

CHAPTER 6 PIPELINE MATERIALS, VALVES AND APPURTENANCES

6.1 PIPELINE MATERIALS

All pipe, fittings, packing, jointing material, valves, and fire hydrants shall be new and conform to Section C of AWWA Standards. All pipe material, solder and flux shall be lead free (less than 0.2% lead in solder and flux and less than 8.0% lead in pipes and fittings).

All standards cited in the text refer to the latest revision of that standard under the same specification number or to the superseding specifications under a new number

Only the materials specified below may be used for pipeline. Steel and cast iron are not permitted for pipelines although steel pipe is permissible for boring casings per Chapter 5.

- A. Polyvinyl Chloride (PVC) Pipe: PVC pipes for utilities shall be provided as shown on the plans and as specified herein.
1. Shop Drawings: Catalog cuts and related data for all pipe and fitting material shall be submitted to the ENGINEER for review. Electronic copies of the approved submittals shall be forwarded to the AUTHORITY.
 2. Materials: All material under this section shall meet Made in America Criteria. PVC Pressure Pipe shall be as specified below. Fittings and adapters shall conform to the same requirements as for pipe, and shall be compatible with pipe.
 - a) General
 - i) Pipe shall be marked as to the type, class or nominal thickness, weight, manufacturer and date of production.
 - ii) PVC pressure pipe shall be installed in strict accordance with the manufacturer's instructions. Minimum depth of cover shall be 36 inches. Adapters shall be provided as required when connections are made to other types of pipe. Refer to Chapter 13 for list of approved manufacturers.
 - iii) All wastewater pressure force main pipe shall be factory dyed industry standard **green** to aid in identification. Potable water pressure pipe shall be factory dyed industry standard **blue**. Effluent transmission pipe shall be factory dyed industry standard **purple**. Polyethylene pipe shall be striped in the appropriate color for intended use.
 - iv) For pressurized pipe, fittings 3" and larger shall be mechanical joint type utilizing synthetic rubber ring gasket and shall conform to the requirements of AWWA/ANSI C110 /A21.10. For gravity sewer, pipe fittings may be ductile iron as above or PVC conforming to AWWA C900.
 - b) Water
 - i) All potable water pipe shall bear the National Sanitation Foundation (NSF) seal of approval stating compliance with ANSI/NSF Standard 61. PVC piping shall comply with ASTM D1785 and shall be UL/FM approved.
 - ii) Pipe for water mains 4" through 10" in diameter shall conform to AWWA C900, DR 18 or C909 (150 PSI), with pipe made to ductile iron outside diameters.
 - iii) Pipe 12" and larger in diameter shall be ductile iron pipe.
 - c) Sewer
 - i) Pipe for sewer pressure force mains 4" through 10" in diameter shall conform to C900/DR25. Pipe 12" and larger in diameter shall be ductile iron.

- ii) All gravity sewer pipes, 4" and larger in diameter, shall be Type PSM pipe conforming to ASTM D3034, with integral bell and spigot rubber O-ring gasket joints. SDR 26 shall be used. Gasketed fittings and accessories shall be compatible with pipe. Refer to Chapter 13 for a list of approved manufacturers.
3. Material Testing:
- a) Potable Water and Wastewater Pressure Forcemain Pipe: Each joint of pressure pipe shall be subjected to and successfully meet a hydrostatic proof test at the factory in accordance with the requirements for each type. Certified test results shall be furnished to the ENGINEER for each shipment of pipe. Pipe fittings shall be subject to inspection and testing in accordance with standard manufacturing practice.
 - b) Gravity Sewer Pipe: PVC gravity sewer pipe, 4" and larger in diameter shall be tested by the manufacturer for pipe flattening, impact resistance, pipe stiffness, joint tightness and extrusion quality (acetone immersion) in accordance with ASTM D3034. Test certificates showing that the pipe conforms to these specifications shall be furnished to the ENGINEER for each shipment of pipe. PVC Gravity Sewer Pipe shall be installed with all pipe sections assembled in accordance with the manufacturer's instructions to form tight joints. All pipe shall pass the deflection test as specified below.
 - c) Deflection Test: All PVC gravity sewer pipe 8" diameter and larger shall be tested after installation and backfill by the CONTRACTOR using methods and equipment approved in writing by the ENGINEER. Testing shall be performed at the CONTRACTOR's expense using a 5% mandrel acceptable to the ENGINEER and BJWSA to insure that initial deflection of pipe does not exceed 5%. All deflection testing shall be performed in the presence of the ENGINEER and BJWSA. CONTRACTOR shall notify the ENGINEER and BJWSA in sufficient time to insure that the both will be present during deflection tests. Deflection testing shall not occur until roadbed sub base has been installed and compacted to its final density. Deflection test records shall identify the location and deflection amount at all points where deflection exceeds the specified limit. Such records shall be certified by the CONTRACTOR, and shall be furnished to the ENGINEER prior to acceptance and payment. Pipe with initial deflection exceeding the specified limit will be unacceptable, and shall be re-bedded to the correct deflection and retested for deflection, at the CONTRACTOR's expense.
 - d) Air Test: Air testing as specified in Section 8 shall not occur until all dry utilities have been installed. Air testing shall not occur until roadbed sub base has been installed and compacted to its final density.
4. Installation: Pipe and fittings shall be installed in accordance with the requirements specified in other Chapters and the manufacturer's instructions. Minimum depth of cover shall be 36 inches. All adapters necessary for the proper jointing of pipe and fittings shall be provided. Connections to other types of pipe shall be made as detailed on the plans. Underground fittings shall be well restrained as detailed on the plans and as specified in this section. Mark pipeline with tracer wire and marking tape. Tracer wire shall be extended from the main wire above the pipe to 12" above ground level at all valve boxes to facilitate attachment to tracing equipment.
- B. Ductile Iron Pipe (DIP): Ductile iron pipe and fittings shall be provided as shown on the plans and as specified herein.
- 1. Shop Drawings: Catalog cuts and related data for all pipe and fitting material shall be

- submitted to the ENGINEER for review. Electronic copies of the approved submittals shall be forwarded to the AUTHORITY.
2. Material: All material under this section shall meet Made in America Criteria. Ductile Iron Pipe shall conform to AWWA C150 and ANSI A21.50, shall be designed for pressure class as follows unless otherwise noted:
 - a) 4-12" 350
 - b) 14-20" 250
 - c) 24"-26" 200
 - d) 30" & greater 150
 3. Ductile iron pressure pipe shall conform to ASTM A377. Pipe shall have push-on or mechanical joint ends conforming to AWWA C111 and ANSI A21.11, except where flanged or other type ends are shown or specified. Flanged piping shall conform to AWWA C115 and ANSI A21.15.
 - a) Pipe shall be marked as Type, Class or nominal thickness, weight, manufacturer, and date of production.
 - b) Pipe wall thickness shall be designed in accordance to bury depth.
 - c) Pipe shall be coated on the outside with a standard bituminous coating in compliance to AWWA C104.
 - d) All potable water piping shall be lined on interior surface with high speed cement conforming to AWWA C104 and ANSI A21.4, 45 mil dry film thickness minimum. Water pipe shall bear the National Sanitation Foundation (NSF) seal of approval stating compliance with ANSI/NSF Standard 61.
 - e) All sewer piping shall be factory lined with a hydrogen sulfide resistant coating specifically designed for sanitary sewer service. Coating shall consist of amine cured Novalec Epoxy polymeric lining, 40 mil nominal thickness. Acceptable products are:
 - i) Protecto 401 by Vulcan Painters, Birmingham, Alabama. Nominal thickness is 40 mil.
 - ii) Corrosion-Clad Polymer Lining No. 201 by Sauereisen Cements, Pittsburgh, Pennsylvania. Nominal thickness is 1/8" (3.175 mm).
 4. Material Testing: Each joint of ductile iron pipe, prior to lining, shall be subjected to and successfully meet a hydrostatic test at the factory in accordance with ANSI/AWWA C151/A21.51. Certified test results shall be furnished to the ENGINEER for each shipment of pipe.
 5. Installation: Pipe and fittings shall be installed in accordance with the manufacturer's instructions and the requirements specified in other sections. Ductile iron pressure pipe shall be installed in accordance with all applicable requirements of AWWA C600. Underground pipe and fittings shall be installed using push-on joints or mechanical joints, except where other type joints are specifically noted. Exposed pipe and fittings shall have Class 125 flanged joints except where Class 250 is specifically noted, or other type joints as shown or specified. All adapters necessary for the proper jointing of pipe and fittings shall be provided. Connections to other types of pipe shall be made as detailed on the plans. Underground fittings shall be well restrained as detailed on the plans and as specified in this Chapter. Detectable marking tape and tracer wire for identification, location, protection, and detection of utility pipelines shall be installed over all lines as specified in this Chapter. Tracer wire shall be extended from the main wire above the pipe to 12" above ground level at all valve boxes to facilitate attachment to tracing equipment. Pipe supports, hangers, and anchors shall be provided as

required.

C. Polyethylene (HDPE) Pipe:

1. General: The pipe supplied under this specification shall be cast iron outside diameter (DIPS), SDR 11 high performance, high molecular weight, high density polyethylene pipe, and shall conform to ASTM D 1248 (Type III C, Category 5, P34). Minimum cell classification values shall be 345434C as referenced in ASTM D 3350. All pipe resin shall be manufactured by the same company that manufactures the pipe itself in accordance with these specifications to insure complete resin compatibility and total product accountability. The fittings supplied in this specification shall be molded or manufactured from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe.
 - a) All potable water pipe shall bear the National Sanitation Foundation (NSF) seal of approval stating compliance with ANSI/NSF Standard 61.
 - i) 1" and 2" service pipe: see Water Service, Section 7.4
 - ii) 4" and larger shall comply with ASTM D 3035 dimension rating. HDPE mains may be installed along certain routes in areas where taps will not occur; such as wetland, creek, and river crossings and other non-developable areas.
 - b) HDPE sewer pressure force mains:
 - i) All HDPE sewer pressure pipe shall comply with ASTM D-3035 dimension ratings and shall be rated for 200 PSI.
2. 2" sewer pressure force mains shall consist of IPS OD High Density Polyethylene, PE 3408, SDR 7. Pipe shall be supplied on roll spool to minimize joints. Connections shall be made utilizing brass compression type couplings or heat fusion butt welds. Refer to Chapter 13 for a list of approved manufacturersShop Drawings: Catalog cuts and related data for all pipe and fitting material shall be submitted to the ENGINEER for review. Electronic copies of the approved submittals shall be forwarded to the AUTHORITY.
3. Physical Properties: Pipe shall conform to the physical properties described below:
 - a) Typical Physical Properties:

PROPERTY	TEST METHOD	UNIT	VALUE
Density	ASTM Method	gms/cc	0.955
Melt Index	ASTM D 1238	gms/10 min	0.14

b) Coefficient of Linear Thermal Expansion:

PROPERTY	TEST METHOD	UNIT	VALUE
Molded Specimen	ASTM D 696	in./in./deg. F	8.3x10-5
Extruded Pipe			1.2x10-4
Conductivity	Dynatech-Colora	BTU-IN/FT/degF	2.7

c) Long Term Strength:

PROPERTY	TEST METHOD	UNIT	VALUE
73 degrees F	ASTM D 2837	PSI	1600
140 degrees F		PSI	800
Material Cell Class	ASTM D 3350		345434c
Material Description	PPI recommendation		PE 3408

d) Environmental Stress Cracking Resistance:

PROPERTY	TEST METHOD	UNIT	VALUE
Condition A,B,&C, F-0	ASTM D 1693	HRS	>5000**
Compressed Ring, F-60	Proposed ASTM	HRS	>800
Tensile Strength, Yield	ASTM D 638	PSI	3200
Type IV Specimen	(2"/min)		
Elongation at Break	ASTM D 638	%	>750
Vicate Softening Temp	ASTM D 1525	deg F	257
Brittleness Temp	ASTM D 746	deg F	<-180
Flexural Modulus	ASTM D 3350	PSI	125,000
Modulus of Elasticity	ASTM D 638	PSI	105,000
Hardness	ASTM D 2240	Shore D	64

4. **Quality Control:** The resin used for manufacturer of the pipe shall be manufactured by the pipe manufacturer, thus maintaining complete quality control of the pipe. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects and shall be identical in color, density, melt index, and other physical properties. The polyethylene resin used shall have all ingredients pre-compound prior to extrusion of pipe, in plant blending is not acceptable. BJWSA may request, as part of the quality control records submittal, certification that the pipe produced is represented by the quality assurance testing. Additionally, test results from manufacturer's testing or random sampling by the ENGINEER that do not meet appropriate ASTM standards or manufacturer's representation, may be cause for rejection of pipe represented by the testing. These tests may include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D.
 - a) BJWSA may request certified lab data to verify the physical properties of the materials supplied under this specification or may take random samples and have them tested by an independent laboratory.
 - b) **Pipe Marking:** All piping shall marked for identification with a minimum of four (4) longitudinal stripes of color corresponding to use.
 - c) **Rejection:** BJWSA reserves the right to reject any polyethylene pipe and fittings failing to meet any of the requirements of this specification.
 - d) **Pipe Dimensions:** Pipe supplied under this specification shall have a nominal cast iron outside diameter unless otherwise specified. The SDR (Standard Dimension Ratio) of the pipe supplied shall be as specified by BJWSA.
5. **Construction Practices:**
 - a) **Handling of Pipe:** Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking should be done in accordance with the pipe manufacturer's recommendations. The handling of the pipe should be done in such a manner that it is damaged by dragging over sharp objects or cut by chokers or lifting equipment.
 - b) **Repair of Damaged Sections:** Segments of pipe having cuts or gouges in excess of 10% of the wall thickness of the pipe should be cut and removed. The undamaged portions of the pipe shall be rejoined using the butt fusion joining method in this Chapter.
 - c) **Pipe Joining:** Sections of polyethylene pipe should be joined into continuous

lengths on the job site above ground. The joining method shall be the butt fusion method and shall be performed according to the manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment, fusion pressures, the technicians and approved fusion equipment. Prior approval of equipment and personnel shall be obtained from BJWSA before fusion begins. The completed pipe joints shall be guaranteed for five years in writing to BJWSA and its CONTRACTOR.

- d) End Connections: Pipes 12 inches and larger shall have flanged ends. Pipes less than 12 inches may be flanged or MJ adapters with insert sleeves.
 - e) Expansion and contraction: HDPE expansion and contraction must be considered in the design.
 - f) Handling of Fused Pipe: Fused segments of pipe shall be handled so to avoid damage to the pipe. When lifting fused sections of pipe, chains or cable type chokers should be avoided. Nylon slings are preferred. Spreader bars should be used when lifting long fused sections. Care should be exercised to avoid cutting or gouging the pipe.
 - g) Installation: Trenching, installation, backfill and testing shall be in accordance with BJWSA specifications and drawings and special method of installation developed for a specific project.
 - h) Directional Drilling: Polyethylene pipe installed by directional drilling shall be installed as directed by the ENGINEER. Directional drilled HDPE pipe shall be pulled in continuous fused sections and connected as outlined above. #8 gauge tracer wire shall be pulled with all directional drills and connected to tracer wiring at interconnection of connecting piping. Directional drills shall not be removed from bore hole once drilling commences. Directional drills that fail once drilling commences shall be abandoned and filled with pressure grout at the CONTRACTORS expense. Directional drilling of polyethylene pipe under public right of ways shall comply with Encroachment permit requirements of appropriate jurisdictional AUTHORITY.
6. Final Testing: After polyethylene piping is installed, backfilled and all air removed, the CONTRACTOR shall apply a hydrostatic pressure of 150 PSI min. to the pipe. The test pressure shall be allowed to stand without make-up pressure for a period of time as required by the pipe manufacturer and approved by the ENGINEER to allow for diameter expansion or pipe stretching to stabilize. After the required equilibrium period the test section shall be returned to the original test pressure. All final testing shall be in conformance with BJWSA specifications.

6.2 VALVES

- A. General: Gate valves shall be used for all sizes 2" through 12". Butterfly valves may be used where the diameter exceeds 12" or if determined necessary by the Authority. All valves shall open left (counter clockwise). All buried valves shall have a 2" square operating nut. Valves with operating nuts greater than 4 FT deep shall have approved valve nut extenders bringing the operating nut up to three feet below grade. All butterfly valves shall have a minimum 450 FT-LB. actuator. All valves are to be designed for a minimum working pressure of not less than 150 PSI unless otherwise specified. All potable water appurtenances that contact potable water shall bear the National Sanitation Foundation (NSF) seal of approval stating compliance with ANSI/NSF Standard 61.
 - 1. Chambers, pits or manholes containing valves, blowoffs, meters, air relief valves, or

- other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer.
2. Shop Drawings: Catalog cuts and related data for all valves and fitting material shall be submitted to the ENGINEER for review. Electronic copies of the approved submittals shall be forwarded to the AUTHORITY.
- B. Gate Valves: All resilient wedge gate valves shall comply with all requirements of AWWA C509, latest revision, and with the below listed requirements. Valves shall be designed for 250 PSI working pressure, factory seat tested at 250 PSI with no leakage past the seat from either side of the disc, and shell tested at 500 PSI. Minimum body and bonnet wall thickness shall be as set forth in Table 2, Section 4.3.1 of AWWA C509. Body and bonnet wall thickness less than the minimum thickness shall not be acceptable. Bonnet to body seal shall be effected by a flat neoprene gasket. Bonnet and body flanges shall be fully machined to assure proper sealing of the gasket. Valve body interior and exterior shall be coated with a minimum of 10 mil of fusion bond epoxy or nylon coating. End connections shall be flanged in accordance with Class 125, ANSI B16.1 for above ground installation, and mechanical joint for underground installation in accordance with AWWA C110/111 or slip-on for use with cast iron OD pipe. Valves shall be of the non-rising stem (N.R.S.) design and shall open left (counter-clockwise). Valves installed above ground and in underground vaults, where specified, shall be furnished with gear actuated hand wheels. All buried valves shall be furnished with 2" square operating nuts. Maximum bury depth to nut shall be 4 FT or valve nut extensions shall be provided. Valves shall have O-Ring sealed stems with one O-Ring located below the thrust collar and with two O-Rings located above the thrust collar. The thrust collar area between the two lower O-Rings shall be factory filled with a lubricant to provide permanent lubrication of the thrust collar area. Valve stems shall be of bronze rolled bar stock and shall have a forged thrust collar. The stem material shall provide 70,000 PSI tensile strength with 15% elongation and a yield strength of 30,000 PSI. Cast stems shall not be acceptable. Stems shall have acme form threads for strength and efficiency. An anti-friction thrust washer shall be provided both above and below the thrust collar for ease of operation. The resilient-seated disc wedge shall be of the resilient wedge fully supported type. Solid guide lugs shall travel within channels in the body of the valve. The disc and guide lugs shall be fully (100%) encapsulated in EPDM rubber. All appurtenances that contact potable water shall bear the National Sanitation Foundation (NSF) seal of approval stating compliance with ANSI/NSF Standard 61. Refer to Chapter 13 for a list of approved manufacturers.
- C. Butterfly Valves: All butterfly valves, except as herein otherwise noted, shall conform to AWWA C504, latest revision. Valve body interior and exterior shall be coated with a minimum of 10 mil of fusion bond epoxy or nylon coating. All valve shafts shall be connected to operators by the use of keys and keyways. The use of compression or friction connections is not acceptable. The seat on disc valves shall be continuous around the periphery of the disc and shall not be penetrated by the valve shaft. Buried service butterfly valves shall be integrally cast mechanical joint ends, short body type, AWWA Class 150B with totally enclosed geared operator and a 2" square operating nut. Valves shall have ASTM A 126, Class 40 cast iron valve body with 125 PSI full faced flanges drilled in accordance with ANSI B16.1. Valve disc shall be contoured cast iron or ductile iron. Standard service above ground butterfly valves shall be flanged end, short body type with enclosed gear actuated hand wheel operators. Valve shaft shall be Type 304 stainless steel with self-lubricating, corrosion resistant sleeve type bearings. Operators shall be 450 FT-LB. gear actuators and be fully gasketed and grease packed to withstand an external ground water pressure of 10 PSI minimum. A valve position indicator shall be furnished for installation in each valve box. The indicator shall be hermetically sealed for installation inside a cast iron valve box and shall show valve disc position, direction of rotation, and

number of turns from fully opened to fully closed. This indicator shall be provided by the valve manufacturer, complete. Appurtenances that contact potable water shall bear the National Sanitation Foundation (NSF) seal of approval stating compliance with ANSI/NSF Standard 61. Refer to Chapter 13 for a list of approved manufacturers.

- D. Plug Valves: Plug valves shall be used on all sewer applications unless approved otherwise by the AUTHORITY. Valves shall be used for installations above ground, direct bury, in concrete vaults or for installations in manholes. Valves installed above ground, in concrete vaults or installed in manholes shall be provided with hand wheel actuators. Valves 4" and larger shall have a minimum 450 FT-LB gear driven actuator and shall be capable of opening valve at rated pressure of 150 PSI. All direct buried sewer pressure force main valves shall have gear actuators with a 2" square operating nut located at a depth not to exceed 4 FT in valve box and concrete collar. Valves on sewer pressure force mains shall be installed at maximum intervals of 2000 FT or as directed by the AUTHORITY. Valves shall open left (counter clockwise). Valves are to be designed for a minimum working pressure of not less than 150 PSI. Valves shall be the non-lubricated eccentric plug type with a resilient seat seal unless otherwise specified and shall be furnished with mechanical joint ends in accordance with ANSI Standard A21.11, unless specified otherwise on the plans. Port area for valves shall be a minimum of 80% of the full pipe area. Valve bodies shall be of ASTM A-126 Class B cast iron. Resilient seat seals shall be of Buna-N or Neoprene, suitable for use in sewage service. Seats shall be of non-metallic with seat coating thermally bonded and in full conformance to AWWA Standard C550. Valves shall be furnished with permanent corrosion resistant bearing surfaces in the upper and lower journals designated to withstand full rated bearing loads and provide long life in sewage service. Valves shall have their internal and external surface protected by fusion bond epoxy or nylon coatings factory applied, thermally bonded and in full conformance to AWWA Standard C550. Nominal valve pressure ratings, body flanges and wall thickness shall be in full conformance to ANSI B16.1-1975. Valves shall seal leak-tight against full rated pressure in both directions. Valve seats shall be tested and provide leak-tight shut-off to 175 PSI for valves 14" and larger, with pressure in each direction. A hydrostatic shell test at twice the rating shall be performed with plug open to demonstrate overall pressure envelope integrity. All gearing shall be fully enclosed in a suitable housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. A suitable stop shall be set to provide watertight shut off in the closed position at full rated pressure. Valve actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket or o-ring seals. All exposed nuts, bolts, springs, and washer used in buried service shall be type 316 stainless steel. Refer to Chapter 13 for list of approved manufacturers.
- E. Swing Check Valves (above ground or in vault): The CONTRACTOR will furnish and install swing check valves as shown on the plans and in accordance with these specifications. Swing check valves shall comply with all requirements of AWWA C508, latest revision, and with the requirements listed below.
1. Valve body interior and exterior shall be coated with a minimum of 10 mil of fusion bond epoxy or nylon coating.
 2. All potable water appurtenances that contact potable water shall bear the National Sanitation Foundation (NSF) seal of approval stating compliance with ANSI/NSF Standard 61.
 3. For swing check valves 4" and larger, bodies and bonnets will consist of ductile iron and will be designed to allow removal of the clapper arm and disc assembly through the

bonnet opening without requiring removal of the valve from the line. Disc will be of ductile iron with bronze or alloy disc rings machined into the disc. The seat ring will be bronze or stainless steel and will be threaded for removal with the valve body in line. Clapper arm shafts will be manufactured of stainless steel, bronze or high tensile aluminum and shall extend through the body for attachment of the weight or spring and will be capable of being field adjusted. Shaft shall be sealed using a packing gland, "O-ring" seals will **NOT** be allowed. Flanged ends will be faced and drilled in accordance with ANSI B 16.1 Class 125. Valves 12" and smaller will have a minimum working pressure rating of 175 PSI and 350 PSI hydrostatic test pressure and valves larger than twelve inches will have a corresponding pressure of 150 PSI and 300 PSI. Swing check valves may be operated by stainless steel spring unless otherwise directed by the ENGINEER. Refer to Chapter 13 for a list of approved manufacturers.

- F. Ball Check Valves: Ball check valves shall not be used, except on 2" force mains in pit.
- G. Air release valves (ARV) shall be provided in accordance with sound engineering practice at high points in water mains as required. ARV must comply with AWWA Section C and shall be designed to operate under a working pressure of 150 PSI, and shall have been tested at a pressure of not less than 300 PSI. ARV shall have a stainless steel body and conical shape or have a cast iron body and cover and shall be 2" in size with IPS inlet threads. Vent piping shall consist of a downward facing screened pipe. Float guides, bushings, lever pins, and all internal parts shall be stainless steel or bronze. Cylindrical stainless steel ARV shall be installed above grade as a pedestal assembly or in a manhole. If installed as a pedestal, the ARV piping must maintain a positive slope if offset from the main. Cast iron conical ARV shall be installed in a manhole. If installed in a manhole, ARV shall be installed in a watertight, flat top manhole a minimum of 4 FT in interior diameter. ARV manholes shall be sited to prevent flooding. Automatic air relief valves shall not be used in situations where flooding of the manhole may occur. Refer to Chapter 13 for a list of approved manufacturers.

6.3 **FITTINGS, APPURTENANCES AND SPECIALTIES:**

- A. Pipe Fittings: Pipe fittings 4" and larger shall be ductile iron conforming to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53. Ductile iron fittings shall be Class 350 for 24-inch and under, and Class 250 for larger than 24". Ductile iron shall conform to ASTM A536, minimum grade 70-50-05. Fittings shall have mechanical joint connections conforming to ANSI/AWWA C111/A21.11, except where flanged or other type ends are shown or specified. Fittings shall be coated/lined specific to use. Ductile iron fittings shall be used on pipe sized 4" or larger. All potable water appurtenances that contact potable water shall bear the National Sanitation Foundation (NSF) seal of approval stating compliance with ANSI/NSF Standard 61.
 - 1. Pressure Pipe Fittings: Pressure pipe fittings 4" and larger shall be gray cast iron or ductile iron conforming to ANSI A21.10. **Cast iron is only to be used if ductile iron fittings are not available.** Cast iron fittings shall be Class 250 for 12" and under, and Class 150 for larger than 12". Ductile iron fittings shall be Class 350 for 24" and under, and Class 250 for larger than 24". Ductile iron shall conform to ASTM A536, minimum grade 70-50-05. Fittings shall have mechanical joints conforming to ANSI/AWWA C111/A21.11, except where flanged or other type ends are shown or specified. Fittings shall be coated interior and exterior with a minimum 12 mil of fusion bond epoxy or nylon. Fittings for 2" diameter piping shall be IPT brass with compression adapters suitable for use on ASTM D-3035 (OD-Controlled) pipe.
 - 2. Full circle and bell repair clamps are not approved for use in a new system.
 - 3. Gravity Sewer Fittings: Gravity sewer fittings 4" through 10" shall be SDR 26 heavy

wall gasketed fittings of a molded, one piece construction. Gravity sewer fittings 12" and larger shall be SDR 26 fabricated or molded one piece heavy wall. Service fittings to the main shall utilize true wye style fittings. All fittings shall comply with UNIBELL standards and shall be installed per UNIBELL and manufacturers recommendations.

- B. Flanges: Flanges for pipe and fittings shall be Class 125 except where Class 250 is specifically noted, and shall conform to ANSI/AWWA C110/A21.10. Drilling and facing of flanges shall be in accordance with ANSI B16.1.
- C. Mechanical Restraints: All joints, fittings, tees and hydrant attachments shall be mechanically restrained. Restrained joints for pipe and fittings shall be the ductile iron mechanical joint type designed for a working pressure of 350 PSI for 24" and under and 250 PSI for 30" and larger. Restrained joint pipe and fittings shall be capable of being deflected after assembly. Refer to Chapter 13 for a list of approved manufacturers.
- D. Pipeline Marking: Detectable marking tape and tracer wire for identification, location, protection and detection of utility pipelines shall be installed over all water lines. Shop drawings and related data shall be submitted to the ENGINEER for review.
1. Marking Tape: Detectable marking tape shall consist of a metalized foil laminated between two layers of color coded inert plastic film suitable for lasting as long as the pipe and shall be resistant to alkalis, acids and other destructive agents found in the soil. The plastic film shall be imprinted with a continuous message, see below. The message shall be in permanent ink. Marking tape shall be not less than 2" wide and not less than 5.5 mil thick with a tensile strength of not less than 120 grams per 1.5 mil. Detectable marking tape shall be the type that can be located by any standard electronic pipe locator. Refer to Chapter 13 for a list of approved manufacturers.

Marker tape should be color coded as follows:

a)	Blue	Water	Caution: Water line buried below
b)	Green	Sewer Gravity	Caution: Sewer line buried below
c)	Brown	Sewer FM Influent	Caution: Sewer line buried below
d)	Purple	Sewer FM Effluent	Caution: Sewer line buried below
 2. Tracer Wire: Tracer wire shall be installed on all pressure pipelines and service lines in a continuous fashion. Tracer wire shall be extended from the main wire above the pipe to 12" above ground level at all valve boxes to facilitate attachment to tracing equipment. It shall be brought to the surface at maximum distance of 700 feet. It shall be accessible from surface at all valve and meter boxes. At locations where tracer wire surfaces between valves, a regular valve box with plain lid and collar shall be installed between a pipeline marker pair. Tracer wire shall be 12 GA single strand or up to 7 strands, copper with insulation UL rated for direct bury underground service. Splices shall be UL rated for direct bury and shall be minimized. Wire for directionally drilled bores shall be a minimum of #8 gauge.
 3. Installation: Marking tape shall be buried a minimum of 12" and a maximum of 18" below finish grade. The tape shall be placed during backfill or installed in any other manner acceptable to the AUTHORITY. Tracer wire will be installed on the top of the pipe and extended up to surface level in all valve boxes and at all service laterals. No loops will be allowed in the tracer wire. Tracer wire shall be taped to the top of pipelines at a minimum of 5 FT intervals in a uniform, continuous manner.
- E. Curb Marking: In projects with curb and gutter, all valves, 45 degree bends, and service laterals shall be clearly marked by embossing letters in curb perpendicular to the appurtenance. An embossed letter shall be stamped in the curb during curb installation and

shall consist of a minimum 3" tall. Lettering shall be "S" for sewer services, "V" for valves, "B" for bend in main, and "W" for water services. Curb marking is in addition to valve and pipe line markers unless 2" diameter brass surveyor's disks are imbedded beside letter with appropriate stamped details.

- F. Tapping Sleeves: Size on size pipeline taps are NOT approved for installations in the BJWSA system. Tapping sleeves shall be fabricated stainless steel with stainless steel bolts. Tapping sleeves shall have outlet flange counter bored to accept a mating tapping valve per MSS SP-60 for true alignment of tapping valve and tapping machine. Sleeve shall have a stepped stainless steel valve flange complying with AWWA C207 Class D, ANSI 316.5, 150 LB drilling. Refer to Chapter 13 for a list of approved manufacturers.
- G. Miscellaneous Appurtenances and Specialties: All material and products under this section must comply with AWWA Section C and shall meet Made in America Criteria. Miscellaneous piping appurtenances and specialties shall be provided where shown on the plans and as required for a complete installation. All appurtenances that contact potable water shall bear the National Sanitation Foundation (NSF) seal of approval for compliance with ANSI/NSF Standard 61.
1. Mechanical Couplings and Adapters: Mechanical couplings and adapters shall be the type and size as shown on the plans, complete with rings, followers, gaskets, bolts, nuts and other items necessary for a complete installation. Couplings and adapters shall be installed in accordance with the manufacturer's instructions to provide permanently tight joints under all reasonable conditions of expansion, contraction, shifting and settlement.
 2. Gaskets: Gaskets for water pipe and fittings shall be vulcanized synthetic rubber free of porous areas, foreign material and visible defects. Gaskets shall be designed to provide a permanent watertight seal at all joints. Rubber gaskets shall conform to all applicable provisions of ASTM F477 and must comply with AWWA Section C. Gasket lubricant shall be non-toxic, shall not support growth of bacteria, shall not impart taste or odor to water, must be NSF certified, and shall have no deteriorating effects on gaskets. Lubricant shall be suitable for the intended use, and shall remain in a usable stage throughout the range of temperature in which the pipe is normally installed. Lubricant shall be delivered to the job site in unopened containers bearing the manufacturer's name and trade name or trademark. Lubricant shall not be vegetable shortening.
 3. Pre-cast Utility Boxes: Pre-cast utility boxes or vaults shall be provided where noted on the plans. Pre-cast concrete shall have a minimum compressive strength of 4000 PSI. Unless otherwise indicated, boxes and vaults shall be provided with traffic type aluminum frames and covers, hinged access doors, and cast iron or composite plastic-steel steps. Pre-cast boxes or vaults shall be installed level and plumb with pipe openings at the proper elevation. Joint sealant shall be rubber, cement, or other type standard with the manufacturer. All pre-cast boxes and vaults shall be designed for heavy traffic loading in accordance with ASTM C857. Pre-cast boxes or vaults used as liquid retaining structures shall be tested for leakage; all leaks shall be repaired prior to final acceptance. All boxes shall contain pump out sump and be sloped to sump.
 4. Utility Manholes: Utility manholes for valves and other equipment shall be constructed of pre-cast or cast-in-place concrete. Unless otherwise indicated, manholes shall be provided with a traffic type aluminum frame and cover and cast iron or composite plastic-steel steps. Joint sealant in pre-cast manholes shall be rubber, cement, or other type standard with the manufacturer. Where noted, valves and other equipment shall be installed in a concrete pipe vault with cast iron manhole frame and cover. Manhole tops shall be set flush with grade or pavement, unless otherwise directed.
 5. Valve Extensions: Valve nut extensions shall have the following properties:

- a) All extensions must be pre-approved for use in BJWSA's system.
 - b) Stem: Must not corrode faster than the stem of the valve. Hot Dipped Galvanized, anticorrosive steel alloy, or stainless steel would be acceptable.
 - c) Attachment: The extension attachment is to bolt to the valve shaft with shear resistance equal or greater to that of the valve shaft, or be physically bolted through the valve operating nut.
 - d) All valve nut extensions installations are to be preformed in the presence of the engineer or BJWSA inspector.
6. Valve Boxes: A gray iron valve box shall be installed on each valve 2" and larger. Valve boxes shall have screw type adjustment. All valve box components shall meet material requirements of ASTM A48 Cl 35. Valve box lids shall indicate use designation ("WATER", "SEWER", FIRE or Plain) cast in the lid. Lids on fire line valves shall be lockable. Gross valve box height adjustment may be accomplished using a single piece of 6" C900 PVC pipe resting on valve box bottom and extending into the bottom of a complete valve box.
- a) Valves in pavement
 - i) Each lid shall weight approximately 11 pounds.
 - ii) Shall have slip type adjustment
 - iii) Box top shall be a minimum of 12" in length, designed to support road load, and be adjustable to future changes in pavement overlays.
 - b) Valves not in pavement
 - i) Each valve box shall be installed with a four inch (4") thick by twenty-four (24") diameter round pre-cast concrete collar per Standard Detail Drawings. Concrete collar top shall be installed flush with final grade and valve box lid shall not extend above collar.
 - ii) Valve boxes shall have screw type adjustment.
7. Valve and Pipeline Markers: All bends and valves except hydrant valves shall be marked with a concrete marker. Valve and pipeline markers installed in landscaped areas shall consist of a reinforced 4" square by 54" long reinforced concrete post with round 2" (min.) round cast bronze or brass survey marker imbedded in the top. Markers located in lawn areas shall not extend above final grade more than 18". Pipe lines located in easements, rural areas, or in right-of-ways shall be marked by paired 6" square by 10 feet reinforced concrete rural markers placed at right of way line. Maximum line lay distance between markers is 700 feet. A 2"(min.) round cast bronze or brass survey benchmark with anchoring lug shall be formed into the side perpendicular to rural marker face between 50 and 60" above final grade. Stamp disk with the distance in feet and direction to the feature. Valve and pipeline markers shall be cast with designation on the face as to its purpose. Water line marker need not be painted. Sewer feature markings shall have the top 4" painted with industrial enamel of the appropriate color. Refer to Standard Detail Drawings for dimensions, designations, and installation practices.
- An approved alternate permanent marking system may be used to reference location of bends and valves.
8. Yard Hydrants: Yard Hydrants shall have locking capability and installed with an approved vacuum breaker. Yard hydrants must have a BJWSA furnished meter installed before each hydrant. At sewer pump stations, the yard hydrant must be placed adjacent to the wet well. Refer to Chapter 13 for a list of approved manufacturers.

9. Blow-off Assemblies: All dead end lines shall have blow-off assemblies sized to provide a minimum of 2.5 FPS flushing velocity. No flushing device shall be directly connected to any type of sanitary sewer. Pipelines 4" in diameter shall be equipped with a self-draining post-type flushing hydrant. Pipelines 6" and larger shall be terminated with full size fire hydrants. Long dead end pipeline runs with insufficient demands to maintain water quality shall be equipped with an approved metered automatic flushing device, which shall be installed to discharge into the storm sewer system. An air gap of at least six (6) inches must be maintained between the blowoff discharge and the storm drain. Refer to Chapter 13 for a list of approved manufacturers.
10. Backflow Prevention Devices: All service connections shall contain an approved backflow preventer at the point of connection to the AUTHORITY's system. Type of backflow preventer required will be determined based upon use and risk of potential contamination. All dedicated fire lines shall contain a minimum of a double check valve backflow prevention device.
 - a) There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contamination materials may be discharge or drawn into the system.
 - b) No bypasses shall be allowed, unless the bypass is also equipped with an equal, approved back-flow prevention device.
 - c) High hazard category cross connections shall require an air gap separation or an approved reduced pressure backflow preventer.
 - d) All piping up to the inlet of the backflow prevention device must be suitable for potable water. The pipe must be AWWA or NSF approved. Black steel pipe cannot be used on the inlet side of the device
 - e) Reduced pressure principle backflow prevention devices shall not be installed in pits or vaults or areas in which the device could be submerged or flooded.

END OF SECTION