

## **SECTION 33 05 31.16 (15067)**

### **PVC C900 WATER MAIN**

#### **PART 1 GENERAL**

##### **1.01 SCOPE**

- A. This section includes materials, installation, and testing of PVC C900 for water main, conforming to AWWA C900. Size range is 4 through 16 inches.
- B. Not for use near gas stations or other sites which may have hydrocarbon contamination.
- C. PVC DR 18 (4 to 16-inches color blue) will be allowed for water mains due to current supply chain disruptions. The WASD will accept water main projects with PVC DR 18 for one year to 9/30/2023. Plans approved after 9-30-2023 will require DIP to be used for potable water mains.
- D. All PVC pipe used shall be of new or recent manufacturer. Pipe with surface discoloration will not be allowed.
- E. Pipe Fittings shall be ductile iron.

##### **1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. Section 33 01 10.54 (02505) "Cleaning and Testing of Mains"
- B. Section 33 01 10.58 (UC-175) "Disinfection of Water Mains"
- C. Section 33 14 00 (15060) "Piping and fittings"
- D. Section 33 14 13 (UC-000) "Water Mains"

##### **1.03 SUBMITTALS**

- A. Submit shop drawings in accordance with the Departments specifications or submit the Pre-Approved Product List Manufacturer.
- B. PVC Pipe not on the Pre-Approved Products list shall supply the following:
  - 1. Provide affidavit of compliance with AWWA C900.
  - 2. 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.
  - 3. Submit copies of the following manufacturer-required tests conducted on project pipe:
    - a. Quick-burst strength of pipe and couplings.

- b. Flattening resistance of pipe.
  - c. Record of additional tests after test sample failure.
4. Submit manufacturer's literature of gray iron and 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 that the minimum safety factor described in AWWA C153 is met.
  5. Submit outline drawings and materials description of service connection saddles, corporation stops, and pipe plugs.
  6. Submit test results for the restrained joint system to be used certified by an independent test laboratory demonstrating compliance with these specifications for each size and pressure rating.

1.04 QUALITY CONTROL

- A. No deflection at the pipe joints is allowed for PVC pressure mains.
- B. Bending of the Pipe Barrel: Gasketed PVC pipes can be laid to the line of a curved trench by bending the pipe barrel into a curved shape. The procedure is as follows:
  1. Keep the spigot in straight alignment with the bell.
  2. Place compacted backfill around the assembled joint. This backfill restrict movement while the curvature is being made.
  3. Place compacted backfill at the inside of the curve at the mid-point of the pipe length to form a fulcrum.
  4. Using only manual effort, move the leading bell of the pipe length to be curved.
  5. **Longitudinal barrel deflection along the pipe barrel shall be based on half of the allowable longitudinal deflection established by the PVC Pipe Association Handbook of PVC Pipe Design and Construction Table 8.4. The allowable pipe barrel deflection in inches shown below is per 20-foot pipe length.**

Pipe Size inch	4	6	8	10	12
Allowable Bending Offset at the opposite end of the R18 PVC 20-foot pipe length, inches	12	8.5	6.5	5	4

- C. PVC pipe shall not be over-homed.
- D. Pipe Bedding Material shall be class 1 backfill material with a maximum rock size of 3/4-inches.
- E. The Department shall have the final determination on allowing the use of PVC C900 DR 18 for potable water mains. The Contractor/Design Engineer shall obtain approval in writing prior to finalizing 100% construction plans.

## **PART 2 - PRODUCTS**

### **2.01 PIPE**

- A. Pipe 4-inches through 16 inches shall conform to AWWA C900 DR 18, rubber-ring gasket bell end or plain end with elastomeric gasket coupling, cast iron equivalent outside diameter, material cell classification 12454 per ASTM D1784, latest revision.
- B. All potable water pipe and fittings installed under this Project shall be color coded as required by FAC Rule 62-555.320(21)(b)3, using blue as a predominant color to differentiate drinking water from reclaimed or other water. Underground plastic pipe shall be solid-wall blue pipe, shall have a co-extruded blue external skin, or shall be white or black pipe with blue stripes incorporated into, or applied to, the pipe wall; and underground metal or concrete pipe shall have blue stripes applied to the pipe wall.
- C. Pipe shall have a gasket locking system at the bell end. This does not restrain the pipe but rather locks the pipe in place and prevents the gasket from rolling.

### **2.02 FITTINGS**

- A. Fittings shall be cement lined, Ductile Iron and conform to AWWA C153, latest revision or AWWA C110, latest revision.

### **2.03 FLANGES**

- A. Flanges on outlets of fittings shall be Class 250 per ASME B16.1.
- B. PVC flanges shall be of the one-piece solid socket design and shall be made of the same material as the pipe. Manufacturer's pressure rating shall be at least 250 psi at a temperature of 73°F. Minimum burst pressure shall be 500 psi. Flanges shall match the dimensions of ASME B16.5, Class 250, steel flanges for outside diameter, bolt circle, and bolt holes. Do not use Van Stone flanges.

### **2.04 OUTLETS**

- A. All connections to PVC require a saddle.

## 2.05 RESTRAINED JOINTS

- A. Provide external restrained joints as indicated in the drawings. Restrained joints shall be provided by restraining systems that incorporate a wedge restraint on the restraint ring to provide positive restraint.
- B. Internal Joint Restraint: RieberLok and Field Lok type gasket restraints are allowed for PVC Pipe in pressure applications.
- C. Restraint devices for 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.
- D. Restraining Glands shall be EBAA Iron Series 2000 and 1600 or approved equal.
- E. The ASTM A536 ductile iron casting of the restrained gland shall be bonded powder coated. The wedge and wedge assembly shall have a bonded liquid polymer coating applied for corrosion protection. The gland shall utilize torque limiting twist off wedge actuation screws.
- F. T-bolts, studs, and connecting hardware shall be high-strength, low alloy material in accordance with AWWA C111.
- G. Design restraining devices to have a 2:1 safety factor based on the design strength of the pipe.

## 2.06 FLANGED COUPLING ADAPTERS

- A. See Section 33 05 98 (15065) – “Miscellaneous Materials”.

## **PART 3 - EXECUTION**

### 3.01 PRODUCT MARKING

- A. The pipe shall be marked by the manufacturer at 5-foot intervals and each coupling to identify the nominal diameter, the outside diameter base, that is, cast-iron or steel pipe (IPS), the material code for pipe and couplings, the dimension ratio number, AWWA C900, and the seal of the testing agency that verified the suitability of the material for potable water service (NSF/ANSI 61).

### 3.02 DELIVERY AND TEMPORARY STORAGE OF PIPE

- A. PVC shall be protected from UV degradation caused by extended exposure to direct sun. Pipe with surface discoloration shall not be installed and immediately removed from the project site. Tarps used to protect the pipe from sunlight shall be placed to allow for adequate ventilation to prevent heat build-up.
- B. Ship, store, and place pipe at the installation site, supporting the pipe uniformly. Avoid scratching the pipe surface. Do not stack higher than 4 feet or with weight on bells. Cover to protect from sunlight.
- C. Do not drag PVC pipe over the ground, drop it onto the ground, or drop objects on it.

- D. Store loose pipes on racks with a maximum support spacing of 3 feet. Provide shades for pipe stored outdoors or installed outdoors until the pipe is filled with water. Store fittings indoors in their original cartons.
- E. Store solvent cement indoors or, if outdoors, shade from direct sunlight exposure. Do not use solvent cements that have exceeded the shelf life marked on the storage container.

### 3.03 HANDLING PIPE

- A. Hoist pipe with mechanical equipment using a cloth belt sling or a continuous fiber rope that avoids scratching the pipe. Do not use a chain. Pipes up to 16 inches in diameter may be lowered by rolling on two ropes controlled by snubbing. Pipes up to 6 inches in diameter may be lifted by hand.

### 3.04 INSTALLING BURIED PIPING

- A. **Pipe Bedding material for PVC shall be well graded Class 1 backfill with a max rock size of ¾-inch compacted in 6-inch lifts.** The minimum trench width shall be the pipe width plus 24-inches (12-inches on each side). **Backfill material shall be No. 57 limerock with a maximum particle size of 2-inches in water or select select backfill placed and compacted at least 90% of maximum density 2-inch maximum particle size per ASHTO Spec No. T-180 in a dry trench to 1 foot above the pipe. See Detail GS 1.9 Sheet 2 of 2.**
- B. Before installation, check pipe and fittings for cuts, scratches, gouges, buckling, kinking, or splitting on pipe ends. Remove any pipe section containing defects by cutting out the damaged section of pipe.
- C. Do not install PVC pipe when the temperature is below 40°F or above 140°F.
- D. Do not install pipe that is gouged or scratched forming a clear depression.
- E. Install in accordance with AWWA C605, and as follows.
  - 1. When installing pipe in trenches, do not deviate more than 1 inch from line or 1/4 inch from grade. Measure for grade at the pipe invert.
  - 2. Backfill materials in the pipe zone shall be imported sand per Section 31 23 33 (02315) "Trenching and Backfilling of Piping Systems". Do not add successive layers unless the previous layer is compacted to 90% relative compaction per ASTM D1557.
  - 3. Compact material placed within 12 inches of the outer surface of the pipe by hand tamping only.
  - 4. Compact trench backfill to the specified relative compaction. Do not float pipe. Do not use high-impact hammer-type equipment except where the pipe manufacturer warrants in writing that such use will not damage the pipe.

5. Pipe installed below the water table where the homing mark is not visible shall utilize an over-insertion prevention device.

### 3.05 Underground Location

- A. All PVC installed shall have the ability to be located aboveground. Tracer Wire, Magnetic Balls and Location Safety Tape (all three) are all required by the Department.
- B. Install 3M compatible magnetic location ball markers every 100 feet approximately 1-foot above the PVC main on straight runs and at any bends, vertical or horizontal. See WASD Standard Detail R 5.0.
- C. Install 10-gauge tracer wire taped to the buried PVC pipe. The tracer wire shall provide a continuous path which can locate the buried installation by inducing a current to the tracer wire.
- D. Install electronically detectable safety tape approximately 1 to 2 feet above the top of the buried PVC pipeline as a visible marker for future excavation.

### 3.06 ASSEMBLY OF RUBBER-GASKET PIPE JOINT

- A. Lay the pipe section with the bell coupling facing the direction of laying.
- B. Lubricate the spigot over the taper and up to the full insertion mark with the lubricant supplied by the pipe manufacturer. If the lubricated pipe end touches dirt, clean the pipe end and reapply lubricant.
- C. Insert the spigot into the bell and force it slowly into position.
- D. Check that the rubber ring has not left the groove during assembly by passing a feeler gauge around the completed joint.

### 3.07 CLEANING AND TESTING

- A. All of the piping installed under this project shall be tested as follows and as directed by the Engineer.
  1. With exceptions as noted below, all PVC piping installed under this Contract shall be cleaned and tested according to section 33 01 10.54 (UC-170) "Cleaning and Testing of Mains".
  2. Unless otherwise specified elsewhere herein, all PVC water main shall be tested at 150 psi in accordance with ANSI/AWWA C605.

### 3.08 FIELD QUALITY CONTROL

- A. All mains shall be flushed to remove all sand, debris, rock and other foreign matter. Dispose of the flushing water without causing a nuisance or property damage.

- B. Pressure and Leakage Testing: Hydrostatically test all pressure pipe. Test PVC Pipe mains in accordance with ANSI/AWWA C605-once all backfill is in place and fully compacted, and after all thrust blocks, if applicable, have cured to their design strength. Do not test against closed valves. All pumps, piping and gauges shall be furnished, installed and operated by the Contractor and all such equipment and devices and their installation shall be approved by the Engineer. Pump shall be of a non-pulsating type suitable for this application and gauge accuracy certification may be required at the Engineer of Record's discretion. All pressure and leakage testing shall be done in the presence of a representative of the Department as a condition precedent to the approval and acceptance of the system.

### 3.09 DISINFECTION

- A. Disinfect in accordance with section 33 01 10.58 (UC-175) "Disinfection of Water Mains and ANSI/AWWA C651 – Disinfecting Water Mains. During the period that the chlorine solution or slug is in the section of pipeline, open and close valves to obtain a chlorine residual at hydrants and other pipeline appurtenances. Swab exposed faces of valves and blind flanges prior to bolting flanges in place with a 1% sodium hypochlorite solution. Disinfect isolation valves, pipe, and appurtenances per AWWA C651, Section 4.7.
- B. Flush with potable water until discolored water, mud, and debris are eliminated. Swab interior of pipe and fittings with a 1% sodium hypochlorite solution. After disinfection, flush with potable water again until water is free of chlorine odor. After confirming the chlorine residual, flush the excess chlorine solution from the pipeline until the chlorine concentration in the water leaving the pipe is either within 0.5 mg/L of the replacement water or no higher than that generally prevailing in the distribution system.
- C. Discharge of chlorinated water into watercourses or surface waters is regulated by the National Pollutant Discharge Elimination System (NPDES). Disposal of the chlorinated disinfection water and the flushing water is the Contractor's responsibility. Schedule the rate of flow and locations of discharges in advance to permit review and coordination with Owner and cognizant regulatory authorities. For measuring chlorine concentration, supply and use a medium range, drop count, DPD drop dilution method kit per AWWA C651, Appendix A.1. Maintain kits in good working order available for immediate test of residuals at point of sampling.

**END OF SECTION**