Panel construction details
e. Include cabinet assembly and layout drawings shown drawn to scale. The assembly drawing shall include a bill of material on the drawing with each panel component clearly defined. The bill of material shall be cross-referenced to the assembly drawing so that a non-technical person can readily identify any component of the assembly by manufacturer and model number.
f. Fabrication and painting specifications including color (or color samples)
g. Submit 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.
h. 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.

i. 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. All costs associated with obtaining the UL seal and any inspections shall be borne by the Contractor and included in the Project Bid Price.

6. Panel Wiring Diagrams: Panel wiring diagrams depicting wiring within and on the panel as well as connections to external devices. 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. The 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 Contractor. Wiring labeling used on the drawings shall match that shown on the Contract Documents or as developed by the Contractor 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" minimum in size.
7. ISA Loop Wiring Diagrams: Detailed ISA loop wiring diagrams showing requirements for each loop which is shown on the contract drawings. The Loop Drawings shall be prepared in accordance with ISA Standard S5.4, latest version, and with the layout following Figures 5 and 6 (shown in the S5.4 Standard), titled “Minimum Required Items Plus Optional Items”. Loop drawings shall be 11" x 17" minimum in size. The information required on the Loop Drawings to satisfy the "minimum" and "optional" requirements is as follows:
   a. Minimum Required Items – The following information shall be provided on Loop Drawings to meet this requirement:
      1) Identification of the loop and loop components shown on the P&IDs Other principal components of the loop to be shown and identified under ISA- 5.1, "Instrumentation Symbols and Identification"
      2) Word description of loop functions within the title. If not adequate, use a supplemental note. Identify any special features or functions of shutdown and safety circuits.
      3) Indication of the interrelation to other instrumentation loops, including overrides, interlocks, cascaded set points, shutdowns and safety circuits.
      4) All point-to-point interconnections with identifying numbers or colors of electrical cables, conductors, pneumatic multitubes, and individual pneumatic and hydraulic tubing and this identification of interconnections includes junction boxes, terminals, bulkheads, ports, and grounding connections.
      5) General location of devices such as field, panel, auxiliary equipment, rack, termination cabinet, cable spreading room, I/O cabinet, etc.
      6) Energy sources of devices, such as electrical power, air supply, and hydraulic fluid supply. Identify voltage, pressure, and other applicable requirements. For electrical sources, identify circuit or disconnect numbers.
      7) Process lines and equipment sufficient to describe the process side of the loop and provide clarity of control action. Include what is being measured and what is being controlled.
      8) Actions or fail-safe positions (electronic, pneumatic, or both) of control devices such as controllers, switches, control valves, solenoid valves, and transmitters (if

reverse- acting). These are to be identified in accordance with ISA-5.1, "Instrumentation Symbols and Identification".

9) References to equipment descriptions, manufacturers, model numbers, hardware types, specifications or data sheets, purchase order numbers.
10) Signal ranges and calibration information, including set point values for switches, and alarm and shutdown devices.

H. Testing Plan Submittal
1. Test Procedures: Submit the procedures proposed to be followed for each test. Procedures shall include test descriptions, forms, and checklists to be used to control and document the required tests. Include sign-off forms for each testing phase or loop with sign-off areas for the Contractor, Engineer, and the Owner. Refer to Section 40 61 21 for specific testing requirements, and submit separate procedures for each specified test phase including:
   a. Unwitnessed Factory Test (UFT)
   b. System Integration Test (SIT)
   c. Witnessed Factory Test (WFT)
   d. Operational Readiness Test (ORT)
   e. Functional Demonstration Test (FDT)
   f. 30-Day Site Acceptance Test (SAT)
2. Test Documentation: Upon completion of each required test, document the test by submitting a copy of the signed off test procedures. Testing shall not be considered complete until the signed-off test procedures have been submitted and favorably reviewed. Submittal of other test documentation, including "highlighted" wiring diagrams with field technician notes, are not acceptable substitutes for the formal test documentation.
3. Each loop shall have a Loop Status signoff form to organize and track its inspection, adjustment and calibration. These forms shall include the following information and check-off items:
   a. Project Name
   b. Loop Number
   c. Detailed test procedure indicating exactly how the loop will be tested including all required test equipment, necessary terminal block numbers, and simulation techniques required.
   d. Tag Number for each component.
   e. Check-offs/sign-offs for each component:
      1) Tag/identification
      2) Installation
      3) Termination - wiring
      4) Termination - tubing
      5) Calibration/adjustment
   f. Check-off/sign-off space for each loop:
      1) Panel interface terminations
      2) I/O interface terminations
      3) I/O signal operation
      4) Inputs/outputs operational: received/sent, processed, adjusted
      5) Total loop operation
      6) Space for comments.
      7) Sign off and date fields for the General Contractor, the Engineer, and the Contractor.

4. Each active analog subsystem element shall have a Component Calibration form. These forms shall have the following information including space for data entry:
   a. Project Name
   b. Loop Number
   c. ISA Tag Number and I/O Module Address
   d. Manufacturer
   e. Model Number/Serial Number
   f. Summary of Functional Requirements, for example:
      1) For Indicators: Scale ranges
      2) For Transmitters/Converters: Scale and chart ranges
      3) For Computing Elements: Function
      4) For Controllers: Action (direct/reverse) control modes (PID)
      5) For Switching Elements: Unit range, differential (fixed/adjustable), reset (auto/manual)
      6) For I/O Modules: Input or output
   g. Calibrations, for example:
      1) For Analog Devices: Required and actual inputs and outputs at 0, 25, 50, 75 and 100 percent of span.
      2) For Discrete Devices: Required and actual trip points and reset points.
      3) For Controllers: Mode settings (PID).
      4) For I/O Modules: Required and actual inputs or outputs for 0, 50 and 100 percent of span.
   h. Space for comments
   i. Sign off and date fields for the General Contractor, the Engineer, and the Contractor.

I. Training Plan Submittal
1. Refer to Section 40 61 26 for specific training requirements.

J. Spares, Expendables, and Test Equipment
1. All spares, expendables, and test equipment in the listed Sections shall be included in a single submittal.
2. This submittal shall include for each subsystem:
   a. A list of, and descriptive literature for, spares, expendables, and test equipment as specified under Division 40 specifications
   b. A list of, and descriptive literature for, additional spares, expendables, and test equipment recommended by the manufacturer
   c. Unit and total costs for the additional spare items specified or recommended for each subsystem.

K. Final System Documentation
1. The Final System Documentation shall consist of operations and maintenance manuals as specified herein. The manuals shall be bound in three-ring binders, maximum size of three inches, with Drawings reduced to 11 inches by 17 inches, then folded to 8.5 inch by 11 inches for inclusion. Each section shall have a uniquely numbered tab divider, and each component within each section shall have a separate binder tab divider.
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 Excel and provided not only as a hardcopy in O&M but also electronically on a CD.
      a) An instrument list for all devices supplied including tag number, description, specification section and paragraph number, manufacturer, model number, serial number, range, span, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.
      b) An equipment list for all non-instrument devices supplied listing description, specification section and paragraph number, manufacturer, model number, serial number, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.

c. Data Sheets with Vendor Operations and Maintenance Information

d. ISA S20 data sheets shall be provided for all field instruments.
   1) Cover page for each device, piece of equipment, and OEM software 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 S20, general data sheet; however, other formats will be acceptable provided they contain all required information.
   2) Final 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 that do not apply at all to the specific model supplied shall be removed.
   3) For any component requiring dip switch settings or custom software configuration, that information shall be included along with the corresponding data sheets and O&M information.

e. As-Built Drawings
   1) Complete As-built Drawings, including all Drawings and diagrams specified in this Section under the "Submittals" paragraph. These Drawings shall include all termination points on all equipment the system is connected to, including terminal points of equipment not supplied by the Contractor.
   2) As-built documentation shall include information from submittals, as described in this Specification, updated to reflect the as-built system. Any errors in or modifications to the system resulting from the Factory and/or Functional Acceptance Tests shall be incorporated in this documentation.

f. Original Licensed Software
   1) Submit original software CD-ROMs for all software provided under this Contract. Submit original documentation, both hard copies and in electronic format, 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 original packages provided by manufacturer.

g. Electronic O&M Information

1) In addition to the hard copy of O&M data, provide an electronic version of all equipment manuals CD-ROM or DVD. Electronic documents shall be supplied in Adobe Acrobat format.
2) Provide electronic files for all custom-developed 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, and fonts into individual zip files along with the drawing file.
    a) Each computer system hardware device shall be backed up onto CD-ROM or DVD after Substantial Completion and shall be turned over to the Owner.
    b) 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.

3. The cover and edge of each volume shall contain the following information:
4. Project Name (refer to Contract Documents)
5. Contract Number (refer to Contract Documents)
6. Instrumentation and Control Systems
7. Hardware Operations and Maintenance Manual
8. Specification Sections
9. Subcontractor Name
10. Date
11. Volume X of Y (Where X is the volume number and Y is the number of volumes)

L. Fiber Optic Cabling and Equipment Submittal
1. Refer to Section 40 66 01 for specific fiber optic cabling and equipment submittal requirements.

1.4 REFERENCE CODES AND STANDARDS

A. Instrumentation equipment, materials and installation shall comply with the National Electrical Code (NEC) and with the latest edition of the following codes and standards:
1. National Electrical Safety Code (NESC)
2. Occupational Safety and Health Administration (OSHA)
3. National Fire Protection Association (NFPA)
4. National Electrical Manufacturers Association (NEMA)
5. American National Standards Institute (ANSI)
6. Insulated Cable Engineers Association (ICEA)
7. The International Society of Automation (ISA)
8. Underwriters Laboratories (UL)
9. UL 508, the Standard of Safety for Industrial Control Equipment
10. UL 508A, the Standard of Safety for Industrial Control Panels
11. UL 50, the Standard of Safety for Enclosures for Electrical Equipment.
12. NFPA 79, Electrical Standard for Industrial Machinery
13. Factory Mutual (FM)
14. All equipment and installations shall satisfy applicable Federal, State, and local codes.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

C. All material and equipment, for which a UL standard exists, shall bear a UL label. No such material or equipment shall be brought onsite without the UL label affixed.

D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents shall take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the Contractor, unless otherwise directed by the Owner/Engineer.

E. In accordance with the intent of the Contract Documents, the Contractor accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way the Contractor's responsibility to comply with all Laws and Regulations at all times

F. Construct all control panels TO affix required labeling in a UL 508 facility.

1.5 CONTRACTOR

A. Provide the services of a pre-approved Contractor for all work under this and related Divisions, as described in this section and related sections.

B. Where shown on the Bid Documents, name the Contractor’s proposed Contractor. Only approved Contractors, as listed herein, will be accepted.

C. Qualifications

1. The Contractor shall be a "systems house," regularly engaged in the design and installation of control and instrumentation systems and their associated subsystems as they apply to the municipal water or wastewater industry with minimum 5-year experience. For the purposes of this and other applicable Divisions, a "systems house" shall be interpreted to mean an organization that complies with all of the following criteria:
    a. Employs a registered professional Control Systems Engineer or Electrical Engineer in the state of Texas to supervise or perform the work required by this Specification Section.
    b. Employs personnel on this project who have successfully completed a manufacturer’s training course on the hardware configuration and implementation of the specific programmable controllers, computers, and software proposed for this project.
    c. Has been in the water/wastewater industry performing the type of work specified in this specification section for a minimum of five continuous years.
    d. The Contractor shall maintain a fully equipped office/production facility with full-time employees capable of fabricating, configuring, installing, calibrating, troubleshooting, and testing the system specified herein. Qualified repair personnel shall be available and capable of reaching the facility within 24 hours
    e. The Contractor shall have an Electrical Contractor’s license in the State of Texas.

D. The Contractor shall be one of the following companies:
   1. Prime Controls
      1725 Lakepointe Drive Lewisville, TX 75057 Phone: 972-221-4849
   2. RLC Controls
      8115 Hicks Hollow McKinney, TX 75071 Phone: 972-542-7375
   3. Control Panels USA, Inc
      16310 Bratton Lane, Building 1, Suite 100, Austin, Texas 78728 Phone: 512-863-3224
   4. TESCO Controls, Inc.
      1221 Abrams ?Rd., Suite 327, Richardson, TX 75081 Phone: 916-395-8800

E. The listing of specific contractor organizations above does not imply acceptance of their products and capabilities that do not meet the specified ratings, features and functions. The contractors listed above are not relieved from meeting these specifications in their entirety.

1.6 HAZARDOUS AREAS

A. Equipment, materials and installation in areas designated as hazardous on the Drawings shall comply with NEC Articles 500, 501, 502, and 503.

B. Equipment and materials installed in hazardous areas shall be UL listed for the appropriate hazardous area classification.

1.7 CODES, INSPECTION AND FEES

A. Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction.

B. Obtain all necessary permits and pay all fees required for permits and inspections.

1.8 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.

B. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.

1.9 RECORD DRAWINGS

A. As the work progresses, legibly record all field changes on a set of Project Contract Drawings, hereinafter called the "Record Drawings". The Record Drawings and Specifications shall be kept up to date throughout the project.

B. Record Drawings shall accurately show the installed condition of the following items:

1. Control Wiring Diagrams including all wire tags.
2. Piping and Instrumentation Diagrams
3. Mounting Details

C. Submit a typical example of a schedule of control wiring raceways and wire numbers, including the following information:
   1. Circuit origin, destination and wire numbers.
   2. Field wiring terminal strip names and numbers with field connection wire color.

D. As an alternate, a typical example of point-to-point connection diagrams showing the same information, may be submitted in place of the schedule of control wiring raceways and wire numbers.

E. Submit the record drawings and the schedule of control wiring raceways and wire numbers (or the point-to-point connection diagram) to the Owner/Engineer.

F. The Contractor's retainage shall not be paid until the point-to-point connection diagrams have been furnished to the Owner/Engineer.

1.10 EQUIPMENT INTERCONNECTIONS

A. Review shop drawings of equipment furnished under other related Divisions and prepare coordinated wiring interconnection diagrams or wiring tables. Submit copies of wiring diagrams or tables with Record Drawings.

B. Furnish and install all equipment interconnections.

1.11 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new, except where specifically identified on the Drawings to be re-used.

B. The Contractor shall not bring onsite, material or equipment from a manufacturer not submitted and approved for this project. Use of any such material or equipment, will be rejected, removed, and replaced by the Contractor, with the approved material and equipment, at his own expense.

C. Material and equipment shall be UL listed, where such listing exists.

D. The Contractor shall be responsible for all material, product, equipment and workmanship being furnished by him for the duration of the project. He shall replace the equipment if it does not meet the requirements of the Contract Documents.

1.12 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. Two copies of these instructions shall be included with the equipment at time of shipment and shall be made available to the Contractor and the Owner.

B. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Accessories shall be packaged and shipped separately.

C. Equipment shall be equipped to be handled by crane. Where cranes are not available, equipment shall be suitable for skidding in place on rollers using jacks to raise and lower the groups.

D. Equipment shall be installed in its permanent, finished location shown on the Drawings within seven calendar days of arriving onsite. If the equipment cannot be installed within seven calendar days, the equipment shall not be delivered to the site, but stored offsite, at the Contractor's expense, until such time that the site is ready for permanent installation of the equipment.

E. Where space heaters are provided in equipment or control panels, provide temporary electrical power, and operate space heaters during jobsite storage and after equipment is installed in a permanent location, until equipment is placed in service.

1.13 WARRANTY

A. Manufacturer's warranties shall be as specified in each of the Specification Sections.

1.14 EQUIPMENT IDENTIFICATION

A. Identify equipment (control panels, control stations, instruments, etc.) furnished under instrumentation sections of Division 40 with the name of the equipment it serves. Control panels, Instruments, meters junction or terminal boxes, etc, shall have nameplate designations as shown on the Drawings.

B. Nameplates shall be engraved, laminated impact acrylic, black lettering on a white background, matte finish, not less than 1/16-in thick by 3/4-in by 2-1/2-in, Rowmark 322402. Nameplates shall be 316 SS screw mounted to all enclosures except for NEMA 4 and 4X. Nameplates for NEMA 4 and 4X enclosures shall be attached with double faced adhesive strips, TESA TUFF TAPE 4970, .009 X ½", no equal. Prior to installing the nameplates, the metal surface shall be thoroughly cleaned, with a 70% alcohol solution, until the metal surface residue has been removed. Epoxy adhesive or foam tape is not acceptable.

PART 2 - PRODUCTS

2.1 EARLY DEVELOPMENT SYSTEM (EDS) GENERAL REQUIREMENTS

A. Within 60 days of contract award, deliver the EDS as specified herein, complete and ready for operation, to the System Integrator for developing and testing of the PLC and HMI applications.

B. The EDS shall include all necessary hardware and software to facilitate the applications software programming and testing as specified herein. The system shall include terminal strips and power supplies for all I/O as shown in the drawings. The system shall be mounted to a

portable rack on wheels, fully wired including all I/O to DIN rail mounted terminals for use by the System Integrator.

C. The Contractor shall set up the system at the staging site and demonstrate with the System Integrator that the system is fully wired, pre-configured, all software loaded, and communications between EDS components are functional.

D. Once staged, the EDS shall be ready for process inputs/outputs monitoring and control programming, building displays, trends, reports, and printing.

E. After completion of staging, the Contractor shall remove all shipping materials (i.e., boxes, crates, packing materials, etc.) and store the materials until the EDS is retrieved from the System Integrator staging facility.

F. The Contractor shall be responsible for ensuring all equipment and supplies until received by the System Integrator. The System Integrator shall be responsible for ensuring all equipment and supplies until the equipment is back in the possession of the Contractor.

G. Notify the System Integrator, in writing, a minimum of one week in advance of delivery. All deliveries shall occur between the hours of 8:30 am and 4:00 pm, Monday through Friday, legal holidays excluded.

H. The PLC system setup shall be mounted on 19-inch vertical rack rails. The rack shall be mobile. Maximum height of individual racks shall be 7-feet. All power supplies, network communication equipment, and PLC appurtenances shall be mounted on the rack assemblies.

I. The Contractor shall be responsible for unloading the EDS and removing all shipping cartons. When the EDS is ready for pickup by the Contractor, the Contractor shall furnish all packing cartons and materials necessary for the shipment of the EDS.

J. The System Integrator shall retain the EDS for a period of twelve months after the system has been received, set up at the System Integrator's staging facility, and accepted by the System Integrator.

K. Once the programming period has expired, the Contractor shall retrieve the EDS from the System Integrator and prepare for the Unwitnessed Factory Test (UFT). All costs associated with shipping the EDS to and from the System Integrator facility shall be borne by the Contractor.

2.2 REQUIRED EDS EQUIPMENT

A. Refer to Section 40 61 00 Plant SCADA System for required equipment.

PART 3 - EXECUTION

3.1 CONTRACTOR COORDINATION MEETINGS

A. Schedule and administer a minimum of three mandatory Contractor Coordination Meetings. Make all arrangements for meetings; prepare agendas and distribute copies to participants at least one week prior to scheduled meetings.

B. Hold meetings at the Contractor's field office at the site and shall include, at a minimum, attendance by the Owner, Engineer, Contractor's Project Engineer, System Integrator's Project Engineer, Contractor's Project Engineer, and Electrical Subcontractor.

C. Prepare and distribute minutes of all Contractor Coordination Meetings within 10 business days following meetings.
   1. Hold the First Contractor Coordination Meeting within 30 days following approval of the Project Plan, Schedule, and Deviation List Submittal.
   2. The purpose of the first meeting is for the Contractor to:
      a. Summarize their understanding of the project.
      b. Discuss any proposed substitutions or alternatives and any comments to the Project Plan Submittal.
      c. Request any additional information required from the Owner and/or Engineer.
      d. Provide a forum for the Contractor and the Owner to coordinate hardware and software related issues.
      e. Solicit the Owner's and Engineer's input into the Contractor's shop drawing development.
      f. Discuss proposed draft of the Contractor Project Schedule.
   3. Hold the Second Contractor Coordination Meeting after the Instruments, Hardware and Software Packages, and Control Panel Drawings submittals have been reviewed by the Engineer and returned to the Contractor. The purpose of the second meeting is to discuss:
      a. Submittal review comments
      b. Schedule for all remaining submittals
      c. Refined/revised Contractor Project Schedule
      d. Equipment installation activities.
      e. Any additional coordination or information needs
   4. Hold the Third Contractor Coordination Meeting one month prior to field testing. The purpose of the third coordination meeting is to discuss any remaining coordination requirements.
   5. A typical Contractor Coordination Meeting agenda may include the following:
      a. Review minutes of previous meetings
      b. Review work progress
      c. Discuss field observations, problems, and decisions
      d. Identify problems which may impede planned progress
      e. Review submittal status
      f. Review of off-site fabrication and delivery schedules
      g. Review Contractor Project Schedule
      h. Corrective measures to regain schedule
      i. Planned activities for subsequent work period
      j. Maintenance of quality and work standards
      k. Effect of proposed changes on schedule and coordination

l. Other business relating to project work

3.2 INTERPRETATION OF DRAWINGS

A. Raceways and conductors for instrumentation, communications, and other miscellaneous low voltage power and signal systems as specified not shown on the Drawings shall be provided as required for a complete and operating system.

B. The Contractor shall terminate all conductors of instrumentation systems to RTU and/or PLC Termination Cabinets, where designated on the Drawings. The conduit and wire, as shown on the electrical interface drawings, may not necessarily be shown on the floor plan.

C. Install conductors carrying low voltage signals (typically twisted shielded pair cables) in raceways totally separate from all other raceways containing power or 120-volt control conductors, Refer to NEC article 725. DC and AC control wiring shall be installed in separate raceways.

D. Redesign of electrical or mechanical work, which is required due to the Contractor's use of a pre-approved alternate instrumentation or control item, or arrangement of equipment and/or layout other than specified herein, shall be done by the Contractor at his/her own expense. Redesign and detailed plans shall be submitted to the Owner/Engineer for approval. No additional compensation will be provided for changes in the work, either his/her own or others, caused by such redesign.

3.3 INSTRUMENTATION EQUIPMENT PADS AND SUPPORTS

A. Equipment pads and supports of concrete or steel including structural reinforcing and foundations, are shown on the Structural Drawings.

3.4 INSTALLATION

A. Any work not installed according to the Drawings and this Section shall be subject to change as directed by the Owner/Engineer. No extra compensation will be allowed for making these changes.

B. All dimensions shall be field verified at the job site and coordinated with the work of all other trades.

C. Equipment shall be protected at all times against mechanical injury or damage by water. Equipment shall not be stored outdoors. Equipment shall be stored in dry permanent shelters as required by each Specification Section. Do not install equipment in its permanent location until structures are weather-tight. If any apparatus has been subject to possible injury by water, Equipment shall be thoroughly dried out and tested as directed by the Owner/Engineer or shall be replaced at no additional cost at the Owner/Engineer’s discretion.

D. Equipment that has been damaged shall be replaced or repaired by the equipment manufacturer, at the Owner/Engineer’s discretion.

E. Repaint any damage to the factory applied paint finish using touch-up paint furnished by the equipment manufacturer. If the metallic portion of the panel or section is damaged, the entire panel or section shall be replaced, at no additional cost to the Owner.

3.5 MANUFACTURER'S SERVICES

A. Provide manufacturer's services for testing and start-up of the equipment as listed in each individual Specification Section.

B. Do not combine testing and startup with training. Testing and start-up time shall not be used for manufacturer's warranty repairs.

C. Check interlocking, control, and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by schematics, wiring diagrams and Control Descriptions.

D. Schedule and coordinate testing with the Owner/Engineer at least two weeks in advance. Provide qualified test personnel, instruments, and test equipment.

E. Refer to the individual Division 40 sections for additional specific testing requirements.

F. Make adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

END OF SECTION

SECTION 40 61 96.1 - PROCESS CONTROL DESCRIPTIONS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. This Section provides the detailed requirements for the programming of the Process Control System Application (both HMI and PLC programming) by the SCADA Integrator (SI) Engineer.

B. This Section is provided for reference to the Contractor. All work associated shall be provided by the SI Engineer as detailed in Specification 40 61 13 - Process Control Systems General Provisions.

1.2 RELATED WORK

A. Process Equipment Divisions

B. Mechanical Equipment Division

C. Electrical Equipment Division

D. Section 40 61 13 Process Control Systems General Provisions

E. Section 27 13 23 Fiber Optic Cable

F. Section 40 67 00 Control System Equipment Panels and Racks

G. Section 40 67 00.1 Process Control System Control Panels

H. Section 40 78 00 Panel Mounted Control Devices

I. Section 40 61 93.1 Process Control Systems Input-Output List

J. Section 40 63 43 Programmable Logic Controllers

K. Section 40 66 00 Network and Communication Equipment

1.3 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS AND DEFINITIONS

A. The following represent the requirements for all control loops. These Process Control Descriptions shall be used in conjunction with all project drawings.

B. Alarms

1. The alarms described herein shall be provided for all devices described below whether the alarm described herein is shown on the Process and Instrumentation Diagrams (P&IDs) or not.
2. For all Controlled devices such as pumps, motorized equipment, or any device under control by the PLC, that generates a start/stop, or on/off, and has one or two discrete feedback state signals, provide an equipment discrepancy alarm.
    a. The discrepancy alarm shall be generated in the PLC when a device receives a change of state discrete command signal from the PLC, and the device feedback state does not match the commanded state within the preset time.
    b. The equipment discrepancy alarm generated by the PLC shall be displayed and alarmed at the SCADA and local (if existing) Human-Machine Interface (HMI), and the device shall be issued a command to stop or close, as appropriate.
    c. If after attaining the command change of state, a device feedback state does not match the commanded state, equipment deviation alarms shall be generated by the PLC.
    d. The equipment deviation alarm generated by the PLC shall be displayed and alarmed at the HMI, and the device shall be issued a command to stop.
    e. After a deviation alarm occurs, the device cannot be restarted at the PLC until the user has issued a reset at the HMI.
3. For all Controlled valves or gates under control by the PLC, that generate an open/close and have one or two discrete open/closed feedback signals, provide an equipment discrepancy alarm.
    a. The discrepancy alarm shall be generated in the PLC when a device receives an open/close discrete command signal from the PLC and the device feedback state does not match the commanded state within a preset time.
    b. The equipment discrepancy alarm generated by the PLC shall be displayed and alarmed at the HMI, and the device shall be issued a command to stop.
    c. If a device feedback state does not match the commanded state, after attaining the commanded state, an equipment deviation alarm shall be generated by the PLC.
    d. The equipment deviation alarm generated by the PLC shall be displayed and alarmed at the HMI, and the device shall be issued a command to stop.
    e. After a deviation alarm occurs, the device cannot be restarted by the PLC until the user has issued a reset.
4. For all analog modulating valves under control by the PLC, that generate an analog state request and have a position feedback signal, provide and equipment discrepancy alarm.
    a. The discrepancy alarm shall be generated in the PLC when a valve receives a signal to open or close to a specific position and the position feedback signal does not indicate the desired position, plus or minus a dead band, within the preset time period.
    b. The equipment discrepancy alarm generated by the PLC shall be displayed and alarmed at the HMI.
    c. If a device feedback position does not match the commanded position, after attaining the commanded position, plus or minus a dead band, a deviation alarm shall be generated by the PLC.
    d. The equipment deviation alarm shall be displayed and alarmed at the HMI, and the device shall be issued a command to stop.
    e. After a deviation alarm occurs, the valve cannot be moved again by the PLC until the Operator has issued a reset at the HMI.

5. For all variable speed pumps under control by the PLC, that generate an analog speed request and have a speed feedback signal, provide an equipment discrepancy alarm.
    a. The discrepancy alarm shall be generated in the PLC when a Variable Frequency Drive (VFD) receives a signal to increase or decrease speed, and the speed feedback signal does not indicate the requested speed, plus or minus a deadband, within a preset time period.
    b. The equipment discrepancy alarm generated by the PLC shall be displayed and alarmed at the HMI.
    c. If a pump is off, and the pump is requested to run, and the pump does not start within a preset time period after the request has been made, a pump discrepancy alarm shall be generated by the PLC.
    d. After a deviation alarm occurs, the pump cannot be controlled again by the PLC until the user has issued a reset at the HMI.
6. Provide at least two high alarms and two low alarms for each analog input. The quantities and types of alarms shall be configured for each input, as appropriate. The alarms generated by the PLC shall be displayed and alarmed at the HMI. To eliminate excessive alarm reporting, the analog point shall remain in alarm until its value returns to its alarm limit, plus or minus its alarm limit deadband.
7. All alarms shall be generated by the PLC. No alarms shall be calculated within the HMI.
8. For each analog point, an alarm shall be generated in the PLC and displayed at the HMI if the PLC detects a loss of signal. For analog points that are used for automatic control, the last "good value" shall be used as the process variable until the alarm is cleared. For the pump stations, if there is a loss of the analog signal from the level sensor, control shall be turned over to the float switches until the alarm is cleared.
9. For each analog point, if the value of the analog point is above or below the instrument range, an out-of-range alarm shall be generated in the PLC and displayed and alarmed at the HMI.
10. Provide alarm classification. Alarm shall be classified as critical, high, and low.

C. Interlocks
1. Provide required PLC-programmed process control interlocks as shown.

D. Tuning Parameters
1. All tuning parameters for each P&ID in the PLC shall be available at the server/ workstations for monitoring and adjustment even if not shown on the P&IDs. Tuning trends shall be provided to monitor the P&ID functions. However, these parameter settings shall be password protected to allow access only to users who are given clearance by the Owner.

E. Equipment Runtimes
1. Runtimes for all motorized equipment shall be totaled in the PLC and indicated at the HMI with one-hour resolution even if not shown on the drawings.
2. The total runtime shall be reset from the HMI; however, this reset shall be password protected to allow access only to users who are given clearance by the Owner.
3. A second accumulated runtime shall also be provided. The Operator shall not have the capability to reset this accumulated runtime.

F. Historical Recording

1. All analog inputs shall be recorded historically even if not shown on the P&IDs.

G. Flow Totalization

1. All flows shall be totalized in the PLC. Previous day's total flow and current day's total flow shall be indicated at the HMI even if not shown on the P&IDs. To eliminate errors due to noise or calibration issues, flows will not be totalized when an associated valve or pump is in the closed or off state.
2. The total flows shall have the ability to be reset from the HMI. However, this reset shall be password protected to allow access only to users who are given clearance by the Owner.

H. Equipment operation mode

1. Equipment local mode selection switch Remote or Auto (SCADA PLC control mode) position shall be programmed inside PLC and status shall be displayed on SCADA HMI screen. Mode selection shall be event log in historian database. Ranges of instruments can be seen in the Process Instrument Schedule Specification 40 70 02.1.

1.2 INDIVIDUAL PROCESS DESCRIPTIONS

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A. Influent Bar Screen and Compactor

1. Process Overview
   a. The differential elevations of wastewater upstream and downstream of the Influent Bar Screen i operation and the speed of the Influent en Rake Motor operates rakes to clean the the screenings to a chute where they fall into the Bar Screenings Compactor hopper. The Bar Screenings Compactor has a motor which compacts the screenings and discharges to a dumpster. A single control panel for both the screen and compactor will be provided by the SI Engineer which have a PLC and motor starters included. A fiber will be installed by the Contractor from the Influent Bar Screen Control Panel PLC to SCADA. SCADA can be used to monitor the operation of the Influent Bar Screen and Compactor.
   b. The Compactor will coordinate with the Bar Screen operation. In addition, motor fault will be displayed.
   c. PLC: Provided by SI Engineer
   d. Control Panel: Provided by SI Engineer
   e. Drawing(s): MA-01, MA-02, P-01
   f. Equipment;
      1) Influent Flow Level Sensor (LIT-101)
      2) Effluent Flow Level Sensor (LIT-102)
      3) Influent High Level Float Switch (LSH-101)
      4) Influent Bar Screen Motor (M-101)
      5) Screen Rake Motor (M-111)
      6) Compactor Motor (M-121)
2. Local Manual Control;

a. There will be a local control panel for the Influent Bar Screen. With the Influent Bar Screen Motor (M-101) Hand/Off Auto switch in the Hand position, the operator may start, stop and control the speed of the Influent Bar Screen Motor (M-101) using the supplied Start and Stop pushbutton operators and the Screen Speed Dial.

b. Level of the bar screen influent flow is measured with the Influent Flow Level Sensor (LIT-101) and displayed at the local control panel and at the HMI.

c. The Screen Rake Motor (M-111) will run whenever the Influent Bar Screen Motor (M-101) is running.

d. The local control panel also has a Hand/Off Auto switch for the Compactor Motor (M-121). In the Hand pc Compactor Motor (M-121).

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e. The Washwater solenoic tors are running.

f. Emergency stop buttons for both the Bar Screen and the Compactor will be located on the Local Control Panel.

3. Local Automatic Control;

a. With the Screen Drive Motor (M-101) Hand/Off Auto switch in the Auto position, the Influent Bar Screen Control Panel will control the start, stop and control the speed of the screen drive motor (M-101) by reading the flow depth difference between the Influent Flow Level Sensor (LIT-101) and the Effluent Flow Level Sensor (LIT-102). The speed of the Screen Drive Motor (M-101) will be proportional to the difference in water depth. This setting will be pre-set by the Vendor and can be adjusted by the Operator at the Influent Bar Screen Control Panel or at SCADA.

b. The Screen Drive Motor (M-101) will start at a preset water level difference between the Influent Flow Level Sensor (LIT-101) and the Effluent Flow Level Sensor (LIT-102). At another preset water level difference, the Screen Drive Motor (M-101) will stop after a time interval set by a timer.

c. The Screen Rake Motor (M-111) will be On when the Screen Drive Motor (M-101) is operating.

d. The Screen Compactor Motor will be On after an accumulated amount of time after the Screen Drive Motor (M-101) is started. It will turn off after a preset time interval after the Screen Drive Motor (M-101) stops.

e. The Screen Drive Motor (M-101) will also start at a preset time interval since last operation and stop after a preset time interval.

f. The Influent High Level Float Switch (LSH-101) will be set to a level greater than the anticipated high flow depth in the influent channel. When depth exceeds this setting, the Influent High Level Float Switch (LSH-101) will close and override the automatic control for the Screen Drive Motor (M-101) and run it at 100% speed Control will return to Automatic when the water level difference between the Influent Flow Level Sensor (LIT-101) and the Effluent Flow Level Sensor (LIT-102) is at a minimum.

g. The Screen Washwater solenoids will be energized when the Screen Drive Motor (M-101) and the Screen Rake Motor (M-111) are running.

h. The Compactor Washwater solenoid will be energized when the Screen Drive Motor (M-101) is running.

4. SCADA Manual C

5. SCADA Automatic

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6. Alarms:

a. When the Influent High Level Float Switch (LSH-101) closes, a Critical alarm will be triggered locally and at the SCADA HMI.

b. When any of the motors trips a fault, a "high" level alarm will display at the Control Panel and be transmitted to SCADA.

B. INFLUENT PUMP STATION

1. Process Overview

a. The Influent Pump Station receives screened wastewater from the Influent Bar Screen and pumps the flow to the Aeration Basins. The local Influent Pump Station Control Panel will control the Influent Pump Station operation. In the Influent Pump Station wetwell, a wastewater level sensor will turn on and turn off the influent pumps in response to wetwell wastewater levels. The Influent Pump Station Control Panel will also alternate the Influent Pumps between lead, lag and standby in order to even the runtime of the pumps. When the wetwell wastewater level reaches high level alarm, a level switch will turn on all 3 Influent Pumps. When the wetwell level falls to low level alarm, a level switch will turn off the Influent Pumps. The discharges of the Influent Pumps are fitted with Pressure Switches to protect them from a no-flow condition. A flowmeter at the Influent Pump Station discharge records incoming WWTF wastewater flow. Each pump will have run and trouble status report to SCADA.

b. PLC: Vendor supplied

c. Drawing(s): MB-02, MB-03, P-01

d. Equipment:

1) Wetwell Level Sensor (LIT-201)
2) Wetwell High-Level Float Switch (LSH-201)
3) Wetwell Low-Level Float Switch (LSL-201)
4) Influent Pump (P-201-01)
5) Influent Pump (P-201-02)
6) Influent Pump (P-201-03)
7) Pump P-201-01 Discharge Pressure Switch (PIT-201)
8) Pump P-201-02 Discharge Pressure Switch (PIT-202)
9) Pump P-201-03 Discharge Pressure Switch (PIT-203)
10) Influent Pump Station Discharge Flowmeter (FIT-201)

2. Local Manual Control
   a. There is a local Influent Pump Station Control Panel located near the Influent Pump Station inside MCC#2. When the Influent Pump HOA Switch for any of the Influent Pumps (P-201-01, P-201-02 or P-201-03) is turned to "Hand", that Influent Pump can be operated by the run/stop buttons.
   b. In addition, there is another set of HOA switches and On/Off buttons located at each pump that can be used in the same way to run the Influent Pumps manually.

3. Local Automatic Control
   a. There is a local Influent Pump Station Control Panel located near the Influent Pump Station inside MCC#3. When the Influent Pump HOA Switch for any of the Influent Pumps (P-201-01, P-201-02 or P-201-03) is turned to "Auto", that Influent Pump will be operated by the PLC in the Influent Pump Station Control Panel.
   b. The Wetwell Level Sensor (LIT-201) will control the operation of the Influent Pumps. The Wetwell Level Sensor (LIT-201) will have level set points set by the vendor for the following setpoints;
      1. Low-Level Alarm – "High" level alarm locally and transmitted to HMI
      2. Lead Pump On -Influent Pump Starts
      3. Lag Pump On – Second Influent Pump Starts
      4. High-Level Alarm – "High" level alarm locally and transmitted to HMI
      5. The setpoints can be reset by the Operator at the PLC or HMI
   c. The Wetwell High-Level Float Switch (LSH-201) will be set to a level above the Wetwell Level Sensor (LIT-201) "High-Level Alarm" setting. At this setting, all Influent Pumps will be turned on and an alarm sent to the PLC and HMI.
   d. The Wetwell Low-Level Float Switch (LSL-201) will be set to a level below the Wetwell Level Sensor (LIT-201) "Low-Level Alarm" setting. At this setting, all Influent Pumps will be turned off and an alarm sent to the PLC and HMI.
   e. Wastewater level in the wetwell will be sensed by the Wetwell Level Sensor (LIT-201). The Influent Pumps will vary flow by speeding up and slowing down using the VFD's to maintain the flow level. If just the Lead pump is running, the Lead Pump will vary flow using the VFD. If the Lag Pump is operating, the Lag Pump will vary flow using the VFD and the Lead Pump will operate at full speed.
   f. The Influent Pump Discharge Pressure Switches (PIT-201, 202, 203) will be set below the maximum discharge pressure of the Influent Pumps, but above the maximum operating pressure of the Influent Pumps. If the Pump discharge pressure is above the setting of the Influent Pump Pressure Switch, an alarm will be sent to the PLC and the HMI, and the Influent Pump will be shut off.

      1. SCADA Manual Control; None
      2. SCADA Automatic Control; None
      3. Alarms
   g. High Level Alarm: When the Wetwell High Level Float Switch (LSH-201) closes, a "Critical" alarm will be triggered locally and at the SCADA HMI.

h. Low Level Alarm: When the Wetwell Low Level Float Switch (LSL-201) closes, a "Critical" alarm will be triggered locally and at the SCADA HMI.

i. The Wetwell Level Sensor (LIT-201) will have adjustable high- and low-level alarm setpoints. The high-level and low-level alarm will send a "High" level alarm to SCADA. The alarm set points will be operator adjustable.

j. The Influent Pump Discharge Pressure Switches (PIT-201, 202, 203), when triggered, will transmit a "Critical" alarm to the PLC and HMI.

k. The Influent Pumps are fitted with internal temperature sensors and seal sensors. If activated, the signal from these sensors will be transmitted to the PLC and to the HMI as a "High" level alarm.

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C. AERATION BASIN SYSTEM

1. Process Overview:

a. There are 2 existing aeration basins fitted with 4 surface mixers. The 4 surface mixers will be kept operational but will only operate as back-up.

b. The aeration basins will be fitted with fine-bubble disk aerators, blowers, submersible mixers and dissolved oxygen (DO) probes to permit a complete process to operate automatically to maintain dissolved oxygen levels for optimum biological process control.

c. A local Control Panel will control the operation of these devices.

d. Airflow from the blowers to the fine bubble disk aerators will be controlled with motorized butterfly valves.

e. The motorized valves on the air distribution pipelines will modulate air going to the fine-bubble disk aerators in order to maintain a DO level.

f. The subsurface mixers will allow the circulation of the mixed liquor in the oxidation ditches.

g. PLC: Vendor supplied

h. Drawing(s): MD-02, MD-03, MD-04, P-02

i. Equipment:

1. Aeration Blower (B-410-01)
2. Aeration Blower (B-410-02)
3. Aeration Blower (B-410-03) (Alternate)
4. Aeration Basin #1 Surface Aerator (SA-401-01) (Existing)
5. Aeration Basin #1 Surface Aerator (SA-401-02) (Existing)
6. Aeration Basin #2 Surface Aerator (SA-402-01) (Existing)
7. Aeration Basin #2 Surface Aerator (SA-402-02) (Existing)
8. Aeration Basin #1 Motorized Butterfly Valve (BFV-401)
9. Aeration Basin #2 Motorized Butterfly Valve (BFV-402)
10. Aeration Basin #1 Air Flowmeter (FE/FIT 401)
11. Aeration Basin #2 Air Flowmeter (FE/FIT 402)
12. Air Pressure Meter (PE/PIT 410)
13. Aeration Basin #1 Subsurface Mixer (SM-401-01)
14. Aeration Basin #1 Subsurface Mixer (SM-401-02)

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15. Aeration Basin #2 Subsurface Mixer (SM-402-01)
16. Aeration Basin #2 Subsurface Mixer (SM-402-02)
17. Aeration Basin #1 DO Meter (AE/AIT-401)
18. Aeration Basin #1 DO Meter (AE/AIT-402)
19. Aeration Basin #2 DO Meter (AE/AIT-403)
20. Aeration Basin #2 DO Meter (AE/AIT-4(

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4. Local Manual Control
   a. A local Control Panel will be installed to control the aeration process.
   b. All of the equipment can be operated manually by selecting "Hand" on the Control Panel
   c. The aeration system can be run manually with the blowers (B-401-01, B-401-02) turned on in "Hand" mode and the Motorized butterfly valves (BFV-401, BFV-402) in the "Open" position.
   d. The blowers (B-401-01, B-401-02) can be speeded up or slowed down by manual control.
   e. All of the subsurface mixers (SM401-01, SM-401-02, SM-402-01, SM-402-02) should be running unless the surface aerators (SA-401-01, SA-401-02, SA-402-01, SA-402-02) are turned on to allow circulation of mixed liquor.
   f. If desired, the aeration system and subsurface mixers can be turned off and the existing surface aerators (SA-401-01, SA-401-02, SA-402-01, SA-402-02) operated manually from the selection at their control panel/disconnect.
   g. Dissolved oxygen concentrations in the mixed liquor can be read at the DO meters (AE/AIT-401, AE/AIT-402, AE/AIT-403, AE/AIT-404) or at the Control Panel.
5. Local Automatic Control
   a. The local Control Panel can control the aeration system in Automatic Mode.
   b. The aeration basins will operate independently of one another in automatic mode.
   c. The DO meters located downstream the aerators, (AE/AIT-401, AE-AIT-403) will control automatic operation, which will operate to maintain a preset DO level in the mixed liquor.
   d. The Control Panel will open and close the Aeration Basin Butterfly Valves (BFV-401, BFV-402) to adjust the air flow in response to the DO readings.
6. SCADA Manual Control: None
   a. SCADA Automatic Control: None
   b. Alarms:
      1) The Air Pressure Meter will generate a "Low" level alarm when the air pressure is outside acceptable limits as set by the Operators.
      2) Blowers are fitted with seal leak and temperature sensors that will generate a "High" level alarm when the readings are outside of values set by the Operator.

3) The subsurface mixers will be fitted with leak and temperature sensors. A "High" level alarm will be ...r high temperature.

4) The surface aerators are fi... "High" level alarm will be ...r high temperature.

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7. CLARIFIER #1 OPERATION
   a. Process Overview
      1) Clarifier #1 receives mixed liquor from the aeration basins via Splitter Box #2. The mixed liquor separates into sludge and clarified water. The sludge discharges to the Sludge Box and the clarified water discharges to the Chlorine Manhole.
      2) The existing Clarifier Motor continuously turns the sludge rake and skimmer.
      3) The Sludge Blanket Level Sensor senses and transmits the thickness of the sludge blanket for the Operators to manually adjust the sludge valve if needed.
      4) PLC: In MCC#1
      5) Drawing(s): ME-01, ME-02, P-03
      6) Equipment:
         i. Clarifier #1 Motor (M-501) (Existing)
         ii. Sludge Blanket Analyzer (LE/LIT-501)
   b. Local Manual Control; Clarifier #1 Motor (M-501) started and stopped by Operator at control panel/disconnect located next to motor.
   c. Local Automatic Control: None
   d. SCADA Manual Control: None
   e. SCADA Automatic Control; None
   f. Alarms
      i. Sludge Blanket Alarm; A "Low" level alarm will be triggered at the Sludge Blanket Analyzer (LE/LIT-501) and transmitted to the HMI if the measured sludge blanket thickness is above a set point set by the Operator.
      ii. Clarifier #1 Motor (M-501); A "High" level alarm will be transmitted to the HMI for over-torque and low oil pressure in the gearbox.

8. CLARIFIER #2 OPERATION
   a. Process Overview
      i. Clarifier #2 receives mixed liquor from the aeration basins via Splitter Box #2. The mixed liquor separates into sludge and clarified water. The sludge discharges to the Sludge Box and the clarified water discharges to the Chlorine Manhole.
      ii. The existing Clarifier Motor continuously turns the sludge rake and skimmer.
      iii. The Sludge Blanket Level Sensor senses and transmits the thickness of the sludge blanket for the Operators to manually adjust the sludge valve if needed.
      iv. PLC: In MCC#1
      v. Drawing(s): ME-01, ME-02, P-03

vi. Equipment:
1. Clarifier #2 Motor (M-502) (Existing)
2. Sludge Blanket Analyzer (LE/LIT-502)

b. Local Manual Control; Clarifier #2 Motor (M-502) started and stopped by Operator at control panel/disconnect located next to motor.
c. Local Automatic Control: None
d. SCADA Manual Control: None
e. SCADA Automatic Control; None
f. Alarms
i. Sludge Blanket Alarm; A "Low" level alarm will be triggered at the Sludge Blanket Analyzer (LE/LIT-502) and transmitted to the HMI if the measured sludge blanket thickness is above a set point set by the Operator.
ii. Clarifier #2 Motor (M-502); A "High" level alarm will be transmitted to the HMI for over-torque and low oil pressure in the gearbox.

9. CHLORINE GAS FEED SYSTEM

a. Process Overview
i. The Chlorine Gas Feed System injects chlorine gas into a water stream fed from the Plant Water System. The chlorinated water then flows to the Chlorine Manhole where the flow is divided and discharged through diffusers into the pipelines that convey Clarifier effluent into the Chlorine Manhole.
ii. Two chlorine gas tanks will be fitted with regulators. The Chlorine Feed System will automatically switch between tanks.
iii. A Chlorine Analyzer mounted in the Chlorine Contact Basin #1 will read the chlorine residual in the clarified water and transmit the reading to the HMI. The operator will adjust the Chlorine Gas feed rate to maintain the Chlorine residual.
iv. PLC: In MCC#4
v. Drawing(s): MF-02, MF-04, P-03
vi. Equipment:
1. Chlorine Feed System (CF-601)
2. Chlorine Analyzer (AE/AIT-601)

b. Local Manual Control
i. An operator can change the feed rate of the Chlorine Feed System (CF-601) directly on the equipment housing.
c. Local Automatic Control: None
d. SCADA Manual Control: The operator can adjust chlorine feed rate at the HMI
e. SCADA Automatic Control; None
f. Alarms
i. Chlorine high residual alarm; A "low" level alarm will be triggered at the Chlorine Analyzer (CA-601) and transmitted to the HMI if the measured chlorine residual is above a set point set by the Operator.

ii. Chlorine low residual alarm: A "low" level alarm will be triggered at the Chlorine Analyzer (CA-601) and transmitted to the HMI if the measured chlorine residual is below a set point set by the Operator.
iii. Chlorine Analyzer fault: A "low" level alarm will be triggered at the Chlorine Analyzer (CA-601) and transmitted to the HMI if the Chlorine Analyzer (CA-601) has a fault condition.

10. CHLORINE CONTACT BASIN OPERATION

a. Process Overview
   i. Chlorine Contact Basins (CCB) #1 and #2 receive chlorinated water from the Chlorine Manhole. In normal operation, the chlorinated water flows through Chlorine Contact Basin #1 and Chlorine Contact Basin #2 in succession to give the required residence time. However, slide gates can be operated to isolate either of the CCB's.
   ii. The existing Chlorine Contact Basin #2 Motor continuously turns the sludge rake and skimmer.
   iii. The Sludge Blanket Level Sensor that will be mounted in Chlorine Contact Basin #2 senses and transmits the thickness of the sludge blanket for the Operators to manually operate the sludge valve when needed.
   iv. PLC: In MCC#3
   v. Drawing(s): MF-03, P-03
   vi. Equipment:
      1. CCB #2 Motor (M-610) (Existing)
      2. Sludge Blanket Analyzer (LE/LIT-610)
b. Local Manual Control; CCB #2 Motor (M-610) started and stopped by Operator at control panel/disconnect located next to motor.
c. Local Automatic Control: None
d. SCADA Manual Control: None
e. SCADA Automatic Control; None
f. Alarms
   i. Sludge Blanket alarm; A "Low" level alarm will be triggered at the Sludge Blanket Analyzer (LE/LIT-610) and transmitted to the HMI if the measured sludge blanket thickness is above a set point set by the Operator.
   ii. Clarifier #2 Motor (M-610); A "High" level alarm will be transmitted to the HMI for over-torque and low oil pressure in the gearbox.

11. SULFUR DIOXIDE GAS FEED SYSTEM

a. Process Overview
   i. The Sulfur Dioxide (SO2) Gas Feed System injects SO2 gas into a water stream fed from the Plant Water System. The treated water then flows to the Sulfur Dioxide Manhole where the flow is discharged through a diffuser into the manhole where the discharge from Chlorine Contact Basin #1 and Chlorine Contact Basin #2 enter the Sulfur Dioxide Manhole.

ii. Two SO2 gas tanks will be fitted with regulators. The SO2 Gas Feed System will automatically switch between tanks.
iii. A Chlorine Analyzer mounted at the Parshall Flume will read the chlorine residual in the dechlorinated water and transmit the reading to the HMI. The operator will adjust the SO2 Gas feed rate to maintain the Chlorine residual.
iv. PLC: In MCC#4
v. Drawing(s): MF-08, MF-09, P-03
vi. Equipment:
1. SO2 Feed System (SOF-610)
2. Chlorine Analyzer (CA-610)

b. Local Manual Control
i. An operator can change the feed rate of the SO2 Feed System (SOF-610) directly on the equipment housing.
c. Local Automatic Control: None
d. SCADA Manual Control: The operator can adjust SO2 feed rate at the HMI
e. SCADA Automatic Control; None
f. Alarms
i. Chlorine high residual alarm; A "low" level alarm will be triggered at the Chlorine Analyzer (CA-610) and transmitted to the HMI if the measured chlorine residual is above a set point set by the Operator.
ii. Chlorine low residual alarm: A "low" level alarm will be triggered at the Chlorine Analyzer (CA-610) and transmitted to the HMI if the measured chlorine residual is below a set point set by the Operator.
iii. Chlorine Analyzer fault: A "low" level alarm will be triggered at the Chlorine Analyzer (CA-610) and transmitted to the HMI if the Chlorine Analyzer (CA-610) has a fault condition.

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12. EFFLUENT PUMP STATION

a. Process Overview
i. The Effluent Pump Station receives dechlorinated water from the SO2 Manhole. ol Panel will control the Effluent Pump ıps or the Reclaimed Water Pump, which

Conformed Changes to Documents as a result of Award of Reduced Scope of Work

ii. vater level sensor will turn on and turn off the Effluent Pumps in response to basin water levels. The Effluent Pump Station Control Panel will also alternate the Effluent Pumps between lead, lag and standby in order to even the runtime of the pumps.
iii. When the basin water level reaches the setting for the high-level alarm, a level switch will turn on all 3 Effluent Pumps.
iv. When the basin water level falls to the setting of the low-level alarm, a level switch will turn off the Effluent Pumps.
v. Each Effluent Pump will have run and trouble status report to SCADA.
vi. PLC: Vendor supplied

vii. Drawing(s): MG-02, MG-03, MG-04, P-04
viii. Equipment:
1. Basin Level Sensor (LE/LIT-701)
2. Basin High-Level Float Switch (LSH-701)
3. Basin Low-Level Float Switch (LSL-701)
4. Effluent Pump (P-701-01)
5. Effluent Pump (P-701-02)
6. Effluent Pump (P-701-03)
7. Pump P-701-01 Discharge Pressure Switch (PIT-701)
8. Pump P-701-02 Discharge Pressure Switch (PIT-702)
9. Pump P-701-03 Discharge Pressure Switch (PIT-703)

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b. Local Manual Control

i. There will be a local Effluent Pump Station Control Panel located near the pumps. When the Effluent Pump HOA Switch for any of the Effluent Pumps (P-701-01, P-701-02 or P-701-03) is turned to "Hand", that Effluent Pump can be operated by the run/stop buttons. In addition, there is another set of HOA switches and On/Off buttons located at each pump that can be used in the same way to run the Effluent Pumps manually.

c. Local Automatic Control

i. There will be a local Effluent Pump Station Control Panel located near the Effluent Pump Station. When the Effluent Pump HOA Switch for any of the Effluent Pumps (P-701-01, P-701-02 or P-701-03) is turned to "Auto", that Effluent Pump will be operated by the PLC in the Effluent Pump Station Control Panel.
ii. The Basin Level Sensor (LIT-701) will control operation of the Effluent Pumps. The Basin Level Sensor (LIT-701) will have level set points set by the vendor for the following setpoints;
1. Low-Level Alarm – "High" level alarm locally and transmitted to HMI
2. Lead Pump On -Effluent Pump Starts
3. Lag Pump On – Second Effluent Pump Starts
4. High-Level Alarm – "High" level alarm locally and transmitted to HMI
5. The setpoints can be reset by the Operator at the PLC or HMI
iii. The Basin High-Level Float Switch (LSH-701) will be set to a level above the Basin Level Sensor (LE/LIT-701) "High-Level alarm" setting. At this setting, all Effluent Pumps will be turned on and an alarm sent to the PLC and HMI.
iv. The Basin Low-Level Float Switch (LSL-701) will be set to a level below the Basin Level Sensor (LE/LIT-701) "Low-Level Alarm" setting. At this setting, all Effluent Pumps will be turned off and an alarm sent to the PLC and HMI.
v. Water level in the Basin will be sensed by the Basin Level Sensor (LE/LIT-701). The Effluent Pumps will vary flow by speeding up and slowing down using the VFD's to maintain the water level. If just the Lead pump is running, the Lead

Pump will vary flow using the VFD. If the Lag Pump is operating, the Lag Pump will vary flow using the VFD and the Lead Pump will operate at full speed.

vi. The Effluent Pump Discharge Pressure Switches (PIT-701-01, 702-01 703-01) will be set below the maximum discharge pressure of the Effluent Pumps, but above the maximum operating pressure of the Effluent Pumps. If the Pump discharge pressure is above the setting of the Effluent Pump Pressure Switch, an alarm will be sent to the PLC and the HMI, and the Effluent Pump will be shut off.

d. SCADA Manual Control; None
e. SCADA Automatic Control; None
f. Alarms
   i. Basin High Level Alarm: When the Basin High Level Float Switch (LSH-701) closes, a "Critical" alarm will be triggered locally and at the SCADA HMI.
   ii. Basin Low Level [illegible] Switch (LSL-701) closes, a "Critica[illegible]e SCADA HMI.
   iii. The Basin Level [illegible]gh- and low-level alarm setpoints. [illegible]end a "High" level alarm to SCADA. The alarm set points will be operator adjustable.
   iv. The Effluent Pump Discharge Pressure Switches (PIT-701, 702, 703), when triggered, will transmit a "Critical" alarm to the PLC and HMI.
   v. The Effluent Pumps are fitted with internal temperature sensors and seal sensors. If activated, the signal from these sensors will be transmitted to the PLC and to the HMI as a "High" alarm.

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13. PLANT EFFLUENT FLOW MEASURING

a. Process Overview
   i. The plant effluent flow rate is measured by a level sensor at the Parshall Flume. The level signal is converted to flow in the level transmitter and transmitted by radio to SCADA.
   ii. PLC:
   iii. Drawing(s): MH-03, P-04
   iv. Equipment:
      1. Plant Effluent Level Sensor and Transmitter (LE/LIT 801)
b. Local Manual Control: None
c. Local Automatic Control: None
d. SCADA Manual Control; None
e. SCADA Automatic Control; None
f. Alarms: A "High" Level alarm will be generated if the flow is outside set limits or if there is a fault at the Plant Effluent Sensor and Transmitter.

14. RAS PUMP STATION

a. Process Overview

i. The Recirculated Activated Sludge (RAS) Pump Station receives sludge from the clarifiers via the Sludge Box as well as Plant drain flows. The local RAS Pump Station Control Panel will control the RAS Pump Station operation. In the RAS Pump Station wetwell, a sludge level sensor will turn on and turn off the RAS pumps in response to wetwell sludge levels. The RAS Pump Station Control Panel will also alternate the RAS Pumps between lead, lag and standby in order to even the runtime of the pumps. When the wetwell sludge level reaches high level alarm, a level switch will turn on all 3 RAS Pumps. When the wetwell level falls to low level alarm, a level switch will turn off the RAS Pumps. The discharges of the RAS Pumps are fitted with Pressure Switches to protect them from a no-flow condition. There are 2 flowmeters at the RAS Pump Station to measure flow of RAS to splitter box #1 and WAS to the Thickener. Each RAS pump will have run and trouble status report to SCADA.

ii. PLC: MCC #5

iii. Drawing(s): MI-04, P-05

iv. Equipment:

1. Wetwell Level Sensor (LIT-901)
2. Wetwell High-Level Float Switch (LSH-901)
3. Wetwell Low-Level Float Switch (LSL-901)
4. RAS Pump (P-901-01)
5. RAS Pump (P-901-02)
6. RAS Pump (P-901-03)
7. Pump P-901-01 Discharge Pressure Switch (PIT-901)
8. Pump P-901-02 Discharge Pressure Switch (PIT-902)
9. Pump P-901-03 Discharge Pressure Switch (PIT-903)
10. RAS Flowmeter (FIT-901)
11. WAS Flowmeter (FIT-910)

b. Local Manual Control

i. There is a local RAS Pump Station Control Panel located near the RAS Pump Station. When the RAS Pump HOA Switch for any of the Influent Pumps (P-901-01, P-901-02 or P-901-03) is turned to “Hand”, that Influent Pump can be operated by the run/stop buttons. In addition, there is another set of HOA switches and On/Off buttons located at each pump that can be used in the same way to run the RAS Pumps manually.

c. Local Automatic Control

i. There is a local RAS Pump Station Control Panel located near the RAS Pump Station. When the RAS Pump HOA Switch for any of the RAS Pumps (P-901-01, P-901-02 or P-901-03) is turned to “Auto”, that RAS Pump will be operated by the PLC in the RAS Pump Station Control Panel.

ii. The Wetwell Level Sensor (LIT-901) will operate the RAS Pumps. The Wetwell Level Sensor (LIT-901) will have level set points set by the vendor for the following setpoints;
    1. Low-Level Alarm – "High" level alarm locally and transmitted to HMI
    2. Lead Pump On -RAS Pump Starts
    3. Lag Pump On – Second RAS Pump Starts
    4. High-Level Alarm – "High" level alarm locally and transmitted to HMI
    5. The setpoints can be reset by the Operator at the PLC or HMI

iii. The Wetwell High-Level Float Switch (LSH-901) will be set to a level above the Wetwell Level Sensor (LIT-901) "High-Level Alarm" setting. At this setting, all Influent Pumps will be turned on and an alarm sent to the PLC and HMI.

iv. The Wetwell Low-Level Float Switch (LSL-901) will be set to a level below the Wetwell Level Sensor (LIT-901) "Low-Level Alarm" setting. At this setting, all Influent Pumps will be turned off and an alarm sent to the PLC and HMI.

v. The plant influent flow will be transmitted by the Influent Pump Station Discharge Flow Meter (FIT-201). The RAS Pumps will vary flow by speeding up and slowing down using the VFD's to maintain a flow proportional to the influent flow. If just the Lead pump is running, the Lead Pump will vary flow using the VFD. If the Lag Pump is operating, the Lag Pump will vary flow using the VFD and the Lead Pump will operate at full speed.

vi. The RAS Pump Discharge Pressure Switches (PIT-901, 902, 903) will be set below the maximum discharge pressure of the RAS Pumps, but above the maximum operating pressure of the RAS Pumps. If the Pump discharge pressure is above the setting of the RAS Pump Pressure Switch, an alarm will be sent to the PLC and the HMI, and the RAS Pump will be shut off.

d. SCADA Manual Control; None

e. SCADA Automatic Control;

i. When the RAS Pump HOA Switch for any of the RAS Pumps (P-901-01, P-901-02 or P-901-03) is turned to "Auto", that RAS Pump will be operated by the PLC in the RAS Pump Station Control Panel and the signals are transmitted to SCADA and the HMI.

ii. The plant influent flow will be transmitted by the Influent Pump Station Discharge Flow Meter (FIT-201). The RAS Pumps will vary flow by speeding up and slowing down using the VFD's to maintain a flow proportional to the influent flow. If just the Lead pump is running, the Lead Pump will vary flow using the VFD. If the Lag Pump is operating, the Lag Pump will vary flow using the VFD and the Lead Pump will operate at full speed. The Operator can input the proportional flow at the HMI.

f. Alarms

i. High Level Alarm: When the Wetwell High Level Float Switch (LSH-201) closes, a "Critical" alarm will be triggered locally and at the SCADA HMI.

ii. Low Level Alarm: When the Wetwell Low Level Float Switch (LSL-201) closes, a "Critical" alarm will be triggered locally and at the SCADA HMI.

iii. The Wetwell Level Sensor (LIT-201) will have adjustable high- and low-level alarm setpoints. The high-level and low-level alarm will send a "High" level alarm to SCADA. The alarm set points will be operator adjustable.
iv. The Influent Pump Discharge Pressure Switches (PIT-201, 202, 203), when triggered, will transmit a "Critical" alarm to the PLC and HMI.
v. The Influent Pumps are fitted with internal temperature sensors and seal sensors. If activated, the signal from these sensors will be transmitted to the PLC and to the HMI as a "High" alarm.

15. THICKENER OPERATION

a. Process Overview
   i. The thickener receives sludge from the Ras Pump Station. The mixed liquor separates into sludge and clarified water. The sludge discharges to the WAS Pump Station and the clarified water discharges to the RAS Pump Station.
   ii. The existing Thickener Motor continuously turns the sludge rake and skimmer.
   iii. The Sludge Blanket Level Sensor senses and transmits the thickness of the sludge blanket for the Operators to adjust the sludge valve if needed.
   iv. PLC: In MCC#1
   v. Drawing(s): P-03
   vi. Equipment:
      1. Thickener Motor (M-911) (Existing)
      2. Sludge Blanket Analyzer (LE/LIT-911)
b. Local Manual Control; Thickener Motor (M-911) started and stopped by Operator at control panel/disconnect located next to motor.
c. Local Automatic Control: None
d. SCADA Manual Control: None
e. SCADA Automatic Control; None
f. Alarms
   i. Sludge Blanket Alarm; A "Low" level alarm will be triggered at the Sludge Blanket Analyzer (LE/LIT-911) and transmitted to the HMI if the measured sludge blanket thickness is above a set point set by the Operator.
   ii. Thickener Motor (M-911); A "High" level alarm will be transmitted to the HMI for over-torque and low oil pressure in the gearbox.

16. WAS PUMP STATION OPERATION

a. Process Overview
   i. The WAS Pump Station receives thickened sludge from the Thickener. A manual plug valve in Valve Vault #2 is operated manually to control the flow of thickened sludge to the WAS Pump Station.
   ii. The Start and Stop buttons for the WAS pumps are in the Belt Filter Press Building, in the Belt Filter Press Control Panel.

iii. Typically the Operator operates the WAS Pump, the Polymer Feed Pump and the Belt Press manually from the Start/Stop controls on the Belt Filter Press Control Panel.
iv. PLC: In MCC#1
v. Drawing(s): P-03
vi. Equipment:
1. WAS Pump (P-921-01) (Existing)
2. WAS Pump (P-921-02) (Existing)

b. Local Manual Control:
i. WAS Pumps (P-921-01, and P-921-02) started and stopped by Operator at Belt Filter Press Control Panel.
ii. Operator adjusts plug valve in Valve Vault #2 to control flow to WAS pump Station.
c. Local Automatic Control: None
d. SCADA Manual Control: None
e. SCADA Automatic Control: None
f. Alarms: The WAS Pumps (P-921-01, -02) are fitted with internal temperature sensors and seal sensors. If activated, the signal from these sensors will be transmitted to the HMI as a "High" alarm.

17. BELT PRESS OPERATION

a. Process Overview
i. The belt press receives thickened sludge from the WAS Pump Station. The sludge is mixed with polymer from the polymer feed pump and conditioned before arriving at the belt press.
ii. The Belt Press Wash Water Booster Pump provides wash water from the potable water system for the Belt Press
iii. The pressed sludge (cake) is conveyed to the outside of the building by a conveyor, where it is discharged on the ground. A truck carries the cake to the biosolids drying bed.
iv. PLC: In MCC#1
v. Drawing(s): P-05
vi. Equipment:
1. Belt Press (BP-941) (Existing)
2. Belt Press Conveyor Motor (M-941) (Existing)
3. Belt Press Wash Water Booster Pump (P-941) (Existing)
4. Polymer Feed Pump (P-941) (Existing)

b. Local Manual Control; WAS Pump, Polymer Feed Pump, Belt Press Wash Water Pump and Belt Press all started and stopped by operator at control panel/disconnect located in Belt Press room.
c. Local Automatic Control: None
d. SCADA Manual Control: None
e. SCADA Automatic Control; None

f. Alarms
    i. Belt Press (BP-941); A “High” level alarm will be transmitted to the HMI for Belt Press Alarm functions.

18. BIOSOLIDS PAD AND PUMP STATION OPERATION

a. Process Overview
    i. The Biosolids Pad stores cake deposited from trucks hauling the cake from the Belt Press.
    ii. The cake is stored and turned infrequently on the Biosolids Pad to allow composting of the cake over a period of 6 months. After the biosolids have been composted, they are hauled to buyers.
    iii. Water draining from the cake and rainfall drains along the Biosolids Pad and is discharged to the Biosolids Drain Pump Station (BSDPS). The BSDPS pumps the drainage water to the Influent Pump Station.
    iv. PLC: In MCC#5
    v. Drawing(s): MK-01 to MK-04, P-05
    vi. Equipment:
        1. Biosolids Drain PS Pump (P-1001-01)
        2. Biosolids Drain PS Pump (P-1001-02)
        3. Biosolids Wetwell Level Sensor (LE/LIT-1001)
b. Local Manual Control
    i. There will be a local Biosolids Drain Pump Station (BSDPS) Control Panel located near the BSDPS. When the Pump HOA Switch for any of the BSDPS Pumps (P-1001-01, -02) is turned to “Hand”, that BSDPS Pump can be operated by the run/stop buttons.
c. Local Automatic Control
    i. There will be a local BSDPS Control Panel located near the BSDPS. When the Pump HOA Switch for any of the BSDPS Pumps (P-1001-01, -02) is turned to “Auto”, that BSDPS Pump will be operated by the PLC in the BSDPS Control Panel.
    ii. The BSDPS Wetwell Level Sensor (LE/LIT-1001) will operate the BSDPS Pumps. The BSDPS Wetwell Level Sensor (LE/LIT-1001) will have level set points set by the vendor for the following setpoints;
        1. Low-Level Alarm – “High” level alarm locally and transmitted to HMI
        2. Lead Pump On -BSDPS Pump Starts
        3. Lag Pump On – Second BSDPS Pump Starts
        4. High-Level Alarm – “High” level alarm locally and transmitted to HMI
        5. The setpoints can be reset by the Operator at the PLC or HMI
    iii. The PLC will switch the pumps between “Lead” and “Lag” operation to even out the wear on the pumps.
d. SCADA Manual Control; None
e. SCADA Automatic Control;

i. When the Pump HOA Switch for any of the BSDPS Pumps (P-1001-01, -02) is turned to “Auto”, that Pump will be operated by the PLC in the BSDPS Control Panel, and the signals are transmitted to SCADA and the HMI.

f. Alarms

i. The Wetwell Level Sensor (LE/LIT-1001) will have adjustable high- and low-level alarm setpoints. The high-level and low-level alarm will send a “High” level alarm to SCADA. The alarm set points will be operator adjustable.

b. The BSDPS Pumps are fitted with internal temperature sensors and seal sensors. If activated, the signal from these sensors will be transmitted to the PLC and to the HMI as a “High” alarm.

END OF SECTION

SECTION 40 70 01.2 - INSTRUMENT SUPPORT HARDWARE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish and install instrumentation mounting and support hardware, as shown on the Drawings and as specified herein.

B. Hardware shall include anchor systems, adhesive anchor systems, metal framing systems, and other instrumentation installation mounting and support systems as specified herein with additional requirements as shown on the Drawings or specified within related sections.

1.2 RELATED WORK

A. Division 40 Process Control Systems Sections

B. Process Equipment Division Sections

C. Mechanical Equipment Division Sections

1.3 SUBMITTALS

A. Submit to the Owner/Engineer, in accordance with Division 1, the manufacturers' names and product designation or catalog numbers for each of the types of materials specified and where shown on the Drawings.

B. The submittal information, for anchor systems, shall contain manufacturer's specifications and technical data including;

1. Acceptable base material conditions (i.e. cracked, un-cracked concrete)
2. Acceptable drilling methods
3. Acceptable bore hole conditions (dry, water saturated, water filled, under water)
4. Manufacturer's installation instructions including bore hole cleaning procedures and adhesive injection.
5. Cure and gel time tables
6. Temperature ranges (storage, installation and in-service).

1.4 REFERENCE CODES AND STANDARDS

A. All products and components shown on the Drawings and listed in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NFPA 70 National Electrical Code (NEC)
2. NFPA 70E Standard for Electrical Safety in the Workplace
3. ASTM E 488-96 (2003); Standard Test Method for Strength of Anchors in Concrete and Masonry Elements, ASTM International.
4. ASTM E 1512-93, Standard Test Methods for Testing Bond Performance of Adhesive-Bonded Anchors, ASTM International
5. AC308; Acceptance Criteria for Post-Installed Anchors in Concrete Elements, Latest revision.

6. SAE 316 Stainless Steel Grades

B. All equipment components and completed assemblies specified in this Section of the Specifications, having a UL standard, shall bear the appropriate label of Underwriters Laboratories.

1.5 QUALITY ASSURANCE

A. The manufacturer of these materials shall have produced similar electrical materials and equipment for a minimum period of five (5) years. When requested by the Owner/Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.6 JOBSITE DELIVERY, STORAGE AND HANDLING

A. Prior to jobsite delivery, the Contractor shall have successfully completed all submittal requirements, and present to the Owner/Engineer upon delivery of the equipment, an approved copy of all such submittals. Delivery of incomplete constructed equipment, onsite factory work, or failed factory tests will not be permitted.

B. Materials shall be handled and stored in accordance with manufacturer's instructions.

C. Adhesive Anchor Systems.

1. Deliver materials undamaged in Manufacturer's clearly labeled, unopened containers, identified with brand, type, and ICC-ES Evaluation Report number.
2. Coordinate delivery of materials with scheduled installation date, minimizing storage time at job-site.
3. Store materials under cover and protect from weather and damage in compliance with Manufacturer's requirements, including temperature restrictions.
4. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
5. Do not use damaged or expired materials.
6. Storage restrictions (temperature range) and expiration date must be supplied with product

D. Metal Framing Systems

1. Material shall be new and unused, with no signs of damage from handling.

1.7 WARRANTY

A. Warranty on equipment and installation is one (1) year from Final Completion, in accordance with Article 6.19 of the General and Supplemental Conditions.

PART 2 - PRODUCTS

2.1 ANCHORING SYSTEMS

A. Acceptable Manufacturers

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   a. HILTI Kwik Bolt 3
   b. Approved equal

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

B. Product Description

1. Torque controlled expansion anchor consisting of anchor body, expansion element (wedges), washer and nut. Anchor shall be used for anchor sizes less than 3/8 inch.
2. All parts and materials shall be manufactured of 316 stainless steel and conform to SAE 316 standards.
3. UL 203 Rated.

2.2 ADHESIVE ANCHORING SYSTEMS

A. Acceptable Manufacturers

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   a. HILTI HIT-RTZ with HIT-HY 200 MAX.
   b. Approved equal
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

B. Product Description

1. Anchor body with helical cone shaped thread on the embedded end and standard threads on the exposed end, with washer and nut, inserted into Injection adhesive. Anchor shall be used for anchor sizes 3/8 inch and larger.
2. All parts and material shall be manufactured of 316 Stainless Steel and shall conform to SAE 316 standards.

2.3 U-CHANNEL SUPPORT SYSTEMS

A. Acceptable Manufacturers

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   a. Tyco Unistrut
   b. Cooper B-Line
   c. Super-Strut
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

B. Product Description

1. Metal framing system for use in the mounting or support of electrical systems, panels and enclosures, and including lighting fixture supports, trapeze hangers and conduit supports.
2. Components shall consist of telescoping channels, slotted back-to-back channels, end clamps allthreads and conduit clamps.
3. Minimum sizes shall be 13/16” through 3-1/4”

4. Components shall be assembled by means of flat plate fittings, 90 degree angle fittings, braces, clevis fittings, U-fittings, Z-fittings, Wing-fittings, Post Bases, channel nuts, washers, etc.
5. Field welding of components will not be permitted.
6. Unless otherwise specified or shown on the Drawings, all parts shall be manufactured of 316 stainless steel and conform to SAE 316 standards.
7. Framing systems for chlorine and ammonia rooms shall be manufactured of structural fiberglass.

2.4 INSTRUMENT PIPE STAND

A. Acceptable Manufacturers
   1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
      a. O'BRIEN Saddlepak
      b. Channel Track
      c. Techline Manufacturing
   2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

B. Product Description
   1. Floor mount pipe stand for use in the mounting or support of Instrumentation Transmitters.
   2. Stand shall consist of a 10 by 10 inch base plate of 1/4 inch steel with a minimum 40 inch long 2 inch steel tube center welded with a minimum of two 8 inch long gussets fully welded for maximum strength. The base plate shall have slotted mounting holes near all four corners.
   3. The stand shall be fully zinc metallized or hot dip galvanize coated.
   4. Field welding of components will not be permitted.

2.5 INSTRUMENT SUNSHIELD

A. Acceptable Manufacturers
   1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
      a. International Metal Engineering Pte. Ltd
      b. Approved Equal
   2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

B. Product Description
   1. For all instruments installed outdoors, provide a pipe stand or structure mounted sunshield for use in the protection of instrumentation from direct sunlight.

2. Sunshield shall consist of a minimum 10-inch overhang measured from front face of instrument, a hinged display shield that protects the display from sun and working space for service of the instrumentation without removal. Refer to Drawings for further details.
3. The sunshield shall be fabricated from 316 stainless steel unless otherwise shown on the Drawings. All mounting hardware shall be 316 stainless steel. Alternate materials, if indicated on the Drawings, shall be aluminum or fiberglass reinforced plastic with UV inhibitors.
4. All aluminum or stainless steel sunshields shall have all edges ground smooth without burs or sharp edges.

2.6 INSTRUMENT TUBING AND FITTINGS

A. Acceptable Manufacturers
1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   a. Tubing
      1) Swagelok
      2) Parker
   b. Fittings
      1) Swagelok
      2) Parker
   c. Valves
      1) Whitney
      2) Parker
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

B. Product Description
1. All instrument air header and branch connections shall be 316 stainless steel materials.
2. All instrument shut-off valves and associated fittings shall be supplied in accordance with the piping specifications and all instrument installation details. Fittings shall be 316 stainless steel. Valves shall be 316 stainless steel.
3. All instrument tubing shall be fully annealed ASTM A269 Seamless 316 grade free of O.D. scratches and having the following dimensional characteristics as required to fit the specific installation:
   a. 1/4-in to 1/2-in O.D. x 0.035 wall thickness
   b. 5/8-in to 1-in O.D. x 0.049 wall thickness
   c. 1-in O.D. x 0.065 wall thickness
   d. 1-1/4-in O.D. x 0.065 wall thickness
   e. 1-1/2-in O.D. x 0.083 wall thickness
   f. 2-in O.D. x 0.095 wall thickness
4. All process connections to instruments shall be annealed 1/2-in O.D. stainless steel tubing, Type 316.
5. All mounting hardware shall be provided of 316 Stainless steel.
6. All tubing shall be supported by stainless steel and installed as per manufacturer's installation instructions.

2.7 THERMOWELL

A. Acceptable Manufacturers
   1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
      a. Ashcroft
      b. Wika
      c. Omega
   2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

B. Product Description
   1. Standard: ASME B40.200.
   2. Pressure-tight, socket-type fitting made for insertion into process piping threaded tap fitting.
   3. Material shall be 316 Stainless Steel unless otherwise directed and shall be compatible with the process piping as shown on the drawings.
   4. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads to match tap provided.
   5. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
   6. Bore: Diameter required to match thermometer bulb or stem as specified else ware
   7. Insertion Length: Length required to match thermometer bulb or stem.
   8. Lagging Extension: shall be furnished on thermowells for insulated piping and tubing
   9. Bushings: For converting size of thermowells internal screw thread to size of thermometer connection shall be provided.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall install all equipment strictly in accordance with the manufacturer's instructions and the Contract Drawings.

B. The location of all devices is shown, in general, on the Drawings and may be varied within reasonable limits so as to avoid any piping or other obstruction without extra cost, subject to the approval of the Owner. Coordinate the installation of the devices for piping and equipment clearance.

C. No electrical equipment, Instrumentation or raceways shall be attached to or supported from, sheet metal walls.

D. Install required safety labels.

3.2 FIELD QUALITY CONTROL

A. Inspect installed equipment for anchoring, alignment, grounding and physical damage.

B. Check tightness of all accessible electrical connections. Minimum acceptable values are specified in manufacturer's instructions.

3.3 POST INSTALLED ANCHOR SYSTEMS

A. Prior to installation of the anchor systems, the hole shall be clean and dry in accordance with the manufacturer’s instructions.

3.4 CLEANING

A. Remove all rubbish and debris from inside and around the installation. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint free rags. Do not use compressed air.

END OF SECTION

SECTION 40 70 02 - PROCESS INSTRUMENT SCHEDULE

PART 1 GENERAL

1.1 SCOPE OF WORK

A. This Section includes a schedule of the Process Instruments.

B. See Supplement following this Specification for the Schedule of Process Instruments.

1.2 RELATED WORK

A. Section 40 70 03 Instrument and Control Components

B. Section 40 75 00 Process Liquid Analytical Measurement

C. Section 40 70 01 Instrument Support Hardware

1.3 SUBMITTALS

A. Refer to Division 01 and the related work sections for submittal requirements.

1.4 SYSTEM DESCRIPTION

A. The Process Instrument Schedule provides a summary of the major process instrumentation requirements as utilized within the control loops represented in the Contract Documents. Additional instruments shall be provided as required to fully implement the functionality as described in these specifications and as recommended by the process and mechanical equipment division suppliers.

B. The Process Instrument Schedule is not intended to be an all-inclusive listing of all elements and appurtenances required to execute the control loop functions; rather, it is intended to supplement and complement the drawings and other specification sections. The Process Instrument Schedule shall not be considered equal to a bill of materials.

C. Provide instrumentation hardware and software as necessary to perform control functions specified herein and as shown on drawings.

1.5 PROCESS INSTRUMENT SCHEDULE

A. The Process Instrument Schedule follows in a Supplement to this Specification.

B. Instruments formatted in italics are for future systems and shall be furnished with these systems in future.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

CITY OF GATESVILLE STILLHOUSE WWTF IMPROVEMENTS - PROCESS INSTRUMENT SCHEDULE

LOCATION	PLAN CODE	PURPOSE	TAG	TYPE	VENDOR/OWNER PROVIDED	LOCAL INDICATOR	TRANSMIT	SWITCH	SETTING	COMMENTS
BAR SCREEN INFLUENT	A	LEVEL SENSOR	LE/LIT-101	LEVEL MEASUREMENT	VENDOR	NO	YES	NO	VENDOR	
BAR SCREEN EFFLUENT	A	LEVEL SENSOR	LE/LIT-102	LEVEL MEASUREMENT	VENDOR	NO	YES	NO	VENDOR	
BAR SCREEN INFLUENT	A	LEVEL SWITCH	LSH-101	HIGH LEVEL FLOAT	VENDOR	NO	YES	YES	EL=754.26	
INFLUENT LIFT STATION	B	LEVEL SENSOR	LE/LIT-201	LEVEL MEASUREMENT	OWNER	NO	YES	NO	VENDOR, 0-22 FT	
INFLUENT LIFT STATION	B	LEVEL SWITCH	LSH-201	HIGH LEVEL FLOAT	OWNER	NO	YES	YES	EL=751.00	
INFLUENT LIFT STATION	B	LEVEL SWITCH	LSM-201	MEDIUM LEVEL FLOAT	OWNER	NO	YES	YES	EL=750.00	
INFLUENT LIFT STATION	B	LEVEL SWITCH	LSL-201	LOW LEVEL FLOAT	OWNER	NO	YES	YES	EL=749.00	
INFLUENT LIFT STATION	B	FLOW METER	FE/FIT-201	ELECTROMAGNETIC FLOW SENSOR/INDICATING TRANSMITTER	OWNER	NO	YES	NO	0-8400 GPM	
INFLUENT LIFT STATION	B	PUMP PRESSURE	PS-201	PRESSURE SENSOR/INDICATING TRANSMITTER	OWNER	NO	YES	YES	0-56 PSI	
INFLUENT LIFT STATION	B	PUMP PRESSURE	PS-202	PRESSURE SENSOR/INDICATING TRANSMITTER	OWNER	NO	YES	YES	0-56 PSI	
INFLUENT LIFT STATION	B	PUMP PRESSURE	PS-203	PRESSURE SENSOR/INDICATING TRANSMITTER	OWNER	NO	YES	YES	0-56 PSI	
AERATION BASIN 1	D	LOW DO METER	AE/AIT-401	DO MEASUREMENT	VENDOR	NO	YES	NO	VENDOR	
AERATION BASIN 2	D	LOW DO METER	AE/AIT-403	DO MEASUREMENT	VENDOR	NO	YES	NO	VENDOR	
AERATION BASIN 1	D	HIGH DO METER	AE/AIT-402	DO MEASUREMENT	VENDOR	NO	YES	NO	VENDOR	
AERATION BASIN 2	D	HIGH DO METER	AE/AIT-404	DO MEASUREMENT	VENDOR	NO	YES	NO	VENDOR	
BLOWER AIR FLOW	D	AIR FLOW METER, AB 1	FE/FIT-401	AIR FLOW SENSOR/INDICATING TRANSMITTER	VENDOR	NO	YES	NO	0-3500 CFM	
BLOWER AIR FLOW	D	AIR FLOW METER, AB 2	FE/FIT-402	AIR FLOW SENSOR/INDICATING TRANSMITTER	VENDOR	NO	YES	NO	0-3500 CFM	
BLOWER AIR CONTROL	D	MO AIR VALVE, AB 1	BFV-401	ACTUATED BUTTERFLY VALVE	VENDOR	NO	YES	NO	VENDOR	
BLOWER AIR CONTROL	D	MO AIR VALVE, AB 2	BFV-402	ACTUATED BUTTERFLY VALVE	VENDOR	NO	YES	NO	VENDOR	
BLOWER AIR PRESSURE	D	AIR FLOW PRESSURE	PS-410	PRESSURE SENSOR/INDICATING TRANSMITTER	VENDOR	YES	YES	NO	0-30 PSI	
CLARIFIER 1 SLUDGE BLANKET SENSOR	E	SB LEVEL INDICATOR	LE/LIT-501	LEVEL MEASUREMENT	OWNER	YES	YES	NO	VENDOR	
CLARIFIER 2 SLUDGE BLANKET SENSOR	E	SB LEVEL INDICATOR	LE/LIT-502	LEVEL MEASUREMENT	OWNER	YES	YES	NO	VENDOR	
CL CONTACT BASIN #2 SLUDGE BLANKET SENSOR	E	SB LEVEL INDICATOR	LE/LIT-610	LEVEL MEASUREMENT	OWNER	YES	YES	NO	VENDOR	
RESIDUAL CHLORINE METER	F	CHLORINE RESIDUAL AT CCB#1	AE/AIT-601	CL2 MEASUREMENT	OWNER	NO	YES	NO	0-10 PPM	
EFFLUENT PUMP STATION	G	PUMP PRESSURE	PS-701	PRESSURE SENSOR/INDICATING TRANSMITTER	VENDOR	NO	YES	YES	0-18 PSI	
EFFLUENT PUMP STATION	G	PUMP PRESSURE	PS-702	PRESSURE SENSOR/INDICATING TRANSMITTER	VENDOR	NO	YES	YES	0-18 PSI	
EFFLUENT PUMP STATION	G	PUMP PRESSURE	PS-703	PRESSURE SENSOR/INDICATING TRANSMITTER	VENDOR	NO	YES	YES	0-18 PSI	
EFFLUENT PUMP STATION	G	LEVEL SENSOR	LE/LIT-701	LEVEL MEASUREMENT	OWNER	NO	YES	NO	VENDOR, 0-13 FT	
EFFLUENT PUMP STATION	G	LEVEL SWITCH	LSH-701	HIGH LEVEL FLOAT	OWNER	NO	YES	YES	EL=760.72	

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Conformed Changes to Documents as a result of Award of Reduced Scope of Work

EFFLUENT PUMP STATION	G	LEVEL SWITCH	LSM-701	MEDIUM LEVEL FLOAT	OWNER	NO	YES	YES	EL=759.43	
EFFLUENT PUMP STATION	G	LEVEL SWITCH	LSL-701	LOW LEVEL FLOAT	OWNER	NO	YES	YES	EL=758.13	
RESIDUAL CHLORINE METER	H	CHLORINE RESIDUAL AT PARSHALL FLUME	AE/AIT-610	CL2 MEASUREMENT	OWNER	NO	YES	NO	0-10 PPM	
PARSHALL FLUME	H	LEVEL INDICATOR	LE/LIT-810	LEVEL MEASUREMENT	OWNER	NO	YES	NO	0-2.33 FT	EXISTING
RAS PUMP STATION	I	RAS FLOW METER	FE/FIT-901	ELECTROMAGNETIC FLOW SENSOR/INDICATING TRANSMITTER	OWNER	YES	YES	NO	0-3400 GPM	
RAS PUMP STATION	I	THICKENER FLOW METER	FE/FIT-910	ELECTROMAGNETIC FLOW SENSOR/INDICATING TRANSMITTER	OWNER	YES	YES	NO	0-120 GPM	
RAS PUMP STATION	I	PUMP PRESSURE	PS-901	PRESSURE SENSOR/INDICATING TRANSMITTER	VENDOR	NO	YES	YES	0-26 PSI	
RAS PUMP STATION	I	PUMP PRESSURE	PS-902	PRESSURE SENSOR/INDICATING TRANSMITTER	VENDOR	NO	YES	YES	0-26 PSI	
RAS PUMP STATION	I	PUMP PRESSURE	PS-903	PRESSURE SENSOR/INDICATING TRANSMITTER	VENDOR	NO	YES	YES	0-26 PSI	
RAS PUMP STATION	I	LEVEL SENSOR	LE/LIT-901	LEVEL MEASUREMENT	OWNER	NO	YES	NO	VENDOR, 0-28 FT	
RAS PUMP STATION	I	LEVEL SWITCH	LSH-901	HIGH LEVEL FLOAT	OWNER	NO	YES	YES	EL=750.00	
RAS PUMP STATION	I	LEVEL SWITCH	LSM-901	MEDIUM LEVEL FLOAT	OWNER	NO	YES	YES	EL=748.00	
RAS PUMP STATION	I	LEVEL SWITCH	LSL-901	LOW LEVEL FLOAT	OWNER	NO	YES	YES	EL=746.00	
THICKENER SLUDGE BLANKET SENSOR	I	SB LEVEL INDICATOR	LE/LIT-911	LEVEL MEASUREMENT	OWNER	YES	YES	NO	VENDOR	
BIOSOLIDS PUMP STATION	I	LEVEL SWITCH	LSH-1001	HIGH LEVEL FLOAT	VENDOR	NO	YES	NO	VENDOR	
BIOSOLIDS PUMP STATION	I	LEVEL SWITCH	LSM-1001	MEDIUM LEVEL FLOAT	VENDOR	NO	YES	NO	VENDOR	
BIOSOLIDS PUMP STATION	I	LEVEL SWITCH	LSL-1001	LOW LEVEL FLOAT	VENDOR	NO	YES	NO	VENDOR	
PLANT WATER PRESSURE SENSOR	L	PRESSURE SENSOR	PE/PIT-704	ELECTROMAGNETIC FLOW SENSOR/INDICATING TRANSMITTER	OWNER	NO	YES	NO	VENDOR	EXISTING
RECLAIM WATER FLOW	L	FLOW METER	FE/FIT-706	ELECTROMAGNETIC FLOW SENSOR/INDICATING TRANSMITTER	OWNER	NO	YES	NO	0-500 gpm	

Conformed Changes to Documents as a result of Award of Reduced Scope of Work

SECTION 40 70 03 - INSTRUMENTATION AND CONTROL COMPONENTS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish, install and test all flow measurement, flow control devices and appurtenances, as shown on the Drawings, specified in the Related Work Sections and Divisions, and as specified herein.

B. Flow equipment, specified in other Divisions, shall be manufactured in accordance with this Section and submitted as a part of the equipment specified in other Divisions.

1.2 RELATED WORK

A. Process Equipment Divisions

B. Mechanical Equipment Division.

C. Electrical Equipment Division.

D. Section 40 61 13 Process Control Systems General Provisions

E. Section 40 70 01.2 Instrument Support Hardware

F. Section 40 70 02.1 Process Instrument Schedule

1.3 SUBMITTALS

A. Submit catalog data for all items supplied from this specification Section as applicable. Submittal shall include catalog data, functions, ratings, inputs, outputs, displays, etc., sufficient to confirm that the meter or relay provides every specified requirement. Any options or exceptions shall be clearly indicated.

B. Submittals for equipment specified herein, for other Sections or Divisions, shall be made in accordance with Division 1 and Section 40 16 13 - Process Control Systems General Provisions

C. Operation and Maintenance manuals shall be provided in accordance with Division 1 and Section 40 16 13 - Process Control Systems General Provisions.

1.4 REFERENCE CODES AND STANDARDS

A. The equipment in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. ISO 2975/VII liquids and BS 5857-2.4 for gases. Transit Time Meters
2. American Society of Mechanical Engineers (ASME). 1971. Fluid meters: Their theory and application.
3. ASME PTC 19.2 - Pressure Measurement
4. ANSI B88.1 Pressure Transducers Calibration
5. ISA S37.6 Strain Gage Transducers Potentiometric
6. Calibration AVS 6.2, 6.4, 6.5 Hazardous Areas
7. IEC 79-10 Intrinsically Safe Circuits
8. ANSI 913 Electrical Instruments in Hazardous Atmospheres
9. National Electrical Safety Code (NESC)
10. Occupational Safety and Health Administration (OSHA)
11. National Fire Protection Association (NFPA)
12. National Electrical Manufacturers Association (NEMA)
13. American National Standards Institute (ANSI)
14. Insulated Cable Engineers Association (ICEA)
15. Instrumentation Society of Automation (ISA)
16. Underwriters Laboratories (UL)
17. UL 508, the Standard of Safety for Industrial Control Equipment
18. UL 508A, the Standard of Safety for Industrial Control Panels
19. UL 50, the Standard of Safety for Enclosures for Electrical Equipment.
20. NFPA 79, Electrical Standard for Industrial Machinery
21. Factory Mutual (FM) ANSI B40.1 Pressure Gauges
22. ISA S37.3 5 Vacuum Gauges
23. IEC 79-3
24. 913 Electrical Instruments in Hazardous Atmospheres
25. ISA RP12.1, 4, 6, 10, 11 Weighing Scales
26. ASME PTC 19.5 – Flow Measurement

B. Each specified device shall also conform to the standards and codes listed in the individual device paragraphs.

1.5 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar instrumentation equipment for a minimum period of five (5) years. When requested by the Owner/Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. Equipment submitted shall fit within the space or location shown on the Drawings. Equipment which does not fit within the space or location is not acceptable.

C. For the equipment specified herein, the manufacturer shall be ISO 9001 2000 certified.

1.6 SPARE INSTRUMENTS AND RELATED COMPONENTS

A. Contractor shall furnish a minimum of one or 10 percent of each installed instrument, whichever is greater.

B. Contractor shall furnish a spare set of gaskets for each installed instrument.

C. All spare equipment shall be packed in a manner suitable for long-term storage and shall be adequately protected against corrosion, humidity and temperature. Individually mark and vacuum seal all spare parts. Provide other spare parts as indicated on the individual device specifications.

1.7 WARRANTY

A. Warranty on equipment and installation is one (1) year from Final Completion, in accordance with Article 6.19 of the General and Supplemental Conditions.

PART 2 - PRODUCTS

2.1 FLOW MEASUREMENT

A. Magnetic Flowmeter and Transmitter
   1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   2. Rosemount 8700
   3. Krohne Optiflux 2100

B. Performance
   1. Flow Range: As noted in Section 40 70 02.1 - Process Instrument Schedule
   2. Power Requirements – 120VAC unless otherwise noted.
   3. Connections;
   4. Diameter- As noted in Plans.
   5. Connection Type: 150-pound ANSI raised-face flanges; AWWA C207, Table 2 Class D, unless otherwise noted.
   6. Materials:
      a. Meter Tube Material: Type 304 or 316 stainless steel, unless otherwise noted.
      b. Liner Material: Polyurethane, unless otherwise noted.
      c. Liner Protectors: 316L SS
      d. Electrode Type: Flush or bullet nose as recommended by the manufacturer for the noted stream fluid.
      e. Electrode Material: Type 316 stainless steel, unless otherwise noted.
      f. Grounding Ring:
      g. Required, unless otherwise noted.
      h. Quantity: Two, unless otherwise noted.
      i. Material: Same as Electrode Material.
   7. Enclosure: NEMA 4X, minimum, unless otherwise noted.
   8. Transmitter:
      a. Mounting: Surface (wall), unless otherwise noted.
      b. Display: Required, unless otherwise noted.
         1) Digital LCD display, indicating flow rate and total.
         2) Bi-directional Flow Display: Required, unless otherwise noted.
         3) Forward and reverse flow rate.
         4) Forward, reverse and net totalization.

C. Parameter Adjustments: By keypad or non-intrusive means.

D. Enclosure: NEMA 4X, minimum, unless otherwise noted.

1. Empty Pipe Detection:
   a. If noted.
   b. Drives display and outputs to zero when empty pipe detected.

E. Signal Interface (at Transmitter):
   1. Analog Output:
      a. Isolated 4 to 20 made for load impedance from 0 ohm to at least 500 ohms minimum for 24V de supply.
      b. Supports Superimposed Digital HART protocol: If noted.
   2. Discrete Outputs: If noted.
      a. Two discrete outputs, typical, rated for up to 30 volts, typical.
      b. Programmable as noted for the following typical parameters:
         (1) Totalizer pulse, high/low flow rates, percent of range, empty pipe zero, fault conditions, forward/reverse, etc.
   3. Discrete Input: If noted.
      a. Contact closure, configured as noted for the following typical parameters: reset totalizer, change range, hold output constant, drive output to zero, and low flow cutoff, etc.

F. Cables:
   1. Types: As recommended by manufacturer.
   2. Lengths: As required to accommodate device locations.

2.2 LEVEL MEASUREMENT

A. Fixed Mount Level Switch:
   1. Manufacturer and Product:
      a. Contegra FS-90
      b. Flygt Model EMH-10

   2. Function: Actuate contact at preset liquid level.
      a. Type: Direct-acting float with enclosed non-mercury switch and integral cable.
      b. Service (Liquid): Wastewater, unless otherwise noted.
      c. Performance:
      d. Setpoint: As noted.
      e. Differential: 4 inches, maximum.
      f. Temperature: 0 degree F to 160 degrees F.

   3. Features:
      a. Assembly: Watertight and impact-resistant.
      b. Body: Polypropylene or SS
      c. Cable:
      d. Combination support and signal.
      e. Length as noted or as necessary per mounting requirements.
      f. PVC cable jacket.
      g. Mounting: Pipe, unless otherwise noted.
      h. Anchor Mounting Kit: If noted.
      i. Compatible with pipe-mounted floats.
      j. 15-pound vinyl-coated cast iron anchor.
      k. 1/8-inch, Type 316 stainless steel viny I-coated wire rope.
      l. Stainless steel cable clips.

4. Signal Interface:
   a. Switch Type: Non-mercury tilt.
   b. Switch Contacts:
      Isolated, rated 4.5A continuous at 120V ac.
      Form C contact (one NO, one NC), unless otherwise noted.

5. Accessories: As noted.

B. L29 Level Element and Transmitter, Radar:
1. Manufacturer and Product:
   a. Endress+Hauser; Micropilot FMR54
   b. Endress+Hauser; Micropilot FMR52 for chemical applications.
   c. Or equal
2. General:
   a. Function: Measure and transmit a signal proportional to level.
   b. Type: Radar pulse-time-of-flight, loop powered.
3. Service:
   a. Fluid: As noted.
   b. Pressure: 0 to 150 psig.
   c. Process Temperature: Minus 40 degrees F to 176 degrees F.
   d. Range: As noted.
   e. Accuracy: Plus or minus 0.25 inch.
   f. Process Connections: As noted.
   g. Signal Interface: 4 to 20 mA HART input/output,
   h. Wetted Parts: 316 Stainless Steel
   i. Wetted Parts: Type 316 stainless steel, unless otherwise noted.

C. Sludge Blanket Detector and Transmitter:
1. Manufacturer and Product:
   EntechDesign; Echosmart
   a. General:
      1) Function: Measure, indicate, and transmit sludge blanket in wastewater clarifier.
      2) Type: Open-channel sampling
      3) Underwater Acoustic.
      4) Power Requirement: 120V AC
      5) Output 4-20 mA
2. Performance:
   Measurement Range: 1.0 to 32.0 ft
   Operating Temperature: 34 to 125 degrees F.
   Accuracy: 0.2 in. at 10.0 ft.
3. Element:
   a. Probe/Sensor:
      1) Stainless steel housing.
      2) Self-cleaning wiper system.
   b. Controller
      1) Local, at sensor location
      2) Displays measured variable.
      3) Menu driven operation.
      4) Graphics display.

5) Cable Length: As required.

D. Level Element/Transmitter for water and wastewater:
1. Manufacturer and Product:
Druck; PTX 1830.
2. Function: Measure and transmit signal proportional to level.
3. Type:
a. Totally submersible pressure sensor (loop powered).
b. Suitable for wastewater.
4. Parts: Sensor, interconnecting cable, other parts as noted.
5. Service:
a. Fluid: Wastewater, unless otherwise noted.
6. Performance:
a. Process Range: As noted. Provide fixed factory range such that noted process range is between 40 percent and 80 percent of fixed factory range.
b. Accuracy: 0.25 percent of full scale.
c. Temperature, Operating: Minus 4 degrees F to plus 140 degrees F.
d. Overpressure:
1) Proof: At least 1.5 times full scale.
2) Burst: At least 2.0 times full scale.
7. Sensor:
a. Silicon pressure-sensing element.
b. External Diaphragm: Flush type, coated with fluoro-polymer.
c. Titanium or Type 316 stainless steel pressure module assembly, unless otherwise noted.
d. For Titanium Sensors Only: 5-year corrosion
8. Sensor Termination Housing
a. NEMA 6/IP 68 rating (submersible).
9. Dimensions, Nominal:
a. Diameter: 0.75 inches.
b. Length: 9.5 inches.
c. Loop powered, 9 to 30V de.
10. Interconnecting Cable:
a. Length: As required.
b. Polyurethane sheathed, unless otherwise noted.
c. Kevlar strain relief cord.
d. Integral vent tube.
11. Sensor Termination Enclosure: Required, unless otherwise noted.
a. Enclosure: NEMA 4X.
b. Houses such noted items as desiccant vent, filter, microfilter, aneroid bellows.
c. 2-Inch Pipe Mounting Kit: If noted.
12. Accessories:
a. Aneroid Bellows: If noted.
b. Desiccant Module: Required, unless otherwise noted.
c. Spare Desiccant Modules: If noted and Quantity.
d. Cable Hanger, Kellems Type Grip: Required, unless otherwise noted.
13. Lightning Protection:
a. Internal (Protects Against Water Lightning Strike): If noted.
External (Protects 4 to 20 mA de Output): Required, unless otherwise noted.
14. Anchor Assembly: If noted.

a. Marine anchor, clamps, Type 316 stainless steel cable or chain, length as required, nominally 3 feet longer than interconnecting cable.

15. Signal Interface: 4 to 20 mA de two-wire loop output, for load impedance of 0 ohm to 750 ohms, minimum for 24V de supply without load adjustment.
16. Certification(s):
    a. Class I, Division 1, Groups A, B, C, and D.
    b. Class II, Division 1, Groups E, F, and G.
    c. Class III, Division 1.

2.3 PRESSURE MEASUREMENT

A. Pressure Transmitter

1. Subject to compliance with the Contract Documents, the following manufacturers and models are acceptable:
    a. Ashcroft; GC51
    b. Foxboro; IGP10
    c. Rosemount; 3051P
    d. Endress + Hauser; Cerabar PMP71B
2. Type
    a. Microprocessor based intelligent type; diaphragm actuated.
    b. The instrument shall measure gage pressure.
3. Function/Performance
    a. Accuracy: PLUS, or minus 0.25% of calibrated span.
    b. Over-pressure Protection: Provide protection to maximum process pressure.
    c. RFI Protection: 0.1 percent error between 27 and 500 MHZ at 20 v/m field intensity.
    d. Input/Output: 4-20 mA HART
    e. Stability: Combined temperature effects shall be less than 0.2 percent of maximum span per 50 degrees F temperature change.
    f. Measurement Range: As noted in Instrument Schedule
4. Physical
    a. Electrical Classification: Intrinsically safe or explosion proof for Class I and Class II, Division 1 locations.
    b. Enclosure: Rated NEMA 4X.
    c. Connection; ½" 14 NPT female or male
5. Display
    a. 4-digit LCD display.
6. Required Options/Accessories
    a. Provide surge protection for each instrument.
    b. Provide a shutoff valve and mounting bracket for each transmitter.
    c. Provide an integral indicator scaled in engineering units.
    d. Provide hand-held programmer(s) where full setup is not available for the instrument directly.
    e. Provide diaphragm seal

B. PRESSURE GAUGE

1. Subject to compliance with the Contract Documents, the following manufacturers and models are acceptable.
    a. Ashcroft; 1279
    b. Ametek/U.S. Gauge; 1981
    c. Wika Type 233.30

2. General
   a. Pressure ratings shall be equal to or exceed the piping.
   b. Gauge material shall be material appropriate for the application.
   c. Range: Indicated in psi
   d. Type: Bourdon tube actuated pressure gauge.
   e. Accuracy: Plus, or minus 1.0 percent of span or better.
   f. Physical:
      1) Case: Phenolic shock resistant or 316 stainless steel for surface/stem mounting with a pressure relieving back. The case shall be vented for temperature/atmospheric compensation. Gauge shall be capable of being liquid filled in the field or at the factory.
      2) Window: Clear acrylic or shatter proof glass.
      3) Bourdon Tube: 316 stainless steel.
      4) Connection: ½-in NPT.
      5) Gauge size: Minimum 4.0 inches viewable.
      6) Pointer travel: Not less than 200-degree nor more than 270-degree arc.
      7) Range: As indicated in the instrument device schedule.
3. Power Requirements - None.
4. Required Options/Accessories
   a. Shutoff valve: Each gauge shall have a process shutoff valve which can also be used as an adjustable pressure snubber.
   b. Special scales: The Engineer reserves the right to require special scales and/or calibration if the manufacturer's standard is not suitable for the application.
   c. Gauges listed as liquid filled in the Instrument Device Schedule shall be liquid filled at the manufacturer's factory.

C. PRESSURE SWITCH
1. Subject to compliance with the Contract Documents, the following manufacturers and models are acceptable:
   a. Static-O-Ring (SOR); V1
   b. Ashcroft; B4
2. General: Ratings shall be equal to or exceed the piping.
3. Type:
   Diaphragm actuated.
4. Function/Performance:
   a. Repeatability: +/- 1.0 percent of pressure.
   b. Setpoint: Field adjustable and set between 30 and 70 percent of the adjustable range.
   c. Dead Band: Adjustable
   d. Reset: Unit shall be of the automatic reset type unless noted otherwise on the Instrument Device Schedules.
   e. Over-pressure Protection: Over-pressure protection to maximum process line pressure.
5. Physical:
   a. Housing: NEMA 4X.
   b. Switching Arrangement: Single pole double throw (SPDT) unless double pole double throw (DPDT) switches are shown on the instrument device schedule.
   c. Wetted Parts: 316 Stainless Steel Alloy, Hastelloy C or Monel diaphragm, viton seals, stainless steel connection port as confirmed compatible with the process fluid by the manufacture.
   d. Connection Size: ½-in NPT.

6. Power Requirements: 120V AC
7. Required Options/Accessories
   a. Shutoff Valve: Provide process shutoff valve which can be used as an adjustable pressure snubber.

D. DIAPHRAGM SEAL - THREADED
1. Subject to compliance with the Contract Documents, the following manufacturers and models are acceptable:
   a. Ashcroft; 200
2. Type
   a. Welded or bonded metal diaphragm.
3. Function/Performance
   a. Purpose: To protect instruments or gauges from the process medium.
   b. A flexible diaphragm shall separate the process medium from the instrument element. Space on the instrument side of the diaphragm shall be completely filled with suitable silicone or instrument oil. The process pressure is transmitted by the liquid filled system to the instrument element.
   c. Filling Screw: Include on all units.
   d. Pressure Limits: 1,000 psi.
   e. Flushing Connection: Include on all units.
   f. Connection with related instrument. ¼ ID minimum size NPT or flexible stainless steel.
4. Physical
   a. Diaphragm: 316L Stainless Steel.
   b. Exposed Surfaces: 316L stainless steel.
5. Power Requirements: None

E. DIAPHRAGM SEAL - CONCENTRIC FLANGE MOUNTED
1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   a. Reotemp; W51
   b. Ashcroft; 402
2. General: Rating to be equal to or greater than the piping.
3. Type
   a. Line mounted, between two flanges.
   b. Flange Drilling conforms to ANSI #125 flanges.
   c. Carbon Steel Flange
   d. 316 Stainless Steel body.
4. Function/Performance
   a. Protect instruments or gauges from the process medium.
   b. Operating principle: A 360°sensing sleeve shall separate the process medium from the instrument element. The volume on the instrument side of the sensing sleeve shall be completely filled with sensing liquid. The process pressure shall be transferred to the instrument element by the sensing liquid.
   c. Pressure Limit: Correspond to flange ratings.
   d. Inside diameter shall conform to schedule 40 pipe.
   e. Bolt drilling shall conform to ANSI 125/150-pound flange and bolting dimensions.
5. Physical
   a. Process connection: 1/4-inch NPT minimum
   b. Diaphram; 316 Stainless Steel

c. Sensing Liquid: Silicone Oil.
d. Power Requirements: None.

F. MANIFOLD
1. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   a. D/A Manufacturing; GP5TC
   b. Parker H Series
   c. Swagelok
2. General - Provide fully machined surfaces.
3. Type - as shown on Drawings or specified elsewhere.
4. Functions/Performance - Two or three-valve, as shown or specified elsewhere.
5. Physical
   a. Manifold shall be of 316 stainless steel.
   b. Flanged or Transmount as shown on the Drawings.
6. Power Requirements - None

PART 3 EXECUTION

A. INSTALLER'S QUALIFICATIONS
1. Installer shall be specialized in installing this type of equipment with minimum five years documented experience.

B. EXAMINATION
1. Examine installation area to assure there is enough clearance to install the equipment.
2. Verify that the equipment is ready to install.
3. Verify field measurements are as instructed by the manufacturer.

C. INSTALLATION
1. The Contractor shall install all equipment per the manufacturer's recommendations and Contract Drawings.
2. All process connections shall be 316 stainless steel tubing, 3/8" minimum, unless otherwise shown on the Drawings. Fittings shall be of the compression type, 316 stainless steel.
3. All conduit entries into the instruments shall use hubs of watertight, threaded aluminum, insulated throat, stainless steel grounding screw, as manufactured by T&B H150GRA Series, or equal.
4. Install stainless steel instrument labels with instrument ID, secured with safety wire.

D. RACEWAY SEALING
1. Where raceways enter terminal boxes, junction boxes, or instrumentation equipment, all entrances shall be sealed with 3M 1000NS Watertight Sealant or approved equal.

E. FIELD QUALITY CONTROL
1. Inspect installed equipment for anchoring, alignment, grounding and physical damage.
2. Check tightness of all accessible electrical connections. Minimum acceptable values shall be specified in the manufacturer's instructions.

F. FIELD ADJUSTING
1. Adjust all equipment for proper range and field conditions, as described in the manufacturer's instructions.
2. Any field adjustments, required for proper system operation, shall be included in the Final O&M.

G. FIELD TESTING
1. Perform all electrical field tests recommended by the manufacturer.
2. Test each interlock system for proper functioning.
3. Test all control logic for proper operation.

H. CLEANING
1. Remove all rubbish and debris from inside and around the equipment. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint free rags. Do not use compressed air.

I. EQUIPMENT PROTECTION AND RESTORATION
1. Touch-up and restore damaged surfaces to factory finish, as approved by the manufacturer. If the damaged surface cannot be returned to factory specification, the surface shall be replaced.

J. MANUFACTURER'S CERTIFICATION
1. A qualified factory-trained and certified representative shall certify in writing that the equipment has been installed, adjusted, including all settings as defined in the Contract Documents.
2. The Contractor shall provide three copies of the representative's certification.

END OF SECTION

SECTION 40 75 00.1 - PROCESS LIQUID ANALYTICAL MEASURMENT

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish, install and test all analytical measurements, analytical control devices and appurtenances, as shown on the Drawings, specified in the Related Work Sections and Divisions, and as specified herein.

B. Analytical equipment, specified in other Divisions, shall be manufactured in accordance with this Section, and submitted as a part of the equipment specified in other Divisions.

1.2 RELATED WORK

A. Process Equipment Divisions.

B. Mechanical Equipment Divisions.

C. Electrical Equipment Division.

D. Section 40 61 13 Process Control Systems General Provisions

E. Section 40 71 01.2 Instrument Support Hardware

F. Section 40 70 02.1 Process Instrument Schedule

1.3 SUBMITTALS

A. Submit catalog data for all items supplied from this specification Section as applicable. Submittal shall include catalog data, functions, ratings, inputs, outputs, displays, etc., sufficient to confirm that the meter or relay provides every specified requirement. Any included options or exceptions shall be clearly indicated.

B. Submittals for equipment specified herein, for other Sections or Divisions, shall be made as a part of equipment submittals furnished under other Sections or Divisions.

C. Operation and Maintenance Manuals.

1. Operation and Maintenance manuals shall be constructed in accordance with Division 1 and shall include the following information:

    a. Manufacturer’s contact address and telephone number for parts and service.
    b. Instruction books and/or leaflets
    c. Recommended renewal parts list and interval of renewal.
    d. Record Documents for the information required by the Submittals above.

1.4 REFERENCE CODES AND STANDARDS

A. The equipment in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. ISO 2975/VII liquids and BS 5857-2.4 for gases. Transit Time Meters
2. American Society of Mechanical Engineers (ASME). 1971. Fluid meters: Their theory and application.
3. International Organization of Standards (ISO 5167-1). 1991. Measurement of fluid flow by means of pressure differential devices Venturi Tube w/ liquid
4. ASME PTC 19.2 Pressure Measurement
5. ANSI B88.1 Pressure Transducers Calibration
6. ISA S37.6 Strain Gage Transducers Potentiometer
7. Calibration AVS 6.2, 6.4, 6.5 Hazardous Areas
8. IEC 79-10 Intrinsically Safe Circuits
9. ANSI 913 Electrical Instruments in Hazardous Atmospheres
10. NFPA 496 Standard for Purged and Pressurized Enclosures for Electrical Equipment.
11. FM Class 3615 – Explosion Proof Electrical Equipment General.
12. FM Class 3611 Class I Division 2 Hazardous Locations.
13. FM Class 3610 Class I, II, III Division 2 Intrinsically Safe Apparatus & Associated Apparatus.
14. FM Class 6310 Combustible Gas Detectors.
15. FM Class 3810 Measuring and Process Control Equipment.
16. ANSI/NEMA 250 – Enclosures for Electrical Equipment.
17. UL 1950 Safety of Information Technology Equipment.

B. All meters, relays and associated equipment shall comply with the requirements of the National Electric Code and Underwriters Laboratories (UL) where applicable.

C. Each specified device shall also conform to the standards and codes listed in the individual device paragraphs.

1.5 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar instrumentation equipment for a minimum period of five (5) years. When requested by the Owner/Engineer, an acceptable list

of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. Equipment submitted shall fit within the space or location shown on the Drawings. Equipment which does not fit within the space or location is not acceptable.

C. For the equipment specified herein, the manufacturer shall be ISO 9001 2000-certified.

1.6 WARRANTY

A. Warranty on equipment and installation is one (1) year from Final Completion, in accordance with Article 6.19 of the General and Supplemental Conditions.

PART 2 PRODUCTS

2.1 CHLORINE RESIDUAL ANALYZER AND TRANSMITTER

A. Subject to compliance with the Contract Documents, the following manufacturers and models are acceptable:
1. HF Scientific; CLX Model 20040

B. Requirements
1. Function/Performance:
a. Chlorine Analyzer shall use USEPA acceptable DPD method of analysis for measuring free and total chlorine.
b. Accuracy 0-6 mg/l or minus 5 percent of 0.03 ml/l of CL2 whichever is greater, 6-10 mg/l plus or minus 10 percent
c. Range shall be 0-10 mg/l with an option of 0-15 mg/l
d. Analyzer shall have a user selectable cycle time.
e. Analyzer will zero the sample cell before every reading.
f. Analyzer will have a removeable cuvette for ease of maintenance, cleaning, and replacement.

2. Outputs:
a. 4-20mA

3. Physical:
a. Analyzer shall be suitable for surface mounting.
b. Viewable window to the optical chamber with clear view of the sample and reaction of the regents.
c. Analyzer must not have a motor or stir bar as a mixing mechanism.
d. Analyzer shall be a complete stand-alone unit and not require external controllers.
e. Enclosure shall be NEMA 4X.

4. Power Requirements:
a. Analyzer shall be 120 VAC powered instrument.

C. Accessories/Documentation Required:
1. Provide a certificate of conformance/calibration subsequent to installation for each analyzer.

2. One (1) year supply of buffer and reagent.

2.2 CHLORINE GAS DETECTOR

A. Subject to compliance with the Contract Documents, the following manufacturers and models are acceptable:
1. MSA International; PrimaX P Series
2. Honeywell; Touchpoint Plus
3. Scott

B. General requirements:
1. Where chemical leak detectors are being called for, the display and alarm notification unit shall not be in the same room as the detector sensor. Mount externally near pedestrian door, shade from direct sun appropriately. Visual and audible alarming locally for any such station.

C. General
1. Provide sufficient lengths of manufacturer's specialty cables for installation of power and signal conductors as provided with each instrument.

D. Type
1. Material: 316 Stainless Steel
2. Electrochemical
3. Electronic, microprocessor based
4. Continuous, dual channel
5. Chlorine concentration indicator

E. Function/Performance
1. Sense the presence of chlorine gas prior to reaching toxic levels.
2. Provide early warning indication to personnel.
3. Response Time: Less than 10 seconds to 90% of final reading from a step change in gas concentration.
4. Range: 0-10 PPM minimum
5. Alarm Settings: Field adjustable.
6. Temperature Limits: 0 to 50 degrees C (32 to 122 degrees F).

7. Sensor Life: Three years.

8. Minimum of two contacts to alert personnel of gas concentration levels.

9. Front mounted power-on and high alarm indicating lights.

10. Indicating meter graduated in Parts per Million (PPM) Chlorine.

11. Minimum two output contacts for remote indications as shown on the Drawings.

12. ModbusRTU Communication Interface to Controller.

F. Physical
1. Housing: Class 1, Div. 1, Groups A, B, C and D.

2. Electrochemical technology.

3. Wall mounting with sensor remote from indicating transmitter.

4. Shielded two-wire or three-wire sensor-to-controller wiring.

5. Adjustable alarm setting.

6. Local Indication.

G. Power Requirements
1. 24 VDC

H. Options/Accessories
1. Provide an integral indicator scaled in engineering units.

2. Provide hand-held programmer(s) where full setup is not available for the instrument.

2.3 PH/ORP SENSOR AND TRANSMITTER

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:
1. Analytical Technology, Inc.; Q46P

2. Emerson; Rosemount 396 Sensor

3. Emerson; Rosemount 56 Dual Channel Transmitter

4. M4Knick; Stratos MS Transmitter

5. M4Knick; SE 555 pH/ORP Sensor

B. General
1. Provide sufficient lengths of manufacturer's specialty cables for installation of power and signal conductors as provided with each instrument.

2. Display – 4-digit LCD Display

3. NEMA 4X Enclosure

C. The transmitter shall be powered as shown on the drawings with the following power requirements:
1. AC powered: 100 to 240 VAC ±10%, 50/60 Hz

2. 24 VDC powered: 24 VDC, ±10%

D. If pump required to feed process liquid to analyzer, pump shall be Little Giant 1-42-A or equal with 1/2" inlet and ¼" outlet. Fit short length of ½" PE tubing to inlet with inlet screen. Connect ¼" PE fitting to outlet with ¼" PE hose to liquid analyzer. Secure pump to structure.

2.4 TURBIDITY ANALYZER AND TRANSMITTER

A. Subject to compliance with the contract documents, the following manufacturers and models are acceptable:
1. Lovibond; PTV 1000

2. Swan Analytical; Monitor AMI Turbiwell 7027

B. The transmitter shall be powered as shown on the drawings with the following power requirements:
1. AC powered: 100 to 240 VAC ±10%, 50/60 Hz

2. 24 VDC powered: 24 VDC, ±10%

C. If pump required to feed process liquid to analyzer, pump shall be Little Giant 1-42-A or equal with 1/2" inlet and ¼" outlet. Fit short length of ½" PE tubing to inlet with inlet screen. Connect ¼" PE fitting to outlet with ¼" PE hose to liquid analyzer. Secure pump to structure.

2.5 DISSOLVED OXYGEN ANALYZER AND TRANSMITTER

A. Subject to compliance with the Contract Documents, the following manufacturers and models are acceptable:
1. Endress+Hauser Oxymax COS61D digital oxygen sensor with Liquiline CM44x or CM44xR transmitter.

B. Performance Criteria

1. Measurement Range: 0-20 mg/l, 0-200 %SAT, 0-400 hPa

2. Repeatability: ±0.5% of measuring range end

3. Max Measured Error: 0.01 mg/l or ±1 % of measured value (< 12 mg/l) ±2 % of measured value (from 12 to 20 mg/l)

4. Response time (t_{90}): 60 sec.

5. Sensor cap lifetime: >2 years (under reference operating conditions, protected against direct sunlight)

6. Temperature Sensor: NTC temperature sensor, 0-50°C (32-122°F)

C. Environmental

1. Process Temperature: -5 to 55 °C (23 to 131°F)

2. Process Pressure: max 10 bar (145 psi)

3. Ambient Temperature: -20 to 60°C (0 to 140°C)

4. Ingress Protection: IP68

D. Transmitter

1. Shall be a multi-parameter controller with up to eight measuring channels based on digital Memosens technology.

2. Programmed computations and features resident in nonvolatile memory.

3. Transmitter firmware shall be upgradable in the field by the user or a factory technician, without removing the transmitter from service.

4. Transmitter shall be available in a NEMA 4X field housing with integral display or a DIN rail-mount version for cabinet mounting with remote display.

5. Digital communications provides for plug and play for all sensor configurations.

6. Shall be capable of modification for new or extended functions by use of modular components that are easily retrofitted in the field without the aid of tools, and without the need to power down the transmitter or re-boot the system.

7. Simple wiring for all types of digital Memosens sensors plus an option for a M12 sensor connector.

8. Digital communications protocols available shall include the following without using an external converter. Digital communication shall be available as a native output from the sampler. Use of an external third-party signal converter is not acceptable.
   a. 4-20mA, HART.
   b. Profibus RS485 with webserver.
   c. Modbus RS485 with webserver.
   d. Modbus TCP with webserver.
   e. EtherNet/IP with webserver.
      (i) EtherNet/IP communication shall be supported with the Electronic Data Sheet (EDS) file available for download directly from the sampler. The Add-On Profile (AOP) for integration shall be a Level 3 profile to simplify control system integration.
      (ii) The EtherNet/IP communications shall also be supported with Add-on Instructions (AOI) files and pre-configured faceplates for ease of control system integration.
9. Transmitter shall have an option for relay outputs, analog inputs, and discrete input/outputs.

10. Option for integral web-server for remote operation, diagnostics and configuration.

E. Sensor
1. Optical fluorescence technology with minimum maintenance and maximum availability.

2. Shall incorporate digital Memosens technology with calibration saved in sensor and a high degree of EMC protection.

3. Simple single-point calibration in air, air-saturated water or in medium shall be possible.

4. Extended maintenance intervals and a high degree of long-term stability; intelligent self-monitoring shall guarantee reliable measure values.

5. Fixed, waterproof cable connection at the sensor with up to 330 feet (100 meters) length between the sensor and transmitter.

F. Accessories
1. Sensor mounting hardware shall be available in a modular assembly system to secure sensors in open basins, channels and tanks. Versions in stainless steel or PVC shall be available for immersion in open basins. The mounting hardware shall be applicable for nearly any type of fixing - fixing on the floor, wall or directly on a rail.

2. A retractable assemby shall be available, constructed in stainless steel and ball valve, to allow for retraction of the sensor from the process without shutting down the process.

3. The sensor cable shall be available in length up to 330 feet (100 m)with a choice of direct wire to the transmitter or connection using M12 quick connections.

2.6 SPARE INSTRUMENTS AND RELATED COMPONENTS

A. Contractor shall furnish a minimum of one or 10 percent of each installed instrument, whichever is greater.

B. All spare equipment shall be packed in a manner suitable for long-term storage and shall be adequately protected against corrosion, humidity and temperature. Individually mark and vacuum seal all spare parts. Provide other spare parts as indicated on the individual device specifications.

PART 3 EXECUTION

3.1 INSTALLER'S QUALIFICATIONS

A. Installer shall be specialized in installing this type of equipment with minimum five years documented experience.

3.2 EXAMINATION

A. Examine installation area to assure there is enough clearance to install the equipment.

B. Verify that the equipment is ready to install

C. Verify field measurements are as instructed by the manufacturer.

3.3 INSTALLATION

A. The Contractor shall install all equipment per the manufacturer's recommendations and Contract Drawings.

B. All process connections shall be 316 stainless steel tubing, 3/8" minimum, unless otherwise shown on the Drawings. Fittings shall be of the compression type, 316 stainless steel.

C. All conduit entries into the instruments shall use hubs of watertight, threaded aluminum, insulated throat, stainless steel grounding screw, as manufactured by T&B H150GRA Series

D. Install stainless steel instrument labels with instrument ID, secured with safety wire.

3.4 RACEWAY SEALING

A. Where raceways enter terminal boxes, junction boxes, or instrumentation equipment, all entrances shall be sealed with 3M 1000NS Watertight Sealant

3.5 FIELD QUALITY CONTROL

A. Inspect installed equipment for anchoring, alignment, grounding and physical damage.

B. Check tightness of all accessible electrical connections. Minimum acceptable values shall be specified in the manufacturer's instructions.

3.6 FIELD ADJUSTING

A. Adjust all equipment for proper range and field conditions, as described in the manufacturer's instructions.

B. Any field adjustments, required for proper system operation, shall be included in the Final O&M.

3.7 FIELD TESTING

A. Perform all electrical field tests recommended by the manufacturer.

B. Test each interlock system for proper functioning.

C. Test all control logic for proper operation.

3.8 CLEANING

A. Remove all rubbish and debris from inside and around the equipment. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint free rags. Do not use compressed air.

3.9 EQUIPMENT PROTECTION AND RESTORATION

A. Touch-up and restore damaged surfaces to factory finish, as approved by the manufacturer. If the damaged surface cannot be returned to factory specification, the surface shall be replaced.

3.10 MANUFACTURER'S CERTIFICATION

A. A qualified factory-trained and certified representative shall certify in writing that the equipment has been installed, adjusted, including all settings as defined in the Contract Documents.

B. The Contractor shall provide three copies of the representative's certification.

END OF SECTION

SECTION 43 25 13.23 - OVERHUNG CLOSE-COUPLED SUBMERSIBLE VOLUTE CENTRIFUGAL PUMPS

PART 1 - GENERAL

1.1 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. American Bearing Manufacturers Association (ABMA):
   a. 9, Load Ratings and Fatigue Life for Ball Bearings.
   b. 11, Load Rating and Fatigue Life for Roller Bearings.
2. American Society of Mechanical Engineers (ASME): B16.1, Cast Iron Pipe Flanges & Flanged Fittings, Class 125.
3. ASTM International (ASTM):
   a. A48, Standard Specification for Gray Iron Castings.
   b. A576, Standard Specification for Steel Bars, Carbon, Hot- Wrought, Special Quality.
4. Hydraulic Institute Standards (HIS).
5. National Electrical Manufacturers Association (NEMA).
6. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code.
   b. 497, Recommended Practice for the Classification of Flammable Liquids, Gases or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.
7. Underwriters Laboratories Inc. (UL).

1.2 DEFINITIONS

A. Terminology pertaining to pumping unit performance and construction shall conform to ratings and nomenclature of Hydraulic Institute Standards.

1.3 SUBMITTALS

A. Action Submittals:

1. Make, model, weight, and horsepower of each equipment assembly.
2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction, including cable seal details.
3. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over entire operating range of pump, from shutoff to maximum capacity. Indicate separately head, capacity, horsepower demand, overall efficiency, and minimum submergence required at guaranteed point.
4. For variable speed motors provide variable speed curves for every 50 rpm over the operational range.
5. Power and control wiring diagrams, including terminals and numbers.
6. Motor data, in accordance with the requirements of Section 26 20 00 - Low-Voltage AC Induction Motors.

7. Adjustable frequency drive data, in accordance with the requirements of Section 26 29 23 – Adjustable Frequency Drives.
8. Factory-finish system.
9. L-10 bearing life calculations per ABMA.

B. Informational Submittals:

1. Special shipping, storage and protection, and handling instructions.
2. Manufacturer's printed installation instructions.
3. Factory and Field Performance Test Reports and Log.
4. Manufacturer's Certification of Compliance that factory finish system meets requirements specified herein.
5. Suggested spare parts list to maintain equipment in service for period of 1 year. Include list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
6. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
7. Operation and Maintenance Data as specified in Section 01 70 00 – Execution and Closeout Requirements.
8. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 70 00 – Execution and Closeout Requirements.

1.4 EXTRA MATERIALS

A. Furnish:

1. For each pump, one set mechanical seals.
2. For each set of pumps, one complete set of any special tools required to dismantle each pump.

1.5 WARRANTY

A. Warranty on equipment and installation is one (1) year from Final Completion, in accordance with Article 6.19 of the General and Supplemental Conditions.

PART 2 - PRODUCTS

2.1 GENERAL

A. Submersible, vertical shaft, centrifugal non-clog type, for pumping wastewater.

B. Designed for continuous operation under submerged or partially submerged conditions, and intermittent operation when totally dry without damage to pump or motor.

C. Pump and Electrical Driver: Meet requirements for class, group, and division location in accordance with NFPA 70.

D. Where adjustable speed drives are required, furnish a coordinated operating system complete with pump, drive, and speed controller.

E. Pumps furnished under this Section to be provided by a single manufacturer.

2.2 SUPPLEMENTS

A. Specific requirements are attached to this Section as supplements.

2.3 COMPONENTS

A. Equipment consists of pump complete with motor, control system, guide rail, anchoring brackets, base elbow, power cable, and pump lifting cable and control panel and level switches.

B. Characteristics:

1. Motor and rotating parts shall be removable from motor end of pump.
2. Mating surfaces to be watertight and fitted with nitrile O-rings.
3. Pumps fitted with dynamically balanced non-clog impellers designed to pass course solids and stringy materials.

C. Lifting Arrangement:

1. Stainless steel chain, 2 feet minimum, and one "grip-eye."
2. Attach chain permanently to pump and access platform with stainless steel wire rope.
3. "Grip-eye" capable of being threaded over and engaging links of stainless-steel chain so pump and motor may be lifted with "grip-eye" and independent hoist.

D. Sliding Guide Bracket:

1. Integral part of pump unit.
2. Pump unit to be guided by no less than two guide bars, or equivalent cable system, and pressed tightly against discharge connection elbow with metal-to-metal contact or through use of profile-type gasket, provided gasket is attached to pump's flange and can be easily accessed for inspection when pump is lifted out of wetwell.
3. Pump metal parts that come into contact with guide rail or cable system shall be made of non-sparking materials.

E. Oil chamber between seals shall be equipped with drain and inspection plug. Plug shall have positive antileak seal and shall be easily accessible from outside.

F. Motor nameplate horsepower not to be exceeded at head-capacity point on pump curve.

G. Pump motor and sensor cables shall be suitable for submersible pump application and cable sizing shall conform to NFPA 70 specifications for pump motors. Cables shall be of sufficient length to reach junction boxes without strain or splicing.

H. Cable Entry System:

1. Junction chamber and motor separated by stator lead sealing gland or terminal board that prevents foreign material entering through pump top.
2. Utilize cable with factory-installed sealing gland with non-shrink epoxy seal system.
3. O-ring compression seal between sealing gland and cable entry point shall also be acceptable.

2.4 CONTROL PANEL

A. Control Panel to be provided by the SI Engineer.

B. NEMA 12 enclosure, for indoor duty.

C. Refer to Section 26 24 19 – 480V Motor-Control Centers, for additional panel requirements.

D. Mount as shown on the Plans.

E. Features:

1. Fused control power transformer, 120V ac.
2. Alternator and pump lead-lag controls.
3. ON/OFF/AUTO switches.
4. Running lights.
5. High level indication.
6. Normally closed, dry, 5 amps at 120V ac contacts for remote indication of:
   a. High level alarm.
   b. Pump failure (temperature or moisture alarm).
7. Terminal strip for interfacing with external wiring.
8. High temperature indication.
9. Moisture alarm indication.
10. Alarm (high temperature, moisture, or high level) beacon located on top of panel.
11. Lightning protection.
12. Intrinsically safe relays as required for UL validation.
13. Alarm silence button.
14. Document pocket located inside panel with pump and panel operation and maintenance manual, and separate laminated pump curve.
15. 110-volt, duplex GFI outlet, weather-protected, and accessible from outside of panel.
16. Run hour meter.
17. 100 watts minimum, condensation heater with thermostat.
18. UL listing mark.

F. Prewired and factory tested.

G. Mount control switches, indicating lights, and switches on hinged front panel.

H. Single Feed: 480 volts, three-phase.

2.5 ACCESSORIES

A. Level Switches: In accordance with 40 70 03- Instrumentation and Control Components for:

1. Low Low Level: Alarm. Pumps off.
2. Medium Level: Reset
3. High High Level: Alarm. Pumps on.

B. Radar Level Transmitter: In accordance with 40 70 03- Instrumentation and Control Components for:

1. Low Low Level: Alarm. Pumps off.
2. Low Level: Lead Pump On
3. High Level: Lag Pump On

4. High High Level: Alarm. Pumps on.

C. Equipment Identification Plate: 16-gauge stainless steel with 1/4-inch die- stamped equipment tag number securely mounted in readily visible location.

D. Anchor Bolts: Type 316 stainless steel, sized by equipment manufacturer, and as specified in Section 05 50 00 - Metal Fabrications. Coat in accordance with Section 09 90 00 - Painting and Coating.

2.6 FACTORY FINISHING

A. Prepare, prime, and finish coat in accordance with Section 09 90 00 - Painting and Coating.

B. Install manufacturer's standard epoxy system for continuous submergence in corrosive water.

2.7 SOURCE QUALITY CONTROL

A. Control Panel:
1. Factory Inspections: Inspect control panels for required construction, electrical connection, and intended function.
2. Factory Tests and Adjustments: Test all control panels actually furnished.

B. Pump:
1. Factory Performance Test:
a. In accordance with HIS 11.6, Level B for submersible pump tests.
b. Include test data sheets, curve test results, and performance test logs.
2. Conduct on each pump.
3. Perform under actual or approved simulated operating conditions.
a. Throttle discharge valve to obtain pump data points on curve at 2/3, 1/3, and shutoff conditions.

C. Submersible Motor Functional Test: In accordance with HIS 11.6.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's printed instructions.

B. Mount the discharge elbow to the floor of the wetwell floor with stainless steel bolts.

C. Connect piping without imposing strain to flanges.

D. No portion of pump shall bear directly on floor of sump.

3.2 FIELD FINISHING

A. Equipment as specified in Section 09 90 00 - Painting and Coating.

3.3 FIELD QUALITY CONTROL

A. Functional Test: Conduct on each pump.

1. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
2. Flow Output: Measured by plant instrumentation and storage volumes.
3. Operating Temperatures: Monitor bearing areas on pump and motor for abnormally high temperatures.
4. Test for continuous 3-hour period
5. Test Report Requirements: In accordance with Hydraulic Institute Standards for submersible pump tests HIS 1.6 and 11.6.

B. Vibration Test:

1. Test with units installed and in normal operation and discharging to connected piping systems at rates between low discharge head and high discharge head conditions specified, shall not develop vibration exceeding limits specified in HIS 11.6.
2. If units exhibit vibration in excess of limits specified adjust or modify as necessary. Units that cannot be adjusted or modified to conform as specified shall be replaced.
3. Flow Output: Measured by plant instrumentation and storage volumes.

3.4 MANUFACTURER'S SERVICES

A. Manufacturer's Representative: Present at Site for minimum person-days listed below, travel time excluded for each pump system:

1. 2 person-days for installation assistance and inspection.
2. 2 person-days for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation

B. Manufacturer's Representative: Present at Site for minimum person-days listed below, travel time excluded for all pump systems (If providing more than 1 pump system, time is for all provided pump systems):

1. 1 person-days for pre-startup Site training.
2. 2 person-days for facility startup.
3. 1 person-days for post-startup training of Owner's personnel. Training shall not commence until accepted detailed lesson plan for each training activity has been reviewed by Engineer.

C. See Section 01 70 00 – Execution and Closeout Requirements.

3.5 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are part of this Specification.

1. Data sheets: Overhung, Close Coupled Submersible Volute Centrifugal Pump Data Sheets.

END OF SECTION

OVERHUNG CLOSE-COUPLED SUBMERSIBLE VOLUTE CENTRIFUGAL PUMP DATA SHEET, INFLUENT PUMP STATION 43 25 13.23 - 01

Tag Numbers: P-201-01, P-201-02, P201-03

Pump Name: Influent Pump Station Pumps 1, 2 and 3

Manufacturer and Model Number: (1) KSB KRT K 200-403/654XEG-S (Basis of Design)
(2) Approved Equal

SERVICE CONDITIONS

Liquid Pumped (Material and Percent Solids): Screened Wastewater

Pumping Temperature (Fahrenheit): Normal: 63 Max: 90 Min: 40

Specific Gravity at 70 Degrees F: 62.3 Viscosity Range: _____

Vapor Pressure at 70 Degrees F: 0.363 psi pH: 7-11

Abrasive (Y/N): Y Possible Scale Buildup (Y/N): N

Total suspended solids (mg/L) 50-300

Maximum diameter solid pump can pass (inches) 3

Min. NPSH Available (Ft. Absolute): See Plans

Suction Pressure (Ft): Max See Plans Rated See Plans

PERFORMANCE REQUIREMENTS

Capacity (US gpm): Rated 2,810

Total Dynamic Head (Ft): Rated 87

Maximum Shutoff Pressure (Ft): 150

Min. Rated Pump Hydraulic Efficiency at Rated Capacity (%): 78.0

Max. Pump Speed at Rated Capacity (rpm): Constant (~~Y~~/N): 1,780

Adjustable (Y/N): Y

DESIGN AND MATERIALS

Pump Type: Heavy-Duty Non-clog (Y/N) Y Other:

Volute Material: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Pump Casing Material: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Motor Housing Material: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Wear Rings Case (Y/N): Y Material: Grey cast iron EN-JL1030 (A 48 Class 30B)
Wear Ring Impeller (Y/N): Y Material: Stainless steel VG 434 (A 890 Grade 5A)

Elastomers: Nitrile Rubber
Fasteners: Stainless Steel
Impeller: Type: Single Vane Non-Clog (Y/N): _Y__ Other: _____
Material: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Shaft Material: Stainless steel EN-1.4021+QT800 (A 276 Type 420)
Base Elbow: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Double Mechanical Seal (Y/N): ___Y_____ Bearing Life (Hrs): _100,000_____

DRIVE MOTOR: See Section 26 20 00 - Low-Voltage AC Induction Motors

Horsepower: __87_ Voltage: _460__ Phase: _3__ Synchronous Speed (rpm): _1775_
Enclosure: Grey cast iron EN-GJL-250 (A 48 Class 35B)
CLASSIFICATION: Class 1, Group D, Division 1, Groups C, D, T3
Other Features: ____ Inverter Duty _____
Moisture Detection Switches (Y/N): __Y_____
Thermal Protection Embedded in Windings (Y/N): ___Y_____

REMARKS: _____

_____

OVERHUNG CLOSE-COUPLED SUBMERSIBLE VOLUTE CENTRIFUGAL PUMP DATA SHEET, EFFLUENT PUMP STATION 43 25 13.23 - 02

Tag Numbers: P-701-01, P-701-02, P-701-03

Pump Name: Effluent Pump Station Pumps 1, 2 and 3

Manufacturer and Model Number: (1) KSB KRT K 200-316/226XFG-K (Basis of Design)
(2) Approved Equal

SERVICE CONDITIONS

Liquid Pumped (Material and Percent Solids): Water - 0%

Pumping Temperature (Fahrenheit): Normal: 82 Max: 95 Min: 40

Specific Gravity at 70 Degrees F: 62.3 Viscosity Range:

Vapor Pressure at 70 Degrees F: 0.363 psi pH: 7-11

Abrasive (Y/N): N Possible Scale Buildup (Y/N): N

Total suspended solids (mg/L) 50

Maximum diameter solid pump can pass (inches) 1

Min. NPSH Available (Ft. Absolute): See Plans

Conformed Changes to Documents as a result of Award of Reduced Scope of Work

Suction Pressure (Ft): Max See Plans Rated See Plans

PERFORMANCE REQUIREMENTS

Capacity (US gpm): Rated 2,810

Total Dynamic Head (Ft): Rated 22

Maximum Shutoff Pressure (Ft): 56

Min. Rated Pump Hydraulic Efficiency at Rated Capacity (%): 79

Max. Pump Speed at Rated Capacity (rpm): Constant (~~Y~~/N): 1180

Adjustable (Y/N): ____Y_____

DESIGN AND MATERIALS

Pump Type: Heavy-Duty Non-clog (Y/N) N Other:

Volute Material: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Pump Casing Material: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Motor Housing Material: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Wear Rings Case (Y/N): Y Material: Grey cast iron EN-JL1030 (A 48 Class 30B)
Wear Ring Impeller (Y/N): Y Material: Semi austenitic CrNi stainless steel VG 434 (A 890 Grade 5A)

Conformed Changes to Documents as a result of Award of Reduced Scope of Work

Elastomers: Viton
Fasteners: Stainless Steel
Impeller: Type: Single Vane Non-Clog (Y/N): _N__ Other: _____
Material: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Shaft Material: Stainless steel EN-1.4021+QT800 (A 276 Type 420)
Base Elbow: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Double Mechanical Seal (Y/N): ___Y_____ Bearing Life (Hrs): _100,000_____

DRIVE MOTOR: See Section 26 20 00 - Low-Voltage AC Induction Motors

Horsepower: _25__ Voltage: _460__ Phase: _3__ Synchronous Speed (rpm): _1174_
Enclosure: Grey cast iron EN-GJL-250 (A 48 Class 35B)
CLASSIFICATION: T3
Other Features: __Inverter Duty _____
Moisture Detection Switches (Y/N): __Y_____
Thermal Protection Embedded in Windings (Y/N): ___Y_____

REMARKS: _____

OVERHUNG CLOSE-COUPLED SUBMERSIBLE VOLUTE CENTRIFUGAL PUMP DATA SHEET, RAS PUMP STATION 43 25 13.23 - 02

Tag Numbers: P-901-01, P-901-02, P-901-03

Pump Name: RAS Pump Station Pumps 1, 2 and 3

Manufacturer and Model Number: (1) KSB KRT D 100-253/184XEG-S (Basis of Design)
(2) Approved Equal

SERVICE CONDITIONS

Liquid Pumped (Material and Percent Solids): Mixed Liquor, 0.4% Solids

Pumping Temperature (Fahrenheit): Normal: 82 Max: 95 Min: 40

Specific Gravity at 70 Degrees F: 62.3 Viscosity Range:

Vapor Pressure at 70 Degrees F: 0.363 psi pH: 7-11

Abrasive (Y/N): N Possible Scale Buildup (Y/N): N

Total suspended solids (mg/L) 4,000

Maximum diameter solid pump can pass (inches) 3

Min. NPSH Available (Ft. Absolute): See Plans

Suction Pressure (Ft): Max See Plans Rated See Plans

PERFORMANCE REQUIREMENTS

Capacity (US gpm): Rated 1,190

Total Dynamic Head (Ft): Rated 45

Maximum Shutoff Pressure (Ft): 70

Min. Rated Pump Hydraulic Efficiency at Rated Capacity (%): 80

Max. Pump Speed at Rated Capacity (rpm): Constant (~~Y~~/N): 1,190

Adjustable (Y/N): Y

DESIGN AND MATERIALS

Pump Type: Heavy-Duty Non-clog (Y/N) Y Other:

Volute Material: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Pump Casing Material: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Motor Housing Material: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Wear Rings Case (Y/N): Y Material: Grey cast iron EN-JL1030 (A 48 Class 30B)
Wear Ring Impeller (Y/N): Y Material: Semi austenitic CrNi stainless steel VG 434 (A 890 Grade 5A)

Elastomers: Nitrile Rubber
Fasteners: Stainless Steel
Impeller: Type: Single Vane Non-Clog (Y/N): _Y__ Other: _____
Material: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Shaft Material: Stainless steel EN-1.4021+QT800 (A 276 Type 420)
Base Elbow: Grey cast iron EN-GJL-250 (A 48 Class 35B)
Double Mechanical Seal (Y/N): ___Y_____ Bearing Life (Hrs): _100,000_____

DRIVE MOTOR: See Section 26 20 00 - Low-Voltage AC Induction Motors

Horsepower: _20_ Voltage: _460__ Phase: _3__ Synchronous Speed (rpm): _1174_
Enclosure: Grey cast iron EN-GJL-250 (A 48 Class 35B)
CLASSIFICATION: Class 1, Group D, Division 1, Groups C, D, T3
Other Features: _____ Inverter Duty _____
Moisture Detection Switches (Y/N): __Y_____
Thermal Protection Embedded in Windings (Y/N): ___Y_____

REMARKS: _____

OVERHUNG CLOSE-COUPLED SUBMERSIBLE VOLUTE CENTRIFUGAL PUMP DATA SHEET, BIOSOLIDS PUMP STATION 43 25 13.23 - 04

3

Tag Numbers: P-1001-01, P-1001-02

Pump Name: Biosolids Drain Pump Station Pumps 1and 2

Manufacturer and Model Number: *(1) Goulds WS1034BF (Basis of Design)*
(2) Approved Equal

SERVICE CONDITIONS

Liquid Pumped (Material and Percent Solids): Sewage

Pumping Temperature (Fahrenheit): Normal: 82 Max: 95 Min: 40

Specific Gravity at 70 Degrees F: 62.3 Viscosity Range: _____

Vapor Pressure at 70 Degrees F: 0.363 psi pH: 7-11

Abrasive (Y/N): Y Possible Scale Buildup (Y/N): N

Total suspended solids (mg/L) 4,000

Maximum diameter solid pump can pass (inches) 2

Min. NPSH Available (Ft. Absolute): See Plans

Suction Pressure (Ft): Max See Plans Rated See Plans

PERFORMANCE REQUIREMENTS

Capacity (US gpm): Rated 156

Total Dynamic Head (Ft): Rated 16

Maximum Shutoff Pressure (Ft): 40

Min. Rated Pump Hydraulic Efficiency at Rated Capacity (%): 75

Max. Pump Speed at Rated Capacity (rpm): Constant (Y/~~N~~): 1,750

Adjustable (Y/N): N

DESIGN AND MATERIALS

Pump Type: Heavy-Duty Non-clog (Y/~~N~~) *Other:*

Volute Material: Grey cast iron
Pump Casing Material: Grey cast iron
Motor Housing Material: Grey cast iron
Wear Rings Case (~~Y~~/N): Y Material: Grey cast iron
Wear Ring Impeller (~~Y~~/N): Material: Grey Cast Iron

Elastomers: Nitrile Rubber
Fasteners: Stainless Steel
Impeller: Type: Single Vane Non-Clog (Y/N): _Y__ Other: _____
Material: Grey cast iron
Shaft Material: Stainless steel
Base Elbow: Grey cast iron
Double Mechanical Seal (Y/~~N~~): ___Y_____ Bearing Life (Hrs): _N/A_____

DRIVE MOTOR: See Section 26 20 00 - Low-Voltage AC Induction Motors

*Horsepower: _1_ Voltage: _460__ Phase: _3__ Synchronous Speed (rpm): _1,750_*
Enclosure: Grey cast iron
CLASSIFICATION: Class B
Other Features: _____
Moisture Detection Switches (~~Y~~/N): __N_____
Thermal Protection Embedded in Windings (~~Y~~/N): ___N_____

REMARKS: _____

SPECIFICATION 46 21 73 - SCREENING WASHING AND COMPACTING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This section includes requirements for furnishing one (1) Screenings Washer and Compactor and associated controls. Equipment shall be installed as shown on the as indicated on the contract drawings and as specified herein, as recommended by the supplier and in compliance with all local, state and federal codes and regulations.

B. Each screenings wash press will consist of a gearmotor, spiral screw with separate thrust bearing, wash water spray system, stainless steel trough, wash zone, press zone, discharge piping, electrical controls, and all other appurtenances required or shown on the drawings.

1.2 REFERENCES

A. The Screenings Washer and Compactor shall, as applicable meet the requirements of the following industry standards:
1. AISI (American Iron and Steel Institute)
2. ANSI (American National Standards Institute)
3. ABMA (American Bearing Manufacturers Association)
4. AGMA (American Gear Manufacturers Association)
5. NEMA (National Electrical Manufacturer’s Association)
6. NFPA (National Fire Protection Association)
7. ASTM (American Society for Testing and Materials)
8. WSC (American Welding Society Code)
9. ASME (American Society of Mechanical Engineers)
10. NEC (National Electrical Code)
11. UL (Underwriters Laboratory Standards)
12. EPA (Environmental Protection Agency)

1.3 EXPERIENCE

A. In order to establish a quality standard for the manufacture and production of the equipment, all manufacturers shall meet the requirements listed in this section.

B. Manufacturers shall have a minimum of five (5) years history of engineering and fabricating screenings wash presses. Documentation of at least ten (10) installations having been installed for a minimum of five (5) years shall be provided.

C. The minimum acceptable standards for the equipment shall conform to the project contract documents as outlined in the respective sections of the specifications and drawings.

1.4 SUBMITTALS

A. Shop Drawing Submittals: The Manufacturer shall furnish submittals to verify compliance with the specification. The submittals shall conform to Section 01 33 00 – Submittal Procedures. In addition to those requirements, the submittals shall include:

1. Certified general arrangement drawings showing all important details including materials of construction, dimensions, loads on supporting structures, and anchor bolt locations.
2. A list of all deviations from drawings and specifications.
3. Descriptive literature, bulletins and/or catalogs of the equipment.
4. Complete data on motors and gear reducers.
5. Wiring diagrams and electrical schematics for all control equipment to be furnished.

B. Other Submittals: Provide other submittals as required by:

1. Section 01 70 00 – Execution and Closeout Requirements
2. Section 01 60 00 - Product Requirements

1.5 WARRANTY

A. Warranty on equipment and installation is one (1) year from Final Completion, in accordance with Article 6.19 of the General and Supplemental Conditions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Where a manufacturer's standard equipment name and/or model number is listed, the equipment system shall be provided as modified to conform to the performance, functions, features, and materials of construction as specified herein. Materials, equipment, components and accessories specified in this Section shall be products of:

1. Saveco North America, Inc. Model SPW200-700
2. Fairfield Service Co. Model SC-085-200
3. Huber Technology

2.2 QUALITY ASSURANCE

A. Equipment manufacturer shall be ISO 9001 certified.

B. The Screenings Washer and Compactor will be fully assembled and run tested to confirm fit and function. A certificate of the shop run test shall be supplied with the shipping documents.

C. The Screenings Washer and Compactor will be shipped to the site fully assembled, if possible, and dependent upon the height of the wash press. Some ancillary components may be removed in order to prevent damage during shipment.

2.3 PERFORMANCE REQUIREMENTS

A. The Screenings Washer and Compactor shall be designed in accordance with the performance and configuration requirements as stated in the Screenings Washer and Compactor Data Sheet following this Specification.

2.4 UTILITY REQUIREMENTS/ENVIRONMENTAL CONDITIONS

A. The location and environmental conditions of the installed Screenings Washer and Compactor will be as shown in the Drawings and as described in the Screenings Washer and Compactor Data Sheet following this Specification.

2.5 DESIGN REQUIREMENTS

A. General

1. The shafted screw type Screenings Washer and Compactor shall be a complete assembly consisting of an inlet hopper between the perforated plate screen and wash press. The shafted screw wash press shall be designed to receive and wash screenings, then reduce the volume and water content by means of a pressing zone. After the compacting and dewatering process, the screenings shall be conveyed through the discharge transportation tube to a dumpster.

2. Screenings Washer and Compactor that use impellers and/or grinders to tear and shred fibrous screenings at the inlet to the compactor and therefore increase the amount of inert material returned to the plant shall not be allowed.

3. The Screenings Washer and Compactor shall be designed and built to withstand maximum possible forces exerted. All structural and functional parts shall be sized to prevent deflections or vibrations that may impair the screw wash press operations. All components of the Screenings Washer and Compactor shall be made of type 304 stainless steel except the shaft screw which shall be from high strength steel with Hardox® 400 flights throughout. Bearings, electrical devices, sprockets, motor and gear reducer shall be of the manufacturer’s standard materials.

4. Shop Surface Preparation/Coating: All weldments shall be cleaned and passivated using a full dip passivation process to remove weld spatter, slag and discoloration. Bearings, electrical devices, drive and wiper chains and sprockets, motor and gear reducer shall be provided with the manufacturer’s standard coating system. Screen weldments not full dipped passivated, using spray on cleaning solutions, passivating welds only or bead blasting shall not be allowed.

5. The Screenings Washer and Compactor shall discharge dewatered screenings capable of passing the EPA Paint Filter Test as described in method 9095 of the EPA publication SW-486.

6. The bottom of the screw housing shall be provided with perforated drainage sections.

7. The shafted screw will be constructed of high strength low alloy carbon steel and Hardox® 400 flights (minimum 400 Brinell), prime coated for protection during shipment.

8. A replaceable nylon brush reinforced with a stainless steel backer shall be attached to the screw flights in the drainage area with stainless steel clips and hardware. To reduce wear on the brush the design shall be such that the screw shall not be allowed to rest in the press housing. The screw shall be fully supported and cantilevered off the thrust bearing.

9. An independent thrust bearing housing shall be flanged mounted to the drive and flanged mounted to the press body. The independent thrust bearing assembly shall be protected from the environment and located in a separately sealed area located inside the press body. The flange portion of the thrust bearing shall have a grease fitting centrally located for ease of maintenance.

10. The thrust bearing shall fully support the screw and handle the load created during compaction and reversal of the screw. The thrust bearing shall utilize an SKF roller bearing complete with double lip grease seals and O-rings. The mounting flange shall have an O-ring seal mounted in a machined groove to seal the housing against the press body.

11. A drain pan shall be mounted to the bottom of the screw housing along the full length of the housing. The pan shall be sloped to the drain outlet and it shall be provided with a flushing water connection. Drain connection shall be minimum 6 inch plain ended pipe. Flush connection shall be minimum 1 inch NPT connection. The drain pan shall be secured in place with hardware and allow for easy removal.

12. The Screenings Washer and Compactor shall be provided with a minimum of two (2) separate connections for injecting wash water into the screenings.

13. Wash water spray nozzles shall be capable of utilizing the screened plant effluent without clogging or fouling.

14. The wash zone shall include a spray wash system to wash organic residue from the screenings. The spray connection will be 1 inch NPT.

15. The inlet hopper shall be designed to accept discharge screenings from the Perforated Plate Screen discharge chute. The hopper shall directly interface with the discharge with no solids or water bypass.

16. The discharge pipe shall be designed to transport the washed, dewatered, and compacted screenings to the discharge point without plugging.

17. For increased washing and compaction performance the discharge pipe will include a manually controlled back pressure device. The back pressure is manually generated by a stainless steel plate positioned by operating personnel. Access to the back pressure device is through a stainless steel access box fitted with a bolt in place hatch with handle. The access box is integral to the discharge pipe. Material of construction 304 stainless steel.

18. The discharge piping following the elbow shall be fabricated type 304 stainless steel.

B. Drive Assembly

1. The gear reducer shall be a flanged mounted directly to the thrust bearing housing and the compactor frame. Gear reducer shall be a helical gear type with hollow input shaft. The unit will be provided with a cast iron frame and be designed in accordance with AGMA recommendations for Class I service based on the horsepower required to operate the wash press.
2. The motor shall be in accordance with Section 26 20 00 - Low-Voltage AC Induction Motors.

2.6 ELECTRICAL CONTROLS AND DEVICES

A. In addition to the drive motor, the equipment supplier shall furnish all electrical items specifically called for in this specification section. The contractor shall supply all other electrical items, and interconnecting wiring of proper size, including all conduit and supports required to place the equipment into service.

1. The following components will be included in the associated screen panel to provide proper operation of the equipment:
   a. Branch circuit protection.
   b. Compactor motor starter (IEC), reversing with overloads.
   c. Hand-Off-Auto selector switches for the screw drive, and screenings spray wash water.
   d. Motor load monitor for overload and over torque protection.
   e. Hour meter for motor.
   f. Emergency Stop
   g. Run and fault indicating lights.
   h. Run and alarm auxiliary contacts for use by the customer.

B. Solenoid Valve: One (1) solenoid valve shall be provided to control flow to the spray wash assembly. The brass body valve shall be 120 Volt, single phase, 60 Hz with a NEMA 4X housing.

2.7 OPERATION, MONITORING, AND CONTROL

A. Sequence of Operation

1. HAND OPERATION: When HAND mode is selected, the spiral will run continuously. When spray wash HAND mode is selected, the spray wash will run continuously.

2. INTERMITTENT AUTOMATIC OPERATION: The control panel will be equipped to control the wash cycle and screw movement. The wash cycle and the screw movement will be controlled independently through the use of timers and counters. The drive motor and spray wash will be controlled automatically when the selector switches are placed in the Auto position.
   a. The press motor starts after an adjustable accumulated run time from the interlocked feeding equipment.
   b. The wash water solenoid is open whenever the screw is in operation.
   c. The washing solenoid closes and the press motor runs for an adjustable length of time, typically set at 30 seconds, to dewater and discharge the screenings.

3. EMERGENCY STOP: The unit can be deactivated at any time by pressing the control panel mounted Emergency Stop push button.

4. FAULT CONDITIONS: Motor overload, high motor torque, or high motor current conditions will stop the motor and illuminate the fault light.

2.8 Anchorage and Fasteners

A. Anchor Bolts: All anchor bolts shall be a minimum of 1/2 inch diameter and made of type 304 stainless steel. The equipment supplier shall furnish all anchor bolts, nuts, and washers required for the equipment.

B. Fasteners: All fasteners shall be type 304 stainless steel. The equipment supplier shall furnish all fasteners required for the assembly of the equipment.

2.9 SPARE PARTS

A. The following minimum spare parts shall be provided for the screenings wash press

1. One (1) brush with mounting clips and hardware for screw.

B. Manufacturer shall recommend any additional spare parts deemed necessary based on experience with the wash press in similar applications.

PART 3 - EXECUTION

3.1 PREPARATION

A. The mounting points TOC shall be level and parallel and of proper size.

B. Contractor shall verify all dimension in the field to ensure compliance of equipment dimensions with the drawings.

3.2 INSTALLATION

C. The installation is the responsibility of the Purchaser. Complete installation procedures are included in the O&M manual shipped with the unit.

3.3 MANUFACTURER'S SERVICES

A. Provide manufacturer's services in accordance with Section 01 70 00 – Execution and Closeout Requirements. The manufacturer services are included in the services required for the Perforated Plate Screen, provided they are from the same manufacturer.

3.4 ADJUSTING AND CLEANING

D. Information on minor periodic adjustments and cleaning is contained in the Operating and Maintenance Manual.

END OF SECTION

SCREENINGS WASHER AND COMPACTOR DATA SHEET

Basis of Design: Saveco North America, Inc. Model SPW200-700

Utility Requirements:

Requirements/Locations	Unit
Spray Wash Water	11 gpm @ 20-40 psi
Power Supply (V/P/Hz)	480/3/60
Wash Press Installation Location (indoor/outdoor)	Outdoor
Wash Press NFPA Classification Requirement	Non-hazardous
Control Panel Location (indoor/outdoor)	Outdoor
Control Panel NFPA Classification Requirement	Non-hazardous

Performance Requirements:

Conditions	Unit
Number of Wash Presses	Qty (1)
Influent Type	Municipal Screenings
Inlet Solids Capacity (CFH)	70
Inlet Length	700 mm (27.6 inches)
Volume Reduction	60 – 85%
Weight Reduction	60 – 85%
Discharged Material Dry Solids	>35%
Min Motor HP	3.0
Washed Screenings Fecal Reduction	90% (<20 mg/g BOD5)

SECTION 46 31 11 - GAS FEED EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Requirements of this Specification Section apply to Chlorine gas and Sulfur Dioxide gas feed systems. Refer to the gas feed data sheets, attached as a supplement to this Section.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Occupational Safety and Health Administration (OSHA).
2. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
3. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
4. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
5. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
6. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
7. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
8. ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 – Submittal Procedures

B. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

C. Manufacturer's Field Reports: Indicate equipment has been installed in accordance with manufacturer’s instructions.

1.4 WARRANTY

A. Warranty on equipment and installation is one (1) year from Final Completion, in accordance with Article 6.19 of the General and Supplemental Conditions.

PART 2 - PRODUCTS

2.1 GENERAL

A. The gas feeders shall automatically regulate gas feed rates in response to a manually set single flow or PLC input signal. Gas is fed from the gas storage tanks to the Gas Feed Panel, and then metered through a vacuum feed to the injector. The gas will be then be injected into water piping supplied by a yard hydrant installed near the injector. The solution is then conveyed to the injection location using the Plant Water system pressure.

B. The gas feeder shall consist of the following elements:
1. Gas Feed Panel containing an automatic gas control valve with integral controller and gas flowmeter.
2. Vacuum regulators at gas tanks
3. Gas Ejector
4. Gas Tank Scale and Indicator

C. Materials – Materials shall be compatible with the gas or liquid being injected.

D. Capacity – Refer to Gas Feed Data Sheet at end of this Specification.

E. Manufacturers:
1. Manufacturer and model numbers named in “Basis of Design” on Data Sheet following this specification is approved.
2. Or approved Equal.

2.2 GAS FEED Wall Panel

A. Gas Feed Valve
1. Plug and orifice that provides linear flow control.
2. Corrosion resistant to gas being fed.
3. Manually controllable in case of power failure.
4. Valve minimum of 12 complete revolutions from full open to full closed.

B. Control Valve Actuator
1. 120/240 VAC
2. Heavy-duty stepping motor
3. Capable of 200 steps per revolution.

C. Housed in NEMA 3R Enclosure.
1. Able to receive external control from 4-20 mA signal and use to modulate gas flow.
2. Able to Transmit gas flow via. 4-20 mA signal.

D. Flowmeter
1. Dual Scale – English/metric
2. Operates in vacuum.
3. Capable of reading 1/20 of maximum value.

2.3 VACUUM REGULATOR

A. The gas control system shall operate under vacuum to prevent gas leakage.

B. There shall be two (2) vacuum regulators installed on two (2) 1-ton gas tanks for each gas feed system.

C. The vacuum regulator shall contain a positive-acting gas control valve

D. The vacuum regulator shall have a diaphragm-operated pressure relief valve

E. The vacuum regulator capable of automatic changeover to the second vacuum regulator.

F. The vacuum regulator shall indicate whether it is in “Reserve”, “Operating” or “No Gas” condition.

G. The vacuum regulator shall have a gas filter.

H. The vacuum regulator shall have a liquid trap and electric heater.

2.4 EJECTOR

A. Equipped with Dual Check Valves

B. Equipped with emergency drain connection

C. Accuracy: +/- 4% over 20:1 range

2.5 SCALE AND INDICATOR

A. Provide two (2) scales suitable for weighing 1-ton gas tanks equal to the tanks currently in-use. Scales shall include trunnions, scale frame and cell.

B. Provide a 2-channel digital weight indicator with 4-20 mA signal output for each scale. Indicator shall have local weight display.

2.6 CHEMICAL VENT AND VACUUM TUBING

A. Flexible Polyethylene Pipe: Pipe and fitting shall conform to ASTM D3350, PE345444C, DR 7, ASTM D3035, and ASTM F714.

2.7 RIGID CHEMICAL PIPING

A. PVC Pipe: ASTM D1785, Schedule 80.
   1. Fittings: ASTM D2466 or ASTM D2467, PVC.
   2. Joints: ASTM D2855, solvent weld.

2.8 FLEXIBLE CHEMICAL TUBING

A. Flexible Polyethylene Pipe: Pipe and fitting shall conform to ASTM D3350, PE345444C, DR 7, ASTM D3035, and ASTM F714.

PART 3 - EXECUTION

2.9 INSTALLATION

A. Install in accordance with manufacturer's printed instructions.

B. Plumb equipment together with tubing suitable for use with gas vacuum.

C. Tubing and fittings shall be compatible with gas being conveyed.

2.10 FIELD QUALITY CONTROL

A. Preliminary Gas Leakage Testing: Pressurize entire gas side of chemical feed system with nitrogen to at least 150 psig. With system under pressure, test each joint and connection for leaks by application of soapy water to each joint and connection.

B. Preliminary Liquid Leakage Testing: Test liquid part of chemical feed system in accordance with the Pipeline Schedule.

C. Functional Tests: Conduct on each gas feed system:
1. Flow Output: Measure weight of chemical in tanks before and after functional tests to compare to quantity of chemical added to the secondary effluent as measured by the chlorine residual sensors.

2.11 MANUFACTURER'S SERVICES

A. Manufacturer's Representative:
1. Present at Site, for minimum person-days listed below, travel time excluded:
a. 1/2 person-days for installation assistance and inspection.
b. 1/2 person-days for functional testing and completion of Manufacturer's Certificate of Proper Installation.

B. Other Requirements, refer to Section 01 70 00 – Execution and Closeout Requirements.

2.12 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification.
1. Gas Feed Equipment Data Sheet.

END OF SECTION

DATA SHEET
CHEMICAL GAS FEED EQUIPMENT

Stillhouse WWTF Improvements

Owner: City of Gatesville

Service: Chlorine Gas Feed

Equip. Tag Number(s): CF-601

BASIS OF DESIGN

GAS FEED PANEL: DeNora Series 2000WP

VACUUM REGULATOR DeNora Series NXT3000

EJECTOR DeNora Series EJ17C1

DESIGN INFORMATION

Gas to be Fed: Chlorine Gas
Max Flow Rate: 358 lb/day
Water Flow: 28 gpm
Water Upstream Pressure: 40 psi
Water Downstream Pressure: 10 psi

DATA SHEET
CHEMICAL GAS FEED EQUIPMENT

Stillhouse WWTF Improvements

Owner: City of Gatesville

Service: Sulfur Dioxide Gas Feed

Equip. Tag Number(s): CF-620

BASIS OF DESIGN

GAS FEED PANEL: DeNora Series 2000WP

VACUUM REGULATOR DeNora Series NXT3000

EJECTOR DeNora Series EJ17C1

DESIGN INFORMATION

Gas to be Fed: Sulfur Dioxide Gas
Max Flow Rate: 184 lb/day
Water Flow: 28 gpm
Water Upstream Pressure: 40 psi
Water Downstream Pressure: 10 psi

SECTION 46 43 21 - CLARIFIER - CENTER PIER SUPPORTED

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section provides for furnishing and installing clarifier equipment and accessories as shown on drawings and as specified.
B. Furnish and install new clarifier parts for the two (2) existing clarifiers.
C. The installation includes miscellaneous items required to provide a complete operating system.

1.2 SUBMITTALS

A. Submittals shall be made in accordance with Section 01 33 00 – Submittal Procedures.
B. Operation and Maintenance Data shall be submitted in accordance with Section 01 70 00 – Execution and Closeout Requirements.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Provide equipment that is a standard product in regular production by a manufacturer whose products have proven reliable in a similar service for at least 5 years.

1.4 WARRANTY

A. Warranty on equipment and installation is one (1) year from Final Completion, in accordance with Article 6.19 of the General and Supplemental Conditions.

PART 2 - PRODUCTS

2.1 SCOPE OF REPLACEMENT

A. The existing clarifiers are Eimco 80 ft diameter Clarifiers, serial Nos. 24281-02-A and 24281-02-B, installed in 1991.
B. The scope of replacement includes the following:
   1. Feedwell
   2. Skimmer Arm and support
   3. Scum Box
   4. Scum Box Flush Assembly
   5. Replacement of rubber gaskets on weirs and adjustment of weir level.

2.2 FEEDWELL

A. Replace the existing feedwell with an equal design, both in material, material thickness and coating. Provide new supports to anchor the feedwell to the clarifier.

2.3 SKIMMER ARM

A. Replace a skimmer arm and skimmer arm supports with an equal design, both in material, material thickness and coating.

2.4 SCUM BOX

A. Replace a scum box and scum flush mechanism with an equal design, both in material, material thickness and coating.

2.5 EFFLUENT WEIRS

A. Furnish neoprene gaskets for the effluent weirs to replace the existing gaskets. When reinstalling the existing weirs, level the weirs so they are level within +/- 1/8 inch.

PART 3 - EXECUTION

3.1 MAINTAIN CAPACITY

A. The Clarifier will be out of service while the part replacements are being installed. Only 1 clarifier can be out of service at a time. Coordinate with the Operator for the timing and duration of replacement of equipment. All bypass pumping, line plugging and other activities to ensure the WWTF can operate during the mechanism replacement is the responsibility of the Contractor.

END OF SECTION