

## SECTION 02510 - PVC TRANSMISSION PIPE (C905)

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes materials and installation of polyvinyl chloride (PVC) pressure transmission pipe conforming to AWWA C905. Sizes shall be limited to 14 inches through 36 inches. In general, the maximum working pressure will be limited to 175 psi. The DISTRICT, at its sole discretion, may allow a working pressure of 200 psi if certain operational conditions concerning the limitations of AWWA C905 PVC pipe are not compromised. AWWA C905 PVC Pipe is intended for use solely as a transmission main.

#### 1.2 REFERENCE SPECIFICATIONS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.
- |    |      |       |   |
|----|------|-------|---|
| 1. | AWWA | C104  | Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water                           |
| 2. | AWWA | C110  | Ductile-Iron and Gray-Iron Fittings 3-in Through 48-in for Water and Other Liquids          |
| 3. | AWWA | C905  | Polyvinyl Chloride Water Transmission Pipe  |
| 4. | AWWA | M23   | PVC Pipe-Design and Installation  |
| 5. | ASTM | D1599 | Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings |

#### 1.3 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
1. Shop Drawings
    - a. Shop drawings showing dimensions and details of pipe joint fittings, fitting specials, valves and appurtenances.
    - b. Detailed layout, spool or fabrication drawings showing pipe spools, spacers, adapters, connectors, fittings and pipe supports not indicated in the Contract Documents.
    - c. Shoring and bracing drawings in accordance with Section 02000.
    - d. Manufacturer's product data and samples of all materials proposed for use on the work.
    - e. Test Reports From:
      1. Hydrostatic proof testing
      2. Sustaining pressure testing
      3. Burst strength testing

2. OWNER's Manual

- a. Manufacturer's technical data and installation instructions.
- b. Manufacturer's certificates of compliance indicating that all materials provided under this Section meet the requirements of the Contract Documents.

1.4 INSPECTION

A. Factory Inspection

1. All pipe may be subject to inspection at the place of manufacture in accordance with the provisions of the referenced standards as supplemented by the requirements herein. The CONTRACTOR shall notify the DISTRICT in writing of the manufacturing starting date not less than 14 calendar days prior to the start of any phase of the pipe manufacture.
2. During the manufacture of the pipe, the DISTRICT shall be given access to all areas where manufacturing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

1.5 TESTING

A. Except as modified herein, pipe shall be tested in accordance with the requirements of this Section and AWWA C905, as applicable.

1. The CONTRACTOR shall perform said material tests in accordance with the requirements of the Contract Documents. The DISTRICT shall have the right to witness all testing conducted by the CONTRACTOR; provided, that the CONTRACTOR's schedule will not be delayed for the convenience of the DISTRICT.
2. All expenses incurred in obtaining samples for testing shall be borne by the CONTRACTOR at no increased cost to the DISTRICT.
3. In addition to those tests specifically required, the DISTRICT may request additional samples of any material for testing by the DISTRICT. The additional samples shall be furnished at no additional cost to the DISTRICT.

**PART 2 - PRODUCTS**

2.1 GENERAL

- A. Polyvinyl Chloride (PVC) pressure pipe in sizes 14 inches through 36 inches shall conform to the applicable requirements of ANSI/AWWA C905.

- B. Acceptable PVC pipe shall carry a current certification of the National Sanitation Foundation (NSF) as acceptable to use in the transport of potable water.
- C. The manufacturer of each shipment of pipe may be required to supply a statement certifying that each lot of pipe has been subjected to the tests specified for PVC pipe, and has been found to meet all the requirements of the AWWA C905 Standard.
- D. Acceptable PVC pipe and couplings shall bear indelible identification markings as required by ANSI/AWWA C905.
- E. The pipe and couplings shall be carefully inspected for defects. Any length of pipe, coupling or elastomeric gasket found to be defective in workmanship or materials, or so damaged as to make repairs and use questionable, shall be rejected and not delivered to the jobsite. The opinion of the DISTRICT shall be final.
- F. Do not install any pipe contaminated with a petroleum product (inside or outside).
- G. 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.
- H. Pipe should be stored, if possible, at the job site in unit packages provide by the manufacturer. Caution should be exercised to avoid compression damage or deformation to bell-ends of the pipe. Pipe shall be supported uniformly while being store and not stacked with the weight on bells. All pipe shall be stored in such a way to protect it from exposure from direct sunlight. The pipe may be covered with an opaque material while permitting adequate air circulation above and around the pipe. Gaskets shall be stored in a cool, dark place out of the direct rays of the sun, preferably in original cartons. For pipe older than 24 months, the DISTRICT will require information on the pipe storage during the period. The DISTRICT reserves the right to reject pipe older than 24 months or to require retesting and recertification by the pipe manufacturer.

## 2.2 PIPE DESIGN CRITERIA

- A. Polyvinyl Chloride (PVC) pipe shall have a Dimension Ratio (DR) of 18 and a Pressure Rating (PR) of 235 psi for 14 inches through 24 inches, and a DR of 21 and a PR of 200 psi for 30 inches through 36 inches. PVC pipe shall conform with all aspects of AWWA C905. Provide pipe with cast iron equivalent outside diameter and integral wall-thickened bell and spigot ends. Provide one elastomeric gasket for each bell end.
- B. PVC pipe shall be provided in standard 20 foot lengths, unless otherwise specified, detailed or required on the approved plans. Shorter lengths, up to 10 feet, will be permitted when authorized by the District's Representative. Field cut lengths of pipe used as closures may not be shorter than 2 feet in length unless approved by the DISTRICT.

- C. Acceptable PVC pipe shall have common profiles for interchangeability between rough-barrel dimensions, couplings, ends, and elastomeric gaskets so as to facilitate future repairs. When assembled, the pipe will have only one gasket per bell and spigot end, and/or two gaskets per coupling.
- D. Earth loads on pipe from 14 inches to 36 inches shall be computed using the prism formula:

$$W_c = HwB_c$$

Where  $W_c$  = Earth load in pounds per linear foot

$H$  = Depth of cover, feet

$w$  = 120 lb/ft<sup>3</sup>

$B_c$  = Outside diameter of pipe, feet

- E. Truck live loads shall be determined using the method recommended by AASHTO in "Standard Specifications for Highway Bridges." For depths of cover less than 10 feet HS-20 live loads shall be added to the earth loads to determine the total load. For depths of cover 3 feet or less, HS-20 live load plus impact shall be included.
- F. Deflection of the pipe after installation shall not exceed 0.03 times the outside diameter. If the calculated deflection exceeds 0.03 times the outside diameter, the pipe class shall be increased or the quality of the pipe zone backfill shall be improved to achieve a higher modulus of soil reaction, E'. For purposes of calculation, values of E' shall be 1100 psi at 90 percent Standard Proctor; 1500 psi at 95 percent Standard Proctor; and 2500 psi at 100 percent Standard Proctor. Similarly, the deflection lag factor for dead loads shall be 1.5 and the bedding constant shall be 0.1.

### 2.3 DEFLECTION COUPLINGS- DUCTILE IRON

- A. A ductile iron short sleeve with mechanical joints shall be used to obtain deflection horizontally or vertically. A deflection of up to 2 degrees shall be permitted at each gasket. Plain end pipes shall be used with these couplings. Should the configuration of the pipeline be such that more than 4 degrees deflection is required, standard fittings shall be used.

### 2.4 DEFLECTION COUPLINGS- PVC

- A. A solid PVC coupling manufactured from DR 18 or DR 21 PVC pipe stock may be used to obtain deflection horizontally or vertically. A straight coupling may be used to obtain deflections up to 2 degrees per gasket, or a total of 4 degrees per coupling. A custom manufactured coupling may be used to obtain deflections up to 3 degrees per gasket, or 6 degrees per coupling. For deflection requirements greater than 6 degrees, ductile iron fittings shall be used. Use of these couplings shall only be permitted upon the prior approval of the DISTRICT.

## 2.5 REPAIR OR TRANSITION COUPLINGS

- A. A ductile iron mechanical straight coupling shall be used to effect repairs on same size pipe, or to transition from one type of plain end pipe to another type of plain end pipe. The coupling shall be epoxy coated inside and outside, and utilize stainless steel bolts and nuts.

## 2.6 FITTINGS

- A. Gray iron or ductile iron fittings, shall have a minimum rated working pressure of 250 psi. The fittings shall have bell ends with gaskets specifically designed for cast iron equivalent outside diameter PVC pipe; or mechanical joint type fittings manufactured specifically for PVC pipe.
- B. Provide Class 250 flanges on gray iron or ductile iron fittings where mating to Class 250 butterfly valves.
- C. Provide ductile iron tapped tees for appurtenance outlets 2-1/2 inches and smaller. Tapped tees shall be constructed of ductile iron, have outlet iron pipe threads, and bell ends designed to fit the type, size and class of pipe.
- D. Provide gray iron or ductile iron tees with a flanged outlet for appurtenance outlets 3 inches and larger.

## 2.7 JOINING

- A. All joints shall be integral, bell and spigot gasketed joints, or plain end with rubber ring couplings.
- B. When the spigot end of pipe is to be inserted into a mechanical joint fitting, the beveled end of the pipe shall be removed prior to insertion.
- C. Solvent weld joints are not permitted.

## 2.8 GASKETS AND LUBRICANTS

- A. Gaskets and lubricants shall be made from materials that are compatible with the plastic material and with each other when used together. They shall not support the growth of bacteria and shall not adversely affect the potable qualities of the water that is to be transported.
- B. One elastomeric gasket shall be furnished with each length of bell-end pipe.

## 2.9 C905 PVC TAPPING SADDLES

- A. A fabricated two-part steel saddle shall be used for wet tap connections where the outlet size is 8 inches or less. Outlet sizes 2-1/2 inches or smaller shall use a 3000 lb. threaded half coupling welded to the two-part saddle. The carbon steel used in the saddle shall have a minimum yield strength of 30,000 psi. The bolts and nuts shall be stainless steel, Type 316. The entire sleeve shall be shop coated inside and outside with a

minimum of 8 mils of fusion bonded powder epoxy in accordance with AWWA C213.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL**

- A. The CONTRACTOR shall install all the pipe closure sections, fittings, valves and appurtenances shown on the approved plans, including bolts, nuts, gaskets and joining materials.
- B. The CONTRACTOR shall excavate sufficiently in advance of pipe laying operations to enable the alignment and profile to be revised to clear existing utilities and to align with existing connection points.
- C. PVC pipe which has been gouged shall not be used. PVC pipe which has received minor scratches during handling may be used solely at the discretion of the DISTRICT.
- D. Before being placed in position, the pipe fittings and accessories shall be cleaned and shall be maintained in a clean condition.
- E. The CONTRACTOR shall maintain the interior of the pipe clean, sanitary and free from foreign materials. At all times when the work of installing pipe is not in progress, all openings into the pipe and the ends of the pipe in the trenches shall be kept tightly closed to prevent the entrance of animals and foreign materials. To prevent unwanted water intrusion, open ends of pipe shall be closed temporarily with a watertight bulkhead.

#### **3.2 INSTALLATION**

- A. Proper care shall be used to prevent damage in handling, moving and placing the pipe. Tools and equipment satisfactory to the DISTRICT shall be provided and used by the CONTRACTOR.
- B. The pipe shall not be handled in a manner that will cause bruises, cracks, or other damage. Any material damaged in the course of installation shall be identified and removed from the job site.
- C. All pipe, fittings, valves, and other pipeline materials shall be lowered into the trench in a manner that prevents damage. Under no circumstances shall pipe, fittings or any other materials be dropped or dumped into trenches.
- D. The pipe shall be hoisted with mechanical equipment using a cloth belt sling or a continuous fiber rope which avoids scratching the pipe. A chain is not permitted.
- E. The full length of each section of pipe and fittings shall rest solidly on the pipe bed, with recessed excavation to accommodate bells, joints and couplings. Anchors and supports shall be provided where necessary and where indicated on the drawings for fastening work into place.

- F. Wood support blocking will not be permitted.
- G. Bell and spigot pipe shall be laid with the bell-ends pointing in the direction of laying. Pipe shall be graded in straight lines taking care to avoid the formation of any dips or low points. Joints shall be installed according to manufacturer's recommendations.
- H. The maximum deflection at any joint shall be in accordance with the manufacturer's recommendations. The pipe layout for curved alignments using 20-foot pipe lengths with bell-end or coupling shall also be as recommended by the manufacturer.
- I. Pipe installation for straight and horizontal or vertical curve alignments shall be as described below. In no case shall the pipe be bent between the couplings, nor shall deflection be made at a joint without the use of a deflection coupling.
- J. Installation tolerances for the pipe shall not vary more than 0.15 foot horizontally or 0.1 foot vertically from the alignment and elevations shown on the approved plans.
- K. Install PVC pipe such that the indelible identification strip markings on each pipe section are continuously aligned for the total length of the pipeline being installed. Orient the strip marking upward to the 12 o'clock position (top) of the trench opening.
- L. Assemble the pipe joint using the lubricant supplied by the manufacturer. Insert the spigot end into the bell or coupling to the proper insertion mark. Check that the elastomeric ring has not left the groove during assembly by passing a feeler gauge around the completed joint.
- M. Pipe shall be cut by means of saws, power driven abrasive wheels or pipe cutters which will produce a square cut. After cutting and before insertion into a PVC bell-end, the end of the pipe shall be beveled using a beveling tool, portable type sander or abrasive disk. When a PVC pipe is to be inserted into a mechanical joint fitting, the end shall be left square or made square by cutting off the beveled end.
- N. The pipe shall have a minimum cover of 36 inches from finished grade.

### 3.3 COPPER TRACER WIRE

- A. All non-metallic pipeline, including water service laterals, shall be provided with a No. 10 AWG insulated copper wire laid along the top of the pipe and held in place with ties or hitches. The ties or hitches shall be spaced not more than 10 feet apart. The copper wire is to be used in the future as a means of locating the pipe with an electronic-type pipe locator.

END OF SECTION