

## 4.0 PIPING AND VALVES

### 4.1 DISCHARGE PIPING

The piping from the individual pump discharge bases, through the valving assembly and out to the force main, shall be in accordance with the following:

A. Four-inch Diameter Piping and Larger:

1. Piping - The discharge piping shall be ductile iron Class 53 or greater A.N.S.I. A-21.51 (AWWA C151) with rigid radius grooves for end preparation in accordance with AWWA C606.
2. Fittings - Fittings shall be ductile iron, ASTM A-536, Grade 65-45-12, or cast iron, ASTM A-48, conforming to the requirements of AWWA C110 for center to end dimensions, AWWA C153 or AWWA 21.10/AWWA C110 for wall thickness, and AWWA C606 rigid radius grooving dimensions for end preparation. Fittings shall be cement lined and have a universal primer coating.
3. Mechanical Couplings - Mechanical couplings shall be ductile iron conforming to ASTM A536, Grade 65-45-12 with a universal primer coating as manufactured by Victaulic (style 31, style 75 or style 307), or approved equal. Couplings shall incorporate gaskets that are specially made to conform to ductile iron pipe surfaces and 304 stainless steel nuts and bolts.
4. Transition Fittings:
  - (a) Grooved to Flanged - The connection of grooved pipe and fittings to flanged pipe and fittings shall be facilitated with flange adapters as manufactured by Victaulic (style 341 Vic-Flange) or approved equal. The flange adapters shall be ductile iron conforming to ASTM A-536, Grade 65-45-12, with a universal primer coating. Gaskets shall have properties as designated by ASTM D-2000 and shall be suitable for the required service. Use 304 stainless steel bolts and nuts on all flange adapters and flanged components.
  - (b) Force Main Connection - The ductile iron pipe shall

be extended at least 4 feet from the outside of the valve vault. The force main shall then be connected to the ductile iron pipe with a mechanical coupling. The coupling shall be a MEGALUG Mechanical Joint Restraint or approved equal.

B. Three-inch Diameter Piping and Smaller:

1. Piping - The discharge piping shall be ASTM 1785 schedule 80 PVC roll grooved pipe in accordance with AWWA C606.
2. Fittings - Fittings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12, and have AWWA C606 grooving dimensions for end preparation. Fittings shall have a Tnemec or approved equal 140 outside coating and inside lining.
3. Mechanical Couplings - Mechanical couplings shall be rigid and cast of ductile iron conforming to ASTM A-536, Grade 65-45-12, alkyd enamel finish, with gaskets conforming to ASTM D-2000 as manufactured by Victaulic (style 07, Zero Flex) or approved equal. Couplings shall utilize 304 stainless steel bolts and nuts.

C. Transition Fittings:

1. Grooved to Flanged - The connection of grooved pipe and fittings to flanged pipe and fittings shall be facilitated with flange adapters as manufactured by Victaulic (style 741 Vic-Flange) or approved equal. The flange adapters shall be ductile iron conforming to ASTM A-536, Grade 65-45-12, with a universal primer coating. Gaskets shall have properties as designated by ASTM D-2000 and shall be suitable for the required service. Use 304 stainless steel bolts and nuts on all flange adapters and flanged components.
2. Force Main Connection - The schedule 80 PVC pipe shall be extended at least 4 feet from the outside of the valve vault. The force main shall then be connected to the schedule 80 PVC pipe. The force main shall be connected to the schedule 80 pipe by means of a solvent well schedule 80 PVC coupling.

4.2 DISCHARGE RISERS

- A. PVC - When plastic pipe is utilized for the pump discharge riser and the riser exceeds 6 feet in length, stainless steel support braces must be installed between the riser and wet well wall. The braces shall be placed at a maximum spacing of 6 feet.
- B. DIP - When ductile iron pipe is utilized for the pump discharge riser and the riser exceeds 8 feet in length, stainless steel support braces must be installed between the riser and wet well wall. The braces shall be placed at a maximum spacing of 8 feet.

#### 4.3 FORCE MAIN REQUIREMENTS

Force mains shall meet the following criteria:

- A. Velocity - A cleaning velocity of at least 2 feet per second must be maintained when one pump is running and a maximum of 8 feet per second shall not be exceeded when both (all) pumps are running.
- B. Air Release Valve - An automatic release valve shall be placed at high points in the force main to prevent air pockets.
- C. Termination - Force mains shall discharge to a gravity sewer in a manner that smoothly directs the force main flow into the gravity sewer flow and minimizes turbulence. Force mains shall be connected to a gravity sewer as per the Standard Details.
- D. Thrust Blocks - The force main shall be fitted with permanent thrust blocks at all bends, tees, plugs, fittings or other significant changes in direction. Thrust blocks shall be constructed as per the Standard Details. Thrust block locations shall be given on both plan and profile views on the construction plans.
- E. Clean-outs - The need for clean-outs on the force main shall be determined during plan review by the City of Columbia. As a general guideline, clean-outs will not be required on force mains under 1800 feet in length. If clean-outs are required, refer to the Standard Details.
- F. Force Main Pressure Test - Contractor shall fill and pressure test the force main. The minimum required test pressure shall be the maximum force main operating pressure plus 50 psi. (City representative shall be present during this test).
- G. Tracer Wire - A green-coated number 12 AWG copper tracer wire shall be installed the entire length of the force main as per the

Standard Details. The tracer wire shall be accessible from the surface at intervals not to exceed 1000. The tracer wire shall be extended into all valve vaults (pump station valve vault, air release vault, clean-out valves, etc.) a minimum of 5 feet, from each direction. If valve vault spacing exceeds 1000 feet, then tracer wire access vaults shall be provided as necessary. The tracer wire access vaults shall be constructed as per the Standard Details. The wire shall be neatly rolled and placed on a stainless steel hook so that it does not interfere with normal operation. When wet well mounted pumps are utilized or when a pump station valve vault is not utilized, a tracer wire access vault shall be provided within 10 feet of the pump station wet well.

- H. Utility Marking Tape - A detectable underground utility marking tape shall be installed the entire length of the force main as per the Standard Details. The tape shall consist of a 35 gauge (0.00035") solid aluminum foil core encased between 2 layers of plastic. The tape shall have an overall minimum thickness of 5.0 mil (0.005"). The aluminum foil must be visible from both sides. No inks or printing shall extend to the edges of the tape. All printing shall be encased to avoid ink rub off. Tape shall be green in color and conform to the following requirements:

Property	Method	Value
Thickness	ASTM D2103	5.0 mils (nominal)
Tensile strength	ASTM D-882	22 lbs/in width (4400 psi)
Elongation	ASTM D-882	<50% at break
Printability	ASTM D2578	>40 dynes/cm <sup>2</sup>

- I. Pipe Material - The force main pipe shall have a pressure rating greater than the system's maximum operating pressure plus 50 psi. D.I.P., PVC and HDPE are acceptable materials. The project plans or specifications shall state the SDR Ratio, Pressure Rating and National Standard of the proposed force main material.

#### 4.4 AIR RELEASE VALVES

An air release valve shall be installed on any high points or "knees" of the force main, as deemed necessary by the City Engineer. The air release valves shall be the short-body style and specifically manufactured for wastewater applications. The body and cover of the valve shall be constructed of heavy-duty

cast iron that has a pressure rating greater than or equal to the force main pipe material. Bolts, pipe, nipples and plugs shall be stainless steel. Street elbows shall be stainless steel or bronze. Isolation and flush valves shall be threaded ball valves with bronze bodies, stainless steel ball and operating lever, and nylon seats.

Air release valves shall be attached to the force main by means of a stainless steel pipe nipple threaded to a cast-iron mechanical joint (m.j.) x m.j. x tap tee. (Air release valves on force mains smaller than 6 inches will require additional support.)

Air release valves shall be placed in a vault as per the Standard Details.

Acceptable air release valve manufacturers are Val-Matic, APCO Valve, Primer Corp. or approved equal.

#### 4.5 PLUG AND CHECK VALVES

- A. Approved shut-off and check valves shall be placed on the discharge line of each pump. The check valves shall be located between the shut-off valve and the pump. Approved shut-off valves shall be placed on the force main as necessary. The shut-off and check valves shall be installed horizontally and located in accordance with the Standard Details.
- B. All valves shall be rated so as to withstand normal working pressure plus allowances for water hammer.
- C. Shut-off Valves - The valves shall be located so that each pump may be isolated from the common discharge header.
  - 1. 3 Inches and Larger - Shut-off valves 3 inches and larger shall be eccentric plug type valves with a resilient faced plug suitable for required service. Valves shall have self-lubricating stainless steel bearings and bearing grit seals. The port shall be circular, have a minimum flow area of 81% of the full pipe area, minimum 90% pipe diameter and be able to pass a cleaning pig when fully open. Flow direction shall be indicated on the valve body.
  - 2. Body - The shut-off valves shall be cast iron body, ASTM A 126 Grade B or ductile iron per ASTM, Grade 65-45-12, and have a universal primer coating. The bonnet shall be ductile-iron material per ASTM A-536, Grade 65-45-12. Grooved valves shall comply with AWWA C-509 and

AWWA C-606 requirements.

3. Plugs - Shut-off valve plugs shall be made of cast iron ASTM A 126 Class B or ductile iron ASTM A-536 covered with a Buna-N Rubber compound. The seats are to be a corrosion-resistant alloy such as 304 stainless steel. Flanged valves shall be in accordance with ANSI B 16.1 Class 125 standards. Grooved valves shall be in accordance with AWWA C606. Sleeve-type bearings shall be utilized in both the upper and lower trunnions. Bearings shall be corrosion resistant and have a low coefficient of friction.
4. Operators - 3-inch to 4-inch shut-off valves shall be provided with a 2- inch square operating nut and wrench head. Valves at the pump station and pump station valve vault that are larger than 4 inches shall be provided with a manual gear operator sized so that the maximum rim pull required is not more than 80 lbs. Valves installed on the force main that are larger than 4 inches shall be provided with a 2-inch square operating nut and wrench head.
5. Sealing requirements - Shut-off valves 3 inches to 6 inches shall provide positive and reverse flow sealing up to 175 psi. Shut-off valves 8 inches to 12 inches shall provide sealing up to 175 psi and reverse sealing up to 50 psi. Shut-off valves larger than 12 inches shall provide positive sealing up to 150 psi and reverse sealing up to 50 psi. These valves have a preferred direction of shut off, and it is the responsibility of the contractor to see that they are properly installed.

Acceptable manufacturers are Clow, Dezurik, Victaulic Series 365 Vic-Plug or approved equal.

6. Smaller than 3 Inches - Shut-off valves smaller than 3 inches shall be ball- type shut-off valves. The valve body shall be ductile iron, ASTM A-395, Grade 65-45-12. The ball and stem shall be Type 316 stainless steel. The valve shall be a standard port, end-entry valve designed for 600 psi, minimum. The valve shall provide a drip free seal. The valves must be provided with a 2-inch square operating nut and wrench head or a concentric tee handle.

Acceptable manufacturers are Victaulic, or approved equal.

- E. Check valves shall be of the swing check type with ASTM A-126 Class B cast-iron body. Check valves shall be either flanged or grooved end type. All fasteners shall be 304 or 316 stainless steel.

2 inches to 3 inches check valve - Acceptable manufacturers are Victaulic (Series 712) Val-Matic or approved equal.

3 inches and larger check valves - Acceptable manufacturers are Victaulic (Series 317), Val-Matic or approved equal.

#### 4.6 BY-PASS PUMP PIPING

All pump stations shall be equipped with a by-pass pump arrangement as per the Standard Details.

- A. Pump stations with a force main that is 4 inches or smaller shall be equipped with a 3-inch by-pass arrangement.
- B. Pump stations with a force main that is 6 inches or larger shall be equipped with a 6-inch by-pass arrangement.

#### 4.7 VALVE CHAMBER DRAIN VALVE

A 4-inch drain pipe shall be installed from the valve vault to the pump vault. The drain pipe shall be ductile iron Class 53 or greater. A flapper-style back-water check valve shall be installed on the valve vault drain line as per Standard Details.

#### 4.8 WET WELL VENT

The wet well structure shall be vented with a 4-inch Sch. 40 stainless steel or aluminum vent pipe (refer to detail drawings).