SERIES 300 PLUNGER VALVE

Suggested Specifications

PART 1 - GENERAL

1.01 Description

A. This section includes specifications for materials, manufacturing, coating, testing, and shipping of ___-inch, 150 lb plunger valve(s).

B. Tag Numbers: FCV-____.

1.02 Related Work Specified Elsewhere

A. Attachment 2 Specification for Electric Motor Actuator

B. Attachment 3 Specification for Painting and Coating

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 Standard Specification for Gray Iron Castings
A216 Standard Specification for Steel Castings, Alloy, Specialty Heat-Treated, for Pressure-Containing Parts, Suitable for High-Temperature Service.
A536 Standard Specification for Ductile Iron Castings
A743 Standard Specification for Castings, 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. American Society of Mechanical Engineers

ASME B16.47 Large Diameter Steel Flanges

E. European (EN or DIN) standards equivalent to referenced American standards, subject to Engineer approval.

1.04 Submittals

A. Prior to manufacture, furnish to the Project Manager for approval, the following:

1. Factory developed production drawings that clearly show valve dimensions, laying lengths, port sizes, component parts, materials of construction, and computer modeling results of estimated noise and cavitation levels.
2. Shop assembly drawings that clearly show dimensions and orientation of valve actuators as installed on the valves and location of internal stops for gear actuators.
3. Shop coating and lining specifications, which clearly identify all valve linings and coatings.

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4. 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.

B. Prior to shipping, furnish to the Project Manager for approval, the following:

1. Coating and lining test reports that verify the valve interior lining condition is tested for absence of holidays and for lining thickness. Describe test results and repair procedures for each valve. Do not ship valves to project site until the reports have been approved by the Project Manager.

2. Factory shop hydrostatic test reports, performance test reports, and any other required test reports. Hydrostatic test reports shall reflect 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.

1.05 Quality Assurance

A. The manufacturer shall be ISO 9001 certified.

B. Shop Testing:

Plunger valve shall be shop tested prior to shipment in accordance with the following minimum standards:

1. Leakage test: Plunger valve shall be qualitatively tested to 1.1 times valve pressure rating to identify drip tight closure of valve seat, seal leaks and other problems in the assembly process in both flow directions.

2. Hydrostatic test: Plunger valve shall be hydrostatically tested to withstand 1.5 times the valve's maximum design operating pressure rating to identify drip tight closure of valve from the inside to the outside.

3. The functional test procedure shall include three (3) complete cycles of operation with the valve actuator settings in place, including but not limited to switches, torque switches, and pilot pressure settings.

C. Manufacturer shall submit certified shop test reports that shall include appropriate information such as handwheel rotation direction, valve full, stroke calibration data, pilot pressure settings, operating times and visual inspection notes.

PART 2 - MATERIALS

2.01 Plunger Valve Manufacturer

A. Valve shall be Pratt Series 300 Plunger valve or equal.

B. Valve manufacturer shall have a minimum of five years of recent continuous product history in the USA or Canada. The manufacturer must have ten years of experience manufacturing a minimum of ten plunger valves.

2.02 Plunger Valve Performance Requirements

A. Performance: Plunger valves shall be capable of controlling flow across the entire flow range specified in the attached equipment data sheet without exceeding MSHA dictated noise level requirements, as stated in this Part 2.02.

B. Noise: Operating noise levels shall not exceed 95 decibels (dB) at a distance of three (3) feet from the valve 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 3-percent.

C. Operation Data

1. Maximum Flow Rate Condition Data:

a. Flow Rate: ____ Cubic Feet per Second (CFS) per valve.

b. Maximum Inlet Pressure: ____ Pounds per Square Inch (PSI).

c. Minimum Outlet Pressure: 0 PSI.

d. Kind of operation: Continuous.

2. Minimum Flow Rate Condition Data:

a. Flow Rate: ____ CFS.

b. Maximum Inlet Pressure (Design): ____ PSI.

c. Minimum Outlet Pressure: 0 PSI.

d. Kind of operation: Continuous.

2.03 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 slider nut operating gear.

C. The plunger shall move in an axial flow direction to reduce or enlarge the annular flow cross section through slots in a digressive 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 downstream plunger face shall hold the profile seal ring. The main plunger O-ring seal shall seat against a replaceable stainless plunger seat, located in the downstream end of the plunger valve body, which creates a leak tight seal when the plunger is in the fully closed position. The main O-ring seal, shall be recessed from direct impact of the flow media and shall be outside the zone of cavitation. Plunger seat seals located in the plunger body or in the cavitation zone shall not be allowed. The upstream plunger O-ring seal shall only be energized when the plunger is in the fully closed position, thus to provide an optimum sealing system and minimize wear. The plunger valve input crank shaft shall be O-ring sealed to ensure corrosion protection to the crank arm and prevent stagnant water in the crank bore.

2.04 Plunger Valve Design Features

A. Plunger valve shall be either a one-piece body design with separate and replaceable body seat or a two piece 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 damaging cavitation.

B. Plunger valve design shall feature a specially customized designed control cylinder with application specific flow control cage to minimize cavitation. Slots shall be fully closed when the valve is placed in the closed position. The seal O-ring on the plunger shall also seat against a replaceable stainless steel seat ring in the body when closed.

C. Plunger valve design, when open during operation, shall feature plunger assembly movement towards the upstream direction to release water through the slots.

D. 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.

E. Plunger guide rails shall have a bronze welded overlay applied directly on the body. The minimum thickness of the bronze overlay shall not be less than 5/32” in the finished machined condition. There shall be a minimum number of 4 guide rails, symmetrical to the plunger load, to allow uniform wear of the guide rails and improved plunger support and vibration attenuation.

F. Motion of the plunger shall be controlled by means of an irreversible, submersible self-locking slider nut gearbox, with optional electric or hydraulic cylinder actuator attached to the slider nut unit.

G. The design of the annular throat cross section in any position of the plunger shall ensure linear regulation of flow.

H. The valve actuator shall operate in accordance with the requirements of Attachment 2, Specification for Electric Motor Actuator.

I. Actuation: The plunger valve shall be actuated as described in Attachment 2, Specification for Electric Motor Actuator.

J. The profile sealing ring at the downstream side of valve body shall be exchangeable without the need to dismantle the valve from the pipeline.

K. Valve end connections shall be ANSI standard pattern flanges for the size and pressure rating specified.

2.05 Material Requirements

A. Materials of construction for the principal component parts shall be as listed in the table below.

Item	Size	Material	Specification
Valve Body	All	Ductile Iron	ASTM A536, GR. 65,45,12
Plunger	All	Stainless Steel	AISI 304
Regulating Cylinder	All	Stainless Steel	AISI 304
Shaft Bushing		Bronze	
Crank Shaft	All	Stainless Steel	AISI 420
Crank Mechanism	All	Stainless Steel	AISI 304
Seat / Retaining Ring	All	Stainless Steel	AISI 304
Plunger Guide Rails	All	Bronze Welded Overlay	
Plunger Sealing Rings	All	Ethylene Propylene Diene Monomer (EPDM)	
Profile Sealing Ring	All	EPDM	
O-Rings at Actuator Shaft	All	EPDM	

B. Fasteners: All studs, bolts, washers, and nuts in contact with water shall be Type 304 or 316 stainless steel.

C. All materials of moving components in contact with each other shall be of dissimilar hardness to prevent galling. The valve shall be moved through an open-close-open cycle three (3) times after final assembly and prior to shipment to ensure this requirement is met.

2.06 Flanges

A. For design pressure up to and including 275 PSI, use American Water Works Association Class E steel flanges or use ANSI B16.5, Class 150 steel flanges.

B. For design pressures exceeding 275 PSI, use ANSI B16.5, Class 300 steel flanges for pipe diameters up to and including 36-inches. Use ASME B16.47, Class 300 steel flanges for pipe diameters 26- through 36-inches.

C. Facing: Flanges of all classes shall be flat faced without projection or raised face. Either a serrated concentric or serrated spiral finish having from 24 grooves per inch to 40 grooves per inch (0.94 to 1.57 grooves per millimeter) shall be used. The cutting tool employed shall have an approximate 0.06-inch (1.52 millimeter) or larger radius. The resultant surface finish shall have a 250 to 500 µin. (6.35 to 12.7 µm) roughness.

PART 3 – EXECUTION

3.01 Installation

A. Valve installation by the DISTRICT shall be in strict accordance with the manufacturer's printed recommendations.

B. Provide four (4) bound copies, and one (1) CD of the Operations and Maintenance Manual. The manual shall include installation instructions, maintenance procedures, and operation parameters.

3.02 Workmanship

A. Valve shall be free from manufacturing defects and shall be manufactured in a workman like manner.

B. Painting shall be per Attachment 3, Specification for Painting and Coating. Grease and scale shall be completely cleaned from the valve prior to painting per Society for Protective Coatings (SSPC) standards.

C. Valves shall be manufactured under the direction of a registered professional engineer.

D. All ductile iron components shall be coated with a Fusion Bonded Epoxy per Attachment 3, Specification for Painting and Coating. A certificate of compliance shall be furnished with each valve stating that the materials supplied meet the material specifications set out herein and the manufacturer's quality assurance program.

3.03 Field Testing and Performance

A. Furnish all required start-up assistance and inspection of installed valve at the DISTRICT's facility.

B. Valves shall be field leak tested to the specified operating pressure in the closed position and shall not leak. Field leakage relevant to the plunger valve shall be corrected by the manufacturer at the manufacturer's expense.

C. Plunger valve shall be subjected to onsite performance testing as part of the commissioning activities in accordance with a written performance test plan. To the extent possible, the valve shall be subjected to variable flow conditions, and the resulting control settings, flow, upstream and downstream pressures, noise levels, and vibration levels shall be documented and compared to the manufacturer's shop test results.

D. Function test through three (3) complete cycles of operation with the valve actuator settings in place, including but not limited to switches, torque switches, and pilot pressure settings.

E. Upon completion of the necessary field testing, the shop test results and field test results comparison shall be discussed and resolved during a meeting or teleconference, as determined by the DISTRICT.

3.04 Warranty

A. Vendor shall supply the manufacturer's warranty.

B. The manufacturer shall warrant its products, including anti-cavitation venting system and actuators incorporated in the work, to be free from defects in materials, workmanship and performance for a period of six years after successful testing and acceptance by the DISTRICT.

C. Upon notice by the DISTRICT, any damage or defect found during the warranty period shall be promptly repaired or replaced by the manufacturer at no cost to the DISTRICT.

D. If warranty service is not immediately available from the Vendor, supplier or the manufacturer, the DISTRICT will perform repairs to re-establish proper operation of the valve. Maintenance or repair work performed by the DISTRICT during the warranty period shall not be cause for voiding the warranty.

END OF SECTION