AIS Waiver Request for Plunger Valve

General Items

Project Name

Tyzack Vault Capital Replacement Project

Description of Work

The Ashley Valley Water Treatment Plant (AVWTP) receives a significant portion of its influent water from the Red Fleet Reservoir. The Red Fleet influent line supplies water to the plant as well as to the Uintah Water Conservancy District through a separate bypass line, flow meter, and flow control valve. The Red Fleet influent line is normally turned off and drained during the winter. The valve that isolates AVWTP from the Red Fleet line (the Tyzack Valve) is a butterfly valve that is at the end of its useful life. It leaks when fully closed and is left open during the winter due to difficulty opening and closing. Shear pins break regularly at the gearbox and the gearbox is often submerged with groundwater causing excessive corrosion. Access to the Tyzack gear box is through a deep, hazardous manhole and presents difficult confined-space safety issues each time the valve must be closed or repaired. There is no access to the valve for maintenance because it is buried. The Red Fleet Bypass Vault flow control valve and flow meter are also near failure and need to be replaced. This project will replace the existing Tyzack access manhole and valve with a new vault and isolation valve as well as replace the worn out isolation valve, flow control valve and flow meter on the Red Fleet bypass line. The existing roller valve will be replaced with a plunger valve and the existing propeller meter will be replaced with a mag meter. This new flow meter will be connected to the plant SCADA system. The new Tyzack vault and valve replacement will resolve a safety and maintenance issue and will provide the needed access for normal operations and maintenance activities.

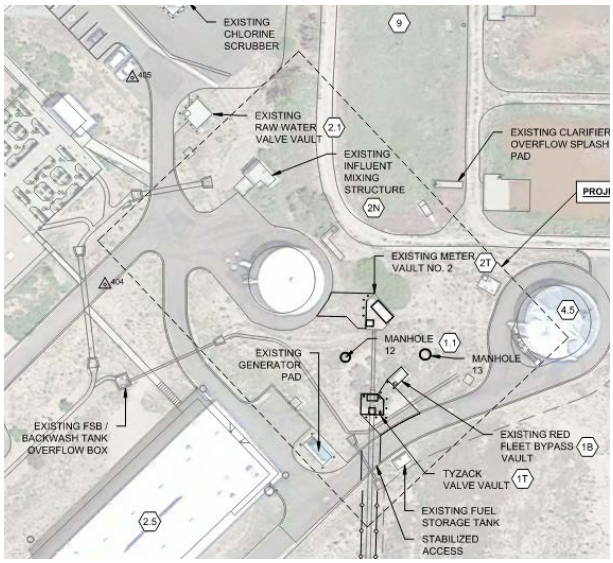

Figure 2. Site Plan

The project will also replace the existing sleeve valve and flow meter in Meter Vault 2. This sleeve valve is near failure and needs replacement. Isolation gates will also be installed in the Influent Mixing Structure to provide better options for maintenance in the Red Fleet and Ashley Springs lines. Because of significant leakage into Meter Vault 2 from the drying beds, the project also includes installation of a new sump collection manhole and groundwater collection system. Fiber for controls for the new equipment will also be included.

Description of the Foreign and Domestic Construction Materials

The plans and specifications require the use of one 18-inch plunger valve. The plunger valve is constructed of stainless steel, bronze, and ductile iron and must be designed to withstand high velocities. Plunger valves are produced internationally but there are no domestic manufacturers that can meet the required specifications within the United States.

Plunger valves are used to control pressure or flow in a water system. The purpose in this project is to control flow into the Red Fleet Bypass line. These valves provide a higher quality project, enhanced system control, and lower maintenance requirements and costs. In addition, they are compact and require much less space than conventional pressure regulating valves. The project Owner has limited staff resources for maintenance of the project. Plunger valves require less maintenance than typical pressure regulating valves. Currently there are zero domestic producers of plunger valves.

Unit of Measure

The valve listed above is measured by 'each'.

Quantity

A total of 1 plunger valve listed in the table below.

Price

Plunger Valve			
Size (inch)	Quantity	Unit Price	Total Costs
18	1	[redacted]	[redacted]

Time of delivery and availability

Delivery time of the plunger valves is not applicable to this waiver. However, plunger valves that meet the required specifications are not fabricated domestically in the United States.

For similar projects, the EPA conducted market research on the supply and availability of plunger valves and concluded that there are no domestic manufacturers of these valves that meet the technical specifications of those projects (similar to the Tyzack Vault Capital Replacement Project specifications).

Location of the construction project

The project is located in Uintah County, Utah as described above.

[redacted]

A detailed justification for the use of foreign construction materials

Plunger valves are needed to control the pressure and flow of the water transmission system into the Red Fleet Bypass line. The plunger valves specified are not manufactured domestically in the United States. The plunger valve's main design features including compact valve design, linear flow characteristics, and custom outlet configurations. All of these characteristics have contributed to the successful application of plunger valves to date in the water delivery industry. The plunger valve has

performed superbly over other valves in the areas of anti-cavitation, noise and vibration reduction, debris passage, closure tightness, operational reliability, durability, and life-cycle cost efficiency. The plunger valve responds well in terms of technical soundness, operations and maintenance requirements, and valve economics for handling energy dissipation and/or flow regulation, particularly under severe flow conditions.

Availability Waiver Request for Plunger Valve

Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials

The plunger valves specified are not manufactured domestically in the United States. There are no domestically manufactured replacement valves that would meet the specifications for the Tyzack Vault Capital Replacement Project.

For similar projects, the EPA conducted market research on the supply and availability of plunger valves and concluded that there are no domestic manufacturers of these valves that meet the technical specifications of those projects (similar to the Tyzack Vault Capital Replacement Project specifications).

Documentation of the assistance recipient's efforts to find available domestic sources, such as description of the process for identifying suppliers and a list of contacted suppliers

CUWCD requested that the prime contractor, WW Clyde, contact domestic suppliers of plunger valves. However, WW Clyde indicated that there are no domestic suppliers for plunger valves that meet the project plans and specifications. WW Clyde's response attached.

Project Schedule

See attached

Relevant excerpts from project

See attached

May 20, 2020

Caitlyn Erickson
Central Utah Water Conservancy District
1426 E 750 N Suite 400
Orem, UT 84097

Re: Ashley Valley Water Treatment Plant Tyzack Vault Capital Replacement Project
Subject: AIS Waiver Prime Contractor Statement

Dear Caitlyn,

The intention of the letter is to inform Central Utah Water Conservancy that the following permanent construction materials specified for the construction of the Ashley Valley Water Treatment Plant Tyzack Vault Capital Replacement Project are not available from domestic suppliers.

WW Clyde & Co. in an effort to meet the AIS requirements, has requested pricing for domestically produced double offset butterfly valves and plunger vales per specification 15206 and 15112 [redacted]. The suppliers have stated that the specified valves are not available from a domestic manufacturing source. [redacted]

Sincerely;

Jeff Whinham
Project Manager

C.C Project Files

SECTION 15110

COMMON WORK RESULTS FOR VALVES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Basic requirements for valves.

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

1.02 REFERENCES

A. American Water Works Association (AWWA):
   1. C111/A21.11 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe Fittings.

B. ASTM International (ASTM):
   1. A 126 - Standard Specification for Gray Iron Casting for Valves, Flanges, and Pipe Fittings.
   2. A 167 - Standard Specification for Stainless and Heat-Resisting Chromium- Nickel Steel Plate, Sheet, and Strip.
   3. A 536 - Standard Specification for Ductile Iron Castings.

C. NSF International (NSF):
   1. 61 - Drinking Water System Components - Health Effects.

D. Society for Protective Coatings (SSPC):
   1. SP 7 - Brush-Off Blast Cleaning.
   2. SP 10 - Near-White Blast Cleaning.

1.03 DESIGN REQUIREMENTS

A. Valves for similar service are to be by the same manufacturer.

B. AGear boxes are to be mounted at floor level. Submerged valve gear boxes are not acceptable. Provide torque tube from valve to actuator and support extension as required by manufacturer.

C. Pressure rating:
   1. Suitable for service under minimum working pressures of 150 pounds per square inch gauge.
   2. When a piping system is specified to be tested at a pressure greater than 150 pounds per square inch gauge, provide valves for that piping system with design

working pressure which is sufficient to withstand the test pressure. Required piping system test pressure is listed in the Piping Schedule in the drawings.

D. Valve to piping connections (unless indicated otherwise):
   1. Valves 3 inch nominal size and larger: Flanged ends.
   2. Valves less than 3 inch nominal size: Screwed ends.
   3. Plastic valves in plastic piping:
      a. Up to 2.5 inches: Provide solvent or heat welded unions.
      b. 3 inches and above: Provide solvent or heat welded flanges.

1.04 SUBMITTALS

A. Submit as specified in Section 01300.

B. Product data:
   1. Submit the following information for each valve:
      a. Valve type, size, pressure rating, Cv factor.
      b. Coatings.
      c. Power valve actuators:
         1) Information on valve actuator including size, manufacturer, model number, limit switches, mounting; and motor enclosure, seating and unseating torque coefficient, dynamic torque, and bearing friction for calculation of maximum operating torque.
         2) Complete wiring diagrams and control system schematics.
      d. Manual valve actuators:
         1) Information on valve actuator including size, manufacturer, model number.
      e. Certified drawings with description of component parts, dimensions, weights, and materials of construction.
      f. Certifications of reference standard compliance:
         1) Submit certification that the valves and coatings are suitable in potable water applications in accordance with NSF 61.
      g. Clearly mark submittal information to show specific items, materials, and accessories or options being furnished.
      h. Factory test data.

C. Operation and maintenance data:
   1. Furnish bound sets of installation, operation, and maintenance instructions for each type of manual valve 4 inch in nominal size and larger, and all non-manual valves. Include information on valve operators in operation and maintenance instruction manual.

1.05 QUALITY ASSURANCE

A. Manufacturer qualifications:
   1. Valves manufactured by manufacturers whose valves have had successful operational experience in comparable service.

1.06 DELIVERY STORAGE AND HANDLING

A. Protect valves and protective coatings from damage during handling and installation; repair coating where damaged.

PART 2 PRODUCTS

2.01 MATERIALS

A. Stainless steel: In accordance with ASTM A 167, Type 316, UNS Alloy S31600 or S30400.

B. Valve and operator bolts and nuts:
   1. Fabricated of stainless steel for the following installation conditions:
      a. Submerged in sewage or water.
      b. In an enclosed space above sewage or water.
      c. In structures containing sewage or water, below top of walls.
      d. At openings in concrete or metal decks.
   2. Where dissimilar metals are being bolted, use stainless steel bolts with isolation bushings and washers.
   3. Underground bolts: Low-alloy steel in accordance with AWWA C111/A21.11.

C. Bronze and brass alloys: Use bronze and brass alloys with not more than 6 percent zinc and not more than 2 percent aluminum in the manufacture of valve parts; UNS Alloy C83600 or C92200 unless specified otherwise.

D. Valve bodies: Cast iron in accordance with ASTM A 126, Class 30 minimum or ductile iron in accordance with ASTM A 536, Grade 65-45-12 minimum unless specified otherwise.

2.02 INTERIOR PROTECTIVE LINING

A. When specified in the particular valve specification, provide valves with type of protective lining specified in the particular valve Specification.

B. Apply protective lining to interior, non-working surfaces, except stainless steel surfaces.

C. Lining types:
   1. Fusion bonded epoxy:
      a. Manufacturers: One of the following or equal:
         1) 3-M Company, ScotchKote 134; certified to NSF 61 for drinking water use.Clean surfaces in accordance with SSPC SP 7 or SP 10, as recommended by epoxy manufacturer.
      b. Apply in accordance with manufacturer's published instructions.
      c. Lining thickness: 0.010 to 0.012 inches except that:
      d. Lining thickness in grooves for gaskets: 0.005 inches.
      e. Do not coat seat grooves in valves with bonded seat.
      f. Quality control:

1) Lining thickness: Measured with a non-destructive magnetic type thickness gauge.
2) Verify lining integrity with a wet sponge-testing unit operating at approximately 60 volts, or as recommended by the lining manufacturer.
3) Consider tests successful when lining thickness meets specified requirements and when no pinholes are found.
4) Correct defective lining disclosed by unsuccessful tests, and repeat test.
5) Repair pinholes with liquid epoxy recommended by manufacturer of the epoxy used for lining.

2. High solids epoxy:
   a. Product equivalent to high solids epoxy specified in Section 09900.
      1) Certified in accordance with NSF 61 for drinking water use.
      2) Interior: Coat valve interior with manufacturer's equivalent high-performance high solids epoxy coating system with a certifiable performance history for the service conditions and as approved by the CONSTRUCTION MANAGER. Manufacturer shall provide for approval, coating information sufficient to allow CONSTRUCTION MANAGER to assess equivalence to the specified high solids epoxy coating specified in Section 09960.
   b. Clean surfaces to meet SP-7 or SP-10, or as recommended by coating manufacturer.
   c. Quality control: After coating is cured, check coated surface for porosity with a holiday detector set at 1,800 volts, or as recommended by coating manufacturer.
      1) Repair holidays and other irregularities and retest coating.
      2) Repeat procedure until holidays and other irregularities are corrected.

2.03 UNDERGROUND VALVES

A. Provide underground valves with flanged, mechanical, or other type of joint required for the type of pipe to which the valve is to be connected.

2.04 VALVE BOXES

A. Provide cast-iron valve boxes at each buried valve to access valve and valve operators.

B. Do not support boxes on valve, valve operator, or pipe.

C. Boxes:
   1. 2-piece, fabricated of cast iron; provide cover, with asphalt varnish or enamel protective coating.
   2. Adjustable to grade, install centered around the upper portions of the valve and valve operator.

2.05 VALVE OPERATORS

A. Valve operator "Open" direction: Open counterclockwise.

B. Provide valves located below operating level or deck with extensions for key operation or floor stands and handwheels.

C. Provide manually operated valves located not more than 6 feet above the operating level with tee handles, wrenches, or handwheels.
   1. Make the valve operator more conveniently accessible by rolling valves, located more than 5 feet but less than 6 feet above the operating level, toward the operating side.
   2. Secure tee handles and wrenches to the valve head or stem, except where a handle or wrench so secured constitutes a hazard to personnel; in which case, stow handle or wrench immediately adjacent to the valve on or in a suitable hanger, bracket, or receptacle.

D. Fit valves located more than 6 feet above operating level with chain operated handles or valve wheels.
   1. Chains: Sufficient length to reach approximately 4 feet above the operating level.
   2. Where chains constitute a nuisance or hazard to operating personnel, provide holdbacks or other means for keeping the chains out of the way.

E. Provide an operator shaft extension from valve or valve operator to finished grade or deck level when buried valves, and other valves located below the operating deck or level, are specified or indicated on the Drawings to be key operated; provide 2 inch square AWWA operating nut, and box and cover as specified, or a cover where a box is not required.

2.06 VALVE POSITION INDICATORS

A. Mounting bracket shall have slotted hole to provide flexibility to offset or makeup misalignment.

B. No bending of bracket allowed to make up for misalignment.

PART 3 EXECUTION

3.01 EXAMINATION

A. Preparation prior to installation:
   1. Install valves after the required submittal on installation has been accepted.
   2. Determine after flanged valves and flanged check valves are selected, the face-to-face dimensions of flanged valves and flanged check valves.

B. Fabricate piping to lengths taking into account the dimensions of flanged valves and flanged check valves.

3.02 INSTALLATION

A. Provide incidental work and materials necessary for installation of valves including flange gaskets, flange bolts and nuts, valve boxes and covers, concrete bases, blocking, and protective coating.

B. Where needed, furnish and install additional valves for proper operation and maintenance of equipment and plant facilities under the following circumstances:
   1. Where such additional valves are required for operation and maintenance of the particular equipment furnished by CONTRACTOR.
   2. Where such additional valves are required as a result of a substitution or change initiated by CONTRACTOR.

C. Install valves with their stems in vertical position above the pipe, except as follows:
   1. Butterfly valves, gate valves aboveground, globe valves, ball valves, and angle valves may be installed with their stems in the horizontal position.
   2. Install buried plug valves with geared operators with their stems in a horizontal position.

D. Install valves so that handles clear obstructions when the valves are operated from fully open to fully closed.

E. Place top of valve boxes flush with finished grade or as otherwise indicated on the Drawings.

F. Valves with threaded connections:
   1. Install valves by applying wrench on end of valve nearest the joint to prevent distortion of the valve body.
   2. Apply pipe joint compound or Teflon tape on external (male) threads to prevent forcing compound into valve seat area.

G. Valves with flanged connections:
   1. Align flanges and gasket carefully before tightening flange bolts.
   2. When flanges are aligned, install bolts and hand tighten.
   3. Tighten nuts opposite each other with equal tension before moving to next pair of nuts.

H. Valves with soldered connections:
   1. Do not overheat connection to prevent damage to resilient seats and metal seat rings.
   2. Position valves in full open position before starting soldering procedure.
   3. Apply heat to piping rather than to valve body.

END OF SECTION

SECTION 15203
ELECTRIC MOTOR ACTUATORS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Use intelligent electric motor actuators unless specifically required otherwise.

B. This Section includes materials, installation and testing of electric actuators for valves in accordance with AWWA C541 and AWWA C542, except as modified below. The electric motor actuator shall include any necessary intermediate gearing between the electric actuator and the valve to which it is attached.

1.2 RELATED WORK

A. Painting and Coating: Section 09900, Protective Coatings.

B. Valves and Operators:

1. Section 15206, Plunger Valves.
2. Section 15216, Angled Sleeve Valves

1.3 SUBMITTALS

A. Action Submittals:

1. Submit complete manufacturer's descriptive information on each actuator and accessory. Provide actuator parts and materials of construction, referenced by AISI, ASTM, SAE, or CDA specification and grade.
2. Dimensions and weights.
3. Coatings.
4. Submit motor data including name plate data, insulation type, output torque, voltage, phases, frequency, current at running torque, and locked rotor, duty rating, and travel times open to close and close to open.
5. Show the maximum torque required to open and to close each motor- actuated valve or cast iron sluice gate.
6. Coordinate torque requirements with gate and valve manufacturer’s to provide an actuator that meets the Specification requirements.

7. Submit electrical schematic drawings and physical wiring diagrams showing all power and control interfaces.

8. Submit information showing the relationship between the operator output torque and the torque limit switch settings.

9. Provide valve versus actuator arrangement drawing confirming orientation of actuator and maintenance/operation access. Obtain Owner's written approval prior to installation and mounting.

B. Informational Submittals:

1. Certification from actuator manufacturer, that actuator meets or exceeds all part of this Section.

2. Factory and field test reports.

3. Operation and Maintenance Data: Manuals shall include the following:
   a. Complete installation instructions.
   b. Operating and maintenance instructions.
   c. Complete parts list.
   d. Part change-out instructions.
   e. The theory of operation for the actuator and the intermediate gearing.
   f. Expanded parts drawings, showing all mechanical and electrical parts.
   g. Electrical schematic drawings and physical wiring diagrams showing all components.
   h. Drawings of electrical component enclosure-physical layout in 3-D view.
   i. List of recommended spare parts.
   j. List of special tools for installation, maintenance, and adjustments.
   k. Lubrication guide with a list of recommended lubricants.

4. Copies of factory training certifications, from actuator manufacturer, for any maintenance or installation technicians, Training certifications shall be specific to the models installed. Certificates shall be approved by the Construction Manager before technicians are authorized to perform any work on the valve actuators.

PART 2 PRODUCTS

[redacted]

[redacted]

2.2 ACTUATOR IDENTIFICATION

A. Identify electric motor actuators by tag number as shown in Electric Motor Actuator Schedule. Identification tags shall be round or oval aluminum tags attached to the actuators with aluminum wire. Tag numbers shall be engraved or stamped on tags in block letters.

2.3 GEARED OPERATORS

A. Geared operators shall be per Section 15110 and individual valve sections.

B. Intermediate Geared Operators:

1. Provide intermediate operators of spur, helical, or bevel gears, between the new electric motor actuator and the new or existing geared valve operators, if needed to provide the specified open/close time, and to provide proper operation of the valve. The intermediate geared operators shall be designed with bearings suitable for adapting to an electric actuator. Operators designed with bushings are not permitted.

2. Intermediate geared operators do not need dial indicating valve position, but shall be enclosed, oil or grease lubricated, with seals provided on shafts to prevent entry of dirt and water.

3. Intermediate geared operators shall be totally enclosed design proportioned to permit operation of valve under full differential pressure equal to valve pressure rating with max input of 150 foot pounds on operating shaft, and shall be oriented to operate with valve stem and electric actuator as per Construction Manager.

4. Support gear shaft at each end by ball or tapered roller bearings. Provide reduction gearing to meet max torque and pull design requirement. The reduction gearing shall run in a proper lubricant.

5. Intermediate geared operator shall open valves by turning counterclockwise.

C. Handwheel: Provide handwheel for manual operation with arrow to indicate “open” rotation. Handwheel shall not rotate during motor operation, and operation of handwheel shall not cause motor to rotate. When in manual operating mode, actuator shall remain in this mode until

motor is energized, at which time actuator will automatically return to electric operation. Movement from motor operation to handwheel operation shall be by a positive, padlockable declutching lever, which mechanically disengages motor and related gearing. Friction type declutch mechanisms are not acceptable. Size handwheel for a maximum pull of 50 pounds under full differential pressure at any point through valve travel including seating and unseating.

2.4 MOTORS FOR ELECTRIC ACTUATORS

A. Provide totally enclosed, high-torque, nonventilated, singe-phase motors, suitable for the facility electrical service shown on Drawings. NEMA service factor rating shall not be used in rating motors for maximum load conditions.

B. Motors for actuators shall be specifically designed and rated for operating times (open to close and close to open) indicated in the Electric Motor Actuator Schedule included as a supplement to this specification.

C. Provide Class F or Class H insulation specifically designed for valve actuation service and rated for continuous duty operation and 1,200 start/stops per hour without overheating. Heat rise after 1,200 start/stops in an hour shall be less than 50 degrees C. Heat rise after three full consecutive valve cycles shall be less than 50 degrees C. If travel time requirements would cause the three- cycle test to extend beyond 60 minutes, limit the test to 60 consecutive minutes. Design actuator so it can cycle valve (or gate) from closed to open and back to closed at travel times indicated in the Electric Motor Actuator Schedule included as a supplement to this specification.

D. Provide motor output capacity sufficient to open or close the valve against the maximum differential pressure when the voltage is 10 percent above or below normal at the specified service conditions.

E. Motor bearings shall be of the anti-friction type, and permanently lubricated.

F. Provide over temperature protection with thermostat sensor. Sensor shall automatically reset on cooling.

2.5 ACTUATOR TORQUE REQUIREMENTS

A. Provide actuator with rated output torque at least 1.5 times the maximum torque required to operate the valve in any position, including seating and unseating conditions and neglecting hammer-

blow effect.

B. Maximum torque requirement is defined as torque required at the most severe operating conditions, including max differential pressure across the valve (defined at the valve pressure rating), and max mechanical friction or other restrictive conditions inherent in the valve assembly. Except where noted otherwise, the maximum line velocity is defined as the flow identified on Drawings and specifications for each valve and pipe. For line water temperature, assume a range of from 40 degrees F to 100 degrees F.

C. Actuator maximum torque shall be calculated with the applied voltage 10 percent below nominal motor voltage rating.

D. Coordinate with the valve manufacturer to assure that the motor actuator stall torque output does not exceed the torque limits of the valve operating stem or shaft.

2.6 ELECTRICAL CHARACTERISTICS

A. Operating Speed and Indication:

1. As indicated in the Electric Motor Actuator Schedule included as a supplement to this specification.
2. Actuator shall have a built-in device that allows motor to reach full speed before engaging valve load. This hammer blow feature shall be engaged if the actuator is in handwheel or motor operation.

B. Actuator Housing:

1. Housing shall be NEMA 4 or NEMA 6.
2. Electrical motor and other electrical elements of the actuator shall be gas and water-tight when the terminal cover is removed.
3. All torque limits, limit switch adjustments, and other configuration shall be carried out without any removal of actuator covers. Configuration shall be available by remote device or at the actuator user interface.
4. Enclosures shall have at least two 1-inch minimum NPT threaded hubs for conduit entry.

C. Power Transmission:

1. Provide actuator with internal, multiple reduction power gearing unit, consisting of spur or helical gears and work gearing of

hardened alloy steel, with the worm gear of alloy bronze. Manufacture all power gearing accurately.

2. Provide self-locking work gear set in the drive train to maintain valve position.

3. Use anti-friction bearings with caged ball or roller throughout.

4. All rotating power train component are to operate immersed in grease or oil with provisions for inspection and relubrication without disassembly.

5. Lubricants shall be suitable for ambient conditions of minus 20 degrees F to 150 degrees F. Adequate seals shall be provided on all shafting.

6. Actuator noise shall not exceed 72 dBA at all times within a 3-foot radius.

7. Design shall permit gear case to be opened for inspection or disassembles without releasing stem thrust or taking the valve out of service.

2.7 INTELLIGENT ELECTRIC MOTOR ACTUATORS (REQUIRED FOR ALL ELECTRIC ACTUATORS)

A. General Design:

1. Include as one integral assembly, the motor, internal reduction gearing, position limit switch functions, torque switch functions, travel limit switch functions, position indicator, declutch lever, handwheel, solid state reversing starter and operator controls.

2. Actuator shall be an intelligent, microprocessor-based design suitable for service for temperatures from minus 30 degrees C to plus 70 degree C.

3. Calibration and setup features shall be available by a nonintrusive front panel interface and handheld setting tool, accessible without requiring removal of covers or use of special tools.

4. Connect electric motor to actuator via a plug-in electrical connector. Motor shall be removable without draining oil or grease from gearbox.

B. Control Interface:

1. Actuator shall:
   a. Be configurable for direct-wired remote open/close control, using 24V dc command lines. Control shall interrogate remote dry contacts providing open/close control.
   b. Both accept and supply 24V dc control power for remote

control. Internal actuator power supplies shall be automatically protected against overcurrent or short circuit conditions.

c. Allow programming of all programmable features via front-panel nonintrusive switches and local display.

d. Actuator shall be equipped and configured for remote Modbus RTU interface for configuration, monitoring, and control.

e. Allow access to all programmable features via a laptop computer connected directly to actuator. If software other than terminal emulator is required for access, then software and cable shall be provided at the time of delivery.

f. Actuator shall provide torque trending graphs in local mode. The actuator shall be capable of displaying a torque graph in both “Reference” and “Recent” modes and shall be able to be viewed in “Local” actuator diagnostic mode. The reference graph mode shall be User selectable as a baseline, and the recent graph displayed shall be the torque generated during the last performance cycle. The User shall be able to select any of the recent graphs to replace the reference graph. Torque shall be digitally displayed in the Diagnostics menu labeled “Torque Profile.” Torque shall be collected in either open or closed directions.”

C. Local/Remote Interface:

1. Actuator shall have a local interface/display screen capable of displaying at least 32 alphanumeric characters and a 0 percent to 100 percent display for valve position readout. All text messages or displays shall be in English.

2. Actuator shall have a local LOCAL-STOP-REMOTE (LSR) mode control switch, and a local OPEN- CLOSE (OC) position command switch. The LSR switch shall be lockable in any position by using a standard padlock.

3. Local and remote programming interfaces shall be protected by user- selectable password protection for all programmable features.

4. The local control switches shall not penetrate the actuator enclosure, and shall electrically isolate the operator from any external voltages.

5. The OC function shall be user-configurable for maintained or inching control.

6. Provide four status contacts, minimum, for remote indication of

valve position. These contacts shall be configurable for normally-open or normally-closed function. These contacts shall be programmable for operation at any position between full open and full closed position, or shall be programmable to indicated any of the following: Mid-travel, local mode, over torque, motor over temperature, manual operation, remote mode, valve moving, close torque switch, open torque switch, hardware failure, or valve jammed. These contacts shall be rated 250V ac/30V dc, 5 amps.

D. Position/Limit/Torque Sensors:

1. Actuators shall employ noncontact-type absolute position encoders, capable of at least 18-bit resolution. Position encoders shall sense actual valve position at all times, during electrical or handwheel operation, with or without applied electrical power, and without the use of batteries. The encoder maximum error shall be less than 1 percent and shall include, repeatability, linearity, and positional accuracy throughout the entire range of motion.

2. Open and close valve travel-limit positions shall be a function of the absolute position encoder, shall be stored in permanent, nonvolatile memory, and shall be easily adjustable from the local or remote interface.

3. Torque shall be measured employing a nonmechanical, fully electronic sensor. The motor-torque limit shall be adjustable over 40 percent to 100 percent of design torque in 1 percent increments.

4. The motor shall automatically de-energize if an over-torque condition is sensed. Torque limit protection shall automatically adjust for initial valve unseating, or for programmed torque seating of valves. A valve movement in the opposite direction of the over torque move shall reset the torque limit protection.

5. The actuator shall provide a 4 mA to 20 mA analog output signal that is proportional to valve position. This signal shall employ the noncontact type absolute position encoders and conform to the accuracy requirements of this Section.

E. Intelligent Control Module: Intelligent control module shall:

1. Be of a modular design, with replaceable circuit boards for troubleshooting.

2. Be entirely housed in actuator, and shall be easily accessible for maintenance.

3. Have control circuit boards or modules that connect with plug-in card connectors or wiring plugs.

4. Include a solid-state motor reversing circuit for modulating up to 1,200 starts per hour. Mechanical reversing contactors are acceptable for modulating up to 600 starts per hour. Failure of the solid-state motor reversing or EM contactor module shall not result in unintended motor operation.

5. Include any necessary internal protection fuses. No external or accessory fuses shall be required for full protection of the motor or control electronics package.

6. Have solid-state motor reversing circuit that does not affect actuator performance, or degrade communications between actuator and remote control equipment.

7. Be capable of 300 starts per hour for modulating service.

8. All control transformers shall include vacuum impregnated coils, and have dual primary fuses.

9. Include an automatic directional reversal delay, to prevent current surges from rapid motor reversal.

10. Incorporate an automatic phase-correction circuit to correct motor rotation errors due to incorrect site wiring.

11. Include an automatic phase-failure detection circuit that shall disable motor rotation if a phase-loss is detected.

12. De-energize motor when it detects a fault or fails.

13. Allow actuator calibration without removing covers or requiring special tools.

14. Allow actuator calibration by answering simple questions on operator display.

15. Accumulate and store diagnostic information about actuator performance including, motor, position encoder, contractor performance, cycle time, handwheel operations, actuator identification, output turns, and a torque profile of valve baseline stroke and the last valve stroke for comparison.

F. Power/Control Wiring:

1. All customer connections shall be in a compartment that is separate from the control circuits and other internal spaces. Accessing the wiring compartment shall not require opening any other actuator compartments.

2. The wiring connections compartment shall contain a suitable number of screw-type terminals to allow connection of step-mode controls wiring and the control wiring shall be physically separated from the power wiring.

2.8 DRIVE SLEEVE

A. Provide a drop-in stem nut held in place with a snap ring, torque bushing, or threaded locknut and keyway which couples with actuator to the intermediate geared operator or valve stem and provides a versatile means of disassembling the actuator from the operator or valve. Removable A1 base is acceptable.

2.9 FACTORY TESTING OF MOTOR ACTUATOR

A. Test each actuator prior to shipment in accordance with AWWA C540. Submit certified test reports. The application torque shall be the maximum torque required to open or close the valve at any position, including seating and unseating conditions.

PART 3 EXECUTION

3.1 ATTACHING ELECTRIC ACTUATORS

A. Protect actuators from damage per manufacturer recommendations at all times. Replace (at no cost to Owner) all electrical enclosures and electrical components found with condensation or related damage.

B. Valve manufacturer shall mount electric motor actuator and accessories on each valve and stroke the valve prior to shipment. Provide preliminary configuration and adjustment of all functions, including limit switches, valve position transmitter, and torque switches.

C. Valve manufacturer shall provide installation, configuration, and testing of each valve actuator by actuator manufacturer-certified technicians. Actuator mounting arrangements shall facilitate operation and maintenance and shall be as indicated, and as verified and acceptable to valve manufacturer and Owner. Provide certification that valve actuators have been installed and adjusted by valve manufacturer. The actuator access cover shall be oriented to prevent the cover from falling in the workspace, causing injury to personnel.

3.2 PAINTING AND COATING

A. Coat the exterior metal surfaces of electric motor actuators per Section 09900, Protective Coatings. Provide rust inhibiting inorganic zinc-rich primer and intermediate and finish coats of high-build epoxy recommended by manufacturer of the equipment.

3.3 FIELD INSTALLATION

A. Install the valve and actuator as indicated on Drawings in accordance with the manufacturer's instructions. Keep units dry, closed, and sealed to prevent internal moisture damage during construction. Provide additional hangers and supports for actuators which are not mounted vertically over the valve or which may impose an eccentric load on the piping system.

3.4 FIELD TESTING OF ELECTRIC MOTOR ACTUATORS

A. Only maintenance technicians that are certified by the actuator manufacturer shall be employed to perform any field testing, adjustment, or set up of the valve actuator.

B. The motor actuators shall be tested, as installed by measuring the current drawn (in amperes) by each motor for unseating, seating, and running conditions. The measured current shall not exceed the current measurement recorded during the factory performance test by more than 5 percent.

C. If the measured current drawn exceeds the above value, provide a larger motor or gear drive or adjust the actuator so that the measured amperage does not exceed the value.

D. Verify that absolute encoder functions are adjusted to their correct settings. Open and close valves twice and assure that absolute encoder functions. Verify the position transmitters and any other information being developed in the actuator complies with requirements contained within this Section or listed on Drawings.

E. Electric motor actuator manufacturer or qualified representative shall be available at the work side to check installation, supervise startup, and conduct field testing and adjustment of equipment. Provide factory-authorized formal training in the operation and maintenance of the equipment to Owner personnel, such that Owner personnel shall be qualified by the equipment manufacturer to maintain their equipment. Documentation of their qualification shall be provided as part of the training package.

3.5 ELECTRIC MOTOR ACTUATOR WARRANTY

A. The electric motor actuator manufacturer shall warrant its product to be free from defects in materials, workmanship, and performance for actuator incorporated in the work for a period of 5 years from the date of Substantial Completion or final acceptance, whichever occurs first. Upon notice by the Owner, any damage or defect found during the warranty period shall be promptly repaired or replaced by the manufacturer at no cost to Owner.

B. In emergency situations, if warranty service is not immediately available from the Vendor/Supplier or Manufacturer, the Owner will perform repairs to re- establish proper operation of the actuator and valve. All defective parts returned by Owner shall be replaced with new parts. If the Owner replaces the entire actuator for cause, the Vendor/Supplier or Manufacturer shall repair or replace the entire actuator.

C. Maintenance or repair work performed by Owner during the warranty period shall not be cause for voiding the warranty.

3.6 SUPPLEMENT

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

1. Electric Motor Actuator Schedule.

END OF SECTION

ELECTRIC ACTUATOR SCHEDULE

Valve Type	Valve Size (inches)	Process Fluid	Maximum Operating Flow (cfs)	Maximum □P (psi)	Service	Travel Time (Minutes)	Control Feature Modifications / Supplement
Sleeve Valve	18	Raw Water	46	150 to 0	M	Per Manufacturer's recommendation during submittal review period	B,C,D,F,H,I,K
Plunger Valve	18	Raw Water	20	150 to 0	M	Per Manufacturer's recommendation during submittal review period	B,C,D,F,H,I,K

Service: O/C = Open-Close, T = Throttling, M = Modulating Control Feature
Modifications/Supplements:
A = Actuator shall open valve upon loss of signal.
B = Actuator shall remain in last position upon loss of signal.
C = Local OPEN-CLOSE momentary pushbuttons that must be continuously depressed to initiate/maintain valve travel; travel stops when pushbutton is released or when end of travel limit is reached.
D = Remote OPEN-CLOSE maintained dry contacts; travel stops when remote contact opens, or when end of travel limit is reached.
E = Three 24V dc interposing relays for remote OPEN-STOP-CLOSE control. Relays powered externally, thereby permitting valve control from greater distances.
F = Motor and control enclosure(s) NEMA 250, Type 6 (IP 68) and Type 4. G = Motor and control enclosure(s) NEMA 250, Type 7.
H = Valve position output converter that generates an isolated 4 mA dc to 20 mA dc signal in proportion to valve position, and is capable of driving into loads of up to 500 ohms at 24V dc.
I= Operation from 480-volt, three-phase power.
J= Local OPEN-CLOSE momentary selector switch; travel stops when selector switch is switched to stop position or when end of travel limit is reached.
K= Capable of network communication through Modbus RTU protocol

SECTION 15206
PLUNGER VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide horizontal in-line plunger valve with electric actuator for the Red Fleet Bypass valve, factory tested and operable, as specified herein, and shown in the plans.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 09900, Protective Coatings

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. American National Standards Institute (ANSI)

B1.20.1 Pipe Threads, General Purpose (Inch)

B16.1 Cast Iron Pipe Flanges and Flanged Fittings

B16.5 Steel Pipe Flanges and Flanged Fittings

B. American Society for Testing and Materials (ASTM)

A48 Specification for Gray Iron Castings

A216 Specification for Steel Castings, Alloy, Specially Heat-Treated, for Pressure-Containing Parts, Suitable for High-Temperature Service.

A536 Specification for Common Requirements for Iron Castings for General Industrial Use.

A743 Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application

C. American Iron and Steel Institute (AISI)

AISI 304 Austenitic Stainless Steel (maximum percent: 0.08C, 2.0 Mn, 1.0 Si, 18-20 Cr, 8-10.5 Ni)

AISI 420 Martensitic Stainless Steel (minimum percent: 0.15C, maximum percent: 1.0 Mn, 1.0 Si, 12-14 Cr, 0.0 Ni,) .

D. European (EN or DIN) standards equivalent to referenced American standards, subject to Construction Manager approval.

E. Purchaser Furnished Data:
Operating Conditions: Purchaser, whether Owner, or Contractor, will furnish valve-operating conditions, design criteria, process criteria, and facility drawings sufficient in detail and extent to allow the Manufacturer to properly customize plunger valve performance.

1.04 SUBMITTALS

A. Submit Manufacturer's data and descriptive literature written in the English language including valve hydraulic performance curves indicating flow rate and pressure drops across valve at variable open settings, cavitation index curves versus flow rates, with bid. Include catalog data, preliminary performance testing procedures, quality control procedures, calculations, detailed construction sheets showing all valve parts and descriptions of materials of construction with and applicable USA material specifications such as AISI, ANSI, ASTM, AWWA, American Society of Automotive Engineers (SAE), or the Copper Development Association (CDA). Identify each valve by tag number to which the catalog data and detail sheets pertain.

B. Furnish for approval prior to manufacture, factory developed production drawings that clearly show valve dimensions, laying lengths, machining tolerances, port sizes, component parts, materials of construction and computer modeling results of estimated noise and cavitation levels.

C. Submit Actuator sizing calculation. Furnish for approval prior to manufacture, shop assembly drawings that clearly show dimensions and orientation of valve actuators as installed on the valves. Clearly show location of internal stops for gear actuators.

D. Furnish for approval prior to manufacture, shop coating and lining specifications which clearly identify all valve linings and coatings. Valve interior linings and exterior coatings shall be NSF approved for potable water usage.

E. During manufacture, furnish coating, lining and weld test reports in searchable electronic PDF format that report and verify the valve interior lining condition is tested for absence of holidays, and lining thickness. Describe test results and repair procedures for each valve. Submit certification that linings and coatings conform to NSF approval for potable water usage. Do not ship valves to project site until the reports have been approved by the Construction Manager and accepted by the Owner.

F. Furnish for approval prior to manufacture a valve summary data sheet that provides the station, valve structure, type, Manufacturer, size, pressure rating, drilling pattern and model number of each valve; and type, and manufacturer and model number of the valve actuator.

G. Furnish for approval prior to shipping the factory shop hydrostatic test reports, performance test reports, and any other required test reports in a searchable electronic PDF format. Hydrostatic test reports shall be presented which reflect the requirement of the test procedures. Performance test reports shall show all relevant test parameters of the valve and actuator assembly as tested in the Manufacturer's facility, and shall indicate valve position, flow rate, and inlet/outlet pressures as a minimum.

H. Submit for approval with bid, factory export packaging specifications, applicable to overseas shipping via surface carrier.

I. Submit for information with bid current quality assurance program certificate of compliance.

J. Flow Rate and cavitation index curves versus valve opening position, and inlet/outlet pressures as a minimum

1.05 SUBSTITUTION

A. Where plunger valves are shown or specified in project specifications or plans issued by the Owner, no Contractor may substitute any other style of valve that has not been specifically approved by the Owner for that application.

1.06 QUALITY ASSURANCE

A. The Manufacturer shall be ISO 9001 Certified

B. Shop Testing: Plunger valves shall be shop tested prior to shipment in accordance with the following:

1. Leakage test: Plunger valves shall be leak tested to 1.1 times the valve's maximum rated pressure at fully closed position. Valve shall be drip-tight or zero leakage.

2. Hydro test valve body to 1.5 times rated pressure. Hydro test valve in closed position to 1.1 times rated pressure proving zero leakage.

3. Functional test: The valve shall be stroked three (3) complete cycles with the valve actuator settings in place (limit switches, torque switches, pilot pressure settings, etc.) One cycle is defined as fully closed to fully open and then to fully closed again. Valve components shall be free from binding and galling between parts. Actuator motor shall not be overloaded.

C. In Place Testing as described in Section 3 of this specification.

D. Manufacturer shall submit certified reports of all the above tests, including appropriate information such as hand wheel rotation direction, valve full, stroke calibration data, operating times and visual inspection notes in a searchable electronic PDF format.

PART 2 - PRODUCTS

2.01 PLUNGER VALVE PERFORMANCE REQUIREMENTS

A. Performance: Valve Manufacturer shall demonstrate by design and calculation that the valve ports or orifices are designed to meet the range of flow and pressure without damaging cavitation to the valve or downstream piping. All calculations shall be reviewed and signed by a registered professional engineer in the United States or a similarly qualified engineer from the country of manufacturer.

B. Noise: Operating noise levels shall not exceed 95 decibels (dBA) at a distance of three (3) feet from the valve as measured under laboratory

conditions at the normal flow point. Material stresses shall not exceed 1/5 of the ultimate or 1/3 of the yield strength of the material. Flow rate as a function of pressure drop across the valve shall be linear to within three percent of flow range.

C. Operating conditions: Valves shall function reliably for the following operating conditions. Headloss through the downstream orifice cone has been accounted for in the listed downstream operating pressures.

Red Fleet Bypass Valve	**Tag No. RFB-PGV-1B-01**
Valve Size (inches)	18"
Operating Range (cfs)	0 - 18
Upstream Max PSI (0 cfs to AVWTP and 1.5 cfs through the bypass valve with regulating tank full)	119
Upstream Normal PSI (10 cfs to AVWTP and 10 cfs through bypass valve with regulating tank half full)	92
Upstream Min PSI (23.2 cfs to AVWTP and 13 cfs through bypass valve with regulating tank empty)	39
Downstream Max PSI (18 cfs through bypass valve)	40
Downstream Normal PSI (10 cfs through bypass valve)	14
Downstream Min PSI (1.5 cfs through bypass valve)	2.5
Full close to full open time (approx manual opening time in seconds)	600

2.02 PLUNGER VALVE OPERATING REQUIREMENTS

A. Valve Assembly Components: Each plunger valve assembly shall consist of a flanged short conical inlet section having an internal cone to divert the water flow into the annular chamber of the body section.

B. An oval body section with an inner annular chamber shall be formed by the body shell. The plunger shall be designed with a customized control cylinder that is part of the internal slider-crank mechanism and is driven by an outside worm gear and electric actuator.

C. The plunger shall move in an axially flow direction to reduce or enlarge the annular flow cross section through slots in a degressive manner, and the medium will flow through the customized control cylinder from the outer annular chamber to the inner chamber of the plunger.

D. The outside of the plunger shall seat against a QUAD-sealing-ring with a double sealing effect, anti-twist protection and shall be impenetrable to dirt at its upstream end which will be against medium pressure from both upstream and downstream sides, and shall have a profile sealing ring which will seat against a stainless steel seat at the downstream valve body end. The

plunger valve shall have a non-wetted and double o-ring sealed actuation shaft to ensure corrosion free operation over a long period of time.

2.03 PLUNGER VALVE DESIGN FEATURES

A. Plunger valve shall be a one-part-body design and shall feature an interior geometry that provides water flow that is guided around the streamlined internal body structure. The design shall feature a geometrically optimized design, a continuous annular cross-sectional reduction from inlet to throttle cross section, and continuous rise of flow velocity to the exit without producing cavitation.

B. Plunger valve design shall feature a specially customized designed control cylinder with a single layer slotted orifice cage to minimize cavitation. Slotted orifice cage shall be acceptable for use in raw water applications. Orifice slots shall be fully closed which the valve is placed in the closed position. The profile sealing ring shall be located out of the flow zone on the downstream side of the valve and held in place by a retaining ring.

C. Plunger valve manufacturer shall provide a stainless steel orifice cone that shall be installed immediately downstream of the plunger valve per the Manufacturer's recommendations. Orifice cone is used to provide back pressure to the plunger valve and shall have a minimum minor loss K-value of 20. Plunger valve sleeve shall be designed so that the sleeve does not contact with the orifice cone when the valve is fully closed. Contractor shall coordinate the installation of the orifice cone with the plunger valve manufacturer prior to ordering piping materials.

D. Plunger valve design, when open during operation, shall feature plunger assembly movement in the upstream side direction to release water through the orifices.

E. Plunger valve design shall feature advance and retract axial strokes of the plunger, guided in the internal body by an internal slider-crank mechanism. The crank shall have a 90-degree angle of rotation.

F. Plunger guide rails shall have a bronze welded overlay applied directly on the body and have an odd number of guide rails for improved range of resonance frequency of the plunger, to reduce the possibility of operational vibration.

G. Motion of the plunger shall be controlled by means of an irreversible, self-locking part-turn worm gear unit, with electric actuator attached to the worm gear unit.

H. The design of the annular throat cross section in any position of the plunger shall ensure linear regulation of flow. Flow orifices shall be designed to meet variable flow characteristics within the flow and pressure ranges indicated.

I. Provide electric actuator with a manual handwheel operator.

J. The profile sealing ring at the downstream side of the valve body shall be exchangeable.

K. Connections: Valve flange shall be provided by ANSI B 16.5 standard bolting pattern flanges for the size and pressure rating specified. Comply with flange mating requirements per Section 02500.

G. The valve shall have the ability to fully retract the perforated cylinder into the valve body.

2.04 MATERIAL REQUIREMENTS

A. Principal Component Parts / Materials of Construction

Item	**Size**	**Material**	**Specification**
Valve Body	All	Ductile Iron	ASTM A536, GR. 60,40,18
Plunger	All	Stainless Steel	AISI 304
Regulating cylinder	All	Stainless Steel	AISI 304
Orifice cone	All	Stainless Steel	AISI 304
Shaft Bushing		Bronze	ASTM B427 or B584 when not subject to dezincification
Crank shaft	All	Stainless Steel	AISI 420
Crank mechanism (sizes 6” – 24”)	All	Stainless Steel	AISI 304
Crank mechanism (sizes 26” – 64”)	All	Ductile Iron	ASTM A536, GR. 65,45,12
Seat / Retaining ring	All	Stainless Steel	AISI 304
Plunger guide rails	All	Bronze Welded Overlay	ASTM B427 or B584 when not subject to dezincification
Quad-sealing-ring	All	EPDM	EPDM 80 Shore A with min. tensile strength of 17.5 psi.
Profile sealing ring	All	EPDM	EPDM 80 Shore A with min. tensile strength of 17.5 psi.
O-Rings, Actuator Shaft	All	EPDM	ASTM 2000 hardness per manufacturer

B. Fasteners: All studs, bolts, washers, and nuts in contact with water shall be Type 316 stainless steel.

C. All materials of moving components in contact with each other shall be of dissimilar hardness to prevent galling.

D. Use flat-faced, AWWA Class E flanges. Properly mate flanges per Section 02500,

2.04 PLUNGER VALVE MANUFACTURER

[redacted]

[redacted]

PART 3 - EXECUTION

3.01 INSTALLATION

A. Valve installation shall be in strict accordance with the Manufacturer's printed recommendations, and the Contract Documents.

B. Four (4) bound copies, and one (1) CD of the Operations and Maintenance Manual are to be provided with the valve. The manuals shall include installation instructions, maintenance procedures and operation parameters.

3.02 WORKMANSHIP

A. Valves shall be free from manufacturing defects and shall be manufactured in a workman like manner. Valves shall be manufactured under the direction of a registered professional engineer.

B. Painting shall be per Section 09900, Painting. Grease and scale shall be completely cleaned from the valve prior to painting per Society for Protective Coatings (SSPC) standards.

D. All ductile iron (and carbon steel) components shall be painted with Fusion Epoxy paint per Painting and Coating. A certificate of compliance shall be furnished with each valve stating that the materials supplied meet the material specification set out herein and the Manufacturer’s quality assurance program.

3.03 FIELD TESTING AND PERFORMANCE

A. Manufacturer shall furnish all required start-up assistance and inspection during both the Operational Flow Testing and during the In-place Tests during system startup at the project site - by a factory trained person. Factory trained representative shall be present during installation and initial operational testing of valve in field.

B. Operational Flow Testing: Perform the following operational flow testing in project system after installing valve under the supervision of the construction manager and the manufacturer’s qualified representative:

Operational flow testing shall be performed on each valve to verify the following:

1. Simulate valve operation using local control.

2. Operate valve at maximum flow for one day or more demonstrating maximum allowed pressure drop across the valve.

3. Operate valve from minimum to maximum flow. Using their specified electric motor actuators, operate valve – actuator assemblies demonstrating the ability to adjust flows starting with the valve at 10% open and increasing at increments of 5% of peak design flow throughout their full stroke range. This

testing and valve cycling need not occur at the full heads the valves will experience when operating within their normal system operations.

4. For all tests, contractor shall record flow, upstream and downstream pressure, valve position set points and actuator motor inrush current. Submit all test results of forecasted operating curves and actual test results.

5. Demonstrate successful “high-pressure” cavitation control operations without damage to the valve or downstream piping facilities. Demonstrate the valve will meet the specified field noise requirements and not be damaged by cavitation in the specified design ranges.

C. In-place (Field) Leakage Test. Contractor shall perform in-place (Field) Leakage Test regardless of which operational flow test method is selected: Field leak test all valves to the specified system tests pressure in the closed position with zero leakage. After verifying zero leakage to Construction Manager satisfaction, exercise each valve through its full stroke at least two times during the second phase of pressure testing and system disinfection.

D. All Operational Flow Testing and In-place (Field) Leakage Tests performed during the construction period (not the 5 year warranty period) shall be witnessed by the Construction Manager and manufacturer's representative. Test results shall be jointly certified by Construction Manager or its representative, Manufacturer’s onsite representative, and the Contractor.

E. If the valve fails any of the tests, it shall be corrected by the Manufacturer within 7 days at the Manufacturer’s expense.

3.04 WARRANTY

A. The plunger valve manufacturer shall warrant its products, including actuators incorporated in the work, to be free from defects in materials, workmanship and performance, including the Owner-performed flow control testing during system startup, for a period of five years after successfully passing all construction period tests specified.

END OF SECTION