

BASIC SPECIFICATIONS

SECTION B

WATER PIPELINE MATERIALS SPECIFICATIONS

1. GENERAL

A. Alternate Pipeline Materials

Where alternate pipeline materials are allowed by the District, the Contractor shall select such materials and construction methods as will result in a satisfactory completed project. All pipe materials shall be new and unused unless otherwise specified. Materials and strength of pipe shall be as shown on the plans or as specified herein.

B. Contractor Furnished Materials

The Contractor shall furnish (excepting materials specifically listed in the Special Requirements to be furnished by the District) and install all pipe, fittings, supports, bolts, nuts, gaskets, jointing materials, appurtenances, auxiliary piping and connections to equipment in accordance with the drawings and specifications, all as required for a complete and workable piping system.

C. Exposed Piping Supports

All exposed piping shall be adequately supported with devices of appropriate design unless otherwise approved by Engineer, the support shall conform to the Standard Drawing A-5 or as shown on the Drawings.

D. Piping Sizes

Pipe sizes are nominal inside diameter unless otherwise noted. All sizes and types of pipe are noted on the Drawings and specified herein. Where pipe is lined, the nominal diameter shall be the inside diameter of the cement mortar lining, except for wrought iron pipe.

E. Dissimilar Metals

All dissimilar metals shall be insulated from one another with approved insulating flange sets or unions.

F. Material Identification

All pipe and fittings delivered to the job site shall be clearly marked to identify the manufacturer's name, material, class, and thickness. All material shall be new and free of blemishes. Acceptance of pipe and accessories by the District will be based on load bearing tests, and inspection of the complete products as specified hereinafter. Acceptance of installed piping will be based on inspection and leakage tests as specified hereinafter.

2. WELDED STEEL PIPE, CML & CMC

Shop fabricated pipe with machine-applied lining and coating, dye-check shop welding performed after hydrostatic testing of cylinders, pipe per AWWA C200, steel plate per ASTM A1011/A1011M, 10 ga. minimum, minimum yield 36,000 psi, cement mortar coating and lining per AWWA C205. Design stress shall not exceed 18,000 psi. Each pipe section shall be provided, prior to delivery, with temporary plastic end covers, with exposed steel shop coated, 40' maximum joint lengths, lap weld bell x plain end spigot, or as indicated on the Drawings and/or Bidding Sheet, including rubber gaskets and gasket lubricant. Pipe furnished herein shall be from an organization which has had not less than ten (10) years successful experience providing pipelines of the type specified.

The minimum steel plate thicknesses utilized for water pipeline shall be as shown below:

**JURUPA COMMUNITY SERVICES DISTRICT
MINIMUM WATER PIPELINE THICKNESS**

Nominal Pipe Diameter	Minimum Cylinder Diameter	Class 150 Minimum Plate Thickness	Minimum Cement Mortar Lining Thickness	Minimum Cement Mortar Coating Thickness
6"	6-5/8" O.D.	0.1345"	1/4"	3/4"
8"	8-5/8" O.D.	0.1345"	1/4"	3/4"
12"	12-3/4" O.D.	0.1345"	5/16"	3/4"
16"	17-3/8" O.D.	0.188"	5/16"	3/4"
18"	19-3/8" O.D.	0.188"	5/16"	3/4"
20"	21-3/8" O.D.	0.188"	5/16"	3/4"
24"	25-3/8" O.D.	0.188"	3/8"	3/4"
30"	31-3/8" O.D.	0.188"	3/8"	3/4"
36"	37-3/8" O.D.	0.188"	3/8"	3/4"

NOTES

1. *Steel thicknesses indicated hereon are minimum; and design steel thickness shall be determined from the pressure imposed (Class, the design stress of the steel and the O.D. of the cylinder). The minimum acceptable yield strength of the steel shall be 36,000 psi. Design stress shall not exceed 18,000 psi regardless of yield strength of steel.*
2. *All materials shall conform with AWWA Specifications C200 (Steel Pipe CML/CMC, Section C205)*

3. DUCTILE IRON WATER PIPE

Ductile Iron Water Pipe shall be used only where specifically approved by District; and shall comply with ANSI A21.51 rubber gasket push-on type joint bell and spigot, conforming to ANSI A21.11 manufactured in sections of 18 feet or 20 feet. Fittings shall be rubber gasket push-on manufactured in accordance with ANSI A21.10. Where indicated on the Project Drawings, restrained joints shall mean the use of T.R. Flex Pipe as manufactured by U.S. Pipe or approved equal. All ductile iron pipe shall be provided with double polyethylene encasement for the entire length of the pipeline, per AWWA C105.

Unless otherwise specified, the interior of the Ductile Iron Water Pipe and fittings shall be lined with a uniform thickness of cement mortar "double thickness" then sealed with a bituminous coating in accordance with AWWA C104 (latest). The outside surfaces

of D.I.P. and fittings shall be coated with a bituminous coating in accordance with ANSI A21.6 or ANSI A21.51.

Standard pressure class for Ductile Iron Water Pipe shall be based on internal pressures and external loadings. Unless otherwise noted, minimum design pressure class shall be 150 psi. Ductile Iron Pipe thickness Class 53 shall be used where flanged, or Victaulic-type pipe joints are specified or indicated on the plans.

All service connections made to the Ductile Iron Pipe shall be a brass double service strap type.

4. POLYVINYL CHLORIDE (PVC) PIPE

PVC pipe shall conform to the latest revision of AWWA C909 unless otherwise specified herein.

All pipe shall be made from quality PVC resin, compounded to provide physical and mechanical properties that are equal or exceed cell class 12454 as defined in ASTM D1784. The pipe bell shall consist of an integral wall section with a factory installed, solid cross-section elastomeric gasket, which meets the requirements of ASTM F477. The elastomeric gasket shall be furnished by the pipe manufacturer.

The bell section shall be designed to be at least as hydrostatically strong as the pipe barrel and meet the requirements of AWWA C909. The joint design shall meet the requirements of ASTM D3139 under both pressure and 22 in HG vacuum.

This specification includes polyvinyl chloride (PVC) pipe of the following classes/working water pressures:

- For Working Pressure up to 150 psi: Class 235 (DR-18)
- For Working Pressure up to 200 psi: Class 305 (DR-14)

AWWA C909 PVC pipe shall be Class 235 minimum (DR-18) or as specified on approved Drawings or elsewhere.

All PVC pipe shall be twenty (20) foot laying lengths and have cast iron outside diameters (C.I.O.D.'s).

PVC pipe shall be installed within one year of its manufactured date. Pipe older than one year shall not be delivered to the construction site.

The District shall require the manufacturer to submit a certificate stating that all pipe has been manufactured and tested in accordance with this specification.

The Contractor shall submit test results showing the physical properties of the materials used in the manufacture of the rubber gaskets, if required by the District. All rubber gaskets furnished under this specification shall be subject to inspection and/or test by the District. Any gasket found to be unsatisfactory by the District shall be immediately replaced by the Contractor, at no expense to the District.

All pipe furnished under these specifications shall be the product of an organization that has had not less than three (3) years of successful experience in the manufacture of pipe of the type specified. The total pipeline shall be the product of one company (or integrated companies) in the business for the design and manufacture of the pipeline materials required herein; unless otherwise approved in writing by the District.

All pipe to be supplied under these specifications must have the following markings on the pipe barrel: Nominal size and O.D. base (for example, 8" C.I.O.D.); dimension ratio number; AWWA pressure class, and manufacturer's name or trademark, and production record code.

All rubber rings shall be furnished by the pipe manufacturer. These rubber rings (elastomeric gaskets) shall be manufactured to conform to the requirements of ASTM F477.

Joints

Unless otherwise specified or shown, all joints of PVC pipe shall be with elastomeric gasket bell ends. Solvent welded joints will not be allowed. The bell ends shall be an integral thickened bell. The minimum wall thickness of the bell, at any point, between the ring groove and the pipe barrel shall conform to the dimension ratio requirements of AWWA C909.

Pipe Outlets 2 Inches and Smaller

Outlet connections to PVC water mains two (2) inches and smaller shall be bronze service saddles with double bronze straps designed specifically for C.I.O.D. PVC pipe. No single strap saddles or full circle saddles are allowed.

Pipe Outlets Larger Than 2 Inches

Outlets in C909 PVC pipe larger than two (2) inches shall be accomplished through the use of ductile fittings.

For outlets to be installed after initial pipeline construction, a tapping saddle may be used subject to advanced written approval by the District.

Ductile Iron Fittings for PVC

Ductile iron fittings proposed to be furnished shall be in compliance with “Section 6. DUCTILE IRON FITTINGS” of this specification.

Restraint Joints for PVC Pipe

Each bell and spigot pipe joint shall be fully restrained. The restraint joint shall be standard manufacturer’s product for C909 PVC pipe for pipe sizes 12 inches and smaller.

Restrained joints shall be accomplished with external restraining devices rated for a minimum of 235 psi (DR 18). The pipe restraint shall have a minimum factor of safety of 2:1.

The bell and spigot joint restraint device shall consist of split rings installed on the spigot end of the pipe and behind the bell. The restraint rings shall apply even pressure around the pipe and provide 360 degrees of contact. The inside diameter of the restraint rings shall be serrated where contact is made with the outside diameter of the PVC pipe. The serrations on the restraint rings shall be machined and provide positive, directional restraint when the rings are tightened onto the PVC pipe.

The restraint device rings shall be ductile iron in accordance with ASTM A536 with Type 316 stainless steel bolts, nuts, rods, and washers. The rings shall be coated with the standard manufacturer’s coating. The coating’s thickness shall not prevent the serration edge from contact with the PVC pipe.

Mechanical Joint Restraint for PVC Pipe to Fittings and Appurtenances

All pipe connections to fittings and appurtenances shall be constructed with restraint joints. The restraint joints shall be standard manufacturer's product for C909 PVC pipe.

The restraint for the mechanical joint fitting shall be incorporated in the design of the follower gland and shall utilize multiple wedge segments that act against the pipe. The wedge segments shall increase their resistance as the line pressure increases. The assembled joint shall maintain the maximum flexibility and deflection of all nominal pipe sizes after the pipe has been buried. Glands shall be manufactured of ductile iron conforming to ASTM A536. The mechanical joint restraint shall be MEGALUG as manufactured by EBAA Iron, Inc., Uni-Flange Series 1400 as manufactured by Ford Meter Box, Inc, or approved equal.

The restraining glands, wedge segments, and actuating bolts shall be manufactured of high-strength ductile iron, conforming to the requirements of ASTM A536, Grade 65-45-12. All bolts and connecting hardware shall be of high strength low alloy material in accordance with ANSI/AWWA C111/A21.11

The dimensions shall be compatible with standardized mechanical joints conforming to the requirements of AWWA C111 / ANSI A21.11 and AWWA C153 / ANSI 21.53 through 24 inches.

Breakaway tops shall be incorporated in the design of the actuating bolts in order to visually ensure that the proper torque has been applied. The manufacturing of the actuating bolt shall ensure precise and consistent operating torque of the breakaway top.

The mechanical joint restraining device shall have a minimum working pressure rating of 235 psi and shall have a minimum factor of safety of 2:1.

The restraining device shall be coated with the standard manufacturer's coating. All buried restraint joints shall be wrapped with double polyethylene encasement. Restraining devices shall be approved by the District.

High Deflection Coupling

Pipe joints shall not be pulled at any angle greater than one-half the maximum angle recommended by the pipe manufacturer. If an angle greater than one-half of the maximum

angle recommended by the pipe manufacturer is required, install ROMAC Alpha Series Coupling to restrain the joint Minimum Curvature. Approval by the Engineer is required before high deflection couplings can be used.

Minimum Curvature

Whenever portions of the proposed sewer construction are to be installed on the radius of a curve, the minimum radius and installation of the pipe shall be in accordance with the manufacturer's recommendations.

Locator Wire

Locator wire shall be installed over all non-metallic pipelines, services, and appurtenances for the purpose of providing a continuous signal path for electronic pipe locators used to determine pipe alignment after installation. Locator wire shall be 14-1 solid insulated copper wire (UF), in a continuous strand, placed on top of pipe and secured with tape. The wire shall be tied to the pipe at 10-foot intervals with plastic adhesive tape. Locator wire shall be brought to the surface in concrete valve boxes as approved by the District at 660 feet maximum on centers and at all appurtenances (i.e. fire hydrants, water services, air valves, blowoffs, valve cans, etc.), thus providing continuous "looping" between the appurtenances and the water main. If pertinent locations exceed the 660 feet maximum spacing the concrete valve box shall be installed at the edge of right-of-way and the face of curb in front of the box marked with the letters "LW". If a curb does not exist a marker post approved by the District shall be installed within 2 feet of the valve box. Two feet of wire shall be looped within all valve boxes. All splices to locator wire shall be made with direct bury connectors as approved by the District.

After all trench backfill operations are complete, the Contractor shall pay for a third-party to conduct the first conductivity test to confirm that the wire is continuous. After the installation of all other underground facilities, the Contractor shall pay a third-party to conduct) the second conductivity test to re-confirm that the wire is continuous. The conductivity tests shall only be performed with a District representative present. The Contractor shall be responsible for all costs to confirm, locate, and repair the breaks in the locator wire identified in the conductivity test. In addition, the Contractor shall reimburse the District for all costs to retest repaired sections of the wire. The Contractor is advised to use care in the installation and backfilling operations to prevent damage to the wire. The Contractor shall provide the District a final report summarizing the results of the

conductivity testing. The report shall include but not be limited to listing points of failure identified during testing and measures taken to repair the breaks, location where tests were taken, dates, JCSD Staff present during testing, and a final summary showing all passed testing.

Splices shall be made at locations approved by the District. The wire connecting device shall be an underground electrical wire connector to splice and effectively moisture-seal the conductors. Wire connectors shall be approved by the District and shall be UL listed and CSA certified for direct burial splices.

5. WELDED STEEL FITTINGS

All bends, reducers, increasers, tees, crosses, wyes, and other special fittings, except as specifically noted on the Drawings, shall be constructed of cement mortar lined steel pipe with coating as specified for balance of pipeline, and shall be shop fabricated in accordance with the latest revision of AWWA C208. (as modified below).

ELBOWS

Angle	0-22 1/2	22 1/2°-45°	45°-67 1/2°	67 1/2°-90°
No. Pieces	2	3	4	5

NOTE: At the break point angles (i.e. 22 1/2°, 45°, and 67 1/2°) the Contractor shall use the elbow with the largest number of pieces.

All fittings shall have a steel cylinder thickness equal to or greater than the specified wall thickness of the pipeline, but not less than 10 gauge. The minimum radius for all bends shall not be less than 2.5 times the nominal diameter of the pipelines. Where simulated weld bells are used for lap-welded fittings, the bell plate thickness shall be 1/4".

Special fittings shall be fabricated from machine cement mortar lined and machine outside coated. The individual parts of the fittings shall be cut from the pipe, welded together, and the coating and lining of shop joints shall be hand applied to provide a finished cement mortar lined and finished outside coated joint comparable to the mechanically applied lining and coating detailed herein.

Specials and fittings fabricated from cylinders that have been hydrostatically tested in accordance with these specifications shall be tested by the dye-check method, or

approved equal, prior to the lining and coating of said material. Contractor shall submit fabrication drawings for all AWWA shop fabricated fittings to the District for approval prior to construction.

Long Radius Steel Elbows

Seamless, forged long radius steel elbows shall be used where specified by the District and shall be shop fabricated in accordance with the latest revision of ASTM A234.

6. DUCTILE IRON FITTINGS

Fittings shall be ductile iron and shall conform to ANSI A21.10 (AWWA C110) or A21.53 (AWWA C153), and ANSI A 21.11 (AWWA C111). Fittings shall be bolted mechanical joints or push-on joints unless otherwise indicated on the plans, bid items, or special provisions. Short body type fittings conforming to AWWA Standard C153 may be used for sizes 4-inch through 24-inch. Fittings up to 24-inch size shall be 350 psi pressure rating and over 24-inch size shall be 150 psi pressure rating.

Flanged fittings shall conform to the requirements of AWWA Standard C110 or C153. Flanges shall be drilled to ANSI B16.1, 125 lb. standard bolt template. The 250 lb. flanges, when required shall be drilled to ANSI B16.1, 250 lb. standard bolt template.

Gaskets for flanged fittings shall be either ring or full-faced, 1/8-inch thick, vulcanized styrene butadiene rubber (SBR) or Neoprene rubber gaskets. The full-faced gaskets shall extend from the inside diameter of the flange to beyond the outside edge of the bolt holes. Ring type gaskets shall be used for 14-inch and larger flange fittings. Blind flanges shall have a gasket that consist of 1/8-inch thick SBR or neoprene rubber sheet, shall cover the entire inside surface of the blind flange and shall be cemented to the surface of the blind flange. In lieu of rubber gasket, the 1/16-inch polytetrafluoroethylene (PTFE) GORE-TEX GR sheet gasketing material, applied full-faced, is an approved equal.

Tee-head bolts and hexagonal nuts for all mechanical joints shall be high strength, low alloy steel, meeting the current provisions of ANSI/AWWA C111/A21.11, "Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings", and must be Cor-Ten or approved stainless steel.

Stainless steel nuts and bolts shall use Anti-Cease as manufactured by Loc-Tite or approved equal.

Hexagonal bolts, nuts, and washers for flanged fittings shall be zinc plated, high strength, low-carbon steel conforming to the chemical and mechanical requirements of ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength, Grade A.

All exposed nuts and bolts shall be coated after assembly with an approved mastic. Threads shall be shown beyond the installed nuts and correct size (diameter) bolts shall be used in all installations.

Fittings shall be tar (seal) coated and cement mortar lined per ANSI A21.4 (AWWA C104). Above grade fittings shall be flanged and from the list of approved manufacturers. Fittings shall be cement mortar lining shall be "double thickness" in accordance with AWWA Standard C104, "Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water".

The outside surfaces of the DIP fittings shall be coated with NO-OX-ID special protective metal coating and wax. All ductile iron fittings shall be polyethylene encased at the time of installation. Polyethylene encasement and installation shall be in accordance with ANSI/AWWA C105. Ductile Iron Fittings need to be produced by a "District Approved Manufacturer".

Flange Adaptors

Flange Adaptors shall be manufactured from ductile iron per ASTM A536 and shall have bolt circles and bolt holes to meet ANSI B16.1 – Class 125 or Class 250 if required and shown on the plans. Flange Adaptors shall be manufactured by EBAA IRON, Inc., Uni-Flange by Ford Meter Box Company, Inc., Tyler Corporation, or approved equal.

7. AWWA GATE VALVES

All resilient seat gate valves shall meet the requirements of AWWA C509-(latest) for rubber seated gate valves and shall be tested bubble-tight. In addition, RS Gate Valves shall be furnished with the following items:

- Valve body and bonnet shall be fusion bonded epoxy coated inside and out (10 mils nominal thickness) and meet all requirements of AWWA C550.
- Low zinc bronze stems.

- All stainless-steel body hardware. Resilient seat gate valves shall be produced by a "District Approved Manufacturer".

8. RUBBER SEATED BUTTERFLY VALVES

Butterfly valves shall conform to the latest revision of AWWA C504 and the following:

- Butterfly valves and operators shall be Class 150B, constructed for direct burial and have flanged ends to mate A.S.A. 150 lb. steel flanges.
- Butterfly valves shall be furnished with operators of the traveling nut or worm gear type, self-locking in any position, and sealed, gasketed, and lubricated to withstand a submersion in water to 10 psi. The valve shall open by counterclockwise rotation of a 2-inch square AWWA operating nut.
- The operator shall be capable of meeting the torque requirements for opening and closing the valve against:
 - 150 psi upstream and 0 psi downstream pressure.
 - Maximum inlet-outlet flow rate of 12 FPS, normal flow rate of 6 FPS, and shall be provided with AWWA stops capable of absorbing up to 300 foot-pounds of input torque without damage to the valve or operator.
- Butterfly valves shall have Buna N seat bonded or mechanically retained, without use of metal retainers or other devices located in the flow stream, to the body and have a disc seating edge of nichrome or stainless steel. All internal mountings or working parts shall be stainless steel.
- Butterfly valves shall have the shaft V-type self-adjusting packing. The shaft shall not be exposed between the valve body and the operator.
- Butterfly valves shall be furnished with records of tests specified in AWWA C504, Section 2.3 and Section 5. All valves shall be furnished with Certified drawings and parts list of the valve and operator. An affidavit of

compliance to AWWA C504 shall be furnished for all valves. Five (5) sets of the above information shall be furnished to the District.

- Butterfly valves shall have their internal and external surfaces (except flange faces, stainless steel, and rubber surfaces) epoxy coated, to meet all requirements of AWWA C550. All butterfly valves shall be lined (holiday free) with a minimum of 10 mils (2-5 mil coats) of Keysite 750, (white); or DeVoe Bar-Rust No. 235 (white). The epoxy lining shall be applied at the valve manufacturer's plant in accordance with the coating manufacturer's application specifications.
- Approved butterfly valves shall be produced by a "District Approved Manufacturer".

9. COPPER TUBING

Copper tubing shall conform to the requirements of the "Specifications for Seamless Copper Water Tube" (ASTM Designation B88) and shall be Type K. As required by the District, copper tubing shall be installed with a 6 mil (minimum) polyethylene sleeve "Polywrap C" by Northtown Company or District approved equal.

10. BLACK STEEL PIPE

Black steel pipe shall conform to the requirements of the ASTM A53/A53M and shall be "Standard Weight" (Type S) unless otherwise designated. Black steel pipe shall not be cement-mortar lined, for sizes up to 3" diameter but shall have fusion bonded epoxy lining and coating. Pipe/fittings sizes 4" and greater shall be cement mortar lined and outside cement mortar coated; cement mortar lined and outside bare; or bare steel, as designated on the Drawings or Specifications.

Unless otherwise shown, black steel pipe, 3 inches in diameter and smaller, shall be joined with malleable iron screwed fittings. Black pipe 4" and greater shall be joined with standard weight welding fittings produced by a "District Approved Manufacturer".

11. RED BRASS PIPE

Brass pipe and fittings shall conform to the requirements of the "Specifications for Seamless Red Brass Pipe, Standard Sizes" (ASTM Designation B43). As required by the

District, brass pipe shall be installed with a 6 mil (minimum) polyethylene sleeve "Polywrap C" by Northtown Company or District approved equal.

12. STAINLESS STEEL PIPE

Stainless steel pipe shall be Type 316 welded, fully finished, and shall conform to the "Specification for Seamless and Welded Austenitic Stainless-Steel Pipe (ASTM A312/A312M).

13. INSULATING UNIONS

Where dissimilar pipe materials are joined, suitable insulating unions shall be installed. Insulating unions shall be produced by a "District Approved Manufacturer".

14. PRESSURE GAUGES

Except as otherwise provided in these specifications, pressure gauges shall be 4-inch diameter dials, liquid filled, AISI 316 stainless steel case, have stainless steel elements, and 1/2-inch bottom connection. Accuracy shall be 0.5% of full scale. In all cases the normal operating pressure of the system to which the gauge is attached shall be within the middle 1/3 of the gauge range. Gauges shall read in pounds per square inch for pressure. Gauge shall be produced by a "District Approved Manufacturer."

15. PRESSURE REGULATING VALVES

A. General

Regulating valve shall be a diaphragm actuated, single seated, hydraulically operated globe-type valve. The valve body shall be ductile iron or stainless steel. It shall have two operating chambers sealed from each other by a flexible synthetic rubber fully supported diaphragm. The valve disc shall be resilient with a rectangular cross section and shall be retained on three sides. Valve bodies and all necessary parts shall be of a size and type suitable for use with pressure as specified and include all necessary fittings for correct pilotry and connections. The model numbers shall be as indicated on the Drawings.

Regulating valves shall be subject to hydrostatic test of not less than twice the maximum pressure rating. Pressure rating (Class) shall be as indicated on the Drawings.

B. Pump Control Valves

Control of valve operation shall be by means of an externally mounted, four-way, solenoid pilot valve. Self-cleaning strainers shall be used to protect the control system. Valve shall utilize line pressure for operation. A Limit-switch shall be installed to be adjustable over entire valve travel. Valve shall be equipped with a built-in lift type check feature to prevent reverse flow. It shall operate independently of the solenoid control. Solenoid valve shall operate on 120 VAC.

C. Pressure Relief Valves

The Pressure Relief Valve shall maintain constant upstream pressure by bypassing or relieving excess pressure and shall maintain close pressure limits without causing surges. The diaphragm assembly containing a valve stem shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. This diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. The diaphragm shall consist of nylon fabric bonded with synthetic rubber and shall not be used as a seating surface. There shall be no pistons operating the valve or pilot controls. All necessary repairs shall be possible without removing valve from the line. The pilot control shall be a direct-acting, adjustable, spring-loaded, diaphragm valve, designed to permit flow when controlling pressure exceeds spring setting. The pilot control system shall operate such that as excess line pressure is dissipating the main valve shall gradually close to a positive, drip-tight seating.

D. Rate of Flow Control Valves

The valve shall maintain a constant rate of flow regardless of fluctuations in upstream pressure. The diaphragm assembly containing a valve stem shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. The diaphragm shall consist of nylon fabric bonded with synthetic rubber and shall not be used as a seating surface. There shall be no pistons operating the valve or pilot controls. All necessary repairs shall be possible without removing valve from the line.

The pilot control shall be a direct-acting diaphragm valve designed to close when the actuating differential increases beyond the spring setting. The actuating differential pressure shall be produced by a thin-edge orifice plate installed in an orifice flange located downstream of the valve.

E. Pressure Reducing/Pressure Sustaining Valves

This valve shall maintain a constant downstream pressure regardless of fluctuations in demand. When the upstream pressure becomes equal to the spring setting of the pressure sustaining control, the valve throttles to maintain a constant inlet pressure. If the downstream pressure is greater than the upstream pressure the valve closes automatically to prevent return flow.

The diaphragm assembly containing a valve stem shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. This diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. The diaphragm shall consist of nylon fabric bonded with synthetic rubber and shall not be used as a seating surface. All necessary repairs shall be possible without removing valve from the line.

The pressure reducing pilot control shall be a direct-acting, adjustable, spring-loaded, normally open diaphragm valve, which closes when downstream pressure exceeds the spring setting.

The pressure sustaining pilot control shall be a direct-acting, adjustable, spring-loaded, normally closed diaphragm valve which opens when upstream pressure exceeds the spring setting. The control system shall include a strainer orifice assembly and an adjustable opening speed control.

F. Altitude Valves

The altitude valve shall maintain a constant downstream pressure regardless of fluctuations in demand and shall also close tight when a pressure reversal occurs. It shall be a hydraulically-operated, pilot-controlled, diaphragm type globe or angle valve. The main valve shall have a single removable seat and a resilient disc. The stem shall be guided at both ends by a bearing in the valve cover and an integral

bearing in the valve seat. No external packing glands are permitted, and there shall be no pistons operating the main valve or any pilot controls.

The pilot control shall be a direct-acting, adjustable, spring-loaded, normally open diaphragm valve, designed to permit flow when controlled pressure is less than the spring setting.

A system of auxiliary check valves shall be used to admit downstream pressure into the main valve cover chamber if pressure reversal occurs. This must result in positive closing of the main valve.

G. Coatings

All regulating valves shall have all wetted ferrous parts epoxy coated. The epoxy shall be thermo-setting, approved for potable water.

All coated surfaces shall be coated with 12 miles of fusion bonded epoxy and be visually and electrically examined for defects. The coating shall be holiday free with a low voltage wet sponge test per AWWA C550.

H. Options

Additional required options to be furnished with the valves shall be indicated on the Drawings utilizing the appropriate model numbers and/or catalog designations.

16. FLOW METERS

A. Service Flow Meters

Service flow meters for 5/8" through 1" diameters shall be displacement type, cold-water meters in accordance with AWWA C700, Latest; produced by a "District Approved Manufacturer". Service flow meters for 1 1/2", 2", and 3" diameters shall be turbine type cold-water meters in accordance with AWWA C701, latest; produced by a "District Approved Manufacturer". Service flow meters 4" diameter and larger shall be produced by a "District Approved Manufacturer" with all bronze turbine by-pass meter. All meters shall be equipped with Radio Reads.

Unless otherwise specified on Drawings and/or on the Bidding Sheet, subsequent to payment of fees and the purchase of the meters through the District, the District will furnish all service meters that are less than or equal to 3" diameter for installation by the Contractor. Meters 4" diameter and larger shall be furnished and installed by the Contractor in accordance with District Standards and Specifications.

The Contractor shall make all connections to the District side and private side of the meters, provide all excavation, backfill, and surface restoration, and furnish all required fittings, adapters, and piping necessary to make the connections. All costs for the work and materials shall be included in the appropriate bid items.

17. NO-OX-ID

For specified outside wrapped steel pipelines and/or where specifically directed by the District, outside pipe coating shall be NO-OX-ID special protective metal coating and wax.

18. PRECAST CONCRETE VAULTS

All precast concrete manhole sections shall be manufactured in a plant especially designed for that purpose. All units will conform to the design shown on the drawings, and all work shall be conducted under strict plant controlled supervision.

Design loads shall consist of dead load, live load, impact, and in addition, loads due to water table, and any other loads which may be imposed upon the structure.

Live loads shall be for H-20 and/or H-20-S16 per AASHTO Standard Specifications for Highway Bridges with revisions. Design wheel load shall be 16 kips. The live load shall be that loading which produces the maximum shears and bending moments in the structure. All reinforcing steel shall be intermediate or hard grade billet steel conforming to ASTM A615/A615M/A706/A706M. Bars other than 1/4" round, or smaller, shall be deformed in accordance with ASTM A615/A615M.

All vaults shall have a 2-piece torsion hinged cover specified for traffic loads where required. The effort necessary to lift the cover shall not exceed OSHA requirements. Cover shall be provided with a 6" x 6" meter reading lid located directly over the meter register. Also, cover shall be provided with a safety chain capable of limiting the travel of

the cover. Precast sections shall be joined with a plastic joint sealing compound. The preformed cold-applied ready-to-use plastic joint sealing compound shall be produced by a "District Approved Manufacturer".

Vaults shall be located outside of sidewalk areas. The dimension from the top of the vault to the centerline of the piping within the vault shall not exceed 5'.

19. FUSION BONDED EPOXY COATING

Wherever fusion-bonded epoxy coating is specified on steel piping or equipment for potable water, the coating system shall consist of one coat of Scotchkote 134; Tnemec Series 104 or District approved equal. Minimum dry film thickness shall be 12.0 mils. Surface preparation shall be SSPC-10. Coating shall be in accordance with NSF-61. Method of application shall be electrostatic spray method heat fusion per coating manufacturer's specifications.

Submit manufacturer's data sheets for review and approval, including method of application; minimum and maximum DFT; recommended surface preparation; application instructions and curing requirements; etc.

20. NSF COMPLIANCE

All materials in contact with domestic water shall comply with the applicable provisions of California Title 22 Regulations Related to Drinking Water, including NSF 60 and 61 certifications; all at no additional cost to the District. Additionally, Contractor shall provide the District with a written "Affidavit of Compliance" with the California Drinking Water Regulations as part of the submittal approval process. District will provide copies of the Contract Documents and related project information to the California Department of Public Health for their approval.

21. PIPE SUPPORTS

Pipe supports shall be adjustable for pipeline products PSG series pipe supports or District approved equal. Pipe support shall be painted with primer and two (2) coats of paint per District specifications. The pipe and saddle shall be separated by 1/8" thick Neoprene Rubber.