

**SECTION 4 – SUPPLEMENT TO DENVER WATER ENGINEERING STANDARDS**

*CHAPTER 6 – MATERIALS*

**4.1. SECTION 6.01 – MATERIALS AND TESTING**

All water system materials, construction and testing shall be in accordance with these Specifications and the most current Denver Water Engineering Standards. Any material proposed as "an equal" must be reviewed and found acceptable by the District, prior to design or construction. Any correspondence with Denver Water regarding the Engineering Standards shall also include the District.

**4.2. SECTION 6.04 – SELECTION OF PIPE**

**Polyvinyl Chloride Pipe**

Polyvinyl Chloride Pipe (PVC) is the pipeline material preferred for use for all sizes of lines in water systems within the Southgate Water District. PVC pipe shall be designed in accordance with AWWA C900/C905 Specifications, latest revision. Minimum design working pressure shall be 150 psi. Minimum design transient or water hammer pressure shall be: 120 psi for 6- and 8-inch lines, 110 psi for 12-inch diameter lines, and 80 psi for 16- and 20-inch diameter lines. Pipe design calculations shall be submitted to the District, upon request.

**Ductile Iron Pipe**

Ductile Iron Pipe (DIP) for main line construction shall be approved for use by the District. Typically, PVC should be used. Ductile Iron Pipe shall be designed in accordance with ANSI/AWWA C150/A21.50 Specifications, latest revision. Minimum design working pressure shall be 150 psi. Minimum design transient or water hammer pressure shall be: 120 psi for 6- and 8-inch lines, 110 psi for 12-inch diameter lines, and 80 psi for 16- and 20-inch diameter lines. Pipe design calculations shall be submitted to the District, upon request.

Flanged DIP for use in vault installations (butterfly valve vaults, pressure regulating valve vaults, etc) shall be coated with a minimum 10-mil epoxy coating system with NSF-61 certification for use in potable water applications. Contractor shall submit proposed coating system to the District for approval.

<b>Minimum Design Transient/Water Hammer</b>	
<b>Pipeline Diameter</b>	<b>Pressure Requirement</b>
6"-8"	120 psi
12"	110 psi
16"-20"	80 psi

**4.3. SECTION 6.05 – PIPE FITTINGS**

All fittings, joints, couplings, and mechanical joint restraint devices shall be lined and coated with fusion-bonded epoxy in accordance with AWWA C116. All bolts, nuts and washers shall be Type 304 or Type 316 stainless steel. Tie rods shall also be Type 304 or Type 316 stainless steel

meeting strength requirements of ASTM A193 B8 or B8M respectively.

#### 4.4. SECTION 6.06 – LINE VALVES

Valves on 6, 8, and 12-inch diameter lines shall be direct-bury gate valves.

Direct bury gate valves shall be resilient seat with non-rising stem and shall be the same size as the main. Valves shall be equipped with mechanical joint ends in accordance with AWWA C111 with tee-head bolts and hexagon nuts fabricated from stainless steel. Valves shall have 2-inch (2") square operating nuts and shall open by turning the nut clockwise (right). Nuts shall be painted red.

Valves on 16-inch diameter lines and larger shall be flanged butterfly valves in vaults.

Butterfly valves shall be designed and manufactured in strict compliance with AWWA C504, except as modified herein. Valves shall have 2-inch (2") square operating nuts and shall open by turning the nut clockwise (right). Nuts shall be painted red.

Butterfly Valve Vault Requirements:

- Manufacturer shall supply design and structural calculations stamped by a Professional Engineer registered in the State of Colorado certifying capacity of the structure and indicating the structure's ability to resist all applicable loads.
- Vault interior shall be a smooth finish throughout with white coating for improved lighting and cleanliness.
- Provide C-55 black damp-proofing coating on exterior bottom half of vault.
- Close all penetrations through the vault wall with "Link-Seal" style seals.
- See Detail W-11 for all other requirements.

#### 4.5. SECTION 6.07 – PRESSURE REGULATING VALVES

Pressure reducing valve shall be Singer Model S106-PR, full port, rolling diaphragm, pressure reducing control valve, Class 150 flange body, stainless steel X107 position indicator, oxynitride stem, stainless steel pilot strainer with stainless steel blow-down, stainless steel isolation ball valves, stainless steel braided hose and fittings, stainless steel pilot with 20-200 psi spring range. Pressure set point will be determined on a case by case basis.

PRV Vault Requirements:

- Manufacturer shall supply design and structural calculations stamped by a Professional Engineer registered in the State of Colorado certifying capacity of the structure and indicating the structure's ability to resist all applicable loads.
- Vault interior shall be a smooth finish throughout with white coating for improved lighting and cleanliness.
- Provide C-55 black damp-proofing coating on exterior bottom half of vault.
- Provide 3" thick R21 spray-on polyurethane foam insulation on vault top section.
- Close all penetrations through the vault wall with "Link-Seal" style seals.

PRV Appurtenances:

- Provide pressure gauge assemblies upstream and downstream of valve. Pressure gauges shall be stainless steel and installed through a service saddle assembly with ball valve isolation. Provide dual scale, glycerine filled, 4" diameter face. Assemblies shall include an additional threaded port with plug on the gauge side of the ball valve (see Detail W-09).
- All ball valves shall be Apollo 82-100 threaded, bronze, 3-piece, full port ball valves.
- Flange adapters, if required, shall be Smith-Blair Model 911 with Cam-Lock joint restraint or District approved equal. Flange adapters with ring style gaskets are not acceptable. Service saddle (required at pressure gauges) shall be Smith-Blair #372 stainless steel with double stud.
- Bolted steel transition couplings (BTSC) shall be a restrained dismantling joint. Provide Romac DJ400 with stainless steel nuts, bolts and limiting rods or District approved equal. See Section 4.12 for additional information.
- All pipe sections and flanged fittings shall be ductile iron in conformance with ANSI/AWWA C110/A21.10 and ANSI B.16 Class 125 Standards. Epoxy coating system shall be provided per Section 4.2.
- Provided stainless steel ASTM F593 hex bolts, ASTM F594 hex nuts, and SAE stainless steel washers used throughout.
- All flange gaskets shall be full face 1/8" thick Toruseal flange gaskets.
- See Detail W-09 for all other requirements.

#### 4.6. SECTION 6.17 – CONCRETE STRUCTURES – (ENCASEMENTS)

##### 4.6.1. GENERAL

Reinforced concrete encasements shall be constructed to the limits shown on the construction drawings. However, should field conditions differ from the reviewed and signed plans (e.g. ground elevations, creek locations), the encasement limits shall be reviewed in the field by the District, prior to any encasement construction.

##### 4.6.2. MATERIALS

Encasements shall be constructed of concrete made from well-graded aggregate and Type II cement, having a minimum twenty-eight (28) day compressive strength of 4000 psi, slump of 2"-4", and air entrainment of 3% to 5%.

Reinforcement steel used in encasements shall be ASTM A36 steel.

##### 4.6.3. INSTALLATION

Reinforced concrete encasement shall be installed in accordance with the "Concrete Encasement" construction detail, found in these Specifications. Minimum clear distance between steel reinforcement and the edge of the concrete encasement shall be three inches (3"). The encasement shall be formed using undisturbed soils or concrete formwork. Concrete shall be vibrated around steel reinforcement using vibration equipment or manual poling and shall not be placed on a frozen or unstable foundation. Suitable concrete protection shall be provided to reduce rapid moisture loss and to protect the concrete from freezing.

##### 4.6.4. TESTING

The Contractor shall submit the concrete mix design to the District for review at least 48 hours prior to encasement construction. The District may require that concrete cylinders be sampled on-site and tested at twenty-eight (28) days to show conformance with the required twenty-eight (28) day compressive strength requirement of 4000 psi. Slump and air entrainment may also be tested at the time of concrete pour, at the District's discretion.

#### 4.7. SECTION 6.23 – MANUFACTURER AND MODELS OF FIRE HYDRANTS

Allowable fire hydrants within the Southgate Water District service area shall be Mueller Super Centurion Model A-423, Waterous Pacer Model WB-67-250 (w/ bronze brushed shoe and shaft coupling), and AVK Series 27. All fire hydrants installed shall be red (Rustoleum 7400 System, #1210402 “Fire Hydrant Red” or District-approved equal).

For new fire hydrant installations, a maximum of one (1) two-foot extension will be allowed to raise the hydrant to the proper elevation above final grade. For existing infrastructure, a maximum of two (2) two-foot extensions will be allowed to raise the hydrant to the proper elevation in the event of changes to final grade. The District reserves the right to require installation of a new hydrant assembly as part of any new grading operations.

#### 4.8. SECTION 6.24 – FIRELINE CONNECTIONS TO MAINS

Firelines shall be sized in accordance with the appropriate Fire Protection Bureau (South Metro Fire Rescue Authority or the Littleton Fire Protection District). Connection of firelines to District infrastructure will be witnessed by the District. Inspection, testing, and acceptance of the fireline will be subject to the appropriate Fire Protection Bureau.

#### 4.9. SECTION 6.25 – SERVICE LINES

Denver Water shall install all taps for services two inches (2”) in diameter or smaller. Service connections larger than two inches (2”) may be installed by the Owner's Contractor in accordance with the Denver Water Engineering Standards.

#### 4.10. SECTION 6.28A – POLYETHYLENE ENCASEMENT

Encasement material shall be high density cross-laminated polyethylene film with a minimum thickness of 4 mils conforming to AWWA C105/A21.5.

#### 4.11. SECTION 6.32 – CARRIER PIPE

Carrier pipe shall be fusible PVC or an internally locking-joint PVC pipe. CertainTeed Certa-Lok PVC pipe is not an approved material.

#### 4.12. SECTION 6.34 – AIR AND VACUUM VALVES

All air and vacuum valves shall be combination air and vacuum valve. Air vacuum/air release valve is not an acceptable alternative. Acceptable manufacturers shall be Val-Matic Series 200, APCO Williamette Series 140C, ARI Flow Control D040 (< 3”) or D060 (3” and >).

Design shall conform to AWWA C512 and be heavy-duty air and vacuum valve, water style. Valve shall be single body type and rated not be less than that specified for the pipe. Body and cover shall be cast iron and float shall be stainless steel. All internal parts shall be stainless steel.

Provide valves with internal deflector and external adjustable discharge orifice to control leakage or blow-by of liquid. All ball valves shall be Apollo 82-100 threaded, bronze, 3-piece, full port ball valves.

Inflow preventers shall be provided to close in the event of a flooded vault preventing contaminated water from reaching the air valve outlet. Acceptable product shall be Wager 2100 Mushroom Check Valve or approved equal. Inflow preventer shall be fully automatic, float operated, and designed to allow the combination air and vacuum valve to perform its normal function of admitting and discharging air under normal operating conditions.

See Detail W-10 for additional information.

#### 4.13. BLOWOFF ASSEMBLY

Permanent blowoff assemblies for locations where a water line dead ends (i.e. cul-de-sacs) shall conform to Denver Water Standard Detail Sheet 76 (2" Blowoff Hydrant) except that a 2" threaded gate valve shall replace the 2" curb stop to isolate the main from the blowoff hydrant assembly. All other requirements of Sheet 76 shall apply. Gate valves for blowoff assemblies shall be AVK Series 03, American Flow Control Series 2500, or District approved equal, with NPT threaded ends meeting the requirements of AWWA C509. Stem and bolts shall be stainless steel with fusion-bonded epoxy coating inside and outside per AWWA C550.

#### 4.14. FLANGED COUPLING ADAPTERS

Acceptable manufacturer of flange coupling adapters shall be Smith-Blair Model 911 with Cam-Lock joint restraint or District approved equal.

All flanged coupling adapters shall be of the restrained type (RFCA). Flanged end and body shall conform to AWWA C219 and coupling end to be compression gland type with follower ring. Flanged adapters shall be made of steel per ASTM A36, Grade C or ductile iron conforming to ASTM A536. Flanged end bolt circle, bolt size, and spacing shall conform to the applicable provisions of ANSI B16.1 and shall be drilled Class 125. Bolts and nuts shall be Type 304 stainless steel. Restraint for the flange adapter shall consist of a plurality of individual actuated gripping wedges. Torque limiting actuating screws shall be used to ensure proper initial set of gripping wedges. The adapter shall have a pressure rating not less than the connecting pipe. Anchor studs shall not be used where joint restraint is required. Furnish adapters with tie rod harness assemblies where indicated. Interior and exterior body of the flange adapter shall be coated with fusion-bonded epoxy.

#### 4.15. DISMANTLING JOINT (IN VAULTS)

Acceptable manufacturer of dismantling joint shall be Romac Model DJ400 or District approved equal conforming to AWWA C219.

Design shall consist of a mechanical joint fitting located between two pipe flanges with restraining rods across the mechanical joint section, providing a restrained system with integral space for removal of adjacent equipment. Body shall be fusion epoxy bonded coated and lined, minimum 200 psi working pressure, and fully restrained. Bolts, nuts and rods shall be stainless steel. An insulating flange kit is required when connecting dissimilar material.