



# Suggested Specification for Steel Water Transmission Pipe

## Section – Steel Pipe

### Part 1 – General

#### 1.01 Description

Scope of Work: Provide and install steel pipe of the sizes and in the locations shown on the drawings and as specified herein.

#### 1.02 Quality Assurance

A. Standards (as applicable):

1. Steel pipe 6 inches and larger: AWWA C200
2. Rubber gasket joints: AWWA C200
3. Cement mortar lining and cement mortar coating: AWWA C205
4. Tape Coating: AWWA C214 and C209
5. Field welding: AWWA C206
6. Steel pipe flanges: AWWA C207
7. Steel pipe fittings: AWWA C208
8. Steel pipe design and installation: AWWA M11
9. Liquid-Epoxy Coating: AWWA C210
10. Heat-Shrinkable Sleeves: AWWA C216
11. Above Ground Exterior Coating: AWWA C218
12. Bolted Sleeve-Type Mechanical Couplings: AWWA C219
13. Polyurethane Coating: AWWA C222

#### 14. Split Sleeve Couplings: AWWA C227

##### B. Qualifications:

1. All steel pipe and fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. In addition, the plant in which the pipe or fittings is manufactured shall be SPFA certified. The pipe and fittings shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with the Specifications as applicable.
2. Pipe manufacturing operations (pipe, fittings, lining, coating, and joints) shall be performed at one (1) location unless otherwise approved.

### 1.03 Submittals

Prior to the start of manufacturing, the following shall be submitted to, and approved by the engineer:

- A. Shop Drawings, including pipe laying schedule and/or layouts. The schedule or layouts shall show each piece by mark number, with station and invert elevation at each pipe end.
- B. Details of specials and fittings.
- C. Calculations for pipe design and fittings reinforcement and/or test data.
- D. Copy of the manufacturer's quality control check of pipe material and production.

Upon completion of the manufacturing, the following shall be submitted to the engineer:

- E. An affidavit of compliance with AWWA standards referenced in this specification.

### 1.04 Handling, Storage and Shipping

- A. Pipe shall be braced as required to maintain roundness of +/- 1 percent during shipping and handling.
- B. Coated pipe shall be shipped on bunks, and secured with nylon belt tied down straps or padded banding located approximately over braces.
- C. Coated pipe shall be stored on padded skids, sand or dirt berms, sand bags, old tires or other suitable means so that coating will not be damaged.

- D. Coated pipe shall be handled with the wide belt slings, padded forks, or other means that will not damage the pipe. Chains, cables or other equipment likely to cause damage to the pipe or coating shall not be used.
- E. Prior to shipment, the pipe shall be visually inspected for damage to the coating. Any damaged areas shall be repaired in accordance with the standard to which the coating was applied.

## Part 2 - Products

### 2.01 Materials

#### A. Pipe:

1. Steel pipe shall be designed in accordance with AWWA M11 and be manufactured in accordance with the requirements of AWWA C200.
2. Pipe shall be designed for \_\_\_\_\_ psi working pressure with an additional \_\_\_\_\_ psi allowance for surge.
3. Pipe shall be designed to the cover conditions as shown on the plans. Modulus of soil reaction (E') values to be used for design shall be 1,000 psi for covers up to 10 feet, 1,200 psi for 10-15 feet of cover and 1,300 psi for 15-20 feet of cover. The allowable deflection shall be 3% of the pipe inside diameter for pipe with flexible coating and 2% for pipe coated with cement mortar.
4. Pipe for use with couplings shall have ends prepared to meet the requirements of the coupling manufacturer.
5. Standard pipe laying lengths shall be a minimum of 40 feet with special lengths, field trim pieces and closure pieces as required by plan and profile for location of elbows, tees, reducers and other in-line fittings
6. Coatings and Linings (unless otherwise specifically noted on the drawings):
  - a. *(Use for tape coated pipe)* Pipe shall be coated with prefabricated multi-layer cold-applied polyethylene tape coatings in accordance with AWWA C214. Total thickness of the coating shall be 80 mils. Specials shall be coated in accordance with AWWA C209 with a total coating thickness of 70 mils minimum.
  - b. *(Use for mortar coated pipe)* Pipe shall be coated with cement mortar in accordance with C205. Coating thickness shall be a minimum of ¾ inch.
  - c. *(Use for Polyurethane coated pipe)* Pipe shall be coated with polyurethane in accordance C222. Coating thickness shall be a minimum of 25 mils.

- d. Pipe shall be cement mortar lined in the shop by the centrifugal process in accordance with AWWA C205. Cement mortar lined pipe shall be braced as required to maintain roundness during shipping and handling and shall have ends capped prior to shipment. For pipe 14 inch nominal diameter and larger, the finished ID after lining shall be the nominal size. For pipe 12 inch nominal diameter and smaller, standard OD pipe sizes shall be furnished.

B. Fittings:

1. Fittings shall be fabricated in accordance with AWWA C200 Section 4 from pipe conforming to the above standards. Fittings fabricated from previously hydrostatically tested straight pipe shall require testing of only those welded seams that were not previously hydrostatically tested in the straight pipe. This testing shall be by the dye penetrant examination per ASTM E 165 or magnetic particle examination in accordance with ASTM E 709. Acceptance criteria shall be in accordance with ASME B&PV Code, Section VIII, Division 1, Appendix 8 for dye penetrant examination, and Appendix 6 for magnetic particle examination.
2. Fittings shall conform to the dimensions of AWWA C208 or may be fabricated into standard or special pipe lengths. Elbows up to 22 ½ degrees shall be two piece; over 22 ½ degrees through 45 degrees shall be three piece; over 45 degrees through 67 ½ degrees shall be four pieces; and over 67 ½ degrees through 90 degrees shall be five pieces. Elbows shall have a minimum radius of 2 ½ times the pipe O.D. All tees, laterals and outlets shall be reinforced in accordance with AWWA M11.

C. Joints (Unless otherwise specifically noted on the drawings):

1. Gasketed Joints: The standard joint for working pressures up to 250 psi (72 inch maximum diameter) shall be rubber gasketed unless otherwise noted on the plans. Gasketed joints shall conform to AWWA C200 Standard and be either the Carnegie or rolled groove type. Rolled groove gasketed joints shall consist of a flared bell end formed and sized by the use of a segmental expander or by forcing the pipe end over a plug die. The spigot end groove, designed to retain the rubber gasket, shall be formed and sized by rolling on male-female dies to match the bell. The difference in diameter between the I.D. of bell and the O.D. of the spigot shoulder at point of full engagement, with allowable deflection, shall be no more than 0.04 inches as measured circumferentially.

The gasket shall have sufficient volume to approximately fill the area of the groove and shall conform to AWWA C200.

The joint shall be suitable for the pressures of the class of pipe on which it is furnished, and shall operate satisfactorily with a deflection, the tangent of which

is not to exceed 0.75 inch/D where D is the outside diameter of the pipe in inches, or with a uniform pull-out of ¾ inch.

Rubber gasketed joints may be furnished only by a manufacturer who has furnished pipe with joints of similar design for comparable working pressure, pipe diameter, pipe length, and wall thickness.

Shop applied coating shall be continuous to the end of the pipe on the bell end and shall be held back on the spigot end sufficiently to allow full engagement of the joint. Shop applied lining shall be continuous to the end of the pipe on the spigot end and shall be held back on the bell end to the point of maximum engagement or further as recommended by the manufacturer. For gasketed joints, the exposed surfaces of the bell and spigot shall be painted with one shop coat of a holding primer.

2. Welded Lap Joints: Field welded lap joints shall be used where restrained joints are indicated on the plans and for all pipe sizes over 72 inch diameter or working pressures greater than 250 psi.

The bell shall provide for a nominal lap such that the minimum engagement, with 1 inch allowable pull, is at least 1 inch or three times the thickness of the bell, whichever is greater. Shop applied lining and coating shall be held back sufficiently to allow for welding of the joint, except that lining shall be continuous to the end of the spigot for pipe diameters 24 inches and smaller.

3. Couplings: Couplings where indicated on the plans shall be Victaulic Depend-O-Lok, Smith Blair, Baker or equal.

Couplings for buried service shall have all metal parts painted with epoxy paint conforming to AWWA C210 or C213.

4. Flanges:

- a. Flanges shall be in accordance with AWWA C207 Class D for pressures to 175 psi on 4 inch through 12 inch diameter, and 150 psi on diameters over 12 inches.
- b. Flanges shall be AWWA C207 Class E for pressures over 150 psi to 275 psi when mating steel to steel; or shall be AWWA C207 Class F for pressures to 300 psi (drilling matches ANSI B16.5 Class 250).
- c. Shop lining and coating shall be continuous to ends of pipe and backs of flanges.
- d. Gaskets: Gaskets shall be furnished in accordance with AWWA C207.

- e. Bolts and nuts for flanges located indoors and in enclosed vaults and structures shall be carbon steel, in accordance with AWWA C207.
- f. Bolts and nuts for buried and submerged flanges and flanges located outdoors above ground or in open vaults in structures shall be Type 316 stainless steel. For Class B and D flanges, bolts shall conform to ASTM A193, Grade B8M, Class 1, and nuts shall conform to ASTM 194, Grade 8M. For Class E and F flanges, bolts shall conform to ASTM A193, Grade B7, and nuts shall conform to ASTM A194, Grade 2H, with bolts and nuts to be zinc plated in accordance with ASTM B633.

## **Part 3 – Execution**

### **3.01 Inspection and Testing**

- A. All pipe shall be inspected and tested at the manufacturing facility.
- B. The Owner shall have the right to have any or all piping, fittings or specials inspected and tested by an independent testing agency at the manufacturing facility or elsewhere. Such inspection and testing will be at the Owner's expense.
- C. Mark as rejected and immediately remove from the jobsite, or repair to the Owner's satisfaction, all pipe lengths exhibiting signs of damage to the lining, coating, joints, or pipe wall.

### **3.02 Installation**

- A. The Contractor shall provide and install all required piping and accessories in accordance with the Contract Documents and manufacturer's recommendations. Pipe installation as specified in this section supplements AWWA M11.
- B. Joint assembly
  - 1. Gasketed joints:
    - a. Install the gasket and assemble the joint in accordance with the pipe manufacturer's recommendations.
    - b. Electrically bond the joint as required in Section \_\_\_\_\_ of these specifications.
    - c. (*Use for tape or polyurethane coated pipe*) Coat the joint exterior by application of either a heat shrinkable sleeve conforming to AWWA C216, or cold applied tape conforming to AWWA C209. The thickness of the heat shrinkable sleeve shall be 70 mil minimum, or as recommended by the sleeve

manufacturer, whichever is greater. The cold applied tape shall consist of two wraps of 35 mil tape for a total thickness of 70 mils.

- d. (*Use for mortar coated pipe*) Coat the joint exterior by placing a heavy duty diaper over the joint. The diaper shall be wide enough to span the entire uncoated area of the joint except for an opening at the top for the placement of the grout. The diaper shall be secured by steel strapping. Grout shall be 1 part type V cement and 2 parts sand mixed with water to the consistency of thick cream. Grout shall be poured in one side of the diaper only. Using a rod, proceed until the entire joint recess is filled.
  - e. Coat the joint interior by mortaring the annular space with a stiff mix of non-shrink grout. The finished joint shall be smooth and flush with the adjacent interior pipe surface.
2. Lap field welded joints:
    - a. Wire brush exposed end of joint surfaces.
    - b. Insert the plain end into the expanded bell such that the minimum overlap at any location around the joint circumference is in accordance with AWWA C206.
    - c. A single full fillet weld shall be provided by certified welders qualified in accordance with AWS D1.1. Where installed in casing pipe, or otherwise noted on the plans, joint shall be provided with a full fillet weld and a seal weld to allow an air test of the joint through a threaded outlet provided by the pipe manufacturer. Air-test the joint in accordance with AWWA C206. The threaded outlet shall be plugged following a successful air test.
    - d. Complete linings and coatings as specified in 3.02.B.1.c, d or e, as applicable.
  3. Flanged joints:
    - a. Assemble flanged joints in accordance with AWWA M11.
    - b. Execute care when tightening joints to prevent undue strain upon valves, pumps and other equipment.
    - c. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.
  4. Mechanical joints:

- a. Mechanical joints shall be installed in accordance with the manufacturer's recommendations.

C. Installing Buried Piping:

1. Inspect each pipe and fitting before lowering the buried pipe or fittings into the trench. Inspect the interior and exterior protective coatings. Patch damaged areas in the field with material compatible with the original. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after installation.
2. Handle pipe in a manner to avoid any damage to the pipe. Do not drop or dump pipe into trenches under any circumstances.
3. When installing piping in trenches, do not deviate more than one inch from line or ¼ inch from grade. Measure for grade at the pipe invert.
5. Grade the bottom of the trench and place a 4 inch minimum layer of bedding material under the pipe. Before installing each section of the pipe, check the grade with a straight edge 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 lifting tackle.
6. At the location of each joint, dig bell (joint) holes in the bottom of the trench and at the sides of dimensions to permit visual inspection of the entire joint and welding if required.
7. Keep the trench in a dewatered condition during pipe installation.
8. When the pipe installation is not in progress, close the open ends of pipe. DO NOT permit trench water, animals, or foreign material to enter the pipe.

D. Installing Interior Piping:

1. All piping and fittings shall be installed true to alignment and rigidly supported thrust anchors shall be provided where required. Any damage to pipe, lining or coating shall be repaired to the satisfaction of the Engineer before the pipe is installed.
2. Sleeves shall be installed of proper size for all pipes passing through floors or walls as shown on the drawings. Where indicated on the drawings, or required for liquid or gas-tightness, the pipe shall be sealed with mechanical seal by Link Seal as manufactured by Thunderline Corp., Wayne, Michigan, or equal.



3. Except as otherwise shown on the drawings either butt weld, lap weld, coupling or flange joints may be used. Prior to approval of joining method, layouts for hanger and supports shall be submitted to the Engineer for approval.
  4. Flanged joints shall be made with bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped.
  5. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall be transmitted to their equipment, a certification shall be submitted stating compliance with such requirements.
- E. **Field Hydrostatic Testing:** Test in accordance with AWWA M11. Field test pressure shall be no more than 125% of the working or operating pressure at the lowest point of the section being tested.