BID DOCUMENTS FOR CONSTRUCTION OF

WES BROWN WATER TREATMENT PLANT VALVE AND ACTUATOR REPLACEMENT – PHASE 2

PROJECT NO. 24-128

FOR

CITY OF THORNTON, COLORADO

JUNE 2025

CONSOR
1157 WEST CENTURY DRIVE, SUITE 220
LOUISVILLE, CO 80027

SECTION 00 01 07 - SEALS PAGE
FOR
WES BROWN WATER TREATMENT PLANT VALVE AND ACTUATOR REPLACEMENT – PHASE 2
FOR
CITY OF THORNTON

See Table of Contents for author of each specification section, identified by author's initials as follows:

AUTHOR'S NAME, ORGANIZATION = INITIALS

CHRISTOPHER MICHAEL MANNING, CONSOR = CMM

TED F. WILLE, BROWNS HILL ENGINEERING & CONTROLS = TFW

GREG REPELLA, REPELLA CONSULTING ENGINEERS = GR

SECTION 00 01 10 – TABLE OF CONTENTS
FOR
WES BROWN WATER TREATMENT PLANT VALVE AND ACTUATOR REPLACEMENT – PHASE 2
FOR
CITY OF THORNTON

Section	Person Responsible	Title	Page
TECHNICAL SPECIFICATIONS			
Division 01 - General Requirements			
01 01 07	N/A	Seals Page	1-1
01 10 00	CMM	Summary of Work	1-6
01 12 16	CMM	Work Sequence	1-3
01 22 20	CMM	Measurement and Payment	1-4
01 33 00	CMM	Submittal Procedures	1-10
01 45 00	CMM	Quality Control	1-4
01 50 00	CMM	Temporary Facilities and Controls	1-5
01 60 00	CMM	Product Requirements	1-2
01 70 00	CMM	Execution and Closeout Requirements	1-10
01 75 00	CMM	Testing, Training, and Commissioning	1-4
Division 02 - Existing Conditions			
02 41 00	CMM	Demolition	1-4
Division 03 - Concrete			
03 60 00	CMM	Grouting	1-3
Division 04 – NOT USED			
Division 05 - Metals			
05 12 00	GR	Structural Steel Framing	1-8
05 50 00	GR	Metal Fabrications	1-16
Division 06 through Division 08 – NOT USED			
Division 09 - Finishes			
09 90 00	CMM	Painting and Coating	1-13
Division 10 - Specialties			
10 14 10	CMM	Identifying Devices	1-3
Division 11 through Division 25 – NOT USED			
Division 26 - Electrical			
26 00 00	TFW	Basic Electrical Materials and Methods	1-14

Division 27 through Division 39 – NOT USED

Division 40 - Process Integration

40 05 13	CMM	Common Work Results for Process Piping	1-8
40 05 51	CMM	Common Work Results for Process Valves	1-9
40 05 51.18	CMM	Butterfly Valves	1-4
40 95 00	TFW	Programmable Logic Controllers	1-6

Division 41 through Division 46 – NOT USED

CONSTRUCTION DRAWINGS

See Sheet G-001 for Drawing Index

END OF SECTION

SECTION 01 10 00 – SUMMARY OF WORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Work covered by Contract Documents.
2. Site access
3. Work by Owner or other Work at the Site.
4. Owner-furnished products.
5. Contractor's use of Site and premises.
6. Future work.
7. Work sequence.
8. Owner occupancy.
9. Permits.
10. Specification conventions.
11. Field service by manufacturer representative.
12. Testing and operation of facilities.
13. Protection of existing structures and work.
14. Safety standards and accident prevention.
15. Warranty period.
16. Or equal clause.
17. Competent person designation.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Work of the Project includes:

1. Replacement of sixty-nine (69) butterfly valves, two (2) pneumatic actuators, and thirty (30) electric actuators. All new pneumatic actuators shall be installed with new air filters.
2. Refurbishment of thirty-eight (38) pneumatic actuators, which includes the replacement of solenoids and speed control valves, and on-site cleaning, degreasing, and repainting.
3. Replacement of all hosing and hose fittings on the pneumatic actuators to be replaced or refurbished.

4. Electrical and controls work for the integration of the new electric actuators.

5. New platforms, walkways, stairs, ladders, and structural elements to improve accessibility to process piping and valving for all filter gallery trains.

B. The defined Work elements are a general outline of principal features of the Work and does not in any way limit the responsibility of the Contractor(s) to perform all Work and furnish all equipment, labor and materials required by the Contract Documents.

1.3 SITE ACCESS

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings and as indicated by requirements of this Section. The Project site is the Wes Brown Water Treatment Plant located at 3651 E 86th Avenue, Thornton, CO 80229.

B. Use of Site: Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.

b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

2. Gate Access: The water treatment plant is a secure facility with gated access. No gate access will be permitted outside of the working hours, as described in Part 1.6, without prior approval from the Owner.

1.4 WORK BY OWNER OR OTHERS

A. Phase 1 of this project is anticipated to be completed during December 2025.

B. Owner-awarded contracts with work at the facility during this project's anticipated construction window may include, but is not limited to, the following:

1. Hydrochloric acid room remodel

2. Chemical tank repairs and coatings

3. Membrane tank repairs and coatings

C. If Owner-awarded contracts or other work by the Owner interferes 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.

1.5 NOT USED

1.6 CONTRACTOR'S USE OF SITE AND PREMISES

A. The Work included in the Contract Documents is to be performed at an existing water treatment facility that is fully operational each year from March 1st to December 1st . The Contractor shall complete all work outside of this time period and shall always cooperate fully with the Owner and the Engineer to ensure that the production capability of the plant will not be impacted and that any interruption to plant operations and associated work are minimized.

1. The specific major requirements for maintaining plant operations are listed below. These requirements are not necessarily complete in every detail:

2. Five day's-notice shall be given to the Owner by the Contractor when any interruption of or modification to the operation of the existing plant and/or piping is desired.

3. Follow the sequence of construction requirements as described in Section 01 12 16, Work Sequence.

B. Partial Owner Occupancy: Owner will occupy the premises during entire construction period Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.

D. Provide not less than 7-day notice to Owner of activities that will affect Owner's operations.

E. Emergency Building Exits during Construction: As directed by the Owner.

F. Construction Operations: Limited to areas indicated on Drawings and as directed by the Owner.

1. 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.

G. Time Restrictions for Performing Work: Non-holiday weekdays from 7 A.M. to 4 P.M., unless otherwise directed by the Owner. No weekend work will be allowed. Requests for variations in work hours shall be made in writing for consideration by the Owner. No work shall be conducted outside of the above-described days and hours without prior approval of the Owner.

H. Construction Plan: Before start of construction, submit electronic copy of the construction plan regarding access to Work, use of Site, and utility outages for acceptance by Owner. After acceptance of plan, construction operations shall comply with accepted plan unless deviations are accepted by Owner in writing.

1.7 WORK SEQUENCE

A. See Section 01 12 16 Work Sequence.

1.8 OWNER OCCUPANCY

A. Schedule and substantially complete designated portions of the Work for occupancy before Substantial Completion of the entire Work.

1. Owner intends to occupy the entire facility throughout the duration of the Project.

2. Owner's use and occupancy of designated areas before Substantial Completion of the entire Project do not relieve Contractor of responsibility to maintain specified insurance coverages on a 100 percent basis until date of final payment.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.9 PERMITS

A. Unless provided for otherwise in these Contract Documents, all permits, licenses, and fees shall be obtained by the Contractor and all costs shall be borne by the Contractor. Contractor shall pay all plan check fees and other fees necessary to obtain permits and shall accommodate special inspections required thereof. Contractor shall be responsible for compliance with all permit provisions and shall accommodate all special inspections required thereof, all at no additional expense to the Owner beyond prices as bid.

B. Furnish all necessary permits for construction of Work including the following:

1. City of Thornton CIP Construction Permit (no fee)

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 FIELD SERVICE BY MANUFACTURER REPRESENTATIVE.

A. For all valves and actuators that are scheduled for replacement or refurbishment, provide services of an experienced, competent, factory-authorized representative of the manufacturer.

B. Arrange for Field Services representative to visit the Site of the Work and inspect, check, adjust as necessary, and approve the Equipment installation. Field Services representative shall be present when Equipment is placed into operation, and shall revisit the Site as often as necessary until problems are corrected, and Equipment installation and operation are acceptable to the Owner and Engineer.

C. Submit to Owner the Field Services representative's completed record forms as required and written report certifying that the Equipment has been properly installed; is in accurate alignment; is free from undue stress imposed by connecting piping or anchor bolts; and has been successfully operated under expected full load conditions.

1.12 TESTING AND OPERATION OF FACILITIES.

A. It is the intent of the Owner to have a complete and operable facility. All the work under this contract will be fully tested and inspected in accordance with the specifications. Upon completion of the work, the Contractor shall operate the completed facilities as required to test the equipment under the direction of the Owner and/or Engineer. During this period of operation by the Contractor, the new facilities will be tested thoroughly to determine their acceptance.

1.13 PROTECTION OF EXISTING STRUCTURES AND WORK.

A. The Contractor must take all precautions and measures necessary to protect all existing structures and work. Any damage to existing structures and work shall be repaired by removing the damaged structure or work, replacing the work and restoring to original condition satisfactory to the Owner and Engineer.

1.14 SAFETY STANDARDS AND ACCIDENT PREVENTION.

A. The Contractor shall be solely and completely responsible for conditions within the treatment facility where construction is taking place, including safety of all persons and property during performance of the work. This requirement shall apply continuously and not be limited to normal working hours. The required and/or implied duty of the Engineer to conduct construction review of the Contractor's performance does not, and is not intended to, include review of the adequacy of the Contractor's safety measures in, on, or near the construction area.

B. The Contractor shall comply with the safety standards provisions of applicable laws and building and construction codes. The Contractor shall exercise every precaution at all times for the prevention of accidents and protection of persons, including employees, and property. During the execution of the work the Contractor shall provide and maintain all guards, railing, lights, warnings, and other protective devices which are required by law or which are reasonably necessary for the protection of persons and property from injury or damage.

1.15 WARRANTY PERIOD.

A. The Contractor shall warrant all furnished materials and equipment for a period of one year from date of initial acceptance of the Work by the Owner with a final site inspection near the one-year term. This warranty shall mean prompt attention to the correction and/or complete replacement of the faulty material or equipment prior to final acceptance of the Work by the Owner. The expiration of the one-year warranty period shall not affect any other claims or remedy available to the Owner. There may be other warranty provisions in these contract documents in addition to those noted above.

1.16 OR EQUAL CLAUSE.

A. In order to establish a basis of quality, certain processes, types of machinery and equipment or kinds of material may be specified on the drawings or herein by designating a manufacturer's name and referring to its brand or product designation. It is not the intent of these specifications to exclude other processes, equipment or materials of a type and quality equal to those designated. When a manufacturer's name, brand, or item designation is given, it shall

be understood that the words "or equal" follow such name or designation, whether in fact they do so or not. If the Contractor desires to furnish items of equipment by manufacturers other than those specified, he shall secure the approval of the Engineer prior to placing a purchase order.

B. No extras will be allowed the Contractor for any changes required to adopt the substitute equipment. Therefore, the Contractor's proposal for an alternate shall include all costs for any modifications to the drawings, such as structural and foundation changes, additional piping or changes in piping, electrical changes or any other modifications which may be necessary or required for approval and adoption of the proposed alternate equipment. Approval of alternate equipment by the Engineer before or after bidding does not guarantee or imply that the alternate equipment will fit the design without modifications.

1.17 COMPETENT PERSON DESIGNATION.

A. Contractor shall designate a qualified and experienced “competent person” at the site whose duties and responsibilities shall include enforcement of applicable OSHA regulations regarding fall protection, the prevention of accidents, and the maintenance and supervision of construction site safety precautions and programs.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 12 16 - WORK SEQUENCE

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes general sequencing, project phasing and coordination requirements for the Work.

B. Contract Requirements:

1. The existing facility is in operation from March 1st to December 1st each year. The functions of the facility shall not be compromised during the course of the Work, except as may be specified herein. Plan and prosecute the Work such that the operation of the treatment facility is not interrupted. All work shall therefore be completed between December 1st, 2025 and March 1st, 2026.

1.2 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Work Sequencing Plan: At a minimum, to include the following:

1. Complete sequence of construction for all activities contained herein.

2. Major work activities to occur.

1.3 PROJECT SPECIFIC WORK CONSTRAINTS

A. Constraints primarily relate to the need to have all work constructed, tested, commissioned, and accepted by Owner prior to March 1st, 2026.

B. Constraints listed below involve limits on activities during construction. These limits relate to the critical nature of the improvements being complete by the plant's annual start-up date and the requirement to allow the Owner complete access to the facility throughout construction.

1. Coordinate construction schedule and operation with Owner.

2. Schedule the constructing, testing, and commissioning of those components of the facility that are required to be fully operational by the date noted above.

1.4 GENERAL WORK CONSTRAINTS

A. Constraints primarily relate to interfacing with and tying into existing processes, power supply, equipment, and other aspects of the water treatment facility.

B. Make every effort to give proper attention to each of these items so as to minimize interruptions of the existing facilities and avoid delays that may result if the constraints are not observed.

C. Constraints listed below involve limits on activities during construction. These limits relate to the critical nature of the existing treatment facility.

1. Coordinate construction schedule and operation with Owner.

2. Coordinate proposed work with Owner, Engineer, and facility operations personnel before implementing unit shutdowns. Under no circumstances cease Work at the end of a normal working day if such actions may inadvertently cause a cessation of any facility operating process; in which case, remain on site until necessary Work and/or repairs are complete.

3. Owner recognizes portions of the facility and facility operations will have to be interrupted or shut down or interfered with in order to accommodate construction activities. Owner will, through its personnel, attempt to accommodate Work, provided that proper notification is given. Owner reserves the right to deny permission for interruption or shutdown on any day.

4. Do not operate any of the existing equipment without written permission from Owner naming the specific piece of equipment, operator(s), and dates equipment may be used. Contractor is liable for any loss or damage caused to property or equipment or any personal injury resulting from or related to this usage.

D. Extended Working Hours: If it is desired to perform any Work outside the specified working hours, obtain written permission from Owner and all necessary permitting agencies, and make all necessary arrangements prior to commencing.

1.5 TEMPORARY SHUTDOWNS

A. The Contractor shall not assume that any Work that interrupts facility operations will be permitted after the annual start-up on March 1st, 2026. However, in the case that the Owner allows some work to be completed after this date, the following will apply:

B. Provide 14-day minimum advance notice to request approval of a temporary shutdown of a facility.

C. Each Notice of Request for Approval of a Temporary Shutdown submitted to Owner shall include the following:

1. Dates, times, and duration of proposed shutdown.

2. Work activities to be performed during the shutdown.

3. Process area (e.g., gallery train 2) that will be impacted by the shutdown.

4. Assistance required of Owner's personnel before, during, and after shutdown.

5. Personnel to be on Site during shutdown.

6. Contingency plan if work during shutdown is not completed during allotted time or critical equipment fails.

D. Upon receipt of such request, Owner will decide what action(s) is required by Owner and if the requested shutdown is acceptable considering the flows through the treatment facility at that time. The request from Contractor will be returned to Contractor with the Owner's written decision noted. If Owner deems that the requested shutdown is unacceptable, Owner will state

such reasons, and Contractor shall reschedule the shutdown as required or coordinate with the Owner for a Contract Amendment to remove the item(s) from the Scope of Work.

E. It is hereby agreed between the Contractor and Owner that disapproval by Owner of the Contractor's shutdown request does not entitle Contractor to any time extension unless Contractor can demonstrate to the satisfaction of Owner, through an updated CPM schedule, that the overall project completion date will not be met as a result of this disapproval.

F. Owner may postpone a planned and approved shutdown at any time due to safety or operational concerns.

G. Contractor shall assume that no temporary bypass for the impacted area(s) will be necessary.

1.6 NOT USED

PART 2 PRODUCTS - (Not Used)

PART 3 EXECUTION

3.1 CONSTRUCTION COMPLETION AND TIMING

Complete construction and testing and obtain Owner's acceptance of all facility improvements detailed in the Scope of Work prior to March 1st, 2026, at which time it is anticipated that the treatment facility will be made fully operational.

END OF SECTION

SECTION 01 22 20 - UNIT PRICE MEASUREMENT AND PAYMENT

PART 1 GENERAL

Measurement and payment will be on a unit price basis in accordance with the prices set forth in the proposal for individual work items. Where work is required but does not appear as a separate item in the proposal, the cost for that work shall be included and absorbed in the unit prices named in the proposal. Contractor shall make a careful assessment when preparing the bid.

1. Mobilization, Bonds, Insurance and Demobilization: Payment for mobilization, bonds, insurance, and demobilization will be on a lump sum basis. The amounts paid for mobilization in the contract progress payment will be based on the percent of the original contract amount that is earned from other contract items, as follows:

    A. When 5 percent of the original contract amount is earned, either 100 percent of the amount for mobilization or 5 percent of the original contract amount, whichever is the least.

    B. When all work is completed, amount of mobilization exceeding 5 percent of the original contract amount.

    This schedule of mobilization progress payments will not limit or preclude progress payments otherwise provided by the contract.

2. Start-up, Testing, Commissioning, and Training: Payment for start-up, testing, commissioning, and training will be on a lump sum basis. Work includes but is not limited to start-up and testing of all equipment for proper functionality and performance; operational acceptance testing; submission of operation and maintenance data; and training for Owner's operations staff as defined in the specifications and drawings demonstrating all aspects of the work are functioning as designed.

3. Remove and Replace 2-inch Wafer Butterfly Valves and Appurtenances: Payment for removing and replacing 2-inch wafer butterfly valves will be on a per each basis. The unit price for butterfly valve replacement shall include all costs for removal and disposal of old valves and appurtenances as well as all costs for the furnishment and installation of new wafer butterfly valves, actuator solenoid valves, actuator speed control valves, and actuator hoses and hose fittings. The unit price shall also include the on-site cleaning, degreasing, and repainting of the existing open/close actuator to remain.

4. Remove and Replace 4-inch Wafer Butterfly Valves and Appurtenances: Payment for removing and replacing 4-inch butterfly valves will be on a per each basis. The unit price for butterfly valve replacement shall include all costs for removal and disposal of old valves and appurtenances as well as all costs for the furnishment and installation of new wafer butterfly valves, actuator solenoid valves, actuator speed control valves, and actuator hoses and hose fittings. The unit price shall also include the on-site cleaning, degreasing, and repainting of the existing open/close actuator to remain.

5. Remove and Replace 6-inch Wafer Butterfly Valves, Modulating Pneumatic Actuators, and Appurtenances: Payment for removing and replacing 6-inch wafer butterfly valves and actuators will be on a per each basis. The unit price for butterfly valve and actuator

replacement shall include all costs for removal and disposal of old valves, modulating pneumatic actuators, and appurtenances as well as all costs for the furnishment and installation of new butterfly valves, modulating actuators, air filters, and actuator hoses and hose fittings.

6. Remove and Replace 8-inch Wafer Butterfly Valves and Appurtenances: Payment for removing and replacing 8-inch butterfly valves will be on a per each basis. The unit price for butterfly valve replacement shall include all costs for removal and disposal of old valves and appurtenances as well as all costs for the furnishment and installation of new wafer butterfly valves, actuator solenoid valves, actuator speed control valves, and actuator hoses and hose fittings. The unit price shall also include the on-site cleaning, degreasing, and repainting of the existing open/close actuator to remain.

7. Remove and Replace 12-inch Wafer Butterfly Valves and Appurtenances: Payment for removing and replacing 12-inch butterfly valves will be on a per each basis. The unit price for butterfly valve replacement shall include all costs for removal and disposal of old valves and appurtenances as well as all costs for the furnishment and installation of new wafer butterfly valves, actuator solenoid valves, actuator speed control valves, and actuator hoses and hose fittings. The unit price shall also include the on-site cleaning, degreasing, and repainting of the existing open/close actuator to remain.

8. Remove and Replace 14-inch Wafer Butterfly Valves and Appurtenances: Payment for removing and replacing 14-inch butterfly valves will be on a per each basis. The unit price for butterfly valve replacement shall include all costs for removal and disposal of old valves and appurtenances as well as all costs for the furnishment and installation of new wafer butterfly valves, actuator solenoid valves, actuator speed control valves, and actuator hoses and hose fittings. The unit price shall also include the on-site cleaning, degreasing, and repainting of the existing open/close actuator to remain.

9. Remove and Replace 18-inch Wafer Butterfly Valves, Modulating Pneumatic Actuators, and Appurtenances: Payment for removing and replacing 18-inch wafer butterfly valves and actuators will be on a per each basis. The unit price for butterfly valve and actuator replacement shall include all costs for removal and disposal of old valves, modulating pneumatic actuators, and appurtenances as well as all costs for the furnishment and installation of new butterfly valves, modulating actuators, air filters, and actuator hoses and hose fittings.

10. Remove and Replace 24-inch Wafer Butterfly Valves and Appurtenances: Payment for removing and replacing 24-inch butterfly valves will be on a per each basis. The unit price for butterfly valve replacement shall include all costs for removal and disposal of old valves and appurtenances as well as all costs for the furnishment and installation of new wafer butterfly valves, actuator solenoid valves, actuator speed control valves, and actuator hoses and hose fittings. The unit price shall also include the on-site cleaning, degreasing, and repainting of the existing open/close actuator to remain.

11. Refurbishment of Pneumatic Actuators for 12-inch Wafer Butterfly Valves: Payment for the refurbishment of pneumatic actuators for 12-inch butterfly valves will be on a per each basis. The unit price for pneumatic actuator refurbishment shall include all costs to protect-in-place the existing wafer butterfly valve and for the furnishment and installation of new actuator

solenoid valves, actuator speed control valves, and actuator hoses and hose fittings. The unit price shall also include the on-site cleaning, degreasing, and repainting of the existing open/close actuator.

12. Remove and Replace 12-inch Flanged Butterfly Valves, Modulating Electric Actuators, and Appurtenances: Payment for removing and replacing 12-inch flanged butterfly valves and actuators will be on a per each basis. The unit price for flanged butterfly valve and actuator replacement shall include all costs for removal and disposal of old valves, modulating electric actuators, and appurtenances as well as all costs for the furnishment and installation of new butterfly valves, modulating electric actuators, and appurtenances.

13. Remove and Replace 18-inch Flanged Butterfly Valves, Modulating Electric Actuators, and Appurtenances: Payment for removing and replacing 18-inch flanged butterfly valves and actuators will be on a per each basis. The unit price for flanged butterfly valve and actuator replacement shall include all costs for removal and disposal of old valves, modulating electric actuators, and appurtenances as well as all costs for the furnishment and installation of new butterfly valves, modulating electric actuators, and appurtenances.

14. Remove and Replace 36-inch Flanged Butterfly Valves, Modulating Electric Actuators, and Appurtenances: Payment for removing and replacing 36-inch flanged butterfly valves and actuators will be on a per each basis. The unit price for flanged butterfly valve and actuator replacement shall include all costs for removal and disposal of old valves, open/close electric actuators, and appurtenances as well as all costs for the furnishment and installation of new butterfly valves, modulating electric actuators, and appurtenances.

15. Remove and Replace 36-inch Flanged Butterfly Valves, Open/Close Electric Actuators, and Appurtenances: Payment for removing and replacing 36-inch flanged butterfly valves and actuators will be on a per each basis. The unit price for flanged butterfly valve and actuator replacement shall include all costs for removal and disposal of old valves, open/close electric actuators, and appurtenances as well as all costs for the furnishment and installation of new butterfly valves, modulating electric actuators, and appurtenances.

16. Remove and Replace 14-inch FRP Damper and Open/Close Electric Actuators: Payment for removing and replacing 14-inch air damper butterfly valves and actuators will be on a per each basis. The unit price for air damper and actuator replacement shall include all costs for removal and disposal of old valves, open/close electric actuators, and appurtenances as well as all costs for the furnishment and installation of new air damper butterfly valves, open/close electric actuators, and appurtenances.

17. Valve Accessibility Improvements: Payment for the valve accessibility improvements work shall be on a lump sum basis. The unit price for the valve accessibility improvements shall include all costs for the demolition and modifications to the existing railing and grating as well as furnishment and installation of structural steel beams, plates, and hardware; aluminum grating, handrails, swing gates, ladders, stairs and all other materials and labor required to complete the accessibility improvements as a complete package.

18. Electrical and Control Work and System Integration: Payment for the electrical and control work and system integration shall be on a lump sum basis. Electrical work shall be broken down into conduit and raceway installation, cable and wire installation, electrical equipment installation and terminations, and coordination with OWNER provided SCADA integrator.

Bid Alternate No. 1 – 36-inch Manually Operated Butterfly Valve: Payment for installation of a new 36-inch manually operated butterfly valve shall be on a lump sum basis. The additional valve is located between valves FV-2358 and FV-2458 on the filter reject header as shown on sheet D-101. The unit price for this valve shall include furnishment and installation of a new manually operated 36-inch butterfly valve including all pipe and fittings necessary to install the new valve on the existing piping as well as demo and removal of existing pipe and fittings that are not reused.

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. This Section contains administrative and procedural requirements for submittals for review, information, and for Project closeout.

B. Section includes:

1. Schedule of Submittals.
2. Submittal requirements.
3. Submittal procedures.
4. Engineer review.
5. Resubmittal procedures.
6. Product data.
7. Shop Drawings.
8. Samples.
9. Design data.
10. Test reports.
11. Certificates.
12. Manufacturer's instructions.
13. Manufacturer's field reports.
14. Erection Drawings.
15. Construction progress schedules.
16. Breakdown of contract price.
17. Construction photographs.
18. Operation and maintenance (O&M) instructions.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action.

B. Informational Submittals: Written and graphic information and physical Samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.3 SCHEDULE OF SUBMITTALS

A. Within 10 days after the Effective Date of the Contract, Contractor shall submit to Engineer a preliminary Schedule of Submittals, including proposed list of major products proposed for use, with specification section reference, name of Manufacturer, supplier, trade name, subcontractor, and model number of each product. Provide a schedule of specific target dates for the submission and return of submittals and shop drawings required by the Contract Documents.

B. For products specified only by reference standards, indicate Manufacturer, trade name, model or catalog designation, and reference standards.

C. The list and schedule shall be updated and resubmitted when requested by the Engineer.

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

1.4 SHOP DRAWING AND SAMPLE SUBMITTAL REQUIREMENTS

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

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

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

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

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

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

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

1.5 SUBMITTAL PROCEDURES

A. Contractor shall submit Shop Drawings and Samples to Engineer for review in accordance with the accepted Schedule of Submittals.

B. Transmit each submittal with Engineer-accepted transmittal form certifying compliance with requirements of Contract Documents.

C. Sequentially number transmittal forms. Mark transmittal forms for resubmittals with original number and sequential alphabetic suffix.

D. Show each Submittal with the following numbering and tracking system:

1. Submittals shall be numbered according to specification section. For example, the first product submittal for Section 05 50 00 would be “05 50 00-1”. Resubmittals of that submittal would be “05 50 00-1.1”, followed by “05 50 00-1.2”, and so on. The second product submittal for that Section would be “05 50 00-2”.

2. Submittals containing product information from multiple sections of the specifications will not be reviewed. Contractor and/or their supplier shall divide submittals in a manner that meets the numbering and tracking system requirements stated herein.

3. Alternative method of numbering may be used if acceptable to Engineer.

E. Identify: Project, Contractor, subcontractor and supplier, pertinent drawing and detail number, and specification Section number appropriate to submittal.

F. 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 according to requirements of the Work and Contract Documents.

G. Coordinate submission of related items.

1. All shop drawings for interrelated items shall be scheduled for submission at the same time.

2. The Engineer may hold shop drawings in cases where partial submission cannot be reviewed until the complete submission has been received or where shop drawings cannot be reviewed until correlated items affected by them have been received. When such shop drawings are held, the Engineer will advise the Contractor in writing that the shop drawing submitted will not be reviewed until shop drawings for all related items have been received.

H. When hard copies of submittals are provided by the Contractor, six copies of all materials shall be provided to the Engineer. Two copies of reviewed submittals will be kept by the Engineer, two copies of reviewed submittals will be transmitted to the Owner, and two copies of reviewed submittals will be returned to the Contractor. If the Contractor requests that more than two copies of the reviewed submittal be returned, then the Contractor shall submit the appropriate quantity of submittals.

I. When electronic transmittals of submittals are provided by the Contractor under established protocols described elsewhere in the Contract Documents or as jointly developed by the Owner, Engineer and Contractor, provide electronic submittals in portable document format (PDF) in addition to the source document format (Word, Excel, AutoCAD, etc.). Reviewed submittals will be returned to the Contractor as PDF electronic files.

J. For each submittal for review, allow not less than 14 days for Engineer review, excluding delivery time to and from Contractor.

K. Identify variations in Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.

L. Allow space on submittals for Contractor and Engineer review stamps or comments.

M. When revised for resubmission, the Contractor shall identify changes made since previous submission. A narrative of changes shall be provided, and shop drawings or calculations shall indicate that a revision was made.

N. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with review comments.

O. Submittals not requested will not be recognized nor processed.

P. Incomplete Submittals: Engineer will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of Engineer.

1.6 ENGINEER REVIEW

A. 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.

B. The Engineer’s review of submittals and shop drawings is not a check of any dimension or quantity and will not relieve the Contractor from responsibility for errors of any sort in the submittals and shop drawings.

C. Submittals made by Contractor that are not required by Contract Documents may be returned without action.

D. The Engineer will review the submitted data and shop drawings and return to the Contractor with notations thereon indicating "No Exception Taken", "Make Corrections Noted", "Rejected", "Revise and Resubmit", or "Submit Specified Item".

1. No subsequent approval is necessary for a “Make Corrections Noted” response. However, the Contractor shall provide the corrected submittal to the Owner and Engineer for informational purposes and to provide confirmation that the corrections were made as instructed.

E. If more than two submissions of an item are required to meet the Project specifications, Contractor shall be responsible for Engineer’s charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

F. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review 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.

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

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

I. Engineer's review of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 1.4.C and Engineer has given written acceptance of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such accepted variation from the requirements of the Contract Documents in a Field Order.

J. Engineer's review of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 1.4 A. and B.

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

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

M. Contractor shall perform the Work in compliance with the requirements and commitments set forth in returned Shop Drawings and Samples, subject to the provisions of Paragraph 1.6.I.

1.7 RESUBMITTAL PROCEDURES

A. 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. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

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

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

PART 2 PRODUCTS

2.1 CONSTRUCTION PROGRESS SCHEDULES

A. Within 10 days after the Effective Date of the Contract, prepare and submit to the Engineer a practicable schedule showing the order in which the Contractor proposes to carry out the Work, the dates on which the important features of the work will start, and the contemplated dates for completing same. A time-scaled bar chart schedule shall include the following:

- Construction activities, with information regarding process area and valve ID (or valve group ID).
- Submittal and review of critical material samples and shop drawings
- Procurement and delivery of critical materials
- Duration of work, including completion times of all stages and their sub-phases

B. Attention is drawn to the plant shutdown date of December 1st, 2025 and plant startup date of March 1st, 2026.

C. Complete Project schedule shall be revised and resubmitted to the Owner and Engineer at a minimum occurrence of every two weeks for review.

D. Three Week Lookahead Schedules: Provide each week at the weekly construction meeting. The previous week's completed work shall be shown on the schedule for a total of 4 weeks shown.

2.2 BREAKDOWN OF CONTRACT PRICE

A. Within 10 days after the Effective Date of the Contract, submit a complete breakdown of all lump sum bid items showing the value assigned to each part of the work, including an allowance for profit and overhead adding up to the total lump sum contract price.

B. Breakdown of lump sum items shall be coordinated with the items in the schedule and shall be in sufficient detail to serve as the basis for progress payments during construction.

C. Engineer will review the contract price breakdown and may request items to be further broken down or for more items be added in order to facilitate tracking of work progress for payment.

D. Preparatory work, bonds, and insurance required in setting up the job will be allowed as a separate entry on the cost breakdown but shall not exceed 5 percent of the total base bid.

E. Upon acceptance of the breakdown of the contract price by the Engineer, it shall be used as the basis for all requests for payment.

2.3 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. Submitted data shall be sufficient in detail for determination of compliance with the Contract Documents.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement Manufacturers' standard data to provide information specific to this Project.

1. Note submittal will be returned to Contractor without review of submittal if products, models, options, and other data are not clearly marked or identified.

C. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. After review, produce copies and distribute according to Paragraph 1.5.M and for record documents.

2.4 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 licensed in the state of Project, 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.

D. All dimensioned shop drawings shall be scalable and provided as full-sized (22-inch x 34-inch) sheets. PDF electronic files shall print as scalable full-sized sheets.

E. After review, produce copies and distribute according to Paragraph 1.5.M and for record documents.

2.5 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 Owner 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 Paragraph 1.5.M and for record documents.

2.6 DESIGN DATA

A. Informational Submittal: Submit data for Engineer's and Owner’s knowledge.

B. Submit information for assessing conformance with information given and design concept expressed in Contract Documents.

2.7 TEST REPORTS

A. Informational Submittal: Submit reports for Engineer's and Owner’s knowledge and records.

B. Submit test reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

2.8 CERTIFICATES

A. Informational Submittal: Submit certification by Manufacturer, installation/application Subcontractor, or Contractor to Engineer and Owner, 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 and Owner.

2.9 MANUFACTURER’S INSTRUCTIONS

A. Informational Submittal: Submit Manufacturer's installation instructions for Owner’s and Engineer's knowledge and records.

B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to Engineer in quantities specified for Product Data.

C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

2.10 MANUFACTURER’S FIELD REPORTS

A. Informational Submittal: Submit reports for Owner’s and Engineer's knowledge and records.

B. Submit report within 48 hours of observation to Engineer for information.

C. Submit reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

2.11 MANUFACTURER'S INSTRUCTIONS

A. Submit Manufacturer's installation instructions for Engineer's knowledge as Contract administrator or for Owner.

B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to Engineer in quantities specified for Product Data.

C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.]

2.12 MANUFACTURER'S FIELD REPORTS

A. Submit reports for Engineer's knowledge and records as Contract administrator or for Owner.

B. Submit report within 48 hours of observation to Engineer for information.

C. Submit reports for information for assessing conformance with information given and design concept expressed in Contract Documents.]

2.13 ERECTION DRAWINGS

A. Informational Submittal: Submit Drawings for Engineer's knowledge and records as Contract administrator or for Owner.

B. Submit Drawings for information assessing conformance with information given and design concept expressed in Contract Documents.

C. Data indicating inappropriate or unacceptable Work may be subject to action by Engineer or Owner.

2.14 CONSTRUCTION PHOTOGRAPHS

A. Provide photographs of Site and construction throughout progress of Work produced by an experienced photographer acceptable to Engineer.

B. Each month submit photographs with Application for Payment.

C. Photographs: Electronic, PDF, or JPEG format.

D. Take Site photographs from different directions and interior photographs of facilities indicating relative progress of the Work.

E. Identify each photo in the electronic file name. Identify name of Project, phase, orientation of view, date, and time of view.

F. Digital Images: Deliver complete set of digital image electronic files on CD-ROM to Owner with Project record documents. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as sensor, uncropped.

1. Digital Images: Uncompressed TIFF format, produced by digital camera with minimum sensor size of 4.0 megapixels, and image resolution of not less than 1024 by 768 pixels.

2. Date and Time: Include date and time in filename for each image.

2.15 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

A. Submit preliminary O&M materials for review by Engineer. The Equipment Manufacturer may furnish instruction manuals prepared specifically for the equipment furnished or standard manuals may be used if statements like "if your equipment has this accessory..." or listings of equipment not furnished are eliminated. O&M materials will be returned to the Contractor for resubmittal if the O&M materials do not clearly indicate what specific equipment was furnished and all items not provided being clearly crossed out. Poorly reproduced copies are not acceptable. Operation and maintenance instructions shall contain the following as a minimum:

1. Reviewed shop drawings and submittal data;

2. Model, type, size, and serial numbers of equipment furnished;

3. Equipment and driver nameplate data;

4. List of parts showing replacement numbers;

5. Recommended list of spare parts;

6. Complete operating instructions including start-up, shutdown, adjustments, cleaning, etc.;

7. Maintenance and repair requirements including frequency and detailed instructions; and

8. Name, address and phone numbers of local representative and authorized repair service.

B. Following review of the preliminary O&M materials by the Engineer and before acceptance of the Work, submit four copies of complete final operation and maintenance instructions for all equipment supplied. Submit items in 8-1/2 x 11-inch heavy-duty three-ring binders when appropriate, or in 8-1/2 x 11-inch file folders. All binders and folders shall have clear plastic pockets on the front of the cover and the spine to allow for insertion of identifying information.

2.16 OTHER REQUIRED SUBMITTALS

A. Other required submittals include the items listed below. This list is provided for Contractor’s convenience only and may not be complete in all respects. Contractor shall provide all submittals specified or required, whether or not listed here.

1. Work Sequencing Plan

2. Start-Up Plan

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 45 00 - QUALITY CONTROL

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers quality control requirements supplementary to those of the General Conditions and Technical Specifications.

1.2 PROVISIONS

A. Contractor's Responsibility for Testing

The Contractor shall be responsible for the cost of all testing as specified in this section. Additional information has been provided regarding the payment responsibility for the Owner with regards to the Project.

B. Owner's Right to Perform Additional Tests

The Owner or Engineer reserves the right to complete additional testing. In such cases, the Contractor shall provide safe access for the Owner or Engineer and their inspectors to adequately inspect the quality of work and the conformance with Project specifications.

1.3 QUALITY ASSURANCE

A. Testing Requirements

An independently owned and operated laboratory approved by the Owner shall perform all testing as specified herein.

B. Testing

1. General

a. All required testing of work and/or materials shall be conducted in the presence of the Owner and/or Engineer. The Contractor shall provide 48-hour notification to the Owner and Owner's representative prior to conducting any and all quality assurance testing.

b. Where such inspection and testing are to be conducted by an independent laboratory or agency, the sample, or samples of material to be tested shall be selected by such laboratory or agency or by the Engineer. The Contractor shall furnish such samples of all materials without charge to Owner.

c. The results from any and all tests are made for the information of the Owner. Regardless of any test results, the Contractor is solely responsible for the quality of workmanship and materials and for compliance with the requirements of the Drawings and Specifications.

2. Costs of Testing

a. The Contractor shall be responsible for and shall pay for all tests as specified in Part 1.2 of this Section. Additional information has been provided regarding the payment responsibility for the Owner with regards to the Project.

b. With regards to all materials to be tested, where test results demonstrate that the material or workmanship does not meet the minimum requirements of the Contract Documents, additional testing shall be completed and shall be paid for by the Contractor with no reimbursement by the Owner.

1.4 SPECIAL INSPECTIONS

Special Inspectors and Testing Agencies conduct Special inspections and testing as required by Chapter 17 of the IBC and as indicated in the Contract Documents.

A. Special Inspectors and Testing Agencies Responsibilities

1. Verify that manufacturers maintain detailed fabrication and quality control procedures and review the completeness and adequacy of those procedures to perform the Work.

2. Promptly notify Owner and Contractor of irregularities and deficiencies observed in the Work during performance of their services.

3. Submit certified written report of each test, inspection and similar quality control service to Owner, Contractor, and jurisdictional authorities. Interpret test results and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

4. Submit final report of special inspections at Substantial Completion, including a list of unresolved deficiencies.

5. Re-test and re-inspect corrected work.

B. Contractor's Responsibilities

1. All payment for work by Special Inspectors and Testing Agencies shall be the responsibility of the Contractor. Contractor shall obtain prior approval from the Owner on the organization(s) that will be performing the special inspection and/or testing.

2. Provide quality requirements to all subcontractors and enforce all requirements.

3. Notify Owner, Engineer, Special Inspectors and Testing Agencies at least 48 hours in advance of time when Work that requires testing or special inspecting will be performed, unless otherwise indicated in the Contract Documents.

4. Pay for any Contractor requested testing and inspecting not required by the Contract Documents.

5. Pay for any re-testing or re-inspections by Special Inspectors and Testing Agencies for replacement work resulting from work that failed to comply with the Contract Documents. Owner will deduct such costs from the Contract Price.

6. Submit copies of licenses, certifications, correspondence, records, and similar documents used to establish compliance with standards and regulations that pertain to performance of the Work to the Owner, Engineer, and Special Inspectors.

7. Where Special Inspection requires pre-construction testing for compliance with specified requirements for performance and test methods, comply with the following:

    a. Provide test specimens representative of proposed products and construction in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

    b. Provide information on configurations of test assemblies, testing procedures and laboratory test records to adequately demonstrate capability of products to comply with performance requirements.

8. Cooperate with Agencies performing required tests, special inspections, and similar quality control services. Notify Agencies in advance of operations to permit assignment of personnel. Provide the following:

    a. Access to the Work.

    b. Incidental labor, equipment, and materials necessary to facilitate tests and special inspections.

    c. Adequate quantities of representative samples of materials that require and inspecting. Assist Agencies in obtaining samples.

    d. Provide facilities for storage and field curing of test samples.

    e. Deliver samples to Testing Agencies.

9. Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and special inspecting.

10. Schedule times for tests, special inspections, obtaining samples, and similar activities. Distribute schedule to Owner, Engineer, Special Inspectors, Testing Agencies, and each party involved in portions of the work where tests and special inspections are required.

1.5 SUBMITTALS

A. Laboratory Test or Inspection Reports

Each report shall be signed and certified by the independently owned and operated testing laboratory. Unless otherwise specified, submit three copies of each report to the Owner or Owner's Representative.

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 SUMMARY

A. Temporary construction facilities and control requirements for the Work include the following. Contractor responsible for providing all other temporary facilities and controls necessary to complete the Work as described in the Contract Documents.

1. Utilities including lighting and electricity, heat, telephone service, internet access and water.
2. Sanitary facilities.
3. Temporary fire protection.
4. Use of existing roads.
5. Enclosures.
6. Parking.
7. Owner's access to facilities.

B. Maintain temporary facilities in proper and safe condition throughout progress of Work.

C. Comply with federal, state, and local codes and regulations, and utility company requirements.

1.2 LAYOUT OF TEMPORARY FACILITIES

A. Before starting Work, submit to Owner, for approval, proposed layout of temporary facilities.

B. Should Contractor require space in addition to that shown on Drawings, Contractor shall make arrangements for storage of materials and equipment in locations off Site.

1.3 UTILITY PROPERTIES AND SERVICE

A. In areas where the Contractor's operations are adjacent to or near a utility and such operations may cause damage which might result in significant expense, loss and inconvenience, the operations shall be suspended until all arrangements necessary for the protection thereof have been made by the Contractor.

1.4 TEMPORARY LIGHTING AND ELECTRICITY

A. General:

1. Temporary lighting shall be sufficient to enable Contractor and Subcontractors to complete Work and enable Owner to observe Work. Illumination shall meet or exceed state code requirements.

B. Temporary electric power may be obtained from Owner's electrical system as follows:

1. Power is available at the site but may be limited. Power is available within existing structures but maybe significantly limited due to existing equipment and loads.

2. Make arrangements with Owner to review potential sources of temporary electricity and limitations of existing power supplies.

3. Based on review and potential sources, Contractor shall develop a layout of temporary electrical power for review by Owner.

4. Contractor is responsible to implement temporary power and provide electrical protection to prevent disruption of plant power from over-current, ground faults, and short circuits.

1.5 NOT USED

1.6 NOT USED

1.7 NOT USED

1.8 WATER FOR CONSTRUCTION AND TESTING

A. Contractor is responsible for making all arrangements necessary for temporary water for construction.

1. Non-potable water for construction purposes will be furnished by the Owner at no cost.

2. The Contractor shall furnish all valves, hoses, connections, and other devices as necessary to obtain sufficient water for construction and for filling and testing of water lines as required. Fire hydrant use is allowed only by permission of the utility owner.

3. Backflow protection is required on all connections to potable water systems.

1.9 SANITARY FACILITIES

A. Provide temporary sanitary facilities conforming to state and local regulations, in sufficient numbers for use of Contractor's and Subcontractor's employees.

B. Maintain in sanitary condition and properly supply with toilet paper.

C. Use of the City's existing sanitary facilities is not allowed.

1.10 TEMPORARY FIRE PROTECTION

A. Provide and maintain fire extinguishers and other fire protection equipment and devices as would be reasonably effective in extinguishing fires during early stages by personnel at Site.

1.11 TEMPORARY SITE AND OTHER ROADS

A. Maintain existing roads used during construction free from accumulation of dirt, mud, and construction debris.

B. Contractor shall repair or replace existing roads that remain to original or better condition prior to Final Completion. Record condition of existing roads prior to construction.

1.12 CONTRACTOR'S WORK AREA

A. Work Area:

1. Limit construction operations and storage of equipment and materials to areas as determined by Owner.

2. Except as provided herein, no private property, or other area adjacent to Site shall be used for storage of Contractor's equipment and materials unless prior written approval is obtained from legal owner of the respective locations.

3. Contractor shall maintain staging areas during construction in a manner that will not obstruct operations of existing facilities. Work shall proceed in an orderly manner, maintaining construction Site and staging area free of debris and unnecessary equipment or materials.

B. Storage and Protection of Equipment and Materials:

1. The Contractor shall be solely responsible for the protection and security of all equipment and materials stored on the site. Equipment and materials stored at the site shall be placed neatly on the job site in an area and environment that will provide protection and security. Materials that are not adequately protected or stored in conformance with the Manufacturer's recommendations will be rejected. Unusable materials (i.e., rejected, or damaged liner material, old concrete chunks, metal scraps, etc.) shall be expeditiously removed from the job site.

2. Provide appropriate barricades, signs, and safety devices in like-new condition where necessary to protect the public and City employees from any hazards associated with the storage of materials and equipment used for this Project.

3. No equipment and/or materials shall be stored outside the immediate work area, in the following locations, or in the following manner, unless otherwise directed by the Owner:

a. In any maintained landscaped or lawn area.

b. In a manner that would totally eliminate parking for the City's existing buildings.

c. In front of any business.

4. The "immediate work area" is the area where work is taking place or will be taking place within one calendar day. The Contractor shall immediately move stored material or equipment which causes a nuisance or creates complaints.

1.13 SECURITY

A. The water treatment plant site is fenced. No other security will be provided by Owner.

B. Outside of the treatment plant is not fenced.

C. Contractor shall be responsible for loss or injury to persons or property where Work is involved and shall provide security and take precautionary measures to protect Contractor's and Owner's interests.

D. Provide and maintain temporary fencing of design and type needed to prevent entry into active construction areas.

1.14 ENCLOSURES

A. Provide and maintain all enclosures, scaffolds, tarpaulins, canopies, warning signs, steps, platforms, and other temporary construction necessary for proper completion of Work.

1.15 PARKING

A. Staging area and other areas within the treatment plant fencing as determined by the Owner may be used for parking of construction personnel's private vehicles and Contractor's lightweight vehicles. Parking shall not impede access or chemical deliveries to the water treatment plant facilities.

B. Make arrangements for additional parking off site as required.

C. No overnight parking, camping, or storage of personal vehicles, trailers or other items will be authorized.

1.16 NOT USED

1.17 NOT USED

1.18 NOT USED

1.19 TEMPORARY VENTILATION

A. Whenever hazardous substances such as dusts, fumes, mists, vapors, or gases exist or are produced in the course of construction work, their concentrations shall not exceed the limits specified in § 1926.55(a) of the OSHA "Safety and Health Regulations for Construction". When ventilation is used as an engineering control method, the system shall be installed and operated according to the manufacturer's recommendations and all applicable OSHA requirements.

1.20 CONSTRUCTION AIDS

A. General:

1. Provide construction aids and equipment required by personnel and to facilitate the execution of the Work; scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes, and other such facilities and equipment.

2. Materials may be new or used, must be suitable for the intended purpose, and meet the requirements of applicable codes, regulations, and standards.

3. When permanent stair framing is in place, provide temporary treads, platforms, and railings for use by construction personnel.

B. Use of Existing Stairs, Elevators, Hoists, and Similar Facilities:

1. Designated stairs in existing building may be used by construction personnel.

2. Elevators in the existing building shall not be used by construction personnel.

3. Provide protective coverings for finished surfaces in interior of elevators. Coordinate usage with Owner.

4. Hoists in existing facilities may be used at the Contractor's risk.

5. Maintain all existing facilities and equipment in a condition equivalent to or better than condition at beginning of usage.

1.21 PROTECTION OF INSTALLED WORK

A. See Section 01 70 00 Execution and Closeout Requirements, Part 3.5.

PART 2 PRODUCTS - (Not Used)

PART 3 EXECUTION

3.1 GENERAL

A. Maintain and operate systems to ensure continuous service for duration of construction.

B. Modify and extend systems, as Work progress requires.

3.2 REMOVAL

A. Completely remove temporary materials, equipment, signs, and structures when no longer required.

B. In unfinished areas, clean and repair damaged caused by temporary installations or use of temporary facilities, restore drainage, and evenly grade, seed, or plant as necessary to provide appearance equal to or better than original.

C. In finished areas, restore existing or permanent facilities used for temporary services to specified, or original condition.

3.3 DAMAGE TO EXISTING PROPERTY

A. Contractor is responsible for replacing or repairing damage to existing buildings, structures, sidewalks, roads, parking areas, and other existing assets.

B. Contractor shall have option of having Owner contract for such Work and have cost deducted from Contract Price.

3.4 OWNER'S USE

A. Contractor shall accommodate the Owner's full access and use of the Site, including the current work area, at all times throughout construction.

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.

1.2 PRODUCTS

A. At minimum, comply with specified requirements and reference standards.

B. Specified products define standard of quality, type, function, dimension, appearance, and performance required.

C. 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.

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. Coordinate on-site storage of equipment and material with Owner.

B. Store and protect products according to Manufacturer's instructions.

C. Store products with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment suitable to product.

E. For exterior storage of fabricated products, place products on sloped supports aboveground.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

H. Provide equipment and personnel to store products; use methods to prevent soiling, disfigurement, or damage.

I. 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 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. Testing, adjusting, and balancing.

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. Preparation.

O. Execution.

P. Cutting and patching.

Q. Protecting installed construction.

R. Final cleaning.

1.2 FIELD ENGINEERING

A. Prior to beginning Work, verify and establish floor elevations of existing facilities to ensure that new Work will meet existing elevations in smooth and level alignment except where specifically detailed or indicated otherwise.

B. Provide field engineering services. Establish elevations, lines, and levels using recognized engineering survey practices.

C. Submit copy of Site drawing and certificate signed by land surveyor certifying elevations and locations of the Work are in conformance with Contract Documents.

D. Maintain complete and accurate log of control and survey Work as Work progresses.

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 Part 3.6 of this Section.

B. Substantial Completion Inspection:

1. When Contractor considers Work to be substantially complete, submit to Owner:

a. Written certificate that Work, or designated portion, is substantially complete.

b. List of items to be completed or corrected (initial punch list).

2. Within seven days after receipt of request for Substantial Completion, Engineer and/or Owner will make inspection to determine whether Work or designated portion is substantially complete.

3. Should Engineer or Owner determine that Work is not substantially complete:

a. Owner will promptly notify Contractor in writing, stating reasons for its opinion.

b. Contractor shall remedy deficiencies in Work and send second written request for Substantial Completion to Owner.

c. Engineer and/or Owner will reinspect Work.

d. Redo and Inspection of Deficient Work: Repeated until Work passes Owner's inspection.

4. When Owner finds that Work is substantially complete, Owner will:

a. Prepare Certificate of Substantial Completion form accompanied by Contractor's list of items to be completed or corrected as verified and amended by Engineer and Owner (final punch list).

b. Submit Certificate to Owner and Contractor for their written acceptance of responsibilities assigned to them in Certificate.

5. After Work is substantially complete, Contractor shall:

a. Allow Owner occupancy of Project under provisions stated in Certificate of Substantial Completion.

b. Complete Work listed for completion or correction within time period stipulated.

6. Owner will occupy all of building as specified in Section 01 10 00 – Summary of Work.

C. 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.

f. Contractor affidavit of release of liens.

g. Consent of surety to final payment.

3. Perform final cleaning for Contractor-soiled areas according to Part 3.6 of this Section.

D. Final Completion Inspection:

1. Within seven days after receipt of request for final inspection, Owner will make inspection to determine whether Work or designated portion is complete.

2. Should Owner consider Work to be incomplete or defective:

a. Owner will promptly notify Contractor in writing, listing incomplete or defective Work.

b. Contractor shall remedy stated deficiencies and send second written request to Owner that Work is complete.

c. Owner will reinspect Work.

d. Redo and Inspection of Deficient Work: Repeated until Work passes Owner's inspection.

1.4 STARTING OF SYSTEMS

A. Coordinate schedule for startup of various equipment and systems.

B. Notify 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, 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. 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. An additional demonstration may be requested by the Owner when the treatment facility returns to full operation after March 1st.

1.6 TESTING, ADJUSTING, AND BALANCING

A. Owner will appoint, employ, and pay for services of independent firm to perform testing, adjusting, and balancing, or perform these services themselves.

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. Measured horizontal and vertical locations of utilities and appurtenances, referenced to known existing floor elevations and wall coordinates.

4. Field changes of dimension and detail.

5. Details not on original Drawings.

6. Submit PDF electronic files of marked-up documents to Engineer prior to Substantial Completion.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit in PDF composite electronic indexed file that includes:

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. 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 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. Photocopies of warranties and bonds.

1.9 NOT USED

1.10 MANUAL FOR EQUIPMENT AND SYSTEMS

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 before Substantial Completion. Draft copy will be reviewed and returned after Substantial Completion, with Engineer and Owner comments. Revise content of document sets as required prior to final submission.

D. Submit in PDF composite electronic indexed file of final manual 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 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, and checking instructions.

J. Include Manufacturer's printed operation and maintenance instructions.

K. Include original Manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

L. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Include list of original Manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Include test and balancing reports as specified in Section 01 40 00 - Quality Requirements.

O. Additional Requirements: As specified in individual product Specification Sections.

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 AND PRODUCT BONDS

A. Obtain warranties and bonds executed by responsible Subcontractors, suppliers, and manufacturers within ten days after completion of applicable item of Work.

B. Execute and assemble transferable warranty documents and bonds 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 electronic PDF.

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 NOT USED

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 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance according to Manufacturer's instructions.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply Manufacturer-required or -recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

3.3 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 movement.

F. Climatic Conditions and Project Status: Install each unit of Work under conditions to ensure best possible results in coordination with entire Project.

1. Isolate each unit of Work from incompatible Work as necessary to prevent deterioration.

2. Coordinate enclosure of Work with required inspections and tests to minimize necessity of uncovering Work for those purposes.

G. 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.

H. Adjust operating products and equipment to ensure smooth and unhindered operation.

I. Clean and perform maintenance on installed Work as frequently as necessary through remainder of construction period. Lubricate operable components as recommended by Manufacturer.

3.4 NOT USED

3.5 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.

3.6 FINAL CLEANING

A. Execute final cleaning prior to final Project assessment.

1. Employ experienced personnel or professional cleaning firm.

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 equipment and fixtures to sanitary condition with appropriate cleaning materials.

D. Clean debris from project area.

E. Remove waste and surplus materials, rubbish, and construction facilities from Site.

END OF SECTION

SECTION 01 75 00 - TESTING, TRAINING, AND COMMISSIONING

PART 1 GENERAL

1.1 SCOPE

This section specifies equipment and system testing and start-up, services of Manufacturer's representatives, training of Owner's personnel, and final testing requirements for the complete facility.

1.2 CONTRACT REQUIREMENTS

A. Testing, training, and start-up are requisite to the satisfactory completion of the Contract.

B. Complete all testing, training, and start-up within the Contract Time(s).

C. Furnish all necessary labor, power, chemicals, tools, equipment, instruments, and services required for and incidental to completing functional testing, performance testing, and operational testing.

D. Provide competent, experienced technical representatives of Equipment Manufacturers for assembly, installation, testing, and operator training.

1.3 START-UP PLAN

A. Submit start-up plan for each piece of equipment and each system not less than 2 weeks prior to planned initial equipment or system start-up.

B. Provide detailed Start-up Progress Schedule with the following activities identified:

1. Manufacturer’s services
2. Installation certifications
3. Operator training
4. Submission of operation and maintenance manual
5. Functional testing
6. Performance testing
7. Operational testing

C. Provide testing plan with test logs for each item of equipment and/or system. Include testing of alarms, control circuits, capacities, speeds, flows, pressures, vibrations, sound levels, and other parameters.

D. Provide summary of shutdown requirements for existing systems if required, which are necessary to complete start-up of new equipment and systems.

E. Revise and update start-up plan based upon review comments, actual progress, or to accommodate changes in the sequence of activities.

1.4 GENERAL START-UP AND TESTING PROCEDURES

A. Mechanical Systems:

1. Remove rust preventatives and oils applied to protect equipment during construction.

2. Install and adjust packing, mechanical seals, O-rings, and other seals. Replace defective seals.

3. Remove temporary supports, bracing, or other foreign objects installed to prevent damage during shipment, storage, and erection.

4. Inspect valves and actuators for proper adjustment. Tighten packing glands to ensure no leakage but permit valve stems to rotate without galling. Verify valve seats are positioned for proper flow direction.

5. Tighten leaking flanges or replace flange gasket. Inspect screwed joints for leakage.

B. Electrical Systems

1. Perform insulation resistance tests on wiring except 120-volt lighting, wiring, and control wiring inside electrical panels.

2. Perform continuity tests on grounding systems.

3. Test and set switchgear and circuit breaker relays for proper operation.

4. Perform direct current high potential tests on all cables that will operate at more than 2,000 volts. Obtain services of independent testing lab to perform tests.

5. Check motors for actual full load amperage draw. Compare to nameplate value.

C. Instrumentation Systems

1. Bench or field calibrate instruments and make required adjustments and control point settings.

2. Leak test pneumatic controls and instrument air piping.

3. Energize transmitting and control signal systems, verify proper operation, ranges, and settings.

1.5 FUNCTIONAL TESTING

A. Functionally test mechanical and electrical equipment for proper operation after general start-up and testing tasks have been completed.

B. Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments, and calibration. Perform initial checks in the presence of and with the assistance of the Manufacturer's representative.

C. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation, and other equipment functions. Generate signals with test equipment to simulate operating conditions in each control mode.

D. Conduct continuous testing under normal operating conditions for as long as required by the Owner. Replace parts which operate improperly.

1.6 CERTIFICATE OF PROPER INSTALLATION

A. At completion of functional testing, furnish written report prepared and signed by Manufacturer's authorized representative, certifying equipment:

1. Has been properly installed, aligned, adjusted, and lubricated.

2. Is free of any stresses imposed by connecting piping or anchor bolts.

3. Is suitable for satisfactory full-time operation under full load conditions.

4. Controls, protective devices, instrumentation, and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning.

5. Control logic for start-up, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly functioning.

B. Furnish written report prepared and signed by the electrical and/or instrumentation subcontractor certifying:

1. Motor control logic that resides in motor control centers, control panels, and circuit boards furnished by the electrical and/or instrumentation subcontractor has been calibrated and tested and is properly operating.

2. Control logic for equipment start-up, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly operating.

C. Co-sign the reports along with the Manufacturer's representative and subcontractors.

1.7 TRAINING OF OWNER’S PERSONNEL

A. Provide operations and maintenance training for items of mechanical, electrical, and instrumentation equipment. Utilize Manufacturer's representatives to conduct training sessions.

B. Coordinate training schedule with City staff. Coordinate training sessions to prevent overlapping sessions. Arrange sessions so that individual operators and maintenance technicians do not attend more than two sessions per week.

C. Provide Operation and Maintenance Manual for specific pieces of equipment or systems 2 weeks prior to training session for that piece of equipment or system.

D. Satisfactorily complete functional testing before beginning operator training.

E. The Owner may videotape the training for later use with the Owner’s personnel.

1.8 MINIMUM SERVICE SCHEDULE

Minimum services as specified shall be provided in accordance with the following schedule:

Specification Section	Equipment	Minimum On-Site Time Requirements		
		1) Equipment Installation	2) Equipment Testing	3) Operator Training
40 05 51 and 40 05 51.18	Butterfly Valves and Actuators	1 CWD total	1 CWD total	1 CWD total

NOTE: CWD is defined as a consecutive working day consisting of 9 hours each from 7:00 a.m. to 4:00 p.m.

1.9 OPERATIONAL TESTING

A. Conduct operational test of all new and refurbished equipment after the completion of operator training. Demonstrate satisfactory operation of equipment and systems in actual operation.

B. Conduct operational test for continuous period of length dictated by Owner.

C. Owner will provide operations personnel, power, fuel, and other consumables for duration of test.

D. Immediately correct defects in material, workmanship, or equipment which became evident during operational test.

E. Repeat operational test when malfunctions or deficiencies cause shutdown or partial operation of the facility or results in performance that is less than specified.

1.10 RECORD KEEPING

A. Maintain and submit to Engineer the following records generated during start-up and testing phase of Project:

1. Daily logs of equipment testing identifying all tests conducted and outcome.

2. Logs of time spent by Manufacturer's representatives performing services on the job site.

3. Equipment lubrication records.

4. Electrical phase, voltage, and amperage measurements.

5. Data sheets of control loop testing including testing and calibration of instrumentation devices and set points.

END OF SECTION

SECTION 02 41 00 - DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of existing facilities.
2. Salvage of materials and equipment.
3. Abandoning and removing utilities.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

1.3 QUALITY ASSURANCE

A. Existing Conditions: Determine the extent of work required and limitations before proceeding with Work.

B. Conform to applicable local, state, and federal codes for environmental requirements in relation to disposal of debris.

1. Burning at the Site for the disposal of refuse, debris, and waste materials resulting from demolition and site clearing operations shall not be permitted.

C. Permits: The Contractor is responsible for obtaining all necessary permits required for completion of the Work described in this Section.

D. Protection of Persons and Property: Meet all federal, state, and local safety requirements for the protection of workmen, other persons, and property in the vicinity of the Work and requirements of the General Provisions.

E. If the existing material to be demolished and removed contains any hazardous materials which will require special handling upon removal, such as asbestos or lead, it is the responsibility of the Contractor to remove and dispose of the material in accordance with all applicable federal, state, and local regulations.

PART 2 PRODUCTS

2.1 MATERIALS

A. Existing Materials: All materials, equipment, miscellaneous items, and debris involved, occurring, or resulting from demolition, clearing, and grubbing work shall become the property of the Contractor at the place of origin, except as otherwise indicated in the Drawings or Specifications.

PART 3 EXECUTION

3.1 EXAMINATION

A. The Owner assumes no responsibility for the actual condition of the facilities to be demolished. The Contractor shall visit the site, inspect all facilities and be familiar with all existing conditions and utilities.

B. Demolition drawings identify major equipment and structures to be demolished only. Auxiliary utilities such as water, air, chemicals, drainage, lubrication oil, hydraulic power fluid, electrical wiring, controls, and instrumentation are not necessarily shown shall be considered incidental to all demolition work.

C. Identify waste and salvage areas for placing removed materials.

3.2 PREPARATION

A. Carefully coordinate the work of this Section with all other work and construction.

B. Disconnect or arrange for disconnection of utilities (if any) affected by required work.

C. Keep all active utilities intact and in continuous operation.

3.3 PROTECTION

A. Utilities: Protect utilities not scheduled for replacement or modifications from damage.

B. Miscellaneous Site Features: Protect all existing miscellaneous site features from damage during construction, including but not limited to existing structures, electrical and controls systems,

C. Repair and Replacement:

1. Damaged items, including but not restricted to those noted above, shall be repaired, or replaced with new materials as required to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of Work of this contract.

2. Any damage to existing facilities or utilities to remain as caused by the Contractor's operations shall be repaired at the Contractor's expense.

3.4 SALVAGE DISPOSITION, STORAGE AND HANDLING

A. General

1. The Contractor shall notify the Owner prior to beginning any demolition work so that any salvage items can be identified and the condition of the salvage item and adjacent equipment, piping, and structures can be documented. The Owner may elect to have any items scheduled for demolition and removal to instead be protected and salvaged at no additional cost to the Owner.

C. Removal

1. Salvaged equipment shall be properly disconnected to retain their full salvage value and carefully stored at a location on the plant site as directed by the Owner.

D. Salvaged Equipment

1. The Contractor shall salvage items designated as a unit. The Contractor shall clean, list, and tag the equipment for storage. Protect from damage and deliver to locations designated by the Owner. Salvage each item with auxiliary systems or equipment required for operation, including drives and control panels.

E. Disposal

1. Legally dispose of items or materials not designated for salvage to Owner. Promptly remove from the site. Items and materials not salvaged to the Owner shall not be stored on site nor shall Contractor bury such materials on site.

3.5 DEMOLITIONS

A. Carefully consider all bearing loads and capacities for placement of equipment and material on site. In the event of any questions as to whether an area to be loaded has adequate bearing capacity, consult with Engineer prior to the placement of such equipment or material.

3.6 NOT USED

3.7 ELECTRICAL AND CONTROL SYSTEM DEMOLITION

A. All electrical and control system demolition work shall at all times be conducted in a safe and proper manner to avoid injury from electrical shock to all personnel.

1. Electrical equipment to be shut off for a period of time shall be tagged, locked out, and sealed with a crimped wire and lead seal and made inoperable.

2. At no time shall live electrical wiring or connections or those which can become energized be accessible to any persons without suitable protection or warning signs.

3.8 NOT USED

3.9 NOT USED

3.10 REMOVAL

A. Remove all materials and debris resulting from abandonment and/or demolition activities from site.

B. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

C. Removal: All material resulting from demolition operations shall be removed from the Project Site and disposed of in a lawful manner.

3.11 NOT USED

3.12 CLEANUP

A. During and upon completion of work, promptly remove all unused tools and equipment, surplus materials, debris, and dust and shall leave all areas affected by the work in a clean, condition, as may be subject to Engineer approval.

B. Adjacent structures and process material and equipment shall be cleaned of dust, dirt, and debris resulting from demolition.

C. Adjacent areas shall be returned to their existing condition prior to the completion of work.

3.13 NOT USED

END OF SECTION

SECTION 03 60 00 - GROUTING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes all work necessary to form, mix, place, cure, repair, finish, and do all other work as required to produce finished grout, in accordance with the requirements of the Contract Documents.

B. Work covered in this Section includes:

1. Grouting
2. Removal of loose and spalling grout and concrete
3. Anchoring, patching, grouting, and sealing

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Codes and Standards - Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified.

1. CRD-C 621, Corps of Engineers Specification for Non-Shrink Grout
2. ASTM C109, “Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50-mm Cube Specimens)”
3. ASTM C531, “Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes”
4. ASTM C579, “Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes”
5. ASTM C827, “Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures”

1.3 SUBMITTALS

A. Certified Test Results: Verifying the compressive strength, shrinkage, and expansion requirements specified herein.

B. Manufacturer's Literature: Containing instructions and recommendations on the mixing, handling, placement, and appropriate uses for each type of non-shrink and epoxy grout used in the work.

1.4 QUALITY ASSURANCE

Field Tests

A. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the Engineer to ensure continued compliance with these specifications. The specimens will be made by the Engineer or its representative.

B. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.

C. All grout, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at the cost of the Contractor.

D. The cost of all laboratory tests on grout shall be borne by the Contractor and the Contractor shall obtain the specimens for testing. The Contractor shall also be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The Contractor shall supply all materials necessary for fabricating the test specimens.

PART 2 PRODUCTS

2.1 PREPACKAGED GROUTS

A. Non-shrink grout: This type of grout is to be used wherever grout is required in the Contract Documents unless another type is specifically referenced.

B. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, non-corrosive, non-chloride, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation of each class of non-shrink grout specified herein shall be that recommended by the Manufacturer for the particular application.

C. Class A non-shrink grouts shall have minimum 28-day compressive strength of 5,000 pounds per square inch (psi); shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRDC 621.

D. Class B non-shrink grouts shall have minimum 28-day compressive strength of 5,000 psi and shall meet the requirements of CRD C621.

E. Application

1. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified in the contract documents; except, for those applications for Class B non-shrink grout specified herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.

2. Class B non-shrink grout shall be used or the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material, grouting under all base plates for structural steel members, and grouting railing posts in place.

F. See structural drawings for additional requirements.

2.2 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where “dry pack” is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

B. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed 4 inches.

2.3 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers approved by the Engineer. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the Manufacturer.

PART 3 EXECUTION

3.1 GENERAL

A. All surface preparation, curing, and protection of cement grout shall be as specified by the Manufacturer. The finish of the grout surface shall match that of the adjacent concrete.

B. The Manufacturer of Class A non-shrink grout shall provide on-site technical assistance upon request.

C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the Engineer.

3.2 GROUTING PROCEDURES

Prepackage Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution of prepackaged grouts shall be done according to the instructions and recommendations of the Manufacturer.

END OF SECTION

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural shapes.
2. Channels and angles.
3. Hollow structural sections.
4. Structural pipe.
5. Structural plates and bars.
6. Floor plates.
7. Bolts, connectors, and anchors.
8. Grout.

1.2 RELATED SECTIONS:

A. Section 03 60 00 - Grouting: Grout for setting base plates.

B. Section 05 50 00 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.3 REFERENCE STANDARDS

A. American Institute of Steel Construction:

1. AISC 303 - Code of Standard Practice for Structural Steel Buildings and Bridges.
2. AISC 341 - Seismic Provisions for Structural Steel Buildings.
3. AISC 360 - Specification for Structural Steel Buildings.

B. American Society of Civil Engineers:

1. ASCE 19 - Structural Applications of Steel Cables for Buildings.

C. American Welding Society:

1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.

D. ASTM International:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

3. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

4. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

5. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.

6. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

7. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

8. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.

9. ASTM A449 - Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.

10. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.

11. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

12. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

13. ASTM A514 - Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.

14. ASTM A529 - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.

15. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.

16. ASTM A572 - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

17. ASTM A588 - Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi Minimum Yield Point, with Atmospheric Corrosion Resistance.

18. ASTM A618 - Standard Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing.

19. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

20. ASTM A786 - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.

21. ASTM A847 - Standard Specification for Cold-Formed Welded and Seamless High-Strength, Low Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance.

22. ASTM A913 - Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process.

23. ASTM A992 - Standard Specification for Structural Steel Shapes.

24. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.

25. ASTM E94 - Standard Guide for Radiographic Examination.

26. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments.

27. ASTM E165 - Standard Practice for Liquid Penetrant Examination for General Industry.

28. ASTM E709 - Standard Guide for Magnetic Particle Testing.

29. ASTM F436 - Standard Specification for Hardened Steel Washers.

30. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.

31. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

32. ASTM F1852 - Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

33. ASTM F2329 - Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.

E. Research Council on Structural Connections:

1. RCSC - Specification for Structural Joints Using ASTM A325 or A490 Bolts.

F. SSPC: The Society for Protective Coatings:

1. SSPC - Steel Structures Painting Manual.

2. SSPC Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

3. SSPC Paint 20 - Zinc-Rich Coating (Type I - Inorganic and Type II - Organic).

4. SSPC SP 3 - Power Tool Cleaning.

5. SSPC SP 6 - Commercial Blast Cleaning.

6. SSPC SP 10 - Near-White Blast Cleaning.

1.4 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with following:

1. Section 05 50 00 - Metal Fabrications for miscellaneous steel supports other than structural steel.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:

1. Indicate Size and location of structural members and connection details.

2. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

E. Mill Test Reports: Submit indicating structural strength, destructive and non-destructive test analysis,

F. Source Quality-Control Submittals: Indicate results of shop and/or factory tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Qualifications Statements:

1. Submit qualifications for fabricator, erector, shop painter, and welders.

1.6 QUALITY ASSURANCE

A. Perform Work according to following:

1. Structural Steel: AISC 303, ASIC 341, AISC 360.

2. High-Strength Bolted Connections: RCSC - Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts.

B. Perform Work according to International Building Code, Colorado Department of Public Health and Environment, and City of Thornton standards.

1.7 QUALIFICATIONS

A. Fabricator:

1. Company specializing in fabricating products specified in this Section with minimum three years' documented experience with following current AISC Certification:

    a. Standard Steel Building Structures (STD).

    b. Conventional Steel Building Structures (SBD).

B. Erector:

1. Company specializing in performing Work of this Section with minimum three years' documented experience with following current AISC Certification:

    a. Certified Steel Erector (CSE).

    b. Advanced Certified Steel Erector (ACSE).

C. Shop Painter:

1. Company specializing in performing Work of this Section with minimum three years' documented experience with following current AISC Certification:

    a. Sophisticated Paint Endorsement - Enclosed (P1).

    b. Sophisticated Paint Endorsement - Covered (P2).

    c. Sophisticated Paint Endorsement - Outside (P3).

D. Welders and Welding Procedures: AWS D1.1 qualified within the previous 12 months.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

A. Structural W-Shapes: As shown on the Drawings.

B. Structural S-Shapes: As shown on the Drawings.

C. Channels and Angles: As shown on the Drawings.

D. Round, Hollow Structural Sections: As shown on the Drawings.

E. Rectangular, Hollow Structural Sections: As shown on the Drawings.

F. Structural Pipe: As shown on the Drawings.

G. Structural Plates and Bars: As shown on the Drawings.

H. Furnish materials according to City of Thornton standards.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. Bolts: As shown on the Drawings.

B. Nuts: As shown on the Drawings.

C. Washers:

1. ASTM F436.

2. Type 1, circular

3. Finish: Mechanically galvanized.

D. Compressible-Washer-Type Direct Tension Indicators:

1. ASTM F959.

2. Type: 325

3. Finish: Mechanically galvanized

4. Plate Washers: ASTM A36.

E. Threaded Rods:

1. ASTM A316

2.3 WELDING MATERIALS

A. Welding Materials:

1. AWS D1.1.

2. Type required for materials being welded.

2.4 FINISHES

A. Prepare structural component surfaces according to SSPC SP 6 .

B. Galvanizing: ASTM A123; hot-dip galvanize after fabrication.

C. Galvanizing for Bolts, Connectors, and Anchors:

1. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

2.5 ACCESSORIES

A. Grout:

1. Non-shrink type; premixed compound consisting of nonmetallic aggregate, cement, water-reducing, and plasticizing additives.

2. Capable of developing minimum compressive strength of 7,000 psi at 28 days.

B. Shop Primer: SSPC Paint 15, Type 1, red oxide

C. Touchup Primer for Galvanized Surfaces:

1. SSPC Paint 20, Type I - Inorganic

2. Comply with ASTM A780.

2.6 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Testing: Test bolted and welded connections as specified in PART 3 for field quality control tests.

C. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that bearing surfaces are at correct elevation.

C. Verify that anchor rods are set in correct locations and arrangements, with correct exposure for steel attachment.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Furnish templates for installation of anchor rods and embedments in concrete and masonry work.

3.3 ERECTION

A. Allow for erection loads and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.

B. Field-weld components as indicated on Drawings

C. Field-connect members with threaded fasteners; torque to required resistance and snug-tighten for bearing-type connections.

D. Do not field-cut or alter structural members without approval of Engineer.

E. After erection, touch up welds and abrasions to match shop finishes.

3.4 GROUT INSTALLATION

A. Shim bearing plates and equipment supports to proper elevation, and snug-tighten anchor bolts.

B. Fill void under bearing surface with grout; install and pack grout to remove air pockets.

C. Moist-cure grout.

D. Remove forms after grout is set; trim grout edges to form smooth surface, splayed 45 degrees.

E. Tighten anchor bolts after grout has cured for a minimum of three days.

3.5 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Plumb: 1/4 inch.

C. Maximum Offset from Alignment: 1/4 inch.

3.6 FIELD QUALITY CONTROL

A. Section 01 45 00 - Quality Control: Requirements for inspecting and testing.

B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Bolted Connections: Inspect according to AISC 303.

1. Visually inspect all bolted connections.

2. Direct Tension Indicators: Comply with requirements of ASTM F959, and verify that gaps are less than gaps specified in Table 2.

D. Welding: Inspect welds according to AWS D1.1.

1. Use certified welders, and conduct inspections and tests as required. Record types and locations of defects found in Work. Record work required and performed to correct deficiencies.

2. Visually inspect all welds.

3. Ultrasonic Inspection: ASTM E164; perform on each full-penetration weld.

E. Correct defective bolted connections and welds.

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. The extent of metal fabrications work is shown on the Drawings and includes items fabricated from iron, steel, stainless steel and aluminum shapes, plates, bars, sheets, strips, tubes, pipes, and castings which are not a part of structural steel or other metal systems in other sections of these specifications.

B. Section Includes:

1. Shop-fabricated metal items
2. Hoist beams and divider beams
3. Ladders
4. Anchor bolts
5. Stairs
6. Handrails and railings
7. Gratings
8. Fasteners
9.

C. Related Sections:

1. Section 09 90 00, Painting and Coating

1.2 REFERENCE STANDARDS

A. Aluminum Association (AA):

1. AA DAF-45 - Designation System for Aluminum Finishes

B. American Architectural Manufacturers Association (AAMA):

1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum
2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
3. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

C. American National Standards Institute (ANSI):

1. ANSI A14.3 - American National Standard (ASC) for Ladders - Fixed - Safety Requirements

D. American Welding Society (AWS):

1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination
2. AWS D1.1 - Structural Welding Code - Steel
3. AWS D1.6 - Structural Welding Code - Stainless Steel

E. ASTM International (ASTM):

1. ASTM A6 - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
2. ASTM A36 - Standard Specification for Carbon Structural Steel
3. ASTM A47, grade as selected - Malleable Iron Castings
4. ASTM A48, Class 30 - Gray Iron Castings
5. ASTM A53- Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
6. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
7. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
8. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
9. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High-Pressure Service and Other Special Purpose Applications
10. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
11. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
12. ASTM A283, Grade C - Steel Plates to be Bent or Cold Formed
13. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes
14. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
15. ASTM A312 - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

16. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners
17. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
18. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
19. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
20. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing
21. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts
22. ASTM A572 - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
23. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
24. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
25. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
26. ASTM A992 - Standard Specification for Structural Steel Shapes
27. ASTM B26 - Standard Specification for Aluminum-Alloy Sand Castings
28. ASTM B85 - Standard Specification for Aluminum-Alloy Die Castings
29. ASTM B177 - Standard Guide for Engineering Chromium Electroplating
30. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
31. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
32. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire
33. ASTM B 308, Alloy 6061-T6, Anodic Coating Class I, AA-C22-A41, anodized after fabrication - Structural Aluminum Shapes and Plates
34. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
35. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

36. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings

37. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings

38. ASTM F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength

39. ASTM F436 - Standard Specification for Hardened Steel Washers

40. ASTM F844 - Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use

41. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 ksi Yield Strength

F. Builders Hardware Manufacturers Association (BHMA):

1. ANSI/BHMA A156.20 - American National Standard for Strap and Tee Hinges and Hasps

G. National Ornamental & Miscellaneous Metals Association (NOMMA):

1. NOMMA Guideline 1 - Joint Finishes

H. SSPC: The Society for Protective Coatings:

1. SSPC - Steel Structures Painting Manual

2. SSPC Paint 20 - Zinc-Rich Coating (Type I - Inorganic and Type II - Organic)

3. SSPC SP 1 - Solvent Cleaning

4. SSPC SP-7 Brush-off Blast Cleaning

5. SSPC SP 10 - Near-White Blast Cleaning

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for Submittals.

B. Manufacturer's Data: For information only, submit copies of Manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions for products to be used in miscellaneous metal work, including paint products.

C. Shop Drawings:

1. General: Submit copies of shop drawings for the fabrication and erection of all assemblies of miscellaneous metal work which are not completely shown by the Manufacturer's data sheets.

a. Include plans, elevations, and details of sections and connections and fabricators proposed shop coat paint or galvanizing specifications.

b. Show anchorage and accessory items.

c. Furnish setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete construction.

d. Indicate welded connections using standard AWS A2.4 welding symbols.

e. Indicate net weld lengths.

2. Stairs, Handrails, and Railings:

a. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

3. Gratings:

a. Indicate details of gratings, plates, component supports, anchorages, openings, perimeter construction details, and tolerances.

D. Samples:

1. Submit two sets of representative samples of materials, illustrating factory finishes as may be requested by the Owner or Engineer.

2. Owner/Engineer's review will be for color, texture, style and finish only.

E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.4 MOCKUPS

A. NOT USED

PART 2 PRODUCTS

2.1 GENERAL

A. For the fabrication of miscellaneous metal work items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names, roughness and defects which impair strength, durability, and appearance. Remove such blemishes by grinding or by welding and grinding prior to cleaning, treating and application of surface finishes including zinc coatings.

2.2 LINTELS

A. NOT USED

2.3 BOLLARDS

A. NOT USED

2.4 LADDERS

A. Aluminum Ladder:

1. ANSI A14.3.
2. Aluminum welded construction.
3. Siderails:
    a. Size: 1/2 by 2 inches
    b. Spacing: 20 inches on center
4. Rungs:
    a. Solid rod. Hex rod or gnarled rebar
    b. Size: 1-inch diameter
    c. Spacing: 12 inches on center
5. Mounting:
    a. Space rungs as shown on Drawings, a minimum of 7 inches from wall surface.
    b. Provide steel mounting brackets and attachments per Drawings.
6. Shop Finish: Galvanized.

B. Ladder Security Enclosure:

1. Description: Formed to enclose ladder siderails and rungs when closed and to swing free of ladder rungs and siderails with minimum 1-1/2-inch clear to siderails in open position.
2. Sheet steel.
3. Thickness: Minimum 16-gauge/0.058-inch formed to enclose ladder siderails and rungs when closed and to swing free of ladder rungs and siderails with minimum 1-1/2-inch clear to siderails in open position.
4. Provide continuous steel hinge full height of enclosure.
5. Provide steel hasp for padlocking in closed and open position.
6. Finish: Match ladder finish.

2.5 WINDOW SECURITY GRILLES

A. NOT USED

2.6 FABRICATED ARCHITECTURAL TRIM

A. NOT USED

2.7 ANCHORS

A. All anchors shall be epoxy anchors or expansion anchors as shown in the Drawings.

B. Materials:

1. As shown in the Drawings.

2. For wetted atmospheric conditions

a. Type 316 stainless steel

3. Threaded rod, nuts, bolts, and washers:

a. Material matching anchor insert type

C. Types:

1. Threaded-type Concrete Inserts:

a. Internally threaded to receive machine bolts

b. Malleable iron, ASTM A47

c. Cast steel, ASTM A27

d. Stainless steel, type 304, ASTM A320

2. Wedge-type Concrete Inserts:

a. Box-type ferrous castings designed to accept bolts having special wedge-shaped heads.

3. Slotted-type Concrete Inserts:

a. Box-type welded construction with slot designed to receive square head bolt and with knockout cover.

D. Manufacturers:

1. Hilti, Inc.

2. Simpson Strong-Tie Co., Inc.

3. Proprietary products as named in the Drawings.

2.8 STAIRS

A. Meet all applicable codes and Occupational Safety and Health Administration (OSHA) requirements.

B. Minimum Design Live (Pedestrian) Load: Fabricate stair assembly to support uniform live load of 100 pounds per square foot (psf) and moving concentrated load of 1,000 psf with deflection of stringer or landing framing not to exceed 1/180 of span.

C. Fabricate stair assembly to NAAMM AMP 510, industrial class.

D. Materials: As shown in the Drawings.

2.9 HANDRAILS AND RAILINGS

A. Maximum spacing between members shall be as directed by local code and OSHA requirements unless otherwise noted on the Drawings.

B. Railing assembly, wall rails, and attachments to resist lateral force of 200 pounds at any point without damage or permanent set. Test according to ASTM E935.

C. Construction:

1. Height: 3 foot, 6-inch high.

2. Outside diameter:

a. 2-inch for top and vertical segments.

b. 1-1/2-inch all others.

3. Top corners of handrail are to be bent to the smallest radius possible without causing grain separation or otherwise impairing the work.

4. Radius Sections -- Roll to radii shown on Drawings.

5. Vertical segments of handrail are to be set plumb and mount as shown on Drawings or as otherwise specified.

6. Spacing between vertical segments will be according to Drawings.

D. Welded Connections:

1. Cope intersections of rails and posts, weld joints of tailings or use welding connectors, at fabricator's option.

a. Other methods of welding may be used when acceptable to the Engineer.

2. Weld corners and seams continuously and in accordance with the recommendations of AWS.

3. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces.

4. Discoloration of finished surfaces and sharp edges will not be acceptable.

E. Materials: As shown on the Drawings.

2.10 GRATINGS

A. Meet all applicable codes and Occupational Safety and Health Administration (OSHA) requirements.

B. Minimum Design Live (Pedestrian) Load: Fabricate stair assembly to support uniform live load of 100 psf and moving concentrated load of 1,000 psf with deflection of stringer or landing framing not to exceed 1/120 of span.

C. Layout:

1. Provide removable grating sections with end-banding bars for each panel.

2. Exposed connections shall fit accurately together to form tight hairline joints.

3. Install all gratings with bearing bars spanning the shortest dimension unless shown otherwise on the plans.

4. Provide welded positioning tabs in support angles at each grating section to prevent lateral movement of grating sections.

5. Layout units to allow grating removal without disturbing items penetrating grating.

D. Penetrations:

1. Provide for notched gratings and banding for penetrations as indicated.

2. Provide banding for openings in grating of same material and size as bearing bars unless otherwise indicated.

3. Wherever bar gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar of same material and size as bearing bars to the cut ends of the bars.

4. Divide panels into sections only to the extent required for installation wherever bar grating platforms, runways, etc., are to be placed around previously installed pipes, ducts, and structural members.

E. Materials: As shown on the Drawings.

2.11 ACCESS HATCHES

A. NOT USED

2.12 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting systems. Acceptable manufacturers are Simpson or equal.

B. Manufacture or fabricate items of sizes, shapes, and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere furnish galvanized steel washers.

2.13 MISCELLANEOUS FABRICATIONS, FRAMING, AND SUPPORTS

A. Provide miscellaneous steel framing and supports required to complete the Work.

B. Fabricate miscellaneous units to the sizes, shapes and profiles shown in the Drawings or, if not shown, of the required dimensions to receive adjacent grating, plates doors, or other work to be retained by the framing.

C. Except as otherwise shown, fabricate from structural steel shapes and plate and steel bars, all welded construction using mitered corners, welded brackets and splice plates and a minimum number of joints for field connection.

D. Cut, drill, and tap units to receive hardware and similar items to be anchored to the work.

E. Equip units with integrally welded anchors for casting into concrete, bolting to structural steel or building into masonry. Furnish inserts if units must be installed after concrete is placed.

F. Galvanize all miscellaneous fabrications unless otherwise noted.

2.14 NON-SHRINK GROUT

A. Where required for anchoring, patching, or sealing, grouting, and sealing compounds shall conform to the requirements of Section 03 60 00, Grouting.

2.15 MATERIALS

A. Materials listed below shall be provided unless otherwise noted in the Drawings or other sections of these specification.

B. Steel:

1. As Shown on the Drawings. If any not included, then see the following:

2. Structural W Shapes: ASTM A992

3. Structural Shapes: ASTM A36

4. Channels and Angles: ASTM A36

5. Steel Plate: ASTM A36

    a. Steel Plate to be Bent or Cold Formed: ASTM A283, Grade C

6. Hollow Structural Sections: ASTM A500, Grade B

7. Structural Pipe: ASTM A53, Grade B, Schedule 40 unless shown otherwise in Drawings

8. Bar: ASTM A36

    a. Cold-Finished Steel Bar: ASTM A108, grade as selected by fabricator

9. Sheet Steel: ASTM A653, Grade 33 Structural Quality

10. Tubing: ASTM A513, Type 5, minimum 50 kilopounds per square inch (ksi) yield strength
11. Standard Bolts: ASTM A307; Grade A
    a. Washers: ASTM F844
12. High Strength Bolts: ASTM A325
    a. Washers: ASTM F436; Type 1
13. Nuts: ASTM A563; heavy-hex type
14. Welding Materials: AWS D1.1; type required for materials being welded

C. Stainless Steel:

1. As Shown on the Drawings. If any not included, then see the following:
2. Bars and Shapes: ASTM A276; Type 316
3. Tubing: ASTM A269; Type 316
4. Pipe: ASTM A312, seamless; Type 316
5. Plate, Sheet, and Strip: ASTM A666; Type 316
6. Bolts, Nuts, and Washers: ASTM A354; Type 316
7. Welding Materials: AWS D1.6; type required for materials being welded

D. Aluminum:

1. As Shown on the Drawings. If any not included, then see the following:
2. Structural Aluminum Shapes and Plates: ASTM B308, Alloy 6061, Temper T66, Anodic Coating Class I, anodized after fabrication
3. Aluminum-Alloy-Drawn Seamless Tubes: ASTM B210 Alloy 6063, Temper T6
4. Aluminum-Alloy Bars: ASTM B211 Alloy 6063, Temper T6
5. Bolts, Nuts, and Washers: Stainless steel or Steel, galvanized
6. Welding Materials: AWS D1.1; type required for materials being welded

E. Bolts, Nuts, and Washers for Equipment and Piping:

1. Select fasteners for the type, grade, and class required for the installation of miscellaneous metal items.
2. As Shown on the Drawings. If any not included, then see the following:
3. Carbon Steel:

a. General: Zinc-coated, ASTM A153

b. Structural Connections: ASTM A307, Grade 2 (60 ksi), hot-dip galvanized

c. Anchor Bolts: ASTM A307, Grade 2 (60 ksi), hot-dip galvanized

d. Pipe and Equipment Flange Bolts: ASTM A193, Grade B-7

e. High Strength Bolts: ASTM F3125, Heavy Hex Head

4. Stainless Steel: Type 316 stainless steel, Class 2; ASTM A193 for bolts; ASTM A194 for nuts

a. Where stainless steel bolts are in contact with dissimilar metals, glass epoxy insulating sleeves and washers shall be used to electrically isolate the bolts.

2.16 FABRICATION

A. Workmanship:

1. Use materials of the size and thicknesses shown in the Drawings or, if not shown, of the required size and thickness to produce adequate strength and durability in the finished product for the intended use as approved by the Engineer.

2. Work to the dimensions shown in the Drawings or accepted on Shop Drawings, using proven details of fabrication and support.

3. Use the type of materials shown in the Drawings or specified for the various components of work.

4. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

5. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise shown in the Drawings.

6. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the Work.

B. Fit and shop-assemble items in largest practical sections for delivery to Site.

C. Fabricate items with joints tightly fitted and secured.

D. Continuously seal join members by means of continuous welds in accordance with the recommendations of AWS, unless otherwise noted or approved.

E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small, uniform radius.

F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

H. Loose Bearing and Leveling Plates:

1. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area.

2. Drill plates to receive anchor bolts and for grouting as required.

3. Galvanize after fabrication.

I. Miscellaneous Steel Trim:

1. Provide shapes and sizes for profiles shown in the Drawings.

2. Except as otherwise indicated, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges.

3. Use concealed field splices wherever possible.

4. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.

J. Fabrication Tolerances:

1. Squareness: 1/16 inch maximum difference in diagonal measurements.

2. Maximum Offset between Faces: 1/16 -inch.

3. Maximum Misalignment of Adjacent Members: 1/16-inch.

4. Maximum Bow: 1/16-inch in 48 inches.

5. Maximum Deviation from Plane: 1/16inch in 48 inches.

2.17 FINISHES

A. Stainless Steel:

1. Satin-Polished Finish: Number 4, satin directional polish parallel with long dimension of finished face.

2. Mirror-Polished Finish: Number 8, mirror polish with preliminary directional polish lines removed.

B. Aluminum:

1. Protection of All Aluminum:

a. Aluminum surfaces in contact with cementitious, masonry or dissimilar materials, apply the following coating system:

1) One (1) coat of epoxy primer, 1 to 2 mils dry film (D.F.).

2) Followed by two (2) coats of Bitumastic, 6 to 8 mils D.F.

3) Followed by two (2) coats of tarset material, 6 to 8 mils D.F.

C. Shop Painting

1. Shop painting of metal fabrications shall be allowed only at the sole discretion of the Engineer.

2. Shop paint miscellaneous metal work in accordance with Section 09 90 00, Painting and Coating, with the following exceptions:

a. Those members or portions of members to be embedded in concrete or masonry.

b. Surfaces and edges to be field welded.

c. Galvanized surfaces.

3. Remove scale, rust, and other deleterious materials before the shop coat of paint is applied.

a. Clean off heavy rust and loose mill scale in accordance with SSPC SP-7, Brush-off Blast Cleaning.

b. Remove oil, grease, and similar contaminates in accordance with SSPC SP-1, Solvent Cleaning.

4. Immediately following surface preparation, brush or spray on metal primer paint, applied in accordance with the Manufacturer's instructions or as specified below.

5. Apply one shop coat of metal primer paint to fabricated metal items, except apply two coats of paint to surfaces which will be inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

D. Touch-up Painting, Pre-painted Items:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint, and paint all exposed areas with the same material as used for shop painting.

2. Apply touch-up coatings by brush or spray to provide a minimum dry film thickness of the original coating thickness.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal and aluminum where Site welding is required.

B. Furnish setting drawings, diagrams, templates, instructions, and directions for the installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections. Coordinate delivery of such items to the Project Site.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, and free from distortion or defects.

B. Make provisions for erection stresses. Install temporary bracing to maintain alignment until permanent bracing and attachments are installed.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal items to in-place construction, including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

D. Fit exposed connections accurately together to form tight hairline joints.

E. Grind joints smooth and touch-up shop paint coat.

F. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

G. Field-weld components indicated on Drawings and Shop Drawings.

H. Perform field welding according to AWS D1.1 with regards to procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work.

I. Obtain approval of Engineer prior to Site cutting or making adjustments not scheduled.

3.4 TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch

B. Maximum Variation from Level: 1/16 inch

C. Maximum Offset from Alignment: 1/4 inch

D. Maximum Out-of-Position: 1/4 inch

3.5 FIELD QUALITY CONTROL

A. Welding: Inspect welds according to AWS D1.1.

B. Replace damaged or improperly functioning hardware.

C. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

D. Touch up factory-applied finishes according to Manufacturer-recommended procedures.

3.6 ADJUSTING

A. Adjust operating hardware and lubricate as necessary for smooth operation.

END OF SECTION

SECTION 09 90 00 - PAINTING AND COATING

PART 1 GENERAL

1.1 SUMMARY

A. Work under this Section shall include the protective coating of all specified surfaces including all surface preparation, pretreatment, coating application, touch-up of factory coated surfaces, protection of surfaces not to be coated, cleanup, and appurtenant work, all in accordance with the requirements of the Contract Documents.

B. This specification is applicable to coated pipe, fittings, and other process equipment and material surfaces listed in the coating schedule at the end of this section.

C. Related Sections

1. Section 01 10 00, Summary of Work.

2. Section 01 33 00, Submittal Procedures.

3. Section 01 45 00, Quality Control.

D. Related Requirements

1. The Coating System Schedules summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes in the Drawings are used to show exceptions to the schedules, to show or extend the limits of coating systems, or to clarify or show details for application of the coating systems.

2. Shop coatings and/or factory finishes on fabricated or manufactured equipment may be specified in other divisions. Some items with factory finishes, or corrosion resistant finishes may be scheduled or directed to be painted by the Engineer to unify a wall finish or color scheme, at the Engineer's discretion.

3. Exclusions - Do not coat the following surfaces unless specified or directed elsewhere: Stainless steel, aluminum, copper, brass, bronze, and other corrosion-resistant material (except for valve bodies and piping); Electrical switchgear and motor control centers having factory finish; Fencing; Multiple coated factory finished baked enamel or porcelain products; Concealed areas such as ducts, piping, conduits, and items specified elsewhere for special linings and coatings.

4. Damaged Factory Finish - If directed by the Engineer, refinish the entire exposed surfaces of equipment chipped, scratched, or otherwise damaged in shipment or installation.

5. All coating coming in contact with potable water shall be NSF approved.

1.2 REFERENCE STANDARDS

A. American Water Works Association (AWWA)

1. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
2. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4-inch and Larger - Shop Applied
3. AWWA C209 - Cold Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Pipelines.
4. ANSI/AWWA C210 - Liquid Epoxy Coating for Exterior and Interior of Steel Pipe.
5. ANSI/AWWA C213 - Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
6. ANSI/AWWA C214 - Tape Coating systems for the Exterior of Steel Water Pipelines.

B. Environmental Protection Agency (EPA)

C. NACE International (NACE)

1. SP0188 – Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

D. National Sanitation Foundation (NSF)

1. NSF International (NSF) Standard No. 61.
2. NSF International (NSF) Standard No. 600 – Health Effects Evaluation and Criteria for Chemicals in Drinking Water (Effective beginning January 1, 2023)

E. Occupational Safety and Health Act (OSHA)

F. The Society for Protective Coatings (SSPC)

1. PA 2 – Procedure for Determining Conformance to Dry Coating Thickness Requirements
2. PA 10 – Guide to Safety and Health Requirements for Industrial Painting Projects.
3. SP1 – Solvent Cleaning
4. SP2 – Hand tool Cleaning
5. SP3 – Power Tool Cleaning
6. SP5 – White Metal Blast Cleaning
7. SP6 – Commercial Blast Cleaning
8. SP7 – Brush-off Blast Cleaning.
9. SP10 – Near-white Blast Cleaning
10. SP11 – Power Tool Cleaning to Bare Metal

11. SP12 – High- and Ultra High-Pressure Water Jetting

12. SP-13 – Surface Preparation of Concrete

13. SP14 – Industrial Blast Cleaning

14. SP 16 – Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.

15. Guide 15 – Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures

B. Coating Materials List

1. The Contractor shall provide a coating materials list which indicates the Manufacturer and the coating number, keyed to the coating systems herein. The amount of copies to submit shall be as specified within Section 01 10 00, Summary of Work.

C. Coating Manufacturer's and Applicator Information -- For each coating system to be used the Contractor shall submit, the following listed data.

1. Manufacturer's data sheet for each product used, including statements on the suitability of the material for the intended use.

2. Manufacturer's instructions and recommendations on surface preparation and application.

3. Colors available for each product and each coat.

4. Compatibility of shop and field applied coatings (where applicable).

5. Material safety data sheet for each product used.

6. The Manufacturer’s recommended products and procedures for field coating repairs and field preparation of field cut pipe ends.

7. The name of the proposed coating applicator shop along with certification that the applicator shop is qualified and equipped to apply the coatings systems as specified.

8. Certificate

a. Submit Manufacturer's certificate of compliance with the specifications and standards signed by a representative in the Manufacturer's employ.

9. Samples

a. Provide painted surface areas at the job for approval of main color selections or submit sample on sample of substrate using required finish system at Engineer’s discretion.

1.4 QUALITY ASSURANCE

A. 01 45 00, Quality Control

B. Applicator Qualifications - The Applicator Contractor must be capable of performing the various items of work as specified. The Applicator Contractor shall furnish a statement covering experience on similar work, a list of machinery, plant, and other equipment available for the proposed work, and a financial statement, including a complete statement of the Applicator Contractor's financial ability and experience in performing similar painting and coating work. The Applicator Contractor shall have a minimum of 5 years practical experience and a successful history in the application of the specified products to concrete/steel surfaces. Upon request, the Applicator Contractor shall substantiate this requirement by furnishing a list of references, which shall include jobs of similar nature.

C. The Contractor shall give the Engineer a minimum of 3 days advance notice of the start of any field surface preparation work of coating application work, and a minimum of 7 days advance notice of the start of any shop surface preparation work.

D. All such work shall be performed only in the presence of the Engineer unless the Engineer has granted prior approval to perform such work in its absence.

E. Inspection by the Engineer, or the waiver of inspection of any portion of the work, shall not relieve the Contractor of its responsibility to perform the work in accordance with these Specifications.

F. Surface Preparation - Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standard TM-01-70.

G. Scaffolding shall be erected and moved to locations where requested by the Engineer to facilitate inspection. Additional illumination shall be provided by the Contractor to cover all areas to be inspected.

H. Paint Products - No request for substitution shall be approved which decreases the film thickness designated or the number of coats to be applied, or which offers a change from the generic type of coating specified. Painting shall be done at such times as the Contractor and Engineer may agree upon in order that dust-free and neat work be obtained. All painting shall be in strict accordance with the Manufacturer's instructions and shall be performed in a manner satisfactory to the Engineer.

I. Manufacturer's Representative - Require Coating Manufacturer's representative to be at job site when the first day's coating application is in progress and periodically during progress of the work.

J. Labels - Deliver to the job site in the original sealed containers with Manufacturer's name, product name, type of product, Manufacturer's specification or catalog number or federal specification number, and instructions for reducing where applicable.

K. Colors - Colors will be selected from Manufacturer's standard colors as reviewed by Engineer and approved by the Owner. Colors for special coatings that are limited in their availability and color selection will be chosen on the basis of Manufacturer's standard colors, provided that

the Manufacturer's product line represents a color range comparable to similar products of other manufacturers.

L. Flame Spread - Provide paint materials which will result in a Class II finish for all coated surfaces in exit corridors, and a Class III finish for all other interior rooms or areas.

M. Film Thickness Testing - On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gauge such as Mikrotest model FM, Elcometer model 456, or equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On non-ferrous metals and other substrates, the coating thickness shall be measured at the time of application using wet film gauge readings and destructive film thickness tests.

1.5 MATERIAL DELIVERY, HANDLING, AND STORAGE

A. Deliver in labeled containers as specified above and store in a locked room accessible for inspection. Comply with fire and health regulations.

B. Provide adequate heat and forced mechanical ventilation for health, safety, and drying requirements. Use explosion proof equipment. Provide face masks.

C. Protect adjacent surfaces with suitable masking and drop cloths as required. Remove cloths or waste from the Project daily.

D. Apply to surfaces under recommended environmental conditions and within the limitations established by the Material Manufacturer. Do not apply coating in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces, unless otherwise permitted by the Coating Manufacturer's printed instructions. Coating application may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the Paint Manufacturer during application and drying periods.

1.6 PROTECTION

A. Follow all safety recommendations of Manufacturer regarding ventilation and danger from explosion or breathing paint fumes or skin exposure, and all applicable O.S.H.A. and other regulations.

B. Protect surface adjacent to work being coated from overspray, drips, or other damage.

1.7 PIPING COLOR CODE

To facilitate identification of piping, the following color scheme will be utilized:

A. Water Lines

Settled Water	Light Blue
Reject Water	Light Brown
Clarifier Vaults	Light Green
Drain Piping	Dark Gray

All Other Process Water	Light Gray/Metallic

B. Other

Compressed Air	Light Gray/Metallic

1. In situations where two colors do not have sufficient contrast to easily differentiate between them, a six-inch band of contrasting color should be on one of the pipes at approximately 30-inch intervals.

2. The name of the liquid or gas, along with directional arrows indicating the direction and type of flow should also be on the pipe. Contractor shall match existing signing.

3. Colors, where not specified, shall be as selected by the Owner.

PART 2 PRODUCTS

2.1 GENERAL

A. Definitions - The terms "paint," "coatings," or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, tape, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat. The term "DFT" means minimum dry film thickness.

B. General - Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, Manufacturer's directions, and name of Manufacturer, all of which shall be plainly legible at the time of use.

C. The Contractor shall use coating materials suitable for the intended use and recommended by their Manufacturer for the intended service.

D. Compatibility - In any coating system 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. If necessary, subject to the approval of the Engineer, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

E. Colors - All colors and shades of colors of all coatings shall be as selected or specified by the Engineer. Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the Manufacturer's standard color samples by the Engineer. Color pigments shall be lead free.

F. Protective Coating Materials - Products shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, the Contractor shall provide the Engineer with the names of not less than 10 successful applications of the proposed Manufacturer's products demonstrating compliance with this specification requirement.

G. Substitute or "Or-Equal" Submittals - 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. 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 or better than the listed materials.

H. The cost of all testing and analyzing of the proposed substitute materials that may be required by the Engineer 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 INDUSTRIAL COATING SYSTEMS

A. General

1. Provide and apply the industrial coatings systems which follow as listed in the coating schedule, as required by these specifications, and as directed by the Engineer. Coat all existing and new exposed interior or exterior surfaces and submerged and intermittently submerged surfaces as indicated, except as specifically excluded in Part 1 of this section or in the Drawings or finish schedules. Coating System Numbers listed below shall be used as the Coating System code letter, and shall be used on any coating submittals or correspondence.

B. Industrial coating systems shall be as follows

1. Coating System 100

a. Location - Exposed, unprimed, non-galvanized, non-submerged metal surfaces, both interior and exterior including piping, and structural steel.

b. Surface Preparation - As specified herein.

c. Coating System - Apply prime coat and topcoat 4.0-6.0 mils DFT each coat of:

1) Tnemec Hi-Build Epoxyline II Series 69

2) Sherwin Williams Macropoxy Series 646

3) Carboline Carboguard 60.

4) Or equal.

2. Coating System 101

a. Location - Exposed metal surfaces, shop primed, both interior and exterior including piping, railings, ladders, steel doors, and any other metal items not otherwise specified.

b. Surface Preparation - As specified herein.

c. Coating System

1) Apply shop prime coat 3.0 mils DFT Tnemec Series 90-97 Tneme-Zinc, one coat 4.0 - 6.0 mils DFT Tnemec Series 69 Hi-Build Epoxoline II, and 3.0 - 4.0 mils DFT of Tnemec Series 175 Endura Shield.

2) Apply shop prime coat 3.0 mils DFT Carboline 859, one coat 4.0 – 6.0 mils DFT Carboline Barboguard 60, and 2.0 – 3.0 DFT of Carboline Carbothane 134HG.

3) Or equal.

3. Coating System 104

a. Location – Non-submerged, exposed to view, PVC piping.

b. Surface Preparation - As specified herein.

c. Coating System - Apply one coat, 4.0 – 6.0 mils DFT of:

1) Tnemec Hi-Build Epoxyline II Series 69

2) Carboline Carboguard 60.

3) Or equal.

2.3 MANUFACTURERS

A. Tnemec Company, Kansas City, MO.

B. Carboline Company, Houston, TX.

C. Sherwin-Williams Company, Cleveland, OH.

D. Or equal.

2.4 SPECIAL PIPE AND CRITICAL SERVICE COATING SYSTEMS

A. General

The following coatings are for buried pipe and surfaces used in critical service conditions. The Manufacturers' products listed in this paragraph are materials which satisfy the material descriptions of this paragraph and have a documented successful record for long term submerged or severe service conditions. Proposed substitute products will be considered as indicated within the paragraph entitled " 'Or-Equal' Clause" in Section 01 10 00, Summary of Work.

1. Coating System 203 - Fusion Bonded Epoxy

a. Location - Ferrous surfaces of sleeve couplings, steel pipe, and fittings.

b. Surface Preparation - As specified herein.

c. Coating System - The coating material shall be 100 percent powder epoxy applied in accordance with the ANSI/AWWA C213 "AWWA Standard for Fusion-Bonded Epoxy

Coating for the Interior and Exterior of Steel Water Pipelines". The coating shall be applied using the fluidized bed process.

1) Liquid Epoxy - For field repairs, the use of liquid epoxy will be permitted, applied in not less than three coats to provide 16 mils DFT. The liquid epoxy shall be a 100 percent solids epoxy recommended by the Powder Epoxy Manufacturer.

2) Coating (DFT = 16 mils), Scotchkote 203, or equal.

3) Total system DFT = 16 mils.

2. Coating System 207 - PVC Tape

a. Location - Small galvanized steel pipe and fittings.

b. Surface Preparation - As specified herein.

c. Coating System - Prior to wrapping pipe with PVC tape, the pipe and fittings shall be primed using a primer recommended by the PVC Tape Manufacturer. After being primed, the pipe shall be wrapped with a 20-mil adhesive PVC tape, half lapped for a total thickness of 40 mils DFT.

PART 3 EXECUTION

3.1 STORAGE, MIXING, AND THINNING OF MATERIALS

A. Manufacturer's Recommendations

1. Unless otherwise specified herein, the Coating Manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.

B. All protective coating materials shall be used by the Manufacturer's recommended shelf life.

C. Storage and Mixing

1. Coating materials shall be protected from exposure to cold weather, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

3.2 CORRECTIONS AND CLEANUP

A. At completion any damaged, de-laminated or defaced coated surfaces shall be touched up, restored, and left in first class condition. Any coated or finished surfaces damaged in fitting or erection shall be restored. If necessary, an entire wall shall be refinished rather than spot finished. Upon completion and prior to final acceptance, all equipment and unused materials accumulated in the coating process shall be removed from the site and any spillage, spatter spots or other misplaced coating material shall be removed in a manner which will not damage surfaces. Perform required patching, repair, and cleaning to the satisfaction of the Engineer.

Cooperate and coordinate work with the work of other trades in the removal and replacement of hardware, fixtures, covers, switch plates, etc., as required for coating.

3.3 EXTRA STOCK

Provide one gallon of each type and color, fully labeled, at completion of job.

3.4 SURFACE PREPARATION

A. General

1. Prepare all surfaces scheduled to receive new coating systems, as required to provide for adequate bonding of the specified coating system to the substrate material. Request review of prepared surfaces by the Engineer prior to proceeding. For existing coated surfaces, hand wash with cleaner or product recommended by Coating Manufacturer to properly prepare existing surface and provide for bonding of coating specified to follow. Remove any loose, peeling or flaking coating, or mildewed areas. Surface preparation minimums shall be as follows:

   a. Exposed metal items, non-submerged, unprimed, non-galvanized both interior and exterior, including piping, structural steel and all other metal items not otherwise specified, shall undergo surface preparation in accordance with SSPC-SP6, "Commercial Blast Cleaning".

   b. Exposed metal items, shop primed, both interior and exterior including piping, steel doors, steel ladders to be painted, and railings, and all other metal items not otherwise specified, shall undergo surface preparation in accordance with SSPC-SP1, "Solvent Cleaning"; SSPC-SP2, "Hand Tool Cleaning"; and SSPC-SP3, "Power Tool Cleaning" as may be required to remove grease, loose, or peeling or chipped paint.

   c. Metal items, unprimed or non-galvanized, continuously or intermittently submerged, both interior and exterior including piping, structural steel, and all other metal items not otherwise specified, shall undergo surface preparation in conformance with SSPC-SP10, "Near-White Blast Cleaning".

   d. Stainless Steel – Non-submerged and submerged, exposed piping and fittings, both interior and exterior shall undergo surface preparation in accordance with SSPC-SP1, "Solvent Cleaning".

   e. Polyvinyl Chloride (PVC) – Non-submerged, both interior and exterior, process piping and plumbing, shall be lightly sanded prior to application of the specified coating system to follow.

   f. Non-submerged Concrete - Clean all concrete surfaces of dust, form oil, curing compounds, or other incompatible matter. Etch and prime if required by Manufacturer for specified coating products to follow. Allow minimum 28-day cure of concrete prior to application of coating systems.

   g. Concrete Masonry Units - Repair all breaks, cracks, and holes with concrete grout. The surface must be free of dirt, dust, loose sand, and other foreign matter. Brush clean.

Allow minimum 28-day cure of concrete joint mortar and repair grout prior to application of coatings system.

h. Wood - Wood surfaces shall be thoroughly cleaned and free of all foreign matter with cracks, nail holes, and other defects properly filled, smoothed, and sandpapered to fine finish. Wipe clean of dust.

i. Preparation of All Existing Coated Surfaces - Removed rough and defective coating film from material surfaces to be painted. Touch up with approved primer. Clean all greasy or oily surfaces, to be painted, with benzine or mineral spirits or Rodda's Gresof before coating, or as recommended by Manufacturer. For walls, patch existing nicks and gouges, sand to match wall finish.

3.5 PRIME COATING

A. Exposed Steel - Prime coat all exposed steel in accordance with SSPC PS 13.01 for epoxy-polyamide coating systems. Prime coats shall be applied following completion of surface preparation requirements as specified in paragraph [3.4.A.1] above.

B. Galvanized Metal - After surface preparation specified above, prime galvanized metal items receiving paints as specified with Tnemec Series 69 Hi-Build Epoxaline II or equal, verifying with Manufacturer before application the compatibility with coatings specified to follow.

C. Shop Primed Metal - Where indicated in the Drawings or coating schedule and following the surface preparation procedures specified in paragraph 3.4.A.1 above, the Contractor shall apply intermediate and topcoats of the specified paint system to shop primed metal. The Contractor shall verify with the Manufacturer(s) representative of the item(s) to be painted, before application, the compatibility of shop primers with the specified intermediate and topcoat coating systems.

D. Non-Shop Primed Metal and Piping - Prime coat all exposed metal and piping, except stainless steel, received at job site following completion of surface preparation requirements as specified in Paragraph 3.4.A.1 above. Prime paint in accordance with SSPC PS No. 13.01 for epoxy-polyamide primers. Epoxy-polyamide primers shall conform to the standards set forth in SSPC Paint Specification No. 22.

E. Cast-In-Place Reinforced Concrete -- After surface preparation specified above, prime coat concrete as specified in the coating schedule found elsewhere in the specifications.

F. Concrete Masonry Units - After surface preparation specified above, prime coat as specified in the coating schedule found elsewhere in the specifications.

G. Wood Surfaces - Following surface preparation specified above, prime coat exterior exposed wood surfaces with appropriate coating system as specified in the painting schedule.

3.6 FIELD PRIME

A. Wherever shop priming has been damaged in transit or during construction, the damaged area shall be cleaned and touched up with field primer specified herein or returned to the shop for resurfacing and re-priming, at the Engineer’s discretion. Metal items delivered to the job site unprimed shall be cleaned and primed as specified herein.

3.7 APPLICATION

A. Thickness - Apply coatings in strict conformance with the Manufacturer's application instructions. Apply each coat at the rate specified by the Manufacturer to achieve the dry mil thickness specified. If material must be diluted for application by spray gun, build up more coating to achieve the same thickness as undiluted material. Correct apparent deficiency of film thickness by the application of an additional coat.

B. Apply to surfaces under recommended environmental conditions and within the limitations established by the Material Manufacturer.

C. Porous Surfaces - Apply paint to porous surfaces as required by increasing the number of coats or decreasing the coverage as may be necessary to achieve a durable protective and decorative finish.

D. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.

E. Coatings shall be applied in accordance with the Manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.

F. 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. Use stripe coating for these areas.

G. 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.

H. Ventilation - Adequately ventilate enclosed rooms and spaces during painting and drying periods.

I. Drying Time - Do not apply next coat of coat until each coat is dry. Test non-metallic surfaces with moisture meter. The Manufacturer's recommended drying time shall mean an interval under normal condition to be increased to allow for adverse weather or drying conditions. Manufacturer's representative shall verify by cure testing, complete cure of coatings systems used for immersion service.

3.8 COATING SCHEDULE

Coating Schedule

Item	Location	Material	Coating System
Piping Coatings (exterior surface of pipe)	Inside Treatment Plant	Steel	Coating System 100
Piping Coatings (exterior surface of pipe)	Inside Treatment Plant	PVC	Coating System 104
Piping Coatings (exterior surface of pipe)	Vaults	Ductile Iron	Coating System 100

Notes:

1. If a location and material are not specifically identified in the table, the coating systems specified in Section 2, Products, shall apply to the entire project as noted in the specifications for each coating system.

END OF SECTION

SECTION 10 14 10 - IDENTIFYING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. This Section covers the work necessary to furnish and install, complete, identifying devices for the Project.

B. Section includes:

1. Process pipe color coding and labeling
2. Process equipment nameplates
3. Valve and actuator tags
4. Door and warning signs

C. Related Sections:

1. Section 40 05 13 - Common Work Results for Process Piping

1.2 STANDARDS, SPECIFICATIONS, AND CODES

A. All safety related signs, markers, labeling, and symbols shall conform to the applicable provisions or codes of the Occupational Safety and Health Administration (OSHA), unless specifically modified hereinafter.

B. All signage providing emergency information or general circulation directions, or identifies rooms for the physically handicapped, shall comply with the requirements of the latest edition of American National Standards Institute (ANSI A117.1).

1.3 SUBMITTALS

A. In accordance with Section 01 33 00, Submittal Procedures.

B. Manufacturer's Data - Specifications and installation instructions for each type of sign required.

C. Samples - Submit three full size samples of each color and finish of pipe labeling, process equipment nameplates, and warning signs with sample letters.

1. Engineer's review of samples will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.
2. Submit samples of any other special identifying or signing provided for elsewhere in this specification.

PART 2 PRODUCTS

2.1 PIPE LABELING AND COLORS

A. Unless noted otherwise on the Drawings or specified differently hereinafter, pipe labeling and colors shall conform to the following schedule to match the existing pipe labeling and colors:

Service	Symbol (label)	Symbol Color (label)	Pipe Color
Plant Water	As directed by the Owner	As directed by the Owner	See Section 09 90 00
Drains	As directed by the Owner	As directed by the Owner	See Section 09 90 00
Misc. Piping	As directed by the Owner	As directed by the Owner	As directed by the Owner

B. Pipe identification labels and flow direction arrows shall consist of lettering and symbols applied over the pipe base color.

C. Coating systems and surface preparation requirements used in color coding piping and lettering and flow arrows shall be as specified in Section 09 90 00, Painting and Coating.

2.2 PROCESS EQUIPMENT NAMEPLATES AND TAGS

A. Nameplates and/or tags shall be used to identify all process equipment including but not limited to valves and actuators, control panels, and any other equipment requiring identification as directed by the Owner.

2.3 FALL HAZARD WARNING SIGNS

A. Painted aluminum with a yellow background and black lettering.

B. Each sign shall contain the following wording:

"CAUTION
FALL HAZARD"

2.4 NOT USED

PART 3 EXECUTION

3.1 PIPE LABELS AND FLOW DIRECTION ARROWS

A. Location: At all connections to equipment, valves, branching fittings, at wall boundaries, and at intervals along the piping not greater than 5 feet on center with at least one label applied to each exposed horizontal and vertical run of pipe. Exposed piping not normally in view, such as behind ceilings and in closets and cabinets, shall also be labeled.

B. Labels shall not be applied to the pipe until all pipe painting is complete or as approved by the Engineer.

C. Application: By stencil over pipe base color. Base coat shall be cured, clean, and dry, prior to application of lettering.

D. Lettering sizes for pipe labels shall be in accordance with ANSI A13.1, Table 3, and based upon the outside diameter of the pipe to which they are applied.

E. Stripes on solution pipe shall be applied at intervals along the piping not greater than 5 feet on center with at least one stripe applied to each exposed horizontal and vertical run of pipe.

3.2 PROCESS EQUIPMENT NAMEPLATES AND TAGS

A. Location: As directed by the Owner.

B. Mounting of process equipment nameplates and/or tags shall be in accordance with the Manufacturer's instructions, and as directed by the Owner.

3.3 NOT USED

3.4 NOT USED

3.5 NOT USED

END OF SECTION

SECTION 26 00 00

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 SUMMARY

A. This section includes basic electrical requirements for materials and methods applicable to electrical equipment specified under this section and other related sections.
   1. Conduit
   2. Boxes
   3. Duct Bank
   4. Wire and Cable
   5. Wiring Devices and Device Plates
   6. Maintenance Materials
   7. Grounding Materials
   8. Luminaries
   9. Power Panels

B. Related Sections:
   1. Division 01 – Shop Drawings and Product Data
   2. Division 01 – Construction Facilities and Temporary Controls
   3. Division 01 – Materials and Equipment
   4. Division 01 – Operation & Maintenance Data
   5. Division 09 – Coatings

1.2 REFERENCES

A. UL – All applicable standards

B. IEEE – All applicable standards

C. IPCEA – All applicable standards

D. NEMA – All applicable standards

E. ANSI/NFPA 70 – National Electrical Code

F. ANSI C2 – National Electrical Safety Code

G. ANSI/NEMA FB 1 – Fittings and Supports for Conduit and Cable Assemblies

H. ANSI/NEMA OS 1 – Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports

I. ANSI/NEMA OS 2 – Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports

J. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)

1.3 SUBMITTALS

A. Information covering all material that is to be used on this project shall be submitted.

B. Each sheet of descriptive literature shall be clearly marked to identify the material or equipment for which it pertains.

C. Equipment on submitted sheets that is not for this project shall be crossed out.

D. As a minimum the following information shall be submitted:
   1. Lamp fixture descriptive sheets identified by the fixture schedule letter
   2. Equipment sheets shall identify what the equipment refers to by calling out the name of the equipment on the sheet.
   3. Schematics and connection diagrams for all electrical equipment shall be submitted.
   4. Submit all types of conduit and cables with manufacturer and sizes as well as all appurtenances.

1.4 QUALITY ASSURANCE

A. Supplier's qualifications
   1. The entire system shall be designed, coordinated, and supplied by a qualified Electrical Contractor who is regularly engaged in the business of building electrical systems for water and wastewater projects. The Electrical Contractor shall provide a "Statement of Qualifications" indicating that they have successfully provided similar work for at least 5 years.

B. Coordination
   1. The electrical equipment shall be designed and coordinated for proper operation with related equipment and materials furnished by other suppliers under other sections of these specifications. All devices shall be applied in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the instrument or device manufacturer and the manufacturer of related equipment.
   2. Installation drawings shall be prepared for interconnecting wiring and piping between the related equipment and the equipment furnished under this section. All interconnecting wiring shall be appropriate for the service and shall result in a properly functioning system.
   3. The Contractor shall provide coordination with other contractors and supervision of installation as required during construction.
   4. All service entrance work shall be in accordance with the local utility standards.
   5. The electrical contractor shall coordinate all service entrance work with the local utility. The local utility is XCEL Energy.
   6. The electrical contractor shall NOT pay for the utility's work. That shall be billed directly to the owner.
   7. Accurately record actual locations of conduit, duct banks, panels, and accessories.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable Building Code.

B. Electrical: Conform to latest version of NFPA 70.

C. Coordinate, obtain and pay for all permits, inspections and approvals of authority having jurisdiction.

D. Comply with local electrical codes in force or in the absence of local electrical code, the latest edition of the National Electrical Code, ANSI C1.

1.6 WARRANTY

A. The electrical contractor shall warrant the supplied equipment and labor for a period of one year from the date of system acceptance.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The work for this project is for a functioning city building. All new work shall be done in a way that allows the existing facility to maintain its operation.

B. All equipment furnished under this Section shall be selected by the Contractor for its superior quality and intended performance. Unless indicated otherwise, all equipment and material shall be new, undamaged, and meet the requirements of UL. Where UL requirements are not applicable, equipment and material shall be identified as such by the supplier and approved by the Engineer before purchase and installation. Equipment and materials used shall be subject to review and shall comply with the following requirements.

1. Conduit
    a. Minimum Size: ¾ inch unless otherwise specified, or ½ inch for luminaries pendants.
    b. Underground Installations:
        i) Over 100V: More than five feet from foundation wall: Use thick wall nonmetallic conduit.
        ii) Within five feet from foundation wall: Use rigid steel conduit
        iii) Under 100V: Use rigid steel conduit
        iv) Minimum size: 1 inch.
    c. Outdoor Locations, Above Grade: Use rigid steel conduit.
    d. In Slab Above Grade:
        i) Use rigid steel conduit for circuits that are 24V or less.
        ii) Use rigid thick wall non-metallic conduit for 120V to 480V circuits.
        iii) Maximum Size Conduit in Slab: 2 inch, 1 inch for conduits that cross over each other, or with structural engineer's approval.
        iv) Conduits shall not be spaced closer than 3 conduit widths on center.

v) Aluminum conduit shall not be embedded in concrete.
vi) Conduits shall not pass through a structural concrete beam without the structural engineer's approval.

e. In or under slab on grade:
i) Use rigid steel conduit for circuits that are 24V or less.
ii) Use rigid thick wall non-metallic conduit.

f. Wet and damp locations: Use PVC coated rigid steel conduit.

g. Dry locations:
i) Concealed: In walls or above ceilings, use rigid steel or aluminum conduit.
ii) Exposed: Use rigid steel conduit or aluminum conduit.

h. Rigid Steel Conduit.
i) Rigid steel conduit shall be heavy wall, hot-dipped galvanized, and shall conform to Fed Spec WW-C-581 and ANSI C80.1, and shall be manufactured in accordance with UL 6.

i. Rigid Nonmetallic Conduit (PVC).
i) PVC conduit shall be heavy wall, schedule 40, shall be UL labeled for aboveground and underground uses.

j. PVC-Coated Rigid Steel Conduit.
i) The conduit shall be rigid steel and before the PVC coating is applied, the hot-dipped galvanized surfaces shall be coated with a primer to ensure a bond between the steel substrate and the coating. The PVC coating shall be bonded to the primed outer surface of the conduit at a thickness of at least 40 mils. A two part urethane chemically cured coating shall be applied at a nominal 2 mil thickness to the interior of all conduit and fittings.
ii) Manufacturers: Ocal, PermaCote, or Robroy Industries.

k. Rigid Aluminum Conduit.
i) Rigid aluminum conduit shall be heavy wall and shall conform to Fed Spec WW-C-581 and ANSI C80.1, and shall be manufactured in accordance with UL 6.

l. Flexible connections
i) Conduit: Moisture proof vinyl jacketed, liquid-tight, hot-dipped galvanized flexible steel and shall be UL labeled.
ii) Connectors: Watertight, Appleton Type ST or STB, Crouse-Hinds Type LT or LTC, or equal.

2. Outlet Boxes
a. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, Galvanized.
i) Luminaries and equipment supporting boxes: rated for weight of equipment supported.
ii) Concealed installations.

b. Nonmetallic outlet boxes: ANSI/NEMA OS 2.

c. Cast Boxes: NEMA FB 1, Type FD, Cast Ferroalloy.
i) Provide gasketed cover by box manufacturer.
ii) Provide threaded hubs.
iii) Models VXF, GRFX as manufactured by Crouse-Hinds.
iv) Models SEH, JBDX, with mounting lugs as manufactured by Appleton.

3. Pull and Junction
    a. Sheet Metal Boxes: NEMA OS 1, Galvanized Steel.
    b. Surface-Mounted Cast Metal Box: NEMA 250, Type 4 flat-flanged, surface-mounted junction box.
        i) Material: Galvanized cast iron Cast aluminum in corrosive areas.
        ii) Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
        iii) Model: WCB as manufactured by Crouse-Hinds.
    c. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting.
        i) Material: Galvanized cast iron.
        ii) Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
        iii) Cover Legend: ELECTRIC.
        iv) Model: WPD as manufactured by Crouse-Hinds.
4. Large Junction Boxes and Wiring Gutters
    a. Indoor Locations:
        i) Steel, NEMA 12.
    b. Outdoors:
        i) Stainless steel.
        ii) Weather-tight NEMA 4.
    c. Construction.
        i) Provide rigid handles for box covers larger than 9 sq. ft. or heavier than 25 lbs.
        ii) Provide split covers for covers larger than 12 sq. ft.
        iii) Aluminum boxes in concrete not allowed.
5. Seal Fittings
    a. Model ESU with Apelco sealing cement and fiber, as manufactured by Appleton.
    b. Model EZS with Chico X Fiber and Chico A compound as manufactured by Crouse-Hinds.
6. Deflection Fittings
    a. Locations:
        i) Underground conduit runs.
        ii) Runs between concrete sections subject to relative movement.
    b. Material:
        i) Ferroalloy hubs.
        ii) Neoprene outer jacket.
        iii) Stainless steel jacket clamps.
        iv) Molded plastic inner sleeve.
        v) Tinned copper braid grounding strap.
    c. Model XD as Manufactured by Crouse-Hinds.
7. Expansion Fittings
    a. Locations:
        i) In long conduit runs, to permit linear movement caused by thermal expansion and contraction.
        ii) In long conduit runs to prevent conduit from buckling.

iii) Indoors and outdoors, where conduit expansion occurs or where there is a wide temperature range.
iv) At structural expansion joints.

b. Material:
i) End fittings: Ferroalloy.
ii) Body: Steel conduit.
c. Provide Bonding Strap When Used Outdoors.
d. Model XJ, as Manufactured by Appleton and Crouse-Hinds.

8. Flexible Sealing Compound
a. "Duxseal" as Manufactured by Johns-Manville.
b. "Permagum" as Manufactured by In mount.
9. Coal Tar Epoxy Paint
10. Wire and Cable
a. 600 Volt Power Cable
i) General Use:
a) Conductors: Single, copper, 12 AWG minimum.
b) All conductors shall be stranded.
c) Insulation: 600V thermoplastic, UL Type THWN/THHN.
d) Suitability: Wet or dry locations at 75° C and 90° C copper temperature.
e) Or as specified for service entrances.
ii) Service entrance and 4 AWG and above:
a) Conductors: Single, stranded, copper.
b) Insulation: 600V cross-linked polyethylene, UL Type XHHW/USE or THHN.
c) Suitability: Wet or dry locations at 75°C and 90° C copper temperature.
iii) Terminations
a) Lugs, cup washers or pressure type; do not use wire nuts on stranded cable or wrap standard cable around screw type terminals
b. Control circuits
i) General Use:
a) Conductors: Single, tinned copper, 14 AWG
b) All conductors shall be stranded
c) Insulation: 600V thermoplastic, UL Type THWN/THHN.
ii) Millivolt or Milliampere Instrumentation and Control.
a) Conductors: 18 AWG stranded copper, 2 or 3 as required.
b) Insulation: 15 mils, minimum, 90°C PVC.
c) Shield: Mylar aluminum tape with 20 AWG copper drain wire, fully covering conductors.
d) Jacket: 20 mils, minimum, 80°C PVC.
e) Suitability: Wet or dry steel conduit.
iii) Manufacturers: Belden "UL Instrumentation Cable – 1032A", Samuel Moore "Dekoron ICMX" No. 1852-686 and 1862-686, or equal.
c. Arc-Proofing Tape: Irvington "77 Arc-Proofing Tape", Slipknot No. 50 or Slipknot No. 3, or approved equal.
11. Grounding and Bonding

a. Provide rod electrodes, exothermic connections and mechanical connections.
b. Building perimeter ground cable shall be minimum of 4/0 AWG bare copper.
c. Duct bank ground cable shall be minimum of 4/0 AWG bare copper.
d. Other ground cable shall be as noted on the drawings.

12. Power Panels
    a. General:
        i) Circuit breaker panel board.
        ii) With neutral.
        iii) Dead front.
    b. Enclosure:
        i) NEMA 12, surface in unfinished areas, NEMA 1 flush in finished areas or as indicated on the drawings.
        ii) Door with latch and lock.
        iii) Typewritten circuit directory.
        iv) Ground stud bolt through cabinet with removable 1/0 AWG bond to the panel ground bus and an external clamp connector for a station ground conductor.
    c. Circuit Breakers:
        i) Molded case thermal magnetic.
        ii) Multiple pole breakers shall be common trip.
        iii) Bolt-in.
        iv) Individually front replaceable.
        v) Indicating “On”, “Off”, and “Tripped”.
        vi) RMS symmetrical interrupting capacity shall be as indicated on the drawings.
        vii) Breakers, trip ratings, and number of poles as indicated on the drawings.
    d. Buses:
        i) Three phase and neutral bus insulated from cabinet.
        ii) Ground bus.
            a) Connected to cabinet.
            b) Clamp type lug for supply circuit and each load circuit.
            c) Removable bond to neutral bus.
        iii) Copper bussing.
        iv) Ampere and voltage ratings as indicated on the drawings.
        v) Bracing coordinated with circuit breakers interrupting capacity.
13. Equipment Disconnects
    a. General:
        i) Heavy-duty safety switches.
        ii) Square D or Cutler-Hammer.
    b. Enclosure:
        i) Indoor dry areas: NEMA 12.
        ii) Outdoor: NEMA 4X.
        iii) Corrosive Areas: NEMA 4X.
        iv) Use above guidelines unless otherwise noted on drawings.
        v) Padlocked external operating handle.
    c. Switch:
        i) 25,000 amp symmetrical withstand or as indicated on the drawings.

ii) Poles to match equipment served.
iii) 600 VAC.
iv) Continuous current rating not less than the serving branch circuit over current protection.
v) Non-fusible except where fusing is required by the served equipment or as noted on the drawings.

2.2 SPARE PARTS

A. The Supplier shall furnish and deliver the following spare parts.

B. The following spare parts to be furnished as a minimum:
1. Two (2) sets of each type of fuse used in the project.
2. Two (2) spare ballast of each type specified.

C. All of the above parts shall be provided as spare parts and shall be packaged new in the original manufacturer's packaging. A list of spare parts shall be provided.

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. General Requirements
1. The instrumentation equipment shall be installed by the Contractor or his subcontractors in accordance with the manufacturers' instructions. The services of the system supplier's technical representative shall be provided as necessary to calibrate, test, and advise others of procedures for adjustment and operation.

B. Inspection
1. Inspect materials and equipment for signs of damage, deterioration or other deleterious effects of storage, transportation, handling, or defects in manufacture or assembly.
a. Replace with identical new materials or equipment or repair to like new condition any materials or equipment showing such effects to the satisfaction of the Engineer and Owner.

C. Equipment Installation
1. Handle, install, connect, clean, condition, align and adjust products and equipment in strict accordance with manufacturer's instructions and in conformity with specification requirements.
a. Separate sheet metal junction boxes, equipment enclosures, sheet metal raceways, etc., mounted on water or earth-bearing walls or wall-mounted outdoors ¼" from wall be corrosion resistant spacer.
b. Seal the base of all outdoor switchgear, motor control center, and similar equipment with grout.

c. Screen or seal with flexible sealing compound all openings into outdoor equipment to prevent the entrance of rodents, wasps, and mud-daubers.
d. Electrical work shall conform to the construction schedule and progress of other trades.
e. Maintain one complete set of manufacturer's installation instructions at the jobsite during installation and until installation is accepted by the Engineer and Owner.
f. Perform all work in accordance with manufacturer's instructions.
    i) Do not omit any preparatory step or installation procedure unless specifically modified or exempted by contract documents.
    ii) Should job conditions or specification requirements conflict with manufacturer's instructions, consult with Engineer prior to proceeding.
g. Field Wiring. Field wiring materials and installation shall conform to the requirements of the electrical section.

D. Identification:
1. Conduit. All conduits shall be provided with identification tags. Tags shall be brass nameplates with 3/8" high lettering and attached to the conduits by means of stainless steel wire. Conduits shall be identified at both ends with the same identification number.
2. Cable. Except for lighting and receptacle circuits, each individual wire in power, control, indication, and instrumentation circuits shall be provided with identification markers at the point of termination. Power wires without individualized identification numbers shall be color coded with electrical tape or colored wire jacket. The wire markers shall be of the heat-shrinkable tube type.
3. Control Stations. Control stations shall be provided with nameplates identifying the related equipment. Pilot controls and indicating lights shall have engraved or etched legends ("start", "stop", etc.) as indicated on the drawings. Nameplates shall be laminated plastic, with 1/8 inch engraved letters, and shall be securely fastened to the control stations.
4. Circuit Breakers. Circuit breakers shall be provided with nameplates identifying related equipment. Nameplates shall be laminated plastic, with 1/8 inch engraved letters, and shall be securely fastened to the circuit breakers.

E. Raceways:
1. General:
    a. Except as otherwise indicated on drawings, conduit shall be concealed in finished areas and exposed in unfinished areas.
    b. Rigid steel conduit and aluminum conduit connections and terminations shall be reamed, de-burred, threaded and provided with bushings.
    c. Securely fasten conduit connections to sheet metal enclosures with locknuts inside and out. Conduit hubs outdoors and in wet locations.
    d. Provide deflection fittings across structural joints where structural movement is allowed.
    e. Keep conduit clear of structural openings and indicated future openings.
    f. Provide flashing and seal watertight conduits through roofs and metal walls.
    g. Neatly grout conduit into any opening cut into structure.

h. Cap or plug conduits during construction to prevent the entrance of trash, dirt and water.
i. Minimum conduit size shall be ¾", except ½" for luminaries pendants or as noted on drawings.
j. Seal conduits with flexible sealing compound forced to a minimum depth equal to the conduit diameter after cable is installed.
    i) At handholes, manholes, and vaults.
    ii) Building entrance junction boxes.
    iii) One inch or larger connections to equipment.
k. Provide flexible conduit where flexible connections are necessary, including each motor without flexible cord.
    i) Keep length to a minimum, not to exceed 6' maximum.
    ii) No sharp bends.
l. Provide suitable pull string in each empty or spare conduit.

2. Conduit exposed in structures:
    a. Install parallel to structural members and surface.
    b. Install conduits of the same general routing parallel with symmetrical bends.
    c. Arrange supports to prevent misalignment during wiring installation.
    d. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
    e. Group related conduits; support using conduit rack. Construct rack using steel channel provide space on each for 25 percent additional conduits.
    f. Install no more than equivalent of three 90° bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inch size.
    g. Provide suitable pull string in each empty conduit except sleeves and nipples.
    h. Maintain 6" clearance to ducts, piping and flues.
    i. Support rigidly with galvanized or cadmium-plated hardware and framing materials, including nuts and bolts.
    j. Provide expansion fittings at 100' centers outdoors, 200' centers indoors; in each conduit run longer than 100' outdoors, 200' indoors.
    k. Provide galvanized pipe caps on conduit stubs for future use.
    l. Allow 7' headroom for horizontal conduit runs, except along structures, piping equipment or where not possible.
    m. Except as otherwise indicated, do not install exposed conduit in water chambers.
    n. Where allowed, coat conduit exposed in water chambers with 2 coats of coal tar paint with paint injuries repaired or use PVC coated conduit.
3. Conduit concealed in structure:
    a. Install between reinforcing steel in slabs with reinforcing in both faces.
    b. Install under reinforcing steel in slabs where only a single layer is provided.
    c. Terminate conduit for future use in equipment or by galvanized couplings and conduit plugs flush with structural surfaces. Seal plugs with self-leveling caulk.
    d. Maximum of two conduits crossing each other in slab.
4. Underground:
    a. One inch minimum.
    b. Encased in concrete.

i) Two inches between conduits.
ii) Three inches over conduit where not reinforced.
iii) Three inches over reinforcing.
iv) Reinforced at and 5’ past portion on disturbed earth or subject to traffic.
v) Reinforced within 5’ of a structure, manhole or vault.
vi) Reinforced for entire length and 2’ beyond each adapter to steel conduit if non-metallic is used in duct bank.
vii) Where capped underground, reinforce the last 2’ and extend steel and conduit 2’ past end of duct bank. Paint all un-encased metal with 2 coats of coal tar paint.
viii) Continue encasement on outdoor risers to 3” above grade and crown and chamfer top.

c. Two foot minimum bend radius at vertical risers, 3 foot elsewhere.
d. Install underground conduit so that it does not drain to cable pulling access in buildings; where necessary, provide a handhole or manhole near or adjacent to building.
e. Provide 3 foot minimum earth cover.
f. Install underground conduits through buildings, manhole, handhole and vault walls in box outs as indicated on the drawings.
g. All steel inside manholes, handholes and vaults shall be galvanized with bared spots treated with zinc rich paint.
h. Provide ¾” galvanized steel pulling eyes on opposite walls below the centerline of each duct bank.
i. Provide end bells at wall terminations and adapters for steel conduit continuations for non-metallic duct systems.
j. Isolate intercommunication and milliampere level instrumentation circuits from all power wiring raceways, conduits, boxes, vaults, manhole and handhole.
k. Provide a full-size extension for each underground conduit entering a building.
l. Rigid nonmetallic conduit (PVC) shall be fastened no less than every 4 feet.

5. Junction boxes and wiring gutters:
a. Install electrical boxes as shown on drawings and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
b. Install pull boxes and junction boxes to maintain headroom and to present neat mechanical appearance.
c. Install level and plumb.
d. Where indicated, provide a removable side opposite underground duct banks.
e. At least code size including space for full size continuation of any conduit not originally continued.
f. Arrange conduit for maximum space for future conduits.
g. Support boxes independently of conduit except cast box that is connected to rigid metal conduits both supported within 12 inches of box.

F. Wire and Cable
1. General:

a. Protect the cable and avoid kinking conductors, cutting or puncturing jackets, contaminating by oil or grease or damaging in any manner.
b. Terminate stranded cable with lugs, cup washers, or pressure type connectors; do not wrap stranded cable around screw type terminals.
c. Splice stranded cable with pressure type connectors; do not use wire nut type connectors on stranded cable.
d. Splice cables only at readily accessible locations.
e. Do not pull cable tight against bushings or press heavily against enclosures.
f. Use cable pulling lubricants as recommended by the cable manufacturer.
g. Use swab to clean conduits and ducts before pulling cables.
h. Install cable and accessories in accordance with manufacturer's instructions.
i. Where necessary to prevent heavy loading of cable connectors due to cable weight, support cables in vertical risers with woven cable grips.
j. Coil and tape spare cable ends.
k. Support each 250 MCM or larger cable, and each conduit group of smaller cables from manholes, handholes or vault walls.
l. Use Stranded conductor for feeders and branch circuits.
m. Use stranded conductors for control circuits.
n. Use conductor not smaller than 12 AWG for power and lighting circuits.
o. Use conductor not smaller than 16 AWG for control circuits.
p. Use 10 AWG conductors for 20 ampere, 120 Volt branch circuits longer than 100 feet.
q. Pull all conductors into raceway at same time.
r. Use suitable wire pulling lubricant for building wire 8 AWG and larger.
s. Protect exposed cable from damage.
t. Neatly train and lace wiring inside boxes, equipment, and panel boards.
u. Clean conductor surfaces before installing lugs and connectors.
v. Make splices, taps, and terminations to carry full ampacity of conductors.

2. Special cables:
   a. Isolate networking and milliampere level instrumentation cables from all power circuits.
   b. Isolate telephone cables from all other circuits.
3. Conductor identification:
   a. Color code all service, feeder, and branch circuit conductors, 277/480 VAC and above as follow:
      i) Phase A: Brown
      ii) Phase B: Orange
      iii) Phase C: Yellow
      iv) Neutral: White
      v) Ground: Bare or Green
   b. Color code all feeder, and branch circuit conductors, 120/208 VAC as follows:
      i) Phase A: Red.
      ii) Phase B: Black.
      iii) Phase C: Blue.
      iv) Neutral: White.
      v) Ground: Bare or Green.

c. Identify single control conductors by color coding orange and by labeling each end of conductors by color coding orange and by labeling each end of conductor with heat shrink-tube type wire markers.
d. Identify multi-conductor instrumentation and control cables with heat shrink-tube type wire markers.
e. Contractor shall establish a control and instrumentation conductor and cable identification system acceptable to Engineer.

G. Grounding Materials:
1. Coordinate installation with other disciplines.
2. Verify that final backfill and compaction has been completed before driving rod electrodes.
3. Install Products in accordance with manufacturer's instructions.
4. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
5. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing.
6. Provide bonding to meet Regulatory Requirements.
7. Install ground cable through building walls within 3' below finish grade and prepare a water stop.
8. Install ground rods and cables as deep in earth as possible and as far from structure as possible, not closer than 6".
9. All branch circuit and feeder circuits to include a copper ground conductor in addition to the conduit ground connection.
10. Connect ground conductors to equipment by ground lugs or clamps.
a. If no ground bus or terminal is provided and enclosure is not explosion-proof or submersible provide a clamp type lug under a permanent assembly bolt or by grounding locknuts or bushings.
b. If an explosion-proof or submersible enclosure is not provided with grounding means, provide an adjacent junction box with a ground lug.
c. Bond grounding system to station piping by connection to the first flange inside the building on either a suction or discharge pipe which will form a good ground connection:
i) Drill and tap the flange.
ii) Provide a bolted connection.
iii) Bond with a copper bar or strap.
d. Form ground conductors on equipment to the contours of the equipment.
e. Install main ground cables with encased underground conduit banks in earth at least 3" below 1 corner of the duct bank.
f. Bond ground cables in underground circuits to main ground cables at each manhole, handhole, and vault.

3.2 FIELD QUALITY CONTROL

A. Low Voltage Cable Testing

1. Test 600 V power cables for continuity and freedom from short circuits and ground, except where grounding is intentional immediately after installation.
2. Test all circuits with a 500 V megger or its equivalent.
3. Replace conductors which read less than 1.5 Megohms between conductors and ground.

3.3 PROTECTION AND STORAGE

A. Protection of equipment during storage:
   1. During construction, all electrical equipment shall be protected against absorption of moisture, and metallic components shall be protected against corrosion. This protection shall be provided immediately upon receipt of the equipment and shall be maintained continuously. Any means necessary shall be used to protect the equipment at the Contractor's expense.

END OF SECTION

SECTION 40 05 13 - COMMON WORK RESULTS FOR PROCESS PIPING

PART 1 GENERAL

1.1 SUMMARY

This Section applies to the furnishing and installation of piping inside a building, structure, enclosure piping and miscellaneous yard piping.

A. Related Sections:

1. Section 09 90 00, Painting and Coating

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME):

1. ASME B1.20.1 Pipe Threads, General Purpose (inch)
2. ASME A13.1 - Scheme for the Identification of Piping Systems.
3. ASME B16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy, and other Special Alloys
4. ASME B16.15 - Cast Copper Alloy Threaded Fittings: Classes 125 and 250.
5. ASME B31.3 - Process Piping.
6. ASME B31.9 - Building Services Piping.

B. ASTM International (ASTM):

1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 6,000 psi Tensile.
3. ASTM A325 - Specification for High-Strength Bolts for Structural Steel Joints.
4. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
5. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
6. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
7. ASTM D792 - Test Methods for Specific Gravity and Density of Plastics by Displacement.
8. ASTM D1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
9. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

10. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

11. ASTM D2000 - Classification System for Rubber Products in Automotive Applications.

12. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

13. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

14. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

C. American Water Works Association (AWWA):

1. AWWA C200 - Steel Water Pipe - 6 In. (150 mm) and Larger.

2. AWWA C207 - Steel Pipe Flanges for Water Works Service, Sizes 4 in through 144 in.

3. AWWA C219 - Bolted, Sleeve-Type Couplings for Plain-End Pipe.

4. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.

5. AWWA C510 - Double Check Valve Backflow Prevention Assembly.

6. AWWA C511 - Reduced-Pressure Principal Backflow Prevention Assembly.

7. AWWA C606 - Grooved and Shouldered Joints.

8. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.

D. American Welding Society (AWS):

1. AWS D1.1 - Structural Welding Code.

E. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry:

1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

F. NSF International (NSF):

1. NSF 61 - Drinking Water System Components - Health Effects.

2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 COORDINATION

A. Coordinate installation of specified items with installation of valves and equipment.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit Manufacturer catalog information for each product specified.

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. Provide all necessary dimensions and details on pipe joints, restraints, fittings, fitting specials, valves, appurtenances, design calculations, and material lists.

3. Provide detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, couplings, and pipe supports necessary to accommodate the equipment and valves provided in a complete and functional system.

D. Manufacturer's Statement: Certifying pipe fabrication and products meet or exceed specified requirements.

E. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS and ASME qualification within previous 12 months.

F. Manufacturer Instructions: Submit special procedures and setting dimensions.

G. Source Quality-Control Submittals: Indicate results of shop tests and inspections.

H. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping appurtenances.

B. Identify and describe unexpected variations to pipe routing or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Drawings:

1. Piping layouts shown in the Drawings are intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. The mechanical drawings are not pipe construction or fabrication drawings. It is the Contractor's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, etc., for a complete and functional system.

B. Inspection:

1. All pipe shall be subject to inspection at the place of manufacture.

2. During the manufacture of the pipe, the Engineer shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

C. Welding:

1. All welding procedures used to fabricate pipe shall be prequalified under the provisions of ANSI/AWS D1.1.

2. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot, and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

D. Welders:

1. Skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used shall do all welding.

2. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local approved testing agency prior to commencing work on the pipeline.

3. Machines and electrodes similar to those used in the Work shall be used in qualification tests.

4. The Contractor shall furnish all material and bear the expense of qualifying welders.

E. Tests: Except where otherwise specified, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards. Welds shall be tested as specified. The Contractor shall perform all tests at no additional cost to the Owner.

1.7 MATERIAL DELIVERY, STORAGE, AND INSPECTION

A. Inspection:

1. Accept materials on Site in Manufacturer's original packaging and inspect for damage.

2. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition.

B. Storage:

1. Store materials according to Manufacturer instructions.

2. Store materials off the ground, to provide protection against oxidation caused by ground contact

C. 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.

D. All defective or damaged materials shall be replaced with new materials.

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 GENERAL

A. All materials in contact with plant and potable water shall conform to ANSI/NSF Standard 61 and meet the "lead free" requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for "lead free".

2. All brass in contact with potable water shall comply with ASTM B584.

B. Unless specified otherwise or indicated differently in the Drawings, all piping systems and process piping materials shall be as listed in the table below or as shown on the Drawings:

Service	Material
Exposed ≥ 4"	Class 52 Ductile Iron or Heavy Wall Welded Steel
Exposed < 4"	Brass - ASTM B 43, Fittings - Bronze - ASTM B 62 Threaded - ANSI/ASME B 16.15 or PVC
Miscellaneous Pipelines	As shown in the Drawings

2.2 DUCTILE IRON PIPE AND FITTINGS

A. Ductile Iron Pipe:

1. Centrifugally cast, conforming to AWWA Standard C151.

2. Coating: Asphaltic exterior coating in accordance with AWWA Standard C151.

3. Pipe Mortar Lining: Shop-applied NSF 61 cement mortar lining, smoothed finish, complying with AWWA C104.

4. Pipe Thickness Class:

a. Comply with AWWA C151.

b. Class 52.

1) The Contractor shall be aware ductile iron piping with thickness class greater than Class 52 may have long fabrication and supplier lead times. The Contractor shall be responsible for coordinating product submittal and delivery times accordingly such as not to delay construction.

5. Joints:

a. Joint types shall be provided as required for the application.

b. Flanged Joints:

1) Flat faced, complying with AWWA C111 and C115, unless otherwise specified.

2) Bolt hole drilling according to ASME/ANSI B16.1, Class 125, or ASME/ANSI B16.1, Class 250, where specified. Flanges shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise shown.

3) The Contractor shall coordinate with pipe, valve, and fitting suppliers to make certain mating pipe, valve, and fitting flanges match in bolt pattern.

4) Pressure rating of flange joints shall not exceed the rating of the pipe or fitting of which they are a part, and the maximum pressure rating of the joint shall be 250 psi.

5) Flange joint connections shall not be exposed to test pressures greater than 1-1/2 times their rated working pressure.

6) Gaskets:

a) Full faced, composed of synthetic rubber and 1/8-inch-thick conforming to ASME B21.1 and AWWA C111.

b) Ring gaskets will be permitted only where specifically noted in the Drawings and Specifications.

c) Gaskets for flanged joints shall be as follows:

(1) Pipe sizes between 6-inch and 24-inch diameter shall be Garlock 3760-U or equal.

c. Grooved Joints:

1) Install grooved and shouldered pipe joints according to AWWA C606.

2.3 STEEL PIPE AND FITTINGS

A. General Service Piping:

1. ASTM A53, seamless, Grade B.

2. Schedule: 40, unless indicated otherwise on Drawings.

2.4 FLEXIBLE TUBING

A. Polyethylene thermoplastic tubing:

1. Standard weight, conforming to ASTM D1248 Type 1, Class A, Category 4, Grade E5.

2.5 STAINLESS STEEL TUBING AND FITTINGS

A. Type 316 stainless steel, unless otherwise specified or shown in the Plans.

B. Meet the material standards set forth in ASTM A269.

C. Fittings: ASTM A276 and ASTM A182.

1. Threaded fittings: National pipe thread meeting the requirements of ASME B1.20.1.

2. Compression fittings: Two-ferrule, mechanical grip design.

D. Unions: Provide to facilitate installation and maintenance of tubing.

E. Manufacturer:

1. Swagelock, or equal.

2.6 PIPE PENETRATIONS

A. Mechanical Sleeve Seals:

1. Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2. Manufacturer: Link-Seal or equal.

2.7 PIPE COATINGS

A. See Section 09 90 00, Painting and Coating.

PART 3 EXECUTION

3.1 GENERAL

A. Furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, hangers, supports, anchors, expansion joints, flexible connectors, valves, accessories, heat tracing, insulation, lining and coating, testing, disinfection, excavation, backfill, and encasement, to provide a functional installation.

B. Pipe shall be installed in accordance with good trade practice. The methods employed in handling and placing of pipe, fittings, and equipment shall be such as to insure that after

installation and testing they are in good condition. Should damage occur to the pipe, fitting or equipment, repairs satisfactory to the Engineer shall be made.

3.2 INSTALLATION

A. Interior Piping Systems:

1. Install non-conducting dielectric connections wherever joining dissimilar metals.

2. Establish elevations of buried piping outside valve vault to obtain not less than 3 feet of cover.

3. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting as specified in Section 09 90 00, Painting and Coating.

4. Install water piping according to ASME B31.9.

5. Install unions downstream of valves and at equipment or apparatus connections.

6. Install brass male adapters each side of valves in copper piped system, solder adapters to pipe.

B. Pipe Penetrations:

1. Exterior Watertight Entries: Seal with mechanical sleeve seals and grout, as shown in the Drawings.

2. Whenever a pipeline of any material terminates at or through a structural wall or floor, install piping or sleeve in advance of pouring of concrete required for the particular installation.

3. Plastic pipe shall not be cast in concrete or masonry walls.

4. Set sleeves in position in forms and provide reinforcing around sleeves.

5. Size sleeves large enough to allow for movement due to expansion and contraction and provide for continuous insulation wrapping.

6. Extend sleeves through floors 1-inch above finished floor level and caulk sleeves.

7. Pipe other than concrete, to be cast in water-bearing walls or more than 4 feet below grade shall have seep rings.

8. All buried piping entering structures shall have a flexible connection installed less than 2 feet outside the structure line or as close to the wall as practical.

3.3 CLEANING, TESTING, AND DISINFECTION

A. Testing and Disinfection: Piping shall be hydrostatically tested, flushed, and disinfected as directed by the Owner.

END OF SECTION

SECTION 40 05 51 – COMMON WORK RESULTS FOR PROCESS VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes basic materials and methods related to valves commonly used for process systems, including utility vaults and water treatment. This Section is to be used in conjunction with Section 40 05 51.18, Butterfly Valves.

B. Section Includes:

1. Valves.
2. Valve actuators.

C. Related Sections

1. Section 09 90 00, Painting and Coating
2. Section 40 05 13, Common Work Results for Process Piping
3. Section 40 05 51.18, Butterfly Valves

1.2 REFERENCE STANDARDS

A. American Water Works Association (AWWA):

1. AWWA C504 - Rubber-Seated Butterfly Valves, 3 In. Through 72 In.
2. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
3. AWWA C541 - Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates.
4. AWWA C542 - Electric Motor Actuators for Valves and Slide Gates.
5. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.

B. ASTM International (ASTM):

1. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
2. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

C. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):

1. MSS SP-25 - Standard Marking System for Valves, Fittings, Flanges and Unions.

D. National Electrical Manufacturers Association (NEMA):

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code (NEC).

F. NSF International (NSF):

1. NSF 61 - Drinking Water System Components - Health Effects.

2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 COORDINATION

A. Contractor shall be solely responsible to coordinate Work of this Section with piping, equipment, and appurtenances.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit Manufacturer's latest published literature. Include illustrations, installation and maintenance instructions, and parts lists.

2. Submit valve cavitation limits.

3. Submit Manufacturer data for actuator with model number and size indicated.

C. Shop Drawings (for electrically actuated valves only):

1. Submit description of proposed installation, including associated wiring diagrams and electrical data as may be specified elsewhere in the contract documents.

2. Provide assembly drawings indicating parts list, materials, sizes, position indicators, limit switches, actuator mounting, wiring diagrams, and control system schematics.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit installation instructions and special requirements, including storage and handling procedures.

F. Lining and coating data.

G. Valve Labeling Schedule: Indicate valve locations and nametag text.

H. Certification of Valves Larger than 12 inches: Furnish certified copies of hydrostatic factory tests, indicating compliance with applicable standards.

I. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

J. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections, including factory-applied coatings.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves and actuators.

B. Operation and Maintenance Data: Submit information for valves.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts:

1. Furnish one set of Manufacturer's recommended spare parts.

B. Tools:

1. Furnish special wrenches and other devices required for Owner to maintain equipment.

2. Furnish compatible and appropriately labeled toolbox when requested by Owner.

1.7 QUALITY ASSURANCE

A. Cast Manufacturer's name, pressure rating, size of valve, and year of fabrication into valve body.

B. Valve Testing: Each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

C. Certification: Prior to shipment, submit for all valves over 12 inches in diameter, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, ASTM, etc. Valves tested and supplied shall be trackable and traceable by serial number, tagged or otherwise noted on valve, upon arrival to Site.

D. Unless otherwise noted, all water works materials provided for the Project shall be new, of first-class quality and shall be made by reputable manufacturers.

E. All material of a like kind shall be provided from a single manufacturer, unless otherwise approved by the Engineer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in Manufacturer's original packaging and inspect for damage.

B. Store materials according to Manufacturer instructions.

1. Store materials in areas protected from weather, moisture, or other potential damage.

2. Do not store materials directly on ground.

C. 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.

D. Handle products carefully to prevent damage to interior or exterior surfaces.

E. All defective or damaged materials shall be replaced with new materials at no cost to the Owner.

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 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the “lead free” requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for “lead free”.

2. All brass in contact with potable water shall comply with ASTM B584.

2.2 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 and shown in the Drawings.

B. 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.

C. Valve Construction:

1. Bodies: Rated for maximum temperature and pressure to which valve will be subjected as specified in valve Sections.

D. Connecting Nuts and Bolts: 316 stainless steel.

2.3 NOT USED

2.4 RUBBER-SEATED BUTTERFLY VALVES

A. As specified in Section 40 05 51.18, Butterfly Valves.

2.5 BUTTERFLY VALVE ACTUATORS

A. All valve actuators shall be pneumatic or electric, as indicated in the Valve Schedule on sheets D-090 and D-091.

B. Actuators shall be sized for the valve design pressure in accordance with AWWA C504.

C. Comply with AWWA C541 and C542, where applicable.

D. Gear-Assisted Manual Actuators:

1. Not used.

E. Handwheel:

1. Furnish permanently attached handwheel where indicated on the Drawings.

2. Rotation: Open left.

3. Permanently affix directional arrow and cast OPEN or CLOSE on handwheel to indicate appropriate direction to turn handwheel.

4. Maximum Operating Force: 60 lbf.

F. Chain Actuator:

1. Not used.

G. Pneumatic Actuators for Butterfly Valves:

1. General

a. Actuators shall either be fully replaced, refurbished, or removed and reset as indicated on the Drawings and Specifications.

b. All actuators shall be double acting and ¼ turn.

c. All actuators shall be installed with a clear cone position monitor.

d. Operating air pressure: 20 psi to 100 psi.

e. Operating temperature: -40°F to 175°F.

2. Casing

a. Material: Die cast aluminum alloy.

b. External finish: Epoxy stove enamel.

c. Seals: Double opposed, molded polyurethane.

d. Seal expanders: Spring-tempered stainless steel

3. Shaft brushes

a. Material: PTFE coated bronze.

4. Couplings

a. Material: Weldable mild steel with zinc plating.

5. Switch boxes

a. Input: 4-20mA

b. Switches: 2 to 4, depending on existing actuator to be replaced or refurbished.

6. Solenoid valves

a. Install with exhaust mufflers, manual override, and speed control.

b. Manufacturer: Numatics or equal.

7. Mounting brackets

a. “Box” style.

b. Material: Weldable mild steel, zinc plated.

8. I/P Controller

a. Input: 4-20mA

9. Manufacturer:

a. Kinetrol

b. Or equal.

H. Electric Motor Actuators for Butterfly Valves:

1. Conduit and wiring as specified in Section 26 00 00 – Basic Electrical and following:

a. 1/12 to 1/2 hp (dependent on valve size and open/close vs modulating operation), 460 VAC, three phase.

2. Control Panel:

a. Factory mounted.

b. NEMA 250, Type 6P.

c. Single-point power connection and grounding lug.

3. Controls: MWG magnetic limit / torque sensor (non-intrusive setting).

4. Disconnect Switch: Factory mounted in control panel.

5. Operation: Open/close or modulating, as indicated on the drawings.

6. Gearing:

    a. Worm gearing.

    b. Lubrication: Grease in sealed housing.

7. Manufacturers

    a. AUMA

    b. Or approved equal.

2.6 BUTTERFLY DAMPERS FOR PROCESS AIR FLOW CONTROL

A. Description: Round, single-blade fiberglass reinforced plastic (FRP) dampers with AMCA Certified Ratings Seal and conforming to ASTM D3982.

1. Frame: One-piece fiber reinforced vinyl ester FRP

2. Axle: 316 SS

3. Blade: One-piece fiber reinforced vinyl ester FRP

4. Bearings: Teflon

5. Internal Hardware: 316 SS

6. Gasket: EPDM

7. External Coating: Gel coat with UV protection and gray color to match existing

8. Approximate Torque Requirement: 600 in-lb

B. Manufacturers:

1. NOV Belco Model 203 or 204

2. Or approved equal.

2.7 ELECTRIC MOTOR ACTUATORS FOR BUTTERFLY DAMPERS

A. Description:

1. Conduit and wiring as specified in Section 26 00 00 – Basic Electrical and following:

    a. 60 Hz, 115 V, 0.8 A (locked rotor), 50% full load duty, single phase.

2. Control Panel:

a. Factory mounted.

b. NEMA 250, Type 4.

c. Single-point power connection and grounding lug.

3. Controls: Open/close.

4. Disconnect Switch: Factory mounted in control panel.

5. Manufacturer:

a. Dresser RCS

b. ABZ Valve

c. Or approved equal.

2.8 SOURCE QUALITY CONTROL

A. Testing: Test valves according to Manufacturer's standard testing protocol, including hydrostatic, seal, and performance testing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping system is ready for valve installation.

3.2 PREPARATION

A. Access: All valves shall be installed to provide easy access for operation, removal, and maintenance and to avoid conflicts between valve operators and structural members or handrails.

B. Valve Accessories: Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the Contractor to properly assemble and install these various items so that all systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on shop drawing submittals.

3.3 INSTALLATION

A. Install valves, actuators, extensions, and accessories according to Manufacturer instructions.

B. Firmly support valves to avoid undue stresses on piping.

C. Coat studs, bolts, and nuts with anti-seizing lubricant.

D. Clean field welds of slag and splatter to provide a smooth surface.

E. Install valves with stems upright or horizontal, not inverted.

F. Install valves with clearance for installation of insulation and allowing access.

G. Provide access where valves and fittings are not accessible.

H. Comply with Division 40 - Process Interconnections for piping materials applying to various system types.

I. Valve Applications:

1. Install shutoff and drain valves at locations as indicated on Drawings and as specified in this Section.

2. Install shutoff and isolation valves.

3. Isolate equipment, part of systems, or vertical risers as indicated on Drawings.

4. Install valves for throttling, bypass, or manual flow control services as indicated on Drawings.

J. Disinfection of Water Piping System:

1. Flush and disinfect system as required by the Owner.

3.4 FIELD QUALITY CONTROL

A. Valve Field Testing:

1. Test for proper alignment.

2. Field test equipment to demonstrate operation without undue leakage, noise, vibration, or overheating.

3. Owner will witness field testing.

3.5 SCHEDULE FOR PROCESS VALVES

A. See sheets D-090 and D-091.

END SECTION

SECTION 40 05 51.18 - BUTTERFLY VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes butterfly valves for use in utility vaults and water treatment plants. Coordinate with Section 40 05 51, Common Requirements Results for Process Valves.

B. Section Includes:

1. Rubber-seated butterfly valves.

C. Related Sections:

1. Section 40 05 13, Common Work Results for Process Piping.

2. Section 40 05 51, Common Requirements Results for Process Valves.

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME):

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.

2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 - Metric/Inch Standard.

3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

B. ASTM International (ASTM):

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 B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

C. American Water Works Association (AWWA):

1. AWWA C504 - Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm).

2. AWWA C550 - Protecting Interior Coatings for Valves and Hydrants.

D. NSF International (NSF):

1. NSF/ANSI Standard 61 - Drinking Water System Components - Health Effects

2. NSF/ANSI Standard 372 - Drinking Water System Components - Lead Content

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. As required by Section 40 05 51, Common Requirements Results for Process Valves.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the “lead free” requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for “lead free”.

2. All brass in contact with potable water shall comply with ASTM B584.

2.2 RUBBER-SEATED BUTTERFLY VALVES

A. Description:

1. Comply with AWWA C504, Class 150B and 250B as indicated in the Valve Schedule on sheets D-090 and D-091.

2. Minimum Pressure Rating:

a. As indicated in the Valve Schedule on sheets D-090 and D-091.

3. End Connections: As indicated in the Valve Schedule on sheets D-090 and D-091.

a. Standard mechanical joint ends comply with ANSI/AWWA C111.

b. Flanged end dimensions and drilling comply with ANSI/ASME B16.1, class 125, unless shown otherwise. Comply with AWWA C115 & ASME 16.5.

1) The Contractor shall coordinate with pipe, valve, and fitting suppliers to make certain pipe, valve, and fitting flanges match in bolt pattern.

4. Linings and Coatings:

a. Corrosion-resistant fusion bonded epoxy conforming to AWWA C550 and NSF 61.

b. All internal and external ferrous surfaces.

c. Do not coat flange faces of valves.

5. Bubble-tight at the rated pressure for bi-directional flow.

6. Style: As indicated in the Valve Schedule on sheets D-090 and D-091.

7. Shaft: Self-lubricating, sleeve-type bearings. One-piece, through-shaft construction.

a. Valve shafts shall be full size for that portion of the shaft extending through the valve bearings, valve disc, and shaft seal.

b. Any portion of the shaft turned down for any reason shall have fillets with radii equal to the offset to minimize stress concentrations at the junction of the different shaft diameters. The turned down portion of the shaft shall be capable of transmitting the maximum operator torque without exceeding a torsional steel stress of 11,500 pounds per square inch (psi).

8. Seats: Mounted on body for valves 24 inches and smaller; field replaceable (mechanically retained in a machined groove) for valves larger than 24 inches.

9. Packing: Replaceable without dismantling valve.

B. Operation:

1. Open counterclockwise, unless otherwise indicated in the Drawings.

2. Operators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position between full open and fully closed without creeping or fluttering.

3. In-Plant Service Valves: As indicated in the Drawings.

C. Materials:

1. Body: ASTM A126, cast iron or ASTM A536, ductile iron. Integrally cast flanged or mechanical end joints.

2. Shaft: 316 or 416 stainless steel.

3. Disc: 316 stainless steel or ductile iron.

4. Seats: Resilient, replaceable, EPDM.

5. Seating Surfaces: 316 stainless steel.

6. Bearings:

a. Sleeve: Corrosion-resistant and self-lubricating.

D. Manufacturers:

1. Bray (wafer).

2. Henry Pratt Company (flanged).

3. Or equal.

2.3 SOURCE QUALITY CONTROL

A. Testing: Test butterfly valves according to AWWA C504.

PART 3 EXECUTION

3.1 INSTALLATION

A. As required by 40 05 51 - Common Requirements Results for Process Valves.

B. Install according to Manufacturer's instructions.

END OF SECTION

SECTION 40 95 00

PROGRAMMABLE LOGIC CONTROLLERS

PART 1 GENERAL

1.1 SUMMARY

A. This section includes the items listed below and all other components necessary for a complete system as noted herein and indicated on the drawings
   1. Programmable Logic Controllers (PLCs)
   2. Communication equipment
   3. HMI software
   4. Programming
   5. Spare parts

B. Related Sections
   1. Division 01 – Materials and Equipment
   2. Section 26 00 00 – Electrical
   3. I/O list

1.2 REFERENCES

A. ISA 5.1 – Instrumentation Symbols and Identification

B. NEMA ICS 1 – General Requirements for Industrial Control and Systems

C. NEMA ICS 2 – Standards for Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated 600 Volts

D. DEMA ICS 3 – Industrial Control and Systems: Factory Built Assemblies

E. NEMA ICS 6 – Industrial Controls and Systems: Enclosures

1.3 DESIGN REQUIREMENTS

A. Discrete input/output signals shall all be 120VAC

B. Analog input/output signals shall all be 4-20mA

C. Analog signal isolators shall be independently powered units capable of driving two 4-20mA signals

D. All required buffers, isolators, signal converter, and amplifiers for coordination with other equipment furnished under other sections, and between items of equipment needed for a complete system shall be furnished under this section of the specifications whether indicated on the Drawings or not or detailed in these specifications or not

1.4 SYSTEM DESCRIPTION

A. Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.
   1. I/O List. An I/O list is attached at the end of this section

1.5 SUBMITTALS

A. Submittals shall be required as noted in Section 26 00 00.

1.6 QUALITY ASSURANCE

A. Supplier's qualifications
   1. The entire system shall be designed, coordinated, and supplied by the system integrator supplier.

B. Coordination
   1. The PLCs and PLC system shall be designed and coordinated for proper operation with related equipment and materials furnished by other suppliers under other sections of these specifications. All devices shall be applied in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the instrument or device manufacturer and the manufacturer of related equipment.
   2. Installation drawings shall be prepared for interconnecting wiring and piping between the related equipment and the equipment furnished under this section. All interconnecting wiring shall be appropriate for the service and shall result in a properly functioning system.
   3. The Contractor shall provide coordination with other contractors and supervision of installation as required during construction.

1.7 WARRANTY

A. The Supplier shall warrant the hardware, software, and configuration related to the operational performance of the facility for a period of one years from the date of system acceptance. The Supplier shall provide a two-year software service agreement to include any and all minor and/or major releases and upgrades, and shall correct any problems or "bugs" which prohibit the SCADA system from performing process operations in accordance with these specifications.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMNTS

A. All equipment furnished under this section shall be selected by the system supplier for its superior quality and intended performance. Unless indicated otherwise, all equipment and material shall be new, undamaged and meet the requirements of UL. Where UL requirements are not applicable, equipment and material shall be identified as such by the

supplier and approved by the Engineer before purchase and installation. Equipment and materials used shall be subject to review and shall comply with the following requirements.

1. Interchangeability. All PLC systems shall be products of the same manufacturer and of the same series or product line. Processors, local and remote input/output hardware, communications modules, and specialty modules shall be interchangeable among all I/O panels and systems.
2. Installed I/O requirements. Each PLC shall have I/O modules installed to accommodate requirements shown on drawings and the I/O List at the end of this section and with a minimum of 20% spares installed.
3. Acceptable Manufacturers.
   a. PLC – Modicon M340, M580, and no equal.
4. Modules shall be added as needed to provide for all the I/O required on the project plus the spares.
5. All Analog signals shall be logged in the Historian Software
6. Autodialer alarms shall be selected and configured per the owner's requirements.

2.2 MATERIALS AND EQUIPMENT

A. Programmable Logic Controller (PLC)
   1. The additions to the PLC system shall include, but are not limited to, the following components:
      a. Input/Output Modules
         i) Analog Input Modules
            a) Number of Inputs: 8
            b) Signal Range: 4-20mA
            c) Module shall be Schneider Electric AMI0810.
         ii) Analog Output Modules
            a) Number of Inputs: 4
            b) Signal Range: 4-20mA
            c) Module shall be Schneider Electric AMO0410.

B. PLC Programming Software
   1. The PLC programming software shall be Scheider Electric EcoStruxure, no equal.

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. General Requirements
   1. It shall be the Supplier's responsibility to ensure that the entire PLC system and HMI system is installed in a satisfactory condition per these specifications and the manufacturer's requirements.

B. Inspection

1. Inspect materials and equipment for signs of damage, deterioration or other deleterious effects of storage, transportation, handling, or defects in manufacture or assembly.
    a. Replace with identical new materials or equipment or repair to like new condition any materials or equipment showing such effects to the satisfaction of the Engineer and Owner.

C. Equipment Installation
1. Handle, install, connect, clean, condition, align and adjust products and equipment in strict accordance with manufacturer's instructions and in conformity with specification requirements.
    a. Maintain one complete set of manufacturer's installation instructions at the jobsite during installation and until installation is accepted by the Engineer and Owner.
    b. Perform all work in accordance with manufacturer's instructions.
        i) Do not omit any preparatory step or installation procedure unless specifically modified or exempted by contract documents.
        ii) Should job conditions or specification requirements conflict with manufacturer's instructions, consult with Engineer prior to proceeding.

D. Adjustment and Cleaning
1. Perform all required adjustments, tests, operational checks, cleaning and other start-up activities required.
2. Take precautions, as necessary, to properly protect all equipment from damage. Installed equipment to be protected from further construction operations.

E. PLC and HMI Programming.
1. The Contractor shall be responsible for all PLC and HMI programming.

3.2 CUSTOMER TRAINING
1. The system supplier shall provide a qualified representative at the job site to train the Owner’s personnel in operating and maintenance of the equipment. The training sessions shall include a technical explanation of the equipment and an actual hands-on demonstration. The training session shall consist of two consecutive 4-hour working days, and the schedule shall be arranged and coordinated with the Engineer.

3.3

I/O LIST WES BROWN WTP PLC-1
I/O List
(Only I/O points other than the packaged systems are shown here)

Tag #	Description	DI	DO	AI	AO	Scale	Notes
HS-5010	UV TRAIN 1 FLOW CONTROL VALVE IN REMOTE	1					EXISTING
ZSC-5010	UV TRAIN 1 FLOW CONTROL VALVE CLOSED	1					EXISTING

ZSO-5010	UV TRAIN 1 FLOW CONTROL VALVE OPENED	1					EXISTING
ZI-5010	UV TRAIN 1 FLOW CONTROL VALVE POSITION INDICATION			1			
ZC-5010	UV TRAIN 1 FLOW CONTROL VALVE POSITION COMMAND				1		
HS-5012	UV TRAIN 1 ISOLATION VALVE IN REMOTE	1					EXISTING
ZSC-5012	UV TRAIN 1 ISOLATION VALVE CLOSED	1					EXISTING
ZSO-5012	UV TRAIN 1 ISOLATION VALVE OPENED	1					EXISTING
ZCO-5012	UV TRAIN 1 ISOLATION VALVE OPEN COMMAND		1				EXISTING
ZCC-5012	UV TRAIN 1 ISOLATION VALVE CLOSE COMMAND		1				EXISTING
HS-5015	UV TRAIN 2 FLOW CONTROL VALVE IN REMOTE	1					EXISTING
ZSC-5015	UV TRAIN 2 FLOW CONTROL VALVE CLOSED	1					EXISTING
ZSO-5015	UV TRAIN 2 FLOW CONTROL VALVE OPENED	1					EXISTING
ZI-5015	UV TRAIN 2 FLOW CONTROL VALVE POSITION INDICATION			1			
ZC-5015	UV TRAIN 2 FLOW CONTROL VALVE POSITION COMMAND				1		
HS-5017	UV TRAIN 2 ISOLATION VALVE IN REMOTE	1					EXISTING
ZSC-5017	UV TRAIN 2 ISOLATION VALVE CLOSED	1					EXISTING
ZSO-5017	UV TRAIN 2 ISOLATION VALVE OPENED	1					EXISTING
ZCO-5017	UV TRAIN 2 ISOLATION VALVE OPEN COMMAND		1				EXISTING
ZCC-5017	UV TRAIN 2 ISOLATION VALVE CLOSE COMMAND		1				EXISTING
HS-5020	UV TRAIN 3 FLOW CONTROL VALVE IN REMOTE	1					EXISTING
ZSC-5020	UV TRAIN 3 FLOW CONTROL VALVE CLOSED	1					EXISTING
ZSO-5020	UV TRAIN 3 FLOW CONTROL VALVE OPENED	1					EXISTING
ZI-5020	UV TRAIN 3 FLOW CONTROL VALVE POSITION INDICATION			1			
ZC-5020	UV TRAIN 3 FLOW CONTROL VALVE POSITION COMMAND				1		
HS-5022	UV TRAIN 3 ISOLATION VALVE IN REMOTE	1					EXISTING
ZSC-5022	UV TRAIN 3 ISOLATION VALVE CLOSED	1					EXISTING
ZSO-5022	UV TRAIN 3 ISOLATION VALVE OPENED	1					EXISTING
ZCO-5022	UV TRAIN 3 ISOLATION VALVE OPEN COMMAND		1				EXISTING
ZCC-5022	UV TRAIN 3 ISOLATION VALVE CLOSE COMMAND		1				EXISTING
		18	3	3	3		Only AI and AO signals are new

END OF SECTION