

**SECTION 33 10 00**  
**WATER UTILITIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

Repair and modification of the underground water distribution system complete, ready for operation, including all appurtenant structures, and new building service lines.

**1.2 RELATED WORK:**

- A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Excavation, trench widths, pipe bedding, backfill, shoring, sheeting, bracing: Section 31 20 11, EARTH MOVING (short form).
- C. Concrete: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- D. Protection of materials and equipment: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.3 DEFINITIONS:**

- A. Water Distribution: Pipelines and appurtenances which are part of the distribution system. The distribution system comprises the network of piping located throughout building areas and other areas of water use, including, valves, and other appurtenances used to supply water for domestic and fire-fighting/fire protection purposes.
- B. Water Service Line: Pipe line connecting building piping to water distribution lines.

**1.4 QUALITY ASSURANCE:**

- A. Products Criteria:
  - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be product of one manufacturer.
  - 2. Nameplate: Nameplate bearing manufacturer's name or identifiable trademark securely affixed in a conspicuous place on equipment or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Comply with the standard specifications and details of Tucson Water for the construction of the project.
- C. Comply with all rules and regulations of Federal, Arizona Department of Environmental Quality having jurisdiction over the design, construction, and operation of potable water systems.
- D. All material surfaces in contact with potable water shall comply with NSF 61.

**1.5 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers' Literature and Data (Submit all items as one package):
  - 1. Piping.
  - 2. Gaskets.
  - 3. Valves.
  - 4. Valve boxes.
  - 5. Corporation and curb stops.
  - 6. Curb stop boxes.
  - 7. Joint restraint.
  - 8. Disinfection products.
- C. Testing Certifications:
  - 1. Certification of Backflow Devices.
  - 2. Hydrostatic Testing.
  - 3. Certification of Disinfection, including free chlorine residuals, and bacteriological examinations.

**1.6 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI/ASME):
  - B16.18.....Cast Bronze Solder Joint Pressure Fittings
  - B16.26-88.....Cast Copper Alloy Fittings for Flared Copper  
Tubes
- C. American Society for Testing and Materials (ASTM):
  - A148M-03.....Standard Specifications for Steel Castings
  - B61-02.....Steam or Valve Bronze Castings
  - B62-02.....Composition Bronze or Ounce Metal Castings
  - B88-02.....Seamless Copper Water Tube
  - B828.....Standard Practice: Soldering and Brazing Copper  
Tube and fittings
  - D1784-03.....Standard Specifications for Rigid PVC Compounds  
and CPVC Compounds
  - D2464-99.....Standard Specifications for Threaded PVC Pipe  
Fittings, Schedule 80
  - D2467-02.....Standard Specifications for Poly (Vinyl  
Chloride) (PVC) Plastic Pipe Fittings, Schedule  
80

D. American Water Works Association (AWWA):

- B300-04.....Hypochlorites
- B301-04.....Liquid Chlorine
- C105-99.....Polyethylene Encasement for Gray and Ductile  
C.I. Piping for Water and Other Liquids
- C511-97.....Reduced Pressure Principle Back-Flow Prevention  
Assembly
- C550-01.....Protective Epoxy Interior Coatings for Valves  
and Hydrants
- C605-94.....Underground Installation of Polyvinyl Chloride  
(PVC) Pressure Pipe and Fittings for Water
- C651-92.....Disinfecting Water Mains
- C800-01.....Underground Service Line Valves and Fittings
- C900-97.....Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches  
Thru 12 Inches, for Water

E. NSF International:

- 14-03.....Plastics Piping Components and Related Materials
- 61-02.....Drinking Water System Components-Health Effects  
(Sections 1-9)

F. Foundation for Cross-Connection Control and Hydraulic Research-2005

G. Copper Development Association's Copper Tube Handbook-2005

H. Tucson Water standard specifications and details.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

All materials shall conform to Tucson Water's standard specifications and details, and the following.

**2.2 POLYVINYL CHLORIDE PIPE AND FITTINGS:**

- A. PVC Pipe and Accessories Smaller than 100 mm (4 inches): Schedule 80, meeting the requirements of ASTM D-1785, Type 1, Grade 1. All exposed piping shall be CPVC meeting requirements of ASTM F441.
- B. Joints:
  - 1. Pipe Less Than 75 mm (3 inches) in Diameter: Threaded (ASTM D-2464) or solvent welded (ASTM 2467). Use Teflon tape or liquid Teflon thread lubricant approved for use on plastic on all threaded joints.
- C. Fittings:
  - 1. For Schedule 80 Pipe less than 75 mm (3 inches) in Diameter: Threaded or solvent weld. Threaded PVC fittings shall conform to ASTM D2464. CPVC fittings shall conform to ASTM F437 for threaded fittings and ASTM F439 for solvent weld fittings.

### **2.3 COPPER PIPE AND TUBING:**

Copper Piping: ASTM B88, Type K, or Type L with flared fittings in accordance with AWWA C800, with sweat cast brass fittings per ANSI B16.18. Use brazing alloy, AWS A5.8, Classification BCuP.

### **2.4 VALVES:**

- A. Asbestos packing is not allowed.
- B. Corporation stops and saddles shall conform to AWWA C800.
- C. Curb Stop: Smaller than 75 mm (3 inches). Waterworks standard for Type "K" copper, single piece cast bronze body with tee top operated plug sealed with O-ring gaskets, 1375 kPa (200 pound) WOG per AWWA C800.

### **2.5 VALVE BOX:**

Cast iron box with PVC riser per Tucson Water standards. Box shall be adapted, without full extension, to depth of cover required over pipe at valve location. Cast the word "WATER" in cover.

### **2.6 BACKFLOW PREVENTER:**

- A. Potable Water and Irrigation Water Service: Reduced Pressure Principle Type AWWA C511, except pressure drop at rated flow shall not exceed 100 kPa (15 psi). Gate valves installed on the assembly shall be resilient seated valve conforming to AWWA C509.
- B. Backflow preventers shall be approved by the Foundation for Cross-Connection Control and Hydraulic Research per current edition of the Manual of Cross-Connection Control.
- C. Backflow preventer shall not be located in any area containing fumes that are toxic, poisonous or corrosive.
- D. Direct connections between potable water piping and sewer connected wastes shall not exist under any condition with or without backflow protection.
- E. Backflow preventer shall be accessed and have clearance for the required testing, maintenance and repair. Access and clearance shall require a minimum of one (1) foot (305 mm) between the lowest portion of the assembly and grade, floor or platform. Installations elevated more than five (5) feet (1524 mm) above the floor or grade shall be provided with a permanent platform capable of supporting a tester or maintenance person.

### **2.7 POTABLE WATER:**

Water used for filling, flushing, and disinfection of water mains and appurtenances shall conform to Safe Drinking Water Act.

## **2.8 DISINFECTION CHLORINE:**

- A. Liquid chlorine shall conform to AWWA B301 and AWWA C651.
- B. Sodium hypochlorite shall conform to AWWA B300 with 5 percent to 15 percent available chlorine.
- C. Calcium hypochlorite shall conform to AWWA B300 supplied in granular form or 5.g tablets, and shall contain 65 percent chlorine by weight.

## **2.9 WARNING TAPE**

Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, non-detectable type, blue with black letters, and imprinted with "CAUTION BURIED WATER LINE BELOW".

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

Construction, testing, and disinfection of the water system shall comply with the Tucson Water standard specification and details and the following:

### **3.2 REGRADING:**

Raise or lower existing valve and curb stop boxes and fire hydrants to finish grade in areas being graded.

### **3.3 PIPE LAYING, GENERAL:**

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Resident Engineer.
- B. All pipe and fittings shall be subjected to a careful inspection just prior to being laid or installed. If any defective piping is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Government. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.
- C. All buried piping shall be installed to the lines and grades as shown on the drawings. All underground piping shall slope uniformly between joints where elevations are shown.
- D. Contractor shall exercise extreme care when installing piping to shore up and protect from damage all existing underground water line and power lines, and all existing structures.

- E. Do not lay pipe on unstable material, in wet trench, or when trench or weather conditions are unsuitable.
- F. Do not lay pipe in same trench with other pipes or utilities unless shown otherwise on drawings.
- G. Hold pipe securely in place while joint is being made.
- H. Do not walk on pipes in trenches until covered by layers of earth well tamped in place to a depth of 300 mm (12 inches) over pipe.
- I. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.
- J. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water and chemical, or mechanical injury. At completion of all work, thoroughly clean exposed materials and equipment.
- K. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by the manufacturer.
- L. Warning tape shall be continuously placed 300 mm (12 inches) above buried water pipes.

#### **3.4 PVC PIPE:**

- A. PVC piping shall be installed in strict accordance with the manufacturer's instructions and AWWA 605. Place selected material and thoroughly compacted to one foot above the top of the pipe and thereafter back filled as specified in Section 31 20 11, EARTH MOVING (short form).
- B. Copper Tracer Wire: Copper tracer wire consisting of No. 12 AWG solid, single conductor, insulated copper wire shall be installed in the trench with all piping to permit location of the pipe with electronic detectors. The wire shall not be spiraled around the pipe nor taped to the pipe. Wire connections are to be made by stripping the insulation from the wire and soldering with rosin core solder. Solder joints shall be wrapped with rubber tape and electrical tape or sealed with epoxy in a gland.

#### **3.5 COPPER PIPE:**

Copper piping shall be installed in accordance with the Copper Development Association's Copper Tube Handbook and manufacturer's recommendations. Copper piping shall be bedded in 150 mm (6 inches) of sand and then back filled as specified in Section 31 20 11, EARTH MOVING (short form).

### **3.6 RESTRAINED JOINTS:**

- A. Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained joints and the joints shall be capable of holding against withdrawal for line pressures 50 percent above the normal working pressure but not less than 1375 kPa (200 psi). The pipe and fittings shall be restrained push-on joints or restrained mechanical joints.
- B. The minimum number of restrained joints required for resisting force at fittings and changes in direction of pipe shall be determined from the length of retained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. Restrained pipe length shall be Tucson Water standard details.
- C. Restrained joint assemblies shall comply with Tucson Water standard specifications.
- D. Thrust blocks shall not be permitted.
- E. Where ductile iron pipe manufactured with restrained joints is utilized, all restrained joints shall be fully extended and engaged prior to back filling the trench and pressurizing the pipe.

### **3.7 PIPE SEPARATION:**

- A. Horizontal Separation-Water Mains and Sewers:
  - 1. Water mains shall be located at least 1.8 m (6 feet) horizontally from sanitary sewer connection.
  - 2. Water mains may be located closer than 1.8 m (6 feet) to a sewer line when:
    - a. Local conditions prevent a lateral separation of 1.8 m (6 feet); and
    - b. The water main invert is at least 450 mm (18 inches) above the crown of the sewer; and
    - c. Special protection is provided.
  - 3. Special protection shall include both the water main and sewer to be constructed of mechanical joint ductile iron pipe. Ductile iron pipe shall comply with the requirements listed in this specification section.
- B. Vertical Separation-Water Mains and Sewers:
  - 1. A water main shall be separated from a sewer so that its invert is a minimum of 600 mm (24 inches) above the crown of the sewer. The vertical separation shall be maintained for that portion of the water main located within 10 feet horizontally of any sewer or drain crossed.

2. Both the water main and sewer shall be constructed of slip-on or mechanical joint ductile iron pipe or PVC pipe equivalent to water main standards of construction when:
  - a. It is impossible to obtain the proper vertical separations described in (1) above; or
  - b. The water main passes under a sewer or drain.
3. A vertical separation of 600 mm (24 inches) between the invert of the sewer and the crown of the water main shall be maintained where a water main crosses under a sewer. Support the sewer or drain lines to prevent settling and breaking the water main.
4. Construction shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer or drain line is at least 3 m (10 feet).

### 3.8 SETTING OF VALVES AND BOXES:

- A. Provide a surface concrete pad 450 by 450 by 150 mm (18 by 18 by 6 inches) to protect valve box.
- B. Clean valve and curb stops interior before installation.
- C. Set valve and curb stop box cover flush with finished grade.
- D. Valves shall be installed plumb and level and in accordance with manufacturer's recommendations.

### 3.9 FLUSHING AND DISINFECTING:

- A. Flush and disinfect new water lines in accordance with AWWA C651.
- B. Initial flushing shall obtain a minimum velocity in the main of 0.75 m/sec (2.5 feet per second). The duration of the flushing shall be adequate to remove all particles from the line.

Pipe Diameter		Flow Required to Produce 2.5 ft/sec(approx.) Velocity in Main		Number of Hydrant Outlets			
				Size of Tap. in. (mm)			
In	(mm)	gpm	(L/sec)	1 (25)	1 1/2 (38)	2 (51)	2 1/2 (64)
				Number of taps on pipe			
4	(100)	100	(6.3)	1	--	--	1
6	(150)	200	(12.6)	--	1	--	1
8	(200)	400	(25.2)	--	2	1	1
10	(250)	600	(37.9)	--	3	2	1
12	(300)	900	(56.8)	--	--	3	2
16	(400)	1,600	(100.9)	--	--	4	2

The backflow preventers shall not be in place during the flushing.



- C. The Contractor shall be responsible to provide the water source for filling, flushing, and disinfecting the lines. Only potable water shall be used, and the Contractor shall provide all required temporary pumps, storage facilities required to complete the specified flushing, and disinfection operations.
- D. The Contractor shall be responsible for the disposal of all water used to flush and disinfect the system in accordance with all governing rules and regulations. The discharge water shall not be allowed to create a nuisance for activities occurring on or adjacent to the site.
- E. The bacteriological test specified in AWWA C651 shall be performed by a laboratory approved by the Arizona Department of Environmental Quality. The cost of sampling, transportation, and testing shall be the responsibility of the Contractor.
- F. Re-disinfection and bacteriological testing of failed sections of the system shall be the sole responsibility of the Contractor.
- G. Before backflow preventers are installed, all upstream piping shall be thoroughly flushed.

**3.10 HYDROSTATIC TESTING:**

- A. Hydrostatic testing of the system shall occur prior to disinfecting the system.
- B. After new system is installed, except for connections to existing system and building, backfill at least 300 mm (12 inches) above pipe barrel, leaving joints exposed. The depth of the backfill shall be adequate to prevent the horizontal and vertical movement of the pipe during testing.
- C. Prior to pressurizing the line, all joint restraints shall be completely installed and inspected.
- D. If the system is tested in sections, and at the temporary caps at connections to the existing system and buildings, the Contractor shall provide and install all required temporary thrust restraints required to safely conduct the test.
- E. The Contractor shall install corporation stops in the line as required to purge the air out of the system. At the completion of the test, all corporation stops shall be capped.
- F. The Contractor shall perform pressure and leakage tests for the new system for 2 hours to 1375 kPa (200 psi). Leakage shall not exceed the following requirements.
  - 1. Copper Tubing: No leaks.
  - 2. Ductile Iron Pipe: AWWA C600. Provide to Resident Engineer office.
  - 3. Polyvinyl Chloride (PVC) AWWA C605. Provide to Resident Engineer office.

**3.11 BACKFLOW PREVENTOR TESTING:**

- A. All backflow preventers shall be tested and certified for proper operation prior to being placed in operation.
- B. Original copies of the certification shall be submitted to the Resident Engineer.

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