

SECTION 3 - STRUCTURE REQUIREMENTS

3.1 DESIGN CRITERIA

All reinforced concrete structures shall be designed using the Working Stress Method. At a minimum this includes the wet well, valve chamber, and control panel pad. The structures may be either pre-cast or cast-in-place as approved by the City.

3.2 JOINING CHAMBERS

The valve chamber shall rest on a haunch poured integral with the wet well walls. Both chambers shall be tied together with a minimum of two (2) threaded tie bolts. The design engineer shall specify the bolt diameter and material strength. Bolts are to be eighteen inches (18") down from top of structure. For top slab thickness greater than 12 inches, place the bolts down six inches (6") from bottom of top slab.

One-half inch (1/2) thick 6"x 6" backing plates shall be used as washers on each end of the tie bolts. Both structure tops shall be at the same elevation separated by a one inch (1") square flexible rubber mastic sealant placed along the perimeter of the valve chamber where it meets the wet well. The tie bolts and the 6"x 6" backing plates shall be stainless steel.

3.3 ACCESS HATCHES

Access hatches shall be cast in the top sections of each chamber. The hinged side of the valve and pump chamber hatches shall be located on each of their respective common tie walls. For valve chambers requiring double hatch doors, the hinges shall be placed on the common wall and the wall opposite the common wall. Hatch specifications are provided in Section 6.6.

3.4 ACCESS OPENINGS

The City requires that no junction boxes or exposed wiring be included in the valve vault. The following accesses are required:

- A six-inch (6") hole shall be centered at the bottom of the valve chamber floor in the tie wall. A four-inch (4") PVC coupler shall be cast in the wet well tie wall and centered with the valve chamber six-inch (6") hole. After the two chambers have been tied together, two (2), four inch (4") PVC stubs shall be glued into the coupler on each side of the tie wall. These stubs will be used for the valve chamber drain piping.
No power or control wiring shall pass between the valve vault and pump station chamber. All wiring shall exit its respective vault and sent directly to either an above ground junction box, or directly to the station control panel. Electric design shall specify whether junction boxes are necessary.

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- One two and one-half inch (2-1/2") hole shall be placed on each side of the valve chamber sidewalls, eighteen inches (18") from the tie wall and eighteen inches (18") from the top of the structure. For a top slab thickness greater than ten inches (10"), place the two and one-half inch (2-1/2") holes down eight inches (8") from bottom of top slab. A two and one-half inch (2-1/2") PVC coupler shall be cast in each hole. One of the openings is to be used for the power and control wires from the panel board. Two openings are provided for flexibility. The opening not used shall be stubbed and capped with a piece of two and one-half inch (2-1/2") PVC

3.5 VALVE CHAMBER FLOOR

The valve chamber floor shall be sloped with a three-sided invert towards the four-inch (4") drainpipe using a two-inch (2") fillet. Gravity pipes, detention pipes and electrical conduits may not be run beneath the valve chamber.

3.6 VALVE SUPPORTS

Valve Chamber piping shall be supported as follows:

- After discharge piping and valves have been installed in the valve chamber an adjustable stainless steel pipe cradle jack shall be under the flowmeter, valves and tee, so that they have a ten inch (10") clearance between the floor and valve flanges. The supports shall be firmly bolted to the valve chamber floor.
Pipe should be additionally supported as deemed necessary by submitted structural design.

3.7 ENTRANCE STEPS

Valve vault entrance steps shall be per City of O'Fallon. They shall be located as follows:

- They shall not be located under or next to any obstructions
Entry steps should provide a clear-in-line visible unobstructed access from the top of the chamber to the bottom of the vault
Steps should be placed on the sidewalls closest to the control panel, approximately in the center of the hatch cover.
Steps should be placed 16" on center.

3.8 DETENTION CHAMBER

Detention shall be installed below ground with an access manhole located at each end. The connection between the detention chamber and the wet well wall shall be made with a 12" PVC pipe (DR 18). The detention tank must be a dedicated system; it may not be used as part of the gravity system. The detention tank and connecting line shall be laid with a minimum 1% slope.

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3.9 CHAMBER SIZING

The pump station wetwell and valve chamber shall each be sized as noted. Access hatches will be correspondingly sized to the chosen structure size.

Table with 4 columns: VALVE Inside Area, VALVE Access Hatch Size, CHAMBER Inside Area, CHAMBER Access Hatch Size, WET WELL Inside Area, WET WELL Access Hatch Size. Values include 6' x 6', 7' x 7', 8' x 8', 72" x 72", 84" x 84", 84" x 84", 6' x 6', 7' x 7', 7' x 7', 48" x 72", 60" x 84", 60" x 84".

To prevent the possibility of the valve chamber pulling the top section of the wet well off of the joint, a poured counter-weight is required to offset the mechanical lever arm tipping force. The counter-weight shall be monolithically poured at the bottom of the upper-most wet well section opposite of the valve chamber tie wall. Size and weight of the counter-weight shall be shown on the plans.

3.10 CONTROL STRUCTURE PAD

The control structure concrete pad shall be a minimum of six inches (6") thick, reinforced with 8 gauge, 6 x 6 welded wire mesh. The concrete shall have four inch (4")-minus with screenings compacted to 95% standard proctor.

The pad shall be poured next to the pump station, parallel to the length of the station structure and centered between the two chambers. Pad dimensions shall be 6' x 13'.

3.11 MISCELLANEOUS ITEMS

- Incoming Manhole Placement: A manhole shall be placed on the gravity line within the fence limits of the pump station.
Detention Chamber Placement: The twelve-inch (12") pipe joining the detention chamber and the pump station shall be no less than 10 feet in length.
Bulkheading: Bulkheading of the detention chamber shall be completed with a pre-cast bulkhead.
Construction Tolerance of Wet Well: The wet well shall be installed so that it is no more than 3 inches per 25 vertical feet out of plumb.

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E. Connection of Gravity Pipe to Structures

All incoming gravity lines and discharge piping will have a "Z-Lok" or "A-Lok" type compression fitting cast-in-place where the piping passes through the valve and wet well chamber walls. The maximum angle of deflection allowed for pipe gaskets is as follows:

- "Z-Lok" = 25 degree
"A-Lok" = 7 degree

All piping outside diameters will be located a minimum of one foot above or below structure joints.

Where required by the City, a double ball expansion joint shall be installed at the connection of the discharge pipes to the wet well. Expansion joint shall be Flex-tend or equivalent.

F. Top of Wet Well and Valve Chamber

The top elevation shall be six inches (6") higher than the surrounding ground elevation. Surrounding ground shall be sloped away from the structure for proper drainage.

G. All joints and connections shall be watertight.

H. Waterproofing of Concrete Components

- The exterior of the lift station and wet well shall be waterproof. Waterproofing should consist of exterior coating and interior chemical resistant liner. Liner shall be 100% solids, high build epoxy coating to provide chemical resistance to wastewater conditions. Coating thickness shall be as recommended by the manufacturer and shall be Raven 405 by Raven Lining Systems or approved equal.
Emergency detention chamber shall also be epoxy lined with Raven 405 or approved equal.
Steel reinforcement used in the all concrete structures shall be epoxy coated to meet ASTM A775.
Waterproofing Admixtures shall be added to all concrete components of the design. Dosage of the admixture shall meet the requirements of the corresponding manufacturer. Admixture shall be:
a. C-500, C-500NF, C-1000, or C-1000NF by Xypex.
b. Aquafin IC Admix by Aquafin
c. Krystol Internal Membrane by Kryton
d. Penetron Admix by Penetron International Ltd.

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SECTION 4 - PIPING AND VALVES

The following specifications shall be used for installation of the pump station piping and valves. Flanged and grooved end piping shall be acceptable means of connecting piping and valving.

All pipes must enter the structure walls with a one-foot minimum clearance from the outside face of the pipe to the face of the adjoining wall to allow for proper pipe gasket placement.

Stainless steel pipe shall be epoxy coated. Epoxy coating shall be suitable for wastewater systems. Pipe shall be ordered and supplied with the coating applied. All hardware in the lift station shall be stainless steel.

4.1 DISCHARGE PIPE MATERIAL

- From the individual pump discharge bases through the header tee to a point a minimum of three feet (3') outside the structural wall, the following materials shall be used:
Four Inch (4") Diameter and Above:
Flange Installation: Stainless steel pipe shall meet ASTM A312 and flanges shall meet ASTM A182. All bolts and nuts for flange connections must be 304 stainless steel (minimum). All flange gaskets must be full face 1/8" thick red rubber.
Grooved End Installation: Fittings shall be manufactured of stainless steel conforming to ASTM A-403, WPW, WPW/S9, or CR/S9, or shall be fabricated from stainless steel pipe conforming to ASTM A312, with factory grooved ends. Fittings shall be type 304/304L or 316/316L stainless steel.
Three inch (3") Diameter:
Solvent-Weld Installation: ASTM 1785 Schedule 80 PVC
Grooved Installation: ASTM 1785 Schedule 80 PVC roll grooved pipe in accordance with C-606. Mechanical couplings shall be of stainless steel conforming to ASTM A-536, Grade T or S nitrile compound gaskets conforming to ASTM D- 2000 designation 5BG615A14B24 with stainless steel nuts and bolts.

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- The following materials shall be used for the force main from a point four feet (4') outside the chamber wall to the discharge manhole:

- Four inch (4") Diameter and Above:
AWWA C-900 PVC Class 150
AWWA C-909 PVC (for pipes 4-inch through 12-inch)
AWWA C-905 PVC (for pipes 14-inch through 48-inch)
Three inch (3") Diameter:
PVC pipe meeting ASTM D2241 (SDR 21) with integral bell and gasket joint design meeting the requirements of ASTM 03139 and F477, minimum pressure class shall be PC 150

4.2 FORCE MAIN REQUIREMENTS

The following elements shall be included in the force main system design:

- Air Relief/Vacuum Valves (ARV): Automatic combination vacuum air relief valves shall be placed at high points in the force main as required.
The valve shall be equipped with all backwash accessories.
The body of the ARV shall be supported to the wall of the structure by a 1-1/4" x 1-1/4" x 1/8" stainless steel angle bracket.
Air release valves shall be installed in a concrete valve vault with a minimum 72" I.D. The valve shall rest on a concrete pad as required to support the valve. A standard size vented access cover shall be provided at each air release valve.
Acceptable Manufacturer: Val-Matic Model 801SBW, Apco Model 445, ARI
Connection to Gravity System: Force mains shall discharge to the gravity sewer system using a wye connection. The point of connection shall be five (5) feet upstream of a manhole in a gravity main. Connections directly to a manhole structure will not be permitted.

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- Gravity Manhole Rehabilitation: The sides and bottom of the force main discharge manhole and a minimum of five (5) manholes downstream of the point of connection (unless otherwise directed by the City) shall be lined with a solventless, 100% solids, corrosion resistant epoxy coating or a lining have multiple, structural fiberglass layers with a non-porous diaphragm bonded between the layers of fiberglass, and molded to the existing structure.
Acceptable Manufacturer: Raven Lining Systems Raven 405, Terre Hill Composites Multiplex Liner THC-610-SL-68, or approved equal.

- New Manhole Construction: When a new manhole is to be constructed at the point of connection to the gravity system, the manhole shall be manufactured with a flexible sheet liner with locking extensions. The bottom of the new manhole shall be treated with the epoxy coating specified above.
Acceptable Manufacturer: Ameron Protective Lining Division, Amer-Plate T• Lock, or approved equal.

- Mechanically Restrained Joints: The force main shall be fitted at all angle points with mechanically restrained joints designed to withstand the thrust developed under the test pressure plus 50 psi. The required number of mechanically restrained joints from the angle point shall be determined by the design engineer and shown in plan and profile (see Section One).

- Clean-Outs: The need for clean-outs on the force main shall be determined during plan review by the City. As a general guide, clean-outs will not be required on force mains less than 1800 feet in length. If clean-outs are required, refer to the City of O'Fallon construction specifications.

- Tracer Wire: Tracer wire, 8 Gauge Copper, will be required to be placed along the forcemain. A minimum of two force main markers with a tracer wire access box shall be placed along the force main alignment. Additional location of the force main markers and access box shall be as described below. When the end of a section of wire is reached and a new section of wire is used, the two sections will be securely connected with a Keamey Connector or equivalent.

- Location of Force Main Markers and Tracer Wire Access Box shall be installed:
Every 500 foot along force main runs for Force Main Markers.
Five (5) feet back from the pavement edge on both sides of a road crossing
Or as directed by the City.
Markers to be CRM3-060-01 or approved equal
Tracer Wire Access Box shall be VALCO TWAB or approved equal and located every 1000 feet and adjacent to a Force Main Marker. Tracer Wire Access Box to be painted green.

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4.3 TRANSITION PIPING

When PVC pipe (See Section 4.1) is used for force main outside the structural walls, a transition pipe must be used to make the transition between the valve chamber and meter vault before exiting the lift station site. The following methods shall be used:

- Four inch (4") Diameter and Larger:
Both pump discharge lines shall be joined to a flanged stainless steel tee. A flanged stainless stub shall be bolted to the tee then passed through the A-lok or Z-lok gasket installed in the valve chamber discharge wall. The PVC force main shall be attached to the stainless steel stub outside of the valve chamber by a long pattern sleeve mechanical joint with Mega-Lug retainer glands.
Three Inch (3") Diameter:
Both pump discharge lines shall be joined to a Schedule 80 PVC socket tee. From the tee, a Schedule 80 PVC stub shall pass through the A-lok or Z-lok gasket installed in the valve chamber discharge wall. Transition the stub to the SDR-21 PVC force main with a PVC coupling outside of the valve chamber.

- DISCHARGE RISERS: Stainless steel support braces must be installed between the riser and wet well wall. The braces shall be placed approximately every 3' on center.

- SHUT-OFF AND CHECK VALVES: 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. All valves shall be rated so as to withstand normal working pressure plus allowances for water hammer. No pump discharge valve shall be vertically mounted or located in the wet well area.

- Shut-off Valves: Shut-off valves shall be plug type valves. The valves shall be located so that each pump may be isolated from the common discharge header. Plug valves shall be of stainless steel body, ASTM A126 Class B, or stainless steel ASTM A536. Valve plugs shall be stainless steel ASTM A126 Class B, or stainless steel meeting ASTM A536, Grade 65-45-12, covered with a Buna-N Rubber compound. The seats are to be a corrosion resistant alloy either 304 stainless steel or nickel.

- Flange Valves: Flange valves shall be in accordance with ANSI B16.1 Class 125 standards.
Grooved End Valves: Grooved end valves shall have end-to-end dimensions in conformance with AWWA C-509 with the grooved ends conforming to AWWA C-606 rigid grooving dimensions. Sleeve type bearings shall be utilized in both the upper and lower

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