

STANDARD SPECIFICATION
SECTION 15292 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE (AWWA C900)

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of PVC pressure pipe conforming to AWWA C900. Size range is 4- to 12-inch nominal pipe size.

1.02 PIPE IDENTIFICATION SYMBOLS

Interpret pipe identification symbols used on the Drawings as follows: PVC-8"-150 designates type of pipe (polyvinyl chloride); nominal pipe size (8 inches); and working pressure rating (Class 150).

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Standard Drawings.
- B. Record Drawings and Submittals: STD SPEC 01300.
- C. Trenching, Backfilling, and Compacting: STD SPEC 02223.
- D. General Concrete Construction: STD SPEC 03000.
- E. Glass Linings and Coatings: STD SPEC 09870.
- F. Painting and Coating: STD SPEC 09900.
- G. Cold Applied Wax Tape Coating: STD SPEC 09952.
- H. Polyethylene Sheet or Tube Encasement: STD SPEC 09954.
- I. Fusion-Bonded Epoxy Lining and Coating: STD SPEC 09961.
- J. General Piping Requirements: STD SPEC 15050.
- K. Miscellaneous Piping Specialties: STD SPEC 15080.
- L. Flexible Pipe Couplings: STD SPEC 15122.
- M. Disinfection of Piping: STD SPEC 15141.
- N. Pressure Testing of Piping: STD SPEC 15144.

1.04 SUBMITTALS

- A. Submit submittal packages in accordance with Standard Specification Section 01300.
- B. Provide affidavit of compliance with AWWA C900.

- C. Submit fully dimensioned cross section of the bell and barrel of the pipe. Show the bell maximum outside diameter in the pressurized area and its minimum wall thickness at the same location.
- D. Submit copies of the following manufacturer required tests conducted on the project pipe:
 - 1. Quick-burst strength of pipe and couplings.
 - 2. Flattening resistance of pipe.
 - 3. Record of additional tests after test sample failure.
- E. Submit manufacturer's literature on ductile iron fittings including dimensions, thickness, weight, coating, lining, and a statement of inspection and compliance with the acceptance tests of AWWA C110 or C153. Submit copy of report of pressure tests for qualifying the designs of all sizes and types of AWWA C153 fittings that are being used in the project. The pressure test shall demonstrate a minimum safety factor of three times the rated working pressure as described in AWWA C153, Section 5.5.
- F. Submit manufacturer's catalog data and descriptive literature for high deflection couplings, repair couplings, service saddles, restrained joints, tracer wire, marking tape, and miscellaneous piping materials.
- G. Submit restrained joint system installation instructions. Include bolt torque limitations and assembly tolerances.

1.05 INSPECTION AND FIELD VERIFICATION

- A. The District's Representative or his authorized representative may inspect materials, productions, and testing at manufacturer's plant.
- B. Where new pipelines are to be connected to existing waterlines of the District, the Contractor shall verify in the field the location, elevation, pipe material, pipe outside diameter, and any other characteristics of the existing waterline before proceeding with the pipe installation. This field verification shall be performed in the presence of the District's Representative. Adjust and align the new piping as necessary to meet the field conditions and provide all required material, labor, and equipment to make the connection.

PART 2 - MATERIALS

2.01 PVC PIPE

Provide PVC pipe conforming to AWWA C900 with material cell classification 12454-B per ASTM D 1784. Provide standard pipe having integral bell and spigot with elastomeric gasket and cast iron equivalent outside diameter. Provide pipe in standard 20-foot laying lengths. Straight pipe sections with plain ends for use with high deflection couplings are not available. Random lengths will not be permitted. Provide either Class 150 or 200 pressure rating as shown on the Drawings. Where PVC pipe is to be installed with restrained joints, provide Class 200 pipe.

2.02 PVC PIPE COLORING AND MARKING FOR RECYCLED WATER SERVICE

PVC pipe shall be purple (Pantone 522) and shall be marked on both sides of the pipe with the wording "CAUTION: RECYCLED WATER--DO NOT DRINK." The lettering shall be minimum 1-inch-high black letters and shall be repeated every 36 inches. The purple coloring shall be achieved by adding pigment to the PVC material as the pipe is being manufactured.

2.03 HIGH DEFLECTION COUPLINGS

Provide PVC couplings with twin elastomeric gaskets which allows 2 degrees of deflection at each gasket for a total of 4 degrees per coupling. Provide couplings for cast iron equivalent outside diameter with 200 psi working pressure rating. Provide CertainTeed High Deflection (HD) Stop Couplings, or District approved equal.

2.04 CLOSURE/REPAIR COUPLINGS

Provide PVC couplings with twin elastomeric gaskets which are designed to connect plain ends of straight pipe. Provide couplings for cast iron equivalent outside diameter with 200 psi working pressure rating. Do not deflect pipe in these couplings. Provide CertainTeed Closure/Repair Couplings, or District approved equal.

2.05 FITTINGS

- A. Provide ductile iron fittings conforming to AWWA C110 with a minimum rated working pressure of 350 psi. Provide fittings with bells and gaskets specifically designed for cast iron equivalent outside diameter PVC pipe. Use mechanical joint fittings or fittings with bells and gasket ends.
- B. In lieu of paragraph 2.05, A., provide ductile iron fittings conforming to AWWA C153 with a minimum rated working pressure of 350 psi. Provide fittings constructed of Grade 70-50-05 ductile iron having a minimum weight equal to the weight tabulated in AWWA C153. Provide fittings with bells and gaskets specifically designed for cast iron equivalent outside diameter PVC pipe. Use mechanical joint fittings or fittings with bells and gasket ends conforming to the dimensional values of AWWA C111. Mechanical joint glands shall be Grade 70-50-05 ductile iron and cast in one continuous ring. Fittings with repaired defects are not acceptable and will be rejected.
- C. For mechanical joint fittings with glands, use tee-head or non-hex head bolts and hex head nuts for joint makeup and gasket seating. Bolts and nuts shall be carbon steel and coated with a corrosion inhibiting fluoropolymer composite material. Provide Tripac 200 Blue Coating System, or District approved equal.

2.06 LINING AND COATING FOR FITTINGS

- A. Line interior of fittings for water pipelines with cement mortar per AWWA C104 and line interior of bells per Standard Specification Section 09900, System No. 5. Provide double thickness lining and use cement conforming to ASTM C150 Type II. Coating on interior bells shall be holiday free.
- B. Coat exterior of fittings for water pipelines with an asphalt material per AWWA C151.

- C. As an alternative to paragraph 2.06, A and B, line and coat fittings and bells with fusion-bonded epoxy per Standard Specification Section 09961. Coating shall be holiday free on the interior surfaces of the fittings, including the bells.
- D. All fittings for sewer force mains shall be glass lined and coated per Standard Specification Section 09870. Coating shall be holiday free on the interior surfaces of the fittings, including the bells.

2.07 FLANGES

Flanges on ductile iron fittings shall conform to AWWA C110 or ASME B16.42 Class 150 with a minimum rated working pressure of 250 psi.

2.08 BOLTS, NUTS AND GASKETS FOR FLANGES

See Standard Specification Section 15050.

2.09 OUTLETS

- A. For outlets 2 inches and smaller with working pressures 200 psi or less, attach a service saddle to the pipe. Provide service saddles with full width, cast bronze bodies conforming to ASTM B 62, O-ring gaskets, and iron pipe threads. Provide Type 304 stainless steel double band straps with four bolts or a single wide strap with four bolts. All stainless steel shall be fully passivated for enhanced corrosion resistance. All saddles shall be pre-sized at the factory for installation on cast iron equivalent outside diameter PVC pipe conforming to AWWA C900. Service saddles shall be Ford Style 202BS, Romac Industries Style 202BS, Smith-Blair Model 393, or District approved equal.
- B. For outlets 3 inches and larger, use a ductile iron tee with a flanged outlet.
- C. For outlets on existing pipes, see Standard Specification Section 15080 for material requirements.

2.10 RESTRAINED JOINTS

When the working pressure is less than 150 psi, provide restrained joints where indicated on the Drawings. Restrained joints shall be provided by restraining systems that incorporate a series of machined serrations on the inside diameter of a restraint ring to provide positive restraint. Restraining systems shall meet or exceed the requirements of UNI-B-13-94 or ASTM F 1674 and the following:

- A. Restraint devices for PVC bell-and-spigot joints shall consist of a split restraint ring installed on the spigot, connected to a solid backup ring seated behind the bell.
- B. Restraint devices for connection to ductile iron mechanical joints shall consist of a split restraint ring installed on the PVC pipe behind the ductile iron fitting follower gland and gasket and shall retain the full deflection capability of the joint.
- C. The split restraint ring shall be machined to match the cast iron equivalent outside diameter of the pipe, provide full 360-degree support around the barrel of the pipe, and shall incorporate a series of machined serrations for gripping the outside surface of the pipe. The serrations shall be uniform and extend the full circumference of the clamp. The ring shall

also incorporate a positive means of avoiding applying excessive clamping force to the pipe.

- D. Materials used in the restraint device shall be ductile iron conforming to ASTM A 536, Grade 65-45-12.
- E. T-bolts, studs, and connecting hardware shall be high strength, low alloy material in accordance with AWWA C111.
- F. Design restraining devices to have a minimum of 2:1 safety factor based on the design strength of the pipe. See Section 3.11 for installation directions.
- G. Restraining devices shall be Uni-Flange Block Buster Series 1300 and 1350, or District approved equal.

2.11 FLEXIBLE PIPE COUPLINGS

See Standard Specification Section 15122.

2.12 FLANGE COUPLING ADAPTERS

See Standard Specification Section 15122.

2.13 POLYETHYLENE ENCASEMENT

See Standard Specification Section 09954.

2.14 TRACER WIRE

Use AWG No. 8 stranded copper wire with high molecular weight polyethylene (HMW/PE) insulation specifically designed for direct burial in corrosive soil or water. Polyethylene insulation shall conform to ASTM D 1248, Type 1, Class C. Wires with cut or damaged insulation are not acceptable and replacement of the entire wire which has been damaged will be required at the Contractor's expense.

2.15 MARKING TAPE

Use detectable marking tape consisting of one layer of aluminum foil laminated between two colored layers of inert plastic film. The lamination bond should be strong enough that the layers can not be separated by hand. Tape shall be a minimum of 5 mils thick and 6 inches wide. Tape shall bear a continuous, printed message every 16 to 36 inches warning of the installation buried below. Tape shall be Terra Tape, Linetec, or District approved equal.

2.16 MARKER POSTS

Provide marker posts for buried pipelines at 500 feet on center except where pipeline is located in a paved street or as directed by the District's Representative. Use construction heart garden grade redwood per Standard Specifications for Grades of California Redwood Lumber issued by the Redwood Inspection Service. Provide seasoned redwood, 4 inches by 4 inches, and surfaced on four sides.

PART 3 - EXECUTION

3.01 PRODUCT MARKING

Legibly mark pipe in blue at 5-foot intervals and each coupling to identify the nominal pipe size, OD base, PVC, dimension ratio number and pressure class, AWWA C900, and the seal of the testing agency that verified the suitability of the material for potable water service where applicable.

3.02 DELIVERY AND TEMPORARY STORAGE OF PIPE

- A. Ship, store, and place pipe at the storage yard or installation site, supporting the pipe uniformly. Avoid scratching the pipe surface. Do not stack higher than 4 feet nor stack with weight on bells. Cover to protect from sunlight.
- B. Do not install pipe that is gouged or scratched forming a clear depression.
- C. Do not install pipe contaminated with a petroleum product (inside or outside).
- D. Do not install any pipe that shows evidence of exposure to sunlight, age, surface deterioration, or other physical damage. The decision of the District's Representative shall be final as to the acceptability of the pipe to be installed.

3.03 HANDLING OF PIPE

Lift pipes with mechanical equipment using wide belt slings or a continuous fiber rope which avoids scratching the pipe. Do not use cable slings or chains. Pipes up to 12 inches in diameter may be lowered by rolling on two ropes controlled by snubbing. Pipes up to 6 inches in diameter can be lifted by hand.

3.04 SANITATION OF PIPE INTERIOR

- A. During laying operations, do not place tools, food, clothing, trash, or other materials in the pipe. Keep the interior of the pipe clean as the pipeline construction progresses. The purpose of maintaining a clean interior is to aid in the passage of the bacteriologic quality after disinfection.
- B. When pipelaying is not in progress, including the noon hour, close the ends of the installed pipe with a plug to deter entry of vermin, children, dirt, storm water, or foreign material.

3.05 PIPE LAYOUT FOR STRAIGHT AND CURVED ALIGNMENTS

- A. Use integral bell end pipe for straight alignments and for radii greater than 1,150 feet.
- B. Use the following various combinations of plain end pipe lengths with high deflection couplings and integral bell end pipe for curved alignments in both horizontal and vertical directions. Do not bend pipe between couplings. Saw cut integral bell end of standard pipe and bevel end for use with deflection couplings. Pipe lengths shorter than 9 feet will not be used unless specifically authorized by the District's Representative.
 - 1. Use 9.5-foot plain end pipe lengths with deflection couplings for all radii between 140 feet to 270 feet.

2. Use 19-foot plain end pipe lengths with deflection couplings for all radii between 270 feet to 560 feet.
3. Use an integral bell end pipe length joined together with a 19-foot plain end pipe length to form a chord. Use deflection couplings on each end of the chord and continue this combination through the curved alignment for all radii between 560 feet to 1,150 feet.

3.06 INSTALLING PIPE IN TRENCH

- A. See Standard Specification Section 02223 for earthwork requirements.
- B. Inspect each pipe and fitting before lowering into the trench. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.
- C. Handle pipe in a manner to avoid any damage to the pipe. Do not drag pipe over the ground, drop it onto the ground, or drop objects on it. Do not drop or allow pipe to fall into trenches.
- D. Laying tolerances for the installed pipe shall not vary greater than 0.3-foot horizontally, or greater than 0.1-foot vertically from the alignment and elevations shown on the Drawings.
- E. Grade the bottom of the trench to the line and grade to which the pipe is to be laid. Remove hard spots that would prevent a uniform thickness of pipe base material (imported sand). Before laying each section of the pipe, check the grade and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of pipe handling slings.
- F. At the location of each joint, dig bell holes in the bottom of the trench and at the sides to permit visual inspection of the entire joint and to prevent the pipe from being supported by the bell end or fitting.
- G. Keep the trench in a dewatered condition during pipelaying. Removal of water shall be in conformance with Standard Specification Section 02223.

3.07 ASSEMBLING PIPE JOINTS

- A. The spigot and integral bell or coupling shall be dirt free and slide together without displacing the rubber ring gasket. Lay the pipe section with the integral bell facing the direction of laying.
- B. Clean the groove of the bell or coupling of all foreign materials. If the gasket groove is dirty or contains debris, carefully remove the gasket and clean the groove. Insert the gasket back into the groove of the bell or coupling prior to installation. Observe the correct direction of the shaped gasket. Feel that the gasket is completely and evenly seated in the groove.
- C. Mark the full insertion depth on the spigot end of the pipe. This mark indicates when the pipe is fully inserted into the bell or coupling. Lubricate the exposed gasket surface and the beveled spigot up to the full insertion mark with the lubricant supplied by the pipe manufacturer. For repair couplings, lubricate pipe for the entire distance the coupling will

travel on the pipe. If the lubricated pipe end touches dirt, clean the pipe end and reapply lubricant.

- D. Insert the spigot into the bell or coupling and force it slowly into position.
- E. Check that the rubber ring gasket has not left the groove during assembly by passing a feeler gage around the completed joint.

3.08 INSTALLING BURIED FITTINGS

- A. The District’s Representative will inspect all fittings prior to installation for damage to the interior protective coatings. Coating shall be holiday free on interior surfaces. Patch damaged areas in the field with material similar to the original.
- B. For mechanical joint fittings, clean the bell socket and the plain end of the pipe of all foreign material and dirt. Place the gland on the pipe spigot with the lip extension toward the plain end. Lubricate the pipe spigot and gasket. Use the same lubricant as supplied by the pipe manufacturer. Install the gasket on the pipe spigot with the narrow edge of the gasket toward the plain end. Insert the pipe into the bell socket and press the gasket firmly into the gasket recess. Keep the joint straight during assembly. Push the gland towards the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand tighten nuts. Make joint deflection after assembly but before tightening nuts. Uniformly tighten bolts and nuts in a progressive diametrically opposite sequence, and torque nuts to 75- to 90-foot-pounds with a calibrated torque wrench. Coat exposed surfaces of tee-head bolts and nuts after tightening with primer for wax tape coating per Standard Specification Section 09952.
- C. For push-on joint fittings, clean the bell ends of the fitting of all foreign material and dirt. Insert the gasket in the groove of the bell and make sure the gasket faces the correct direction. Feel that the gasket is completely and evenly seated in the groove. When pipe is cut in the field, bevel the plain end prior to installation. Lubricate the exposed gasket surface and the beveled pipe spigot with the same lubricant supplied by the pipe manufacturer. Insert the spigot into the bell and force it slowly into position. Keep the joint straight while pushing. Make joint deflection after the joint is assembled.
- D. When necessary to deflect pipe from a straight line in either the horizontal or vertical plane, do not exceed the following joint deflection angles for buried fittings. The angles shown are for each joint and are maximum deflections.

Nominal Pipe Size (inches)	Mechanical Joint (degrees)	Push-on Joint (degrees)
4	6-1/2	4
6	5-1/2	4
8	4	4
10	4	4
12	4	4

3.09 INSTALLING FLANGED JOINTS

See Standard Specification Section 15050 for installation instructions.

3.10 INSTALLING SERVICE SADDLES

- A. Place the service saddle on the pipe and hand tighten the nuts while positioning the saddle in its final location. Uniformly tighten the nuts in a progressive diametrically opposite sequence and torque with a calibrated torque wrench to the saddle manufacturer's recommended values.
- B. Connect a corporation stop to the saddle per Standard Specification Section 15080. Apply Teflon joint compound or tape to the male threads before installing the corporation stop. Make joints watertight.
- C. Mount a tapping machine on the corporation stop to cut a hole in the pipe with a shell type cutter made specifically for PVC pipe. Do not use other devices or hand equipment to bore through the pipe wall.

3.11 INSTALLING RESTRAINED JOINTS

- A. Follow the manufacturer's installation instructions for the restrained joint system. Tighten the clamping bolts on the restraint rings to the recommended torque. Do not over-tighten the retaining nuts behind the restrainer ears.
- B. Wrap restrained joint including bolts and nuts with wax tape coating per Standard Specification Section 09952.

3.12 INSTALLING FLEXIBLE PIPE COUPLINGS

Install flexible pipe couplings per Standard Specification Section 15122.

3.13 INSTALLING FLANGE COUPLING ADAPTERS

Install flange coupling adapters per Standard Specification Section 15122.

3.14 INSTALLING POLYETHYLENE ENCASEMENT

Wrap buried service saddles, fittings, flanged joints, and restrained joints with polyethylene material per Standard Specification Section 09954. Wrap metallic items and buried joints with polyethylene sheet and overlap the adjoining pipe a minimum of one foot. Secure in place with 2-inch-wide plastic adhesive tape. Complete the wrap prior to placing concrete anchors, supports, or thrust blocks per Standard Specification Section 02223. Repair polyethylene material damaged during construction.

3.15 INSTALLING TRACER WIRE

Prior to backfill, install tracer wire on top of pipe and secure in place with 2-inch wide plastic adhesive tape at maximum 10-foot intervals. Run tracer wire continuously along pipe and terminate in adjacent valve boxes for buried assemblies or buried valves. Where buried splices occur, use an electrical splicing kit consisting of a split bolt connector, mold, and a two part encapsulating epoxy resin such as Scotchcast, or District approved equal. Provide

24 inches of coiled wire at access points for attachment of pipe locating equipment. Each installed run of pipe shall be capable of being located using the tracer wire. Protect wire insulation from damage during installation and backfilling. Wire insulation that is broken, cut, or damaged shall be replaced.

3.16 INSTALLING MARKING TAPE

After the pipe zone has been backfilled and compacted, place the marking tape on the compacted pipe zone material and center over the pipe. Run tape continuously along the trench and tie ends of tape together. Wrap marking tape around valve box extension pipes and continue along pipe.

3.17 SETTING MARKER POSTS

Locate marker posts on centerline of pipeline and space at 500 feet on center. Cut redwood post to a 5-foot length and chamfer the top. Paint post per Standard Specification Section 09900, System No. 60. Use white paint for the finish coats. For potable water, use blue paint for the top 4 inches of the chamfered end and stencil in 2-inch-high blue letters the word "WATER" on the post. For recycled water, use purple paint for the top 4 inches of the chamfered end and stencil in 2-inch-high purple letters the abbreviation "RW" on the post. Excavate a hole 16 inches in diameter by 2 feet deep. Set the redwood post plumb, fill hole with concrete to 2 inches above finish grade, and crown to slope away from post. Concrete shall be Class C per Standard Specification Section 03000.

3.18 PRESSURE TESTING

See Standard Specification Section 15144 for pressure testing requirements.

3.19 DISINFECTION

See Standard Specification Section 15141 for chlorination requirements.

END OF SECTION