

**SECTION 33 10 00****WATER UTILITIES****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section specifies materials and procedures for construction of underground water distribution for domestic and/or fire supply systems outside the building that are complete and ready for operation. This includes piping, structures, appurtenances and all other incidentals.

**1.2 RELATED WORK**

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- B. Concrete: Section 03 30 00, CAST IN-PLACE CONCRETE.
- C. Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- D. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

**1.3 DEFINITIONS**

- A. Water distribution system: Pipelines and appurtenances which are part of the distribution system outside the building for potable water and fire supply.
- B. Water service line: Pipeline from main line to 5 feet outside of building.

**1.4 ABBREVIATIONS**

- A. PVC: Polyvinyl chloride plastic.
- B. DI: Ductile iron pipe.
- C. WOG: Water, Oil and Gas.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A. Ensure that valves are dry and internally protected against rust and corrosion. Protect valves against damage to threaded ends and flange faces.
- B. Use a sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- C. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

- D. Protect stored piping from moisture and dirt by elevating above grade. Protect flanges, fittings, and specialties from moisture and dirt.
- E. Store plastic piping protected from direct sunlight and support to prevent sagging and bending.
- F. Cleanliness of Piping and Equipment Systems:
  - 1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.
  - 2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.

#### **1.6 COORDINATION**

- A. Coordinate connection to water main with Public Utility company.
- B. Coordinate water service lines with building contractor.

#### **1.7 QUALITY ASSURANCE:**

- A. Products Criteria:
  - 1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
  - 2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least three years. Digital electronic devices, software and systems such as controls, instruments or computer work stations shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years.
- C. Regulatory requirements:
  - 1. Comply with the rules and regulations of the public utility company having jurisdiction over the connection to public water lines and the extension and/or modifications to public utility systems.
  - 2. Comply with the rules and regulations of the Federal, State, and Local Health Department having jurisdiction for potable water-service.
  - 3. Comply with rules and regulations of Federal, State, and Local authorities having jurisdiction for fire-suppression water-service piping including materials, hose threads, installation and testing.

- D. Provide certification of factory hydrostatic testing of not less than 500 psi (3.5 MPa) in accordance with AWWA C151. Piping materials shall bear the label, stamp or other markings of the specified testing agency.
- E. Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
  - 1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
  - 2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
  - 3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
  - 4. All welds shall be stamped according to the provisions of the American Welding Society.
- F. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation.
- G. Applicable codes:
  - 1. Plumbing Systems: IPC, International Plumbing Code.
  - 2. Electrical components, devices and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.
  - 3. Fire-service main products shall be listed in the FM Global "Approval Guide" or Underwriters Laboratories (UL) "Fire Protection Equipment Directory".

#### **1.8 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):
  - MSS SP-60-2004 .....Connecting Flange Joint Between Tapping Sleeves  
and Tapping Valves
  - MSS SP-108-2002.....Resilient-Seated Cast Iron, Eccentric Plug  
Valves

MSS SP-123-1998(R2006)..Non-Ferrous Threaded and Solder-Joint Unions  
for Use With Copper Water Tube

C. American Society of Mechanical Engineers (ASME):

- A112.1.2-2004.....Air Gaps in Plumbing Systems (for Plumbing  
Fixtures and Water-Connected Receptors))
- A112.6.3-2001.....Floor Drains
- B16.1-2010.....Gray Iron Pipe Flanges and Flanged Fittings,  
Class 25, 125, 250
- B16.18-2001.....Cast Copper Alloy Solder Joint Pressure  
Fittings
- B16.22-2001.....Wrought Copper and Copper Alloy Solder Joint  
Pressure Fittings
- B16.24-2006.....Cast Copper Alloy Pipe Flanges and Flanged  
Fittings; Classes 150, 300, 600, 900, 1500 and  
2500
- B31.....Code for Pressure Piping Standards

D. American Society for Testing and Materials (ASTM):

- A36/A36M-08.....Carbon Structural Steel
- A48/A48M-08(2008).....Gray Iron Castings
- A536-84(2009).....Ductile Iron Castings
- A674-10.....Polyethylene Encasement for Ductile Iron Pipe  
for Water or Other Liquids
- B61-08.....Steam or Valve Bronze Castings
- B62-09.....Composition Bronze or Ounce Metal Castings
- B88/B88M-09.....Seamless Copper Water Tube
- C651-05.....Disinfecting Water Mains
- C858-10e1.....Underground Precast Utility Structures
- D1785-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe,  
Schedules 40, 80, and 120
- D2239-03.....Polyethylene (PE) Plastic Pipe (SIDR-PR) Based  
on Controlled Inside Diameter

D2464-06.....Threaded Poly(Vinyl Chloride) PVC Pipe  
Fittings, Schedule 80

D2466-06.....Poly(Vinyl Chloride) (PVC) Pipe Fittings,  
Schedule 40

D2467-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe  
Fittings, Schedule 80

D2609-02(2008).....Plastic Insert Fittings for Polyethylene (PE)  
Plastic Pipe

D3350-10a.....Polyethylene Plastics Pipe and Fittings  
Materials

F714-10.....Polyethylene (PE) Plastic Pipe (SDR-PR) Based  
on Outside Diameter

F1267-07.....Metal, Expanded, Steel

E. American Water Works Association (AWWA):

B300-10.....Hypochlorites

B301-10.....Liquid Chlorine

C104-08.....Cement-Mortar Lining for Ductile Iron Pipe and  
Fittings

C105/A21.5-10.....Polyethylene Encasement for Ductile Iron Pipe  
Systems

C110-08.....Ductile Iron and Gray-Iron Fittings

C111/A21.11-07.....Rubber-Gasket Joints for Ductile Iron Pressure  
Pipe and Fittings

C115/A21.11-11.....Flanged Ductile Iron Pipe with Ductile Iron or  
Gray-Iron Threaded Flanges

C151/A21.51-09.....Ductile Iron Pipe, Centrifugally Cast

C153/A21.53-11.....Ductile Iron Compact Fittings for Water Service

C502-05.....Dry-Barrel Fire Hydrants

C503-05.....Wet-Barrel Fire Hydrants

C504-10.....Rubber-Seated Butterfly Valves

C508-09.....Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS

C509-09.....Resilient-Seated Gate Valves for Water Supply Service

C510-07.....Double Check Valve Backflow Prevention Assembly

C511-07.....Reduced-Pressure Principle Backflow Prevention Assembly

C512-07.....Air Release, Air/Vacuum and Combination Air Valves

C550-05.....Protective Interior Coatings for Valves and Hydrants

C600-10.....Installation of Ductile Iron Mains and Their Appurtenances

C605-11.....Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

C606-11.....Grooved and Shouldered Joints

C651-05.....Disinfecting Water Mains

C700-09.....Cold-Water Meters, "Displacement Type," Bronze Main Case

C800-05.....Underground Service Line Valves and Fittings

C900-09.....Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution

C906-07.....Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 64 In. (1,600 mm), for Water Distribution and Transmission

C907-04.....Injection-Molded PVC Pressure Fittings, 4 Inch through 12 Inch (100 mm through 300 mm), for Water Distribution

M23-2nd Ed.....PVC Pipe, Design and Installation

- M44-2nd Ed.....Distribution Valves: Selection, Installation,  
Field Testing and Maintenance
- F. National Fire Protection Association (NFPA):
- NFPA 24-2010 Ed.....Installation of Private Fire Service Mains and  
Their Appurtenances
- NFPA 1963-2009 Ed.....Fire Hose Connections
- G. NSF International (NSF):
- NSF/ANSI 61-2010.....Drinking Water System Components - Health  
Effects
- H. American Welding Society (AWS):
- A5.8/A5.8M-2004 .....Filler Metals for Brazing and Braze Welding
- I. American Society of Safety Engineers (ASSE):
- 1003-2009 .....Water Pressure Reducing Valves
- 1015-2009.....Double Check Backflow Prevention Assemblies and  
Double Check Fire Protection Backflow  
Prevention Assemblies
- 1020-2004.....Pressure Vacuum Breaker Assembly
- 1047-2009.....Performance Requirements for Reduced Pressure  
Detector Fire Protection Backflow Prevention  
Assemblies
- 1048-2009.....Performance Requirements for Double Check  
Detector Fire Protection Backflow Prevention  
Assemblies
- 1060-2006.....Performance Requirements for Outdoor Enclosures  
for Fluid Conveying Components
- J. Underwriters' Laboratories (UL):
- 246.....Hydrants for Fire-Protection Service
- 262.....Gate Valves for Fire-Protection Service
- 312.....Check Valves for Fire-Protection Service
- 405.....Fire Department Connection Devices

- 753.....Alarm Accessories for Automatic Water-Supply  
Control Valves for Fire Protection Service
- 789.....Indicator Posts for Fire-Protection Service
- 1091.....Butterfly Valves for Fire-Protection Service
- 1285.....Pipe and Couplings, Polyvinyl Chloride (PVC),  
and Oriented Polyvinyl Chloride (PVCO) for  
Underground Fire Service

## **1.9 WARRANTY**

- A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will furnish all manufacturers' and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

## **PART 2 - PRODUCTS**

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### **2.1 RESTRAINED JOINT POLYVINYL CHLORIDE (PVC) PIPE:**

- A. Provide restrained Joint PVC Pipe Conforming to the requirements of AWWA C900/DR18. The outside diameter shall match standard cast iron/ductile iron diameter.
- 1. B. 1. The restrained Joint Pipe System shall also meet all short and long term pressure test requirements of AWWA C900. Pipe, couplings, and locking splines shall be completely non-metallic to eliminate corrosion problems.
- 2. 2. 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.
- 3. C. Pipe and couplings shall be made from unplasticized PVC compounds having a minimum cell classification of 12454, as defined in ASTM D 1784. The compounds shall qualify for a Hydrostatic Design Basis (HDB) of 4000 psi for water at 73.4°F in accordance with the requirements of ASTM D 2837.
- D. PVC restrained-joint piping system can be installed conventionally in trenches, or by using trenchless techniques such as Horizontal Directional Drilling (HDD) and Pipebursting.



B. E. Restrained PVC Pipe shall be suitable for installation without the need for thrust blocks.

C. F. Fittings:

1. 1. Class-Rated Pipe 75 mm (3 inches) in Diameter and Greater:  
Ductile iron with mechanical joints conforming to the requirements of AWWA C153.
2. 2. 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.

## 2.2 COPPER PIPE AND TUBING:

D. 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.

## 2.3 VALVES:

E. A. Asbestos packing is not allowed.

F. B. Gate:

1. 1. 75 mm (3 inches) and Larger: Resilient seated, ductile iron body, bronze mounted, inclined seats, non-rising stem type turning counter-clockwise to open, 1375 kPa (200 pound) WOG. AWWA C509. The resilient seat shall be fastened to the gate with stainless steel fasteners or vulcanizing methods. The interior and exterior shall be coated with thermo-setting or fusion epoxy coating in accordance with AWWA C550.
2. 2. Operator:
  - a. a. Underground: Except for use with post indicators, furnish valves with 50 mm (2 inch) nut for socket wrench operation. Post indicator shall comply with the requirements of NFPA 24 and shall be fully compatible with the valve provided.
  - b. b. Above Ground and in Pits: Hand wheels.
3. 3. Joints: Ends of valves shall accommodate, or be adapted to, pipe installed.

G. C. Check: Swing.

1. 1. Smaller than 100 mm (4 inches): Bronze body and bonnet, ASTM B61 or B62, 1375 kPa (200 pound) WOG.
2. 2. 100 mm (4 inches) and Larger: Iron body, bronze trim, swing type, vertical or horizontal installation, flange connection, 1375 kPa (200

pound) WOG. Check valves for fire lines shall conform to AWWA C508 and shall be epoxy coated and lined per AWWA C550.

H. D. Corporation stops and saddles shall conform to AWWA C800.

I. E. 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.

#### **2.4 MECHANICAL JOINT RESTRAINT FOR AWWA PVC PIPE:**

A. Restraint devices for nominal pipe sizes 3 inch through 36 inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10.

The devices shall have a working pressure rating equal to that of the pipe on which it is used. Ratings are for water pressure and must include a minimum safety factor of 2:1 in all sizes.

B. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536.

Ductile iron gripping wedges shall be heat treated within a range of 370 to 470 BHN.

All components shall be manufactured and assembled in the United States. The purchaser shall, with reasonable notice, have the right to plant visitation to his/her expense.

C. Mechanical joint restraint shall require conventional tools and installation procedures per AWWA C600, while retaining full mechanical joint deflection during assembly.

Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.

D. Mechanical Joint Restraints shall be listed by Underwriters Laboratories in the 4 inch through 12 inch sizes. Mechanical Joint Restraints shall be Factory Mutual Approved in the 4 inch through 12 inch sizes.

Mechanical Joint Restraints, 4 inch through 24 inch, shall meet or exceed the requirements of ASTM F1674 of the latest revision.

Mechanical joint restraint shall be Series 2000PV produced by EBAA Iron Inc. or approved equal.

E. The coating shall be a polyester based powder to provide corrosion resistant coating, impact and UV resistance.

#### **2.5 CURB STOP BOX:**

J. Cast iron extension box with screw or slide type adjustment and flared base. Box shall be adapted, without full extension, to depth of cover required over pipe at stop location. Cast the word "WATER" in cover and set cover flush with finished grade. Curb stop shut-off rod shall extend 600 mm (2 feet) above top of deepest stop box.

## **2.6 VALVE BOX:**

K. Cast iron extension box with screw or slide-type adjustment and flared base. Minimum thickness of metal shall be 5 mm (3/16 inch). Box shall be adapted, without full extension, to depth of cover required over pipe at valve location. Cast the word "WATER" in cover. Provide 4 "T" handle socket wrenches of 16 mm (5/8 inch) round stock long enough to extend 600 mm (2 feet) above top of deepest valve box.

## **2.7 POST INDICATOR VALVE:**

L. A. Valve: Valve shall conform to the specifications listed in Section 2.3 for butterfly valves. The Post Indicator shall conform to NFPA 24, and shall be fully compatible with the valve and all the supervisory switches.

## **2.8 FIRE HYDRANTS:**

M. A. Size of main valve opening of each hydrant shall be 125 mm (5 inches), minimum. Hose thread, size of fire apparatus connection, and shape, size and direction of rotation of operating head of hydrant shall be identical with present local fire department and/or water department standards in use at station.

N. B. Hydrant shall be type AWWA C502, heavy construction, of proper length to connect pipe without extra fittings, and shall be the traffic type with safety flange on barrel and safety couplings on the valve stem with the following features:

- 1.1. Interior removable without digging up hydrant; can be packed under pressure; 150 mm (6 inch) bell connection; one steamer nozzle and two hose nozzles with nozzle caps securely chained to barrel; suitable drainage device; single rubber or leather-faced valve in base; nozzles, stuffing boxes, wedge nuts, seat rings, clamp plates, etc. Threaded joints or spindles shall be bronze. Upper and lower barrels shall be of equal diameters. Upper barrel shall be of sufficient length to permit setting hydrant with barrel flange not more than 50 mm (2 inches) above finished grade. All fire hydrants shall have 150 mm (6 inch) bottom connection.

2.2. Provide fire hydrants with a finish paint identical to the existing fire hydrants.

O.C. Provide 4 wrenches with handles not less than 350 mm (14 inches) long.

## **2.9 PIPE SLEEVES:**

P. Ductile iron or zinc coated steel.

## **2.10 POTABLE WATER:**

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

## **2.11 DISINFECTION CHLORINE:**

R.A. Liquid chlorine shall conform to AWWA B301 and AWWA C651.

S.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.

## **2.12 WARNING TAPE:**

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

# **PART 3 - EXECUTION**

## **3.1 BUILDING SERVICE LINES:**

U. Install Domestic, Fire and Chilled water service lines to point of connection within 5 feet of each building to which such service is to be connected and make connections thereto.

## **3.2 PIPE LAYING, GENERAL:**

V.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 COR.

W.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.

- X. 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.
- Y. 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.
- Z. E. Do not lay pipe on unstable material, in wet trench, or when trench or weather conditions are unsuitable.
- AA. F. Do not lay pipe in same trench with other pipes or utilities unless shown otherwise on drawings.
- BB. G. 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.
- CC. H. 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.
- DD. I. 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.
- J. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by the manufacturer.
- K. Warning tape shall be continuously placed 300 mm (12 inches) above buried water pipes.

### **3.3 PVC PIPE:**

- EE. A. Installing Pipe: Lay pipe in accordance with AWWA C600. Provide a firm even bearing throughout the length of the pipe by tamping selected material at the sides of the pipe up to the spring line.
- FF. B. All pipe shall be sound and clean before laying. When laying is not in progress, the open ends of the pipe shall be closed by watertight plug or other approved means.
- GG. C. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe.
- HH. D. Jointing Pipe:
  - 1.1. PVC Restrained Joints shall be made in strict accordance with the manufacturer's instruction.
  - 2.2. Flanged joints shall be in accordance with AWWA C115. Flanged joints shall be fitted so that the contact faces bear uniformly on the gasket and then are made up with relatively uniform bolt stress.

II. E. Copper Tracer Wire: Copper tracer wire consisting of No. 14 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. At least every 300 m (1000 feet), provide a 2.3 kg (5 pound) magnesium anode attached to the main tracer wire by solder. The solder joint shall be wrapped with rubber tape and with electrical tape. An anode shall be attached at the end of each line.

JJ. F. Magnetic markers may be used in lieu of copper tracer wire to aid in future pipe locating. Generally, install markers on 6 m (20 foot) centers. If pipe is in a congested piping area, install on 3 m (10 foot) centers. Prepare as-built drawing indicating exact location of magnetic markers.

#### **3.4 COPPER PIPE:**

KK. 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 00, EARTH MOVING.

#### **3.5 RESTRAINED JOINTS:**

LL. A. All Sections of piping require restrained joints and shall be constructed using pipe and fittings with restrained "locked-type" 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.

MM. B. Restrained joint assemblies for mating PVC Pipe with ductile iron mechanical joint pipe shall be Mega Lug or other mechanical joint coupled as manufactured by American Cast Iron Pipe Company, EBBA Iron Sales or approved equal.

NN. C. All pipe fittings, (elbows, tees, crosses) shall be flanged ductile iron. PVC pipe shall be mated to fittings utilizing a mechanical joint restraint for PVC pipe, such as EBBA Iron Sales, Inc. Series 800 Coverall or approved equal.

OO. D. PVC mechanical joint fittings shall be restrained with EBBA Iron Sales, Inc. Series 2000RV Restrainer or approved equal. The restraining device shall be designed to fit standard flanged joints. Glands shall be manufactured of ductile iron conforming to ASTM A536. Set screws shall be hardened ductile iron and require the same torque in all sizes. Steel set screws not permitted. These devices shall have the stated pressure rating with a minimum safety factor of 2:1. Glands shall be listed with Underwriters Laboratories and/or approved by Factory Mutual.

PP. E. Thrust blocks shall not be permitted.

### **3.6 PIPE SEPARATION:**

QQ. A. Horizontal Separation-Water Mains and Sewers:

- 1.1. Water mains shall be located at least 3 m (10 feet) horizontally from any proposed drain, storm sewer, sanitary or sewer service connection.
- 2.2. Water mains may be located closer than 3 m (10 feet) to a sewer line when:
  - a. a. Local conditions prevent a lateral separation of 3 m (10 feet); and
  - b. b. The water main invert is at least 450 mm (18 inches) above the crown of the sewer; and
  - c. c. The water main is either in a separate trench or in the same trench on an undisturbed earth shelf located one side of the sewer.

RR. B. Vertical Separation-Water Mains and Sewers:

- 1.1. A water main shall be separated from a sewer so that its invert is a minimum of 450 mm (18 inches) above the crown of the drain or sewer whenever water mains cross storm sewers, sanitary sewers or sewer service connections. The vertical separation shall be maintained for that portion of the water main located within 10 feet horizontally of any sewer or drain crossed. A length of water main pipe shall be centered over the sewer to be crossed with joints equidistant from the sewer or drain.
- 2.2. A vertical separation of 450 mm (18 inches) between the invert of the sewer or drain 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.

3.3. 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).

### 3.7 SETTING OF VALVES AND BOXES:

- SS.A. Provide a surface concrete pad 450 by 450 by 150 mm (18 by 18 by 6 inches) to protect valve box when valve is not located below pavement.
- TT.B. Clean valve and curb stops interior before installation.
- UU.C. Set valve and curb stop box cover flush with finished grade.
- VV.D. Valves shall be installed plumb and level and in accordance with manufacturer's recommendations.

### 3.8 SETTING OF FIRE HYDRANTS:

- WW.A. Set center of each hydrant not less than 600 mm (2 feet) nor more than 1800 mm (6 feet) back of edge of road or face of curb. Fire apparatus connection shall face road with center of nozzle 450 mm (18 inches) above finished grade. Set barrel flange not more than 50 mm (2 inches) above finished grade.
- XX.B. Set each hydrant on a slab of stone or concrete not less than 100 mm (4 inches) thick and 375 mm (15 inches) square. The service line to the hydrant, between the tee and the shoe of the hydrant, shall be fully restrained.
- YY.C. Set bases in not less than 0.4 cubic meter (1/2 cubic yard) of crushed rock or gravel placed entirely below hydrant drainage device.
- ZZ.D. Clean interiors of hydrants of all foreign matter before installation.

### 3.9 PIPE SLEEVES:

AAA. Install where water lines pass through retaining walls, building foundations and floors. Seal with modular mechanical type link seal. Install piping so that no joint occurs within a sleeve. Split sleeves may be installed where existing lines pass through new construction.

### 3.10 FLUSHING AND DISINFECTING:

- BBB.A. Flush and disinfect new Domestic water lines in accordance with AWWA C651.
- CCC.B. Initial flushing shall obtain a minimum velocity in the main of 0.75 m/sec (2.5 feet per second) at 40 PSI residual pressure in water main. The duration of the flushing shall be adequate to remove all particles from the line.

DDD. Pipe Diameter	EEE. Flow Required to Produce	HHH. Number of Hydrant Outlets
		III. Size of Tap. in. (mm)



		FFF. 2.5 ft/sec (approx.) GGG. Velocity in Main		JJJ. 1 ( 25)	KKK. 1 ½ (38)	LLL. 2 (51)	MMM. 2 1/2-in NNN. (64 mm)
OOO. 1 n	PPP. (mm)	QQQ. gp m	RRR. (L/sec )	SSS. Number of taps on pipe			
TTT. 4	UUU. (100)	VVV. 10 0	WWW. (6.3)	XXX. 1	YYY. - -	ZZZ. - -	AAA. 1
BBBB.	CCCC. (150 )	DDDD. 2 00	EEEE. (12.6 )	FFFF. - -	GGGG. 1	HHHH. - -	IIII. 1
JJJJ.	KKKK. (200 )	LLLL. 4 00	MMMM. (25.2 )	NNNN. - -	OOOO. 2	PPPP. 1	QQQQ. 1
RRRR. 0	SSSS. (250 )	TTTT. 6 00	UUUU. (37.9 )	VVVV. - -	WWWW. 3	XXXX. 2	YYYY. 1
ZZZZ. 2	AAAA. (30 )	BBBB. 9 00	CCCC. (56. 8)	DDDD. - -	EEEE. - -	FFFF. -	GGGG. 2
HHHH 6	IIII. (40 0)	JJJJ. 1 , 600	KKKK. (100 .9)	LLLL. - -	MMMM. - -	NNNN. -	OOOO. 2

PPPP.

QQQQ. 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.

RRRR. 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.

SSSS. E. The bacteriological test specified in AWWA C651 shall be performed by a laboratory approved by the Health Department of the State. 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.

### 3.11 HYDROSTATIC TESTING:

TTTT. A. Hydrostatic testing of the system shall occur prior to disinfecting the system.

UUUU. 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.

VVVV. C. Prior to pressurizing the line, all joint restraints shall be completely installed and inspected.

WWWWW. 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.

XXXXX. 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.

YYYYY. 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.

- 1.1. Copper Tubing: No leaks.
- 2.2. PVC Pipe: AWWA C600.

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