

# WATER

## *218 Attachment 1*

### **Town of Marion**

#### **Marion Department of Public Works Water Division**

### **INSTALLATION AND ACCEPTANCE OF WATER MAINS [Amended 11-6-2012]**

#### **GENERAL REQUIREMENTS**

All materials used shall be approved by the Water Division before installation and shall be installed in accordance with the manufacturer's recommendations.

The Board of Selectmen, Water and Sewer Commissioners, reserve the right to add, delete or otherwise modify these regulations at any time.

#### **INTRODUCTION**

1. **PLANS AND DIMENSIONS:**

The Contractor shall furnish a complete set of plans of the proposed water main installation for approval by the Board of Water and Sewer Commissioners and Water Division prior to construction of the water main, showing a street layout, property lines and subdivision boundaries. These plans shall be made by a Registered Land Surveyor, Professional Engineer or other qualified person. The Water Division reserves the right to alter the location of the water main shown in order to provide the best method of water service.

2. **RECORD DRAWINGS:**

Following the completion of the installation, the Contractor shall provide the Water Division with two sets of record plans showing the actual location of all water mains, including fittings, valves, hydrants, service connections, curb stops and boxes. The Contractor shall also provide the location of gate boxes (installed over all gate valves) with at least two ties to houses, telephone poles, hydrants or other objects located within 100 feet of the respective gate box. The Contractor shall provide the location of each service box (installed over each curb stop) and corporation installed at the water main with ties from the service box and corporation to each front corner of the house into which the service is installed, together with the distance from the corporation to the curb stop.

3. **DIG SAFE:**

The Contractor is solely responsible for determining the actual locations of all existing utilities, including services. The Contractor shall call "Dig Safe" (1-888-344-7233) for field location of all utilities prior to commencement of construction and provide the Water Division with associated Dig Safe numbers. In addition, the Contractor shall contact the Marion DPW for water, sewer and drain line locations. Dig Safe markings shall be maintained throughout the duration of the work and remarked as necessary.

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### 4. PROTECTION OF WORK:

All work is to be carefully protected so that no injury will come to it from water, frost, accident or other cause, and any injury that may come to the work is to be repaired by the Contractor at his expense.

### 5. WORK IN PROGRESS AND FINAL:

Extreme care shall be taken that the work and all appurtenances shall be done carefully and completely, and, if later, errors, leaks, or poor work are discovered that they shall be thoroughly repaired and rectified by the Contractor/Developer/Owner for up to one year after the acceptance of the entire system by the Water Division.

### 6. SANITARY CONVENIENCES:

The Contractor shall provide all necessary sanitary conveniences, properly secluded from public observation, and shall carry out all directions relating to same given by the Water Division.

### 7. CARE OF MATERIALS:

The Contractor shall have charge of and be liable for the loss of, or damage to, any materials delivered to him, or in the vicinity of the work to be used thereon, and shall furnish men to handle them for examination by Water Division personnel and shall keep trimmed up piles so placed as not to endanger the work. All materials so delivered, whether furnished by the Contractor or the Town, and all refuse, rubbish and materials until removed shall not occupy private land without approval of the Department of Public Works Superintendent and permission from the owner.

### 8. MATERIALS TO BE REMOVED:

The Contractor is to promptly remove from the work and its vicinity all rejected materials and the surplus earth, refuse, rubbish and excavated materials to such points as shall be directed by the DPW Superintendent and shall dispose of them without expense to the Town.

## CONDITIONS OF CONSTRUCTION

### 1. PIPING REQUIREMENTS:

The piping system shall meet the following minimum requirements and shall be subject to the approval of the Water Division:

- a. Pipe shall be Ductile Iron Class 52 or Polyvinyl Chloride (PVC) C900.
- b. Hydrants shall be spaced at 500 feet maximum.
- c. Hydrants along a street shall be installed on the "short-side" of the street relevant to the water main and at the back side of sidewalks, where applicable.
- d. Every hydrant shall be equipped with a six-inch shut-off valve, bolted to the hydrant anchor tee.

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- e. In-line valves shall be spaced no more than 1,000 feet apart or as determined by the Water Division.
- f. Connections to the existing water distribution system shall be made by a cut-in and installed with a tee and three valves, subject to the discretion of the DPW Superintendent. Under various circumstances, the Water Division may allow the use of a tapping sleeve and valve.
- g. Dead ends shall be avoided by looping of all water mains. Acquisition of property or easements and related engineering services necessary for looping shall be the responsibility of the developer. The Water Division Superintendent shall determine easement width. The easement shall be dedicated for the purpose of supplying water only; all other utilities, i.e., gas, electric, sewer, telephone, etc., shall be prohibited.
- h. All water mains and service pipe shall be laid in a trench separate from any other utility. The horizontal distance between water mains or service pipe and any other utility shall be a minimum of 10 feet. Exception to this rule shall be at the discretion of the DPW Superintendent.
- i. All materials shall be in accordance with "Materials Standards." All materials shall be new and shall be of the type currently used by the Water Division.
- j. All construction shall be in accordance with "Construction Standards." All construction shall be of the best quality, in accordance with the current practice of the Water Division.

### 2. TIME FRAME FOR CONNECTIONS:

Connections to the existing water distribution system may be made only during the period beginning April 15 and ending November 15 of one calendar year. Work outside of this timeframe is subject to approval from the DPW Superintendent.

### 3. NEW SUBDIVISION AND DEVELOPERS RESPONSIBILITY:

Connections to the existing water distribution system for new subdivisions shall be made by Water Division personnel unless otherwise authorized by the DPW Superintendent. The developer shall pay the full cost of labor, materials and equipment required for construction of the connection by Water Division personnel. Water service connections and water main tie-ins are subject to fees set forth by the Water Division.

Construction of water mains and water service connections are generally conducted by the developer, who shall be responsible for the full cost of labor, material and equipment required for construction of the water mains and service connections. Construction of said water mains and service connections shall be as shown on the construction plans approved by the Water Division. At the request of the developer, the Water Division may waive this requirement and allow the developer to construct the water mains and service connections utilizing a contractor approved by the Water Division.

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### 4. PIPING SYSTEMS:

All piping systems constructed as service connections and located on private property shall be under the control of the Water Division for the use of the premises where laid and shall be maintained at the expense of the property owner. The piping system, which includes gates, hydrants, fittings, etc., shall be maintained in accordance with the standards of the Water Division.

All water main piping systems that are either originally or subsequently in accepted streets and/or public ways shall belong to the Water Division. These pipes will be considered a part of the Water Division water distribution system.

### 5. INSPECTION OF CONSTRUCTION:

All construction by the developer's contractor shall be subject to full-time inspection by either Water Division personnel (when available) or by personnel of its consulting Engineer. The cost of such inspection shall be charged to the developer. The developer shall coordinate the construction activity so that this full-time inspection can be provided easily and economically.

Construction by Water Division personnel will not require inspection.

### 6. WATER SYSTEM USAGE:

The developer and/or its contractor shall not operate any hydrants, valves, curb stops or corporations, nor shall they draw any water from the system without the specific approval of the Department of Public Works Superintendent.

No contractor, developer, or any other entity shall be allowed to use Town water for building, construction, or private purposes without written authorization of the DPW Superintendent. Any such temporary water service will be subject to charges for installation and for water usage, as well as a service charge each time the Water Division has to turn it on or off. Water usage will be metered or estimated and will be charged for at the prevailing wage rates at the time of use.

Only Water Division personnel will operate valves, hydrants, corporations and curb stops, after authorization by the Department of Public Works Superintendent. Failure to conform to these requirements will result in an assessment and loss of water service.

## EXCAVATION AND PREPARATION OF TRENCH

### 1. REGULATIONS AND PERMITS:

All excavations shall comply with the provisions of Associated General Contractors of America, Inc. (AGCA) "Manual of Accident Prevention in Construction," Occupational Safety and Health Administration (OSHA), United States Department of Labor Requirements, American National Standards Institute (ANSI) "Safety Regulations for Construction and Demolition," American Society for Testing & Materials (ASTM), American Water Works Association (AWWA) Standards and the Massachusetts Highway Department "Standard Specifications for Highways and Bridges." The Water Division also requires a Permit to Disturb Surface, Trench Permit and associated fees.

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### 2. PROTECTION OF PROPERTY:

Care shall be taken to preserve and protect from damage all property, either public or private, along and adjacent to the line of work. All existing pipes, culverts, poles, wires, fences, mailboxes, stonewalls, curbs, bounds, etc. shall be temporarily removed, supported in place or otherwise protected from injury, and shall be restored to at least as good condition as that in which they were found immediately prior to the start of work. Lawns, shrubs, bushes, planting beds and decorative trees disturbed or damaged shall be restored to a condition equal to that found prior to the start of work.

### 3. EXCAVATION:

All trench excavation shall be accomplished by open cut method. When excavating trenches in roadways having an improved pavement, the pavement shall be cut prior to excavation using a water-cooled abrasive saw, pneumatic chisel or a wheel cutter attached to a front-end loader. Bracing and support of all trench excavation shall meet all requirements of local and state ordinances and OSHA regulations.

### 4. TRENCH SIZE:

Trenches shall be excavated to the necessary width and depth for proper installation of pipe and shall have vertical sides to 12 inches above the pipe. Widths of trenches shall provide 12 inches of clearance between the sides of the trench and the outside face of the pipe. Maximum trench width (to 12 inches above the pipe) shall be pipe diameter plus 36 inches. Above 12 inches over the pipe, the maximum trench width shall be as close to the above width as installation requirements allow. Trench depth shall be a minimum of six inches below the pipe barrel, or 1/4 of the pipe diameter, whichever is greater. Trenches should be excavated to a depth that allows for a minimum of five feet of cover from the top of installed pipe to ground surface.

### 5. ROCK EXCAVATION:

Rock shall be removed to the limits of the trench and be removed to provide clearance of at least six inches below and on each side of all pipes, valves and fittings. Ledge shall be removed to a depth of six inches below the bottom of pipe and at least two feet greater in width than the inside dimension of the water main.

### 6. PIPE BEDDING:

6.1. Ductile Iron Pipe: Gravel borrow shall be granular material, well graded from fine to coarse, with a maximum size of three inches, shall not contain vegetation, masses of roots or individual roots and shall be free from loam and other organic matter, clay and other fine or harmful substances.

6.2. Polyvinyl Chloride (PVC) Pipe: Concrete sand shall consist of clean, inert, hard, durable grains of quartz or other hard durable rock free from loam or clay, surface coatings and deleterious materials. Concrete sand shall meet ASTM C-33, and the maximum particle size shall be 3/8 inch.

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### 7. WATER SERVICE EXCAVATION:

For services outside the paved areas, trench excavation shall be utilized. For services to be installed beneath paved surfaces, a pneumatic drive device such as a "Hole Hog" or equal trenchless method shall be utilized to drive the new service beneath the pavement.

## **FURNISHING AND INSTALLING WATER MAINS AND ASSOCIATED APPURTENANCES**

### 1. PIPE:

Ductile Iron Pipe shall be Class 52, manufactured by U.S. Pipe or approved equal meeting the requirements of ANSI/AWWA C151/A21.51. All mechanical and push-on joints and gaskets shall meet the requirements of ANSI/AWWA C111/A21.11, and lining shall conform to ANSI/AWWA C104/A21.4. Thickness of cement-mortar lining shall be 1/8 inch for pipes 12 inches and smaller and 3/16 inch for pipe 14 inches and larger, and shall be seal coated per AWWA C104. Pipe shall be provided with all necessary accessories to make up the joint. Field Locking Gaskets shall be Field-Lok 350 type as manufactured by U.S. Pipe or approved equal, and shall be boltless, integral restraining system and shall be rated for 350 psi in accordance with the performance requirement of ANSI/AWWA C111/A21.11. Installation and jointing of ductile iron pipe shall be in accordance with AWWA C600 Section 9b and 9c, latest revision, as applicable.

PVC Pipe shall meet the requirements of AWWA Specification C900 and NSF Standard No. 61, shall be furnished in twenty-foot laying lengths and shall have cast iron outside dimensions. PVC pipe shall be pressure class 150 (DR-18), and each length will be tested at 800 psi. Joints shall be bell and spigot with a locked-in gasket conforming to ASTM D3139 and ASTM F477. All joint restraint systems shall be as designed and tested for use specifically with PVC pipe.

Pipe Installation: The spigot end of the pipe and the inside of the bell end of pipe shall be thoroughly cleaned prior to joining. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint. When laying is not in progress, including lunchtime, a watertight plug shall close the open ends of the pipe. When cutting of pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on type bell shall be beveled to conform to the manufactured spigot end. All ductile iron pipes shall be installed in polyethylene encasement. All PVC pipe shall be laid in trench with tracer tape at least three inches wide. No pipe shall be laid in water, in an unsuitable trench, or during unsuitable weather conditions.

### 2. PIPE FITTINGS:

Ductile Iron Pipe Fittings shall be used for all ductile iron and PVC pipe. All fittings shall meet the requirements of ANSI/AWWA C153/A21.53, shall have a pressure rating of 350 psi, lining and coating the same as pipe, mechanical joint in compliance with ANSI/AWWA C111/A21.11 and marking on fittings shall comply with ANSI/AWWA C110/A21.10.

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- 2.1 Anchor Tees: shall be mechanical joint, each having a bell and plain end, with a split mechanical joint on the plain end. Gate valves shall be secured directly to the tee by using the standard mechanical joint gasket and standard bolts.
  - 2.2 Retainer Gland: shall be cast of high-strength ductile iron and fitting with ductile iron wedging devices and twist-off pressure nuts.
  - 2.3 Couplings: shall be cast or ductile iron, consisting of a middle ring, two rubber gaskets, and the followers with stainless steel bolts and nuts. Coupling and gasket shall be sized for the particular application intended.
  - 2.4 Plugs: shall be ductile iron with mechanical joint push-on and retainer feature and shall be provided with a threaded corporation or bleeder valve so that air and water pressure can be relieved prior to future connection.
  - 2.5 Sleeves: shall be ductile iron with mechanical joint, long body style meeting or exceeding the requirements of ANSI/AWWA C110/A21.10 or latest revision thereto.
  - 2.6 Transition Couplings: shall be Dresser Style 162 as manufactured by Dresser Industries Inc., or approved equal.
  - 2.7 Sleeve-type couplings (PVC pipe only): shall be from domestic manufacturer equal to Style 153 for cast iron pipe and asbestos cement pipe, manufactured by Dresser Mfg. Div., Bradford, Pennsylvania or approved equal. Couplings shall be furnished with the pipe stop removed. Couplings shall be provided with plain, Grade 27, rubber gaskets and with black, steel, track-head, corrosive-resistant bolts with nuts.
3. POLYETHYLENE ENCASUREMENT:
- Polyethylene encasement shall be according to ANSI/AWWA C105/A21.5 seamless and shall be manufactured of virgin polyethylene material conforming to the requirements of ANSI/ASTM Standard Specification D1248. The specified nominal thickness for low-density cross-laminated polyethylene film is 0.008 inch (eight mils) and 0.004 inch (four mils) for high-density cross-laminated polyethylene film.
- Polyethylene encasement shall be provided for the entire length of new ductile iron water main and at all side street connections, and installed in accordance with AWWA C105, Method A and per manufacturer's specifications. All lumps of clay, mud, cinders etc. on the pipe surface shall be removed prior to installation, and during installation, soil or embedment material shall not be trapped between the pipe and the polyethylene. The polyethylene shall be fitted to the contour of the pipe creating a snug but not tight encasement with minimum space between the polyethylene and the pipe. Sufficient slack shall be provided in contouring to prevent stretching the polyethylene cause by backfilling operations. Overlaps and ends shall be secured with adhesive tape provided by the manufacturer.
4. BURIED VALVES AND APPURTENANCES:
- Resilient Seated Gate Valves shall meet the requirements of ANSI/AWWA C509 and shall be manufactured by M&H, Type 4067, rated for 200 psi and tested to 400 psi, or approved

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equal. Valves shall have ductile iron body, bronze stem, fully encapsulated wedge, epoxy-coated interior and exterior, non-rising stem with two O-ring stem seals, two-inch square operating nut and open counter clockwise (left). Generally, valves shall be set and aligned plumb, supported by a flat stone or solid concrete block, with the trench bottom being firmly compacted.

Valve Boxes shall be of domestic manufacturer, shall be two-piece sliding type, have a cast iron body and cover with the word "WATER" cast into the cover in raised letters, and the valve box barrel shall not be less than 5 1/4 inches in diameter. Valve boxes shall be set centered and plumb over the operating nuts of all direct burial valves. The top of each valve box shall be set to finished grade with at least 10 inches of overlap remaining between the upper sections for future vertical adjustment. Minimum overlap for lower, extension pieces shall be six inches.

### 5. HYDRANTS:

Hydrants shall be in full compliance with AWWA C502 and shall be U.S. Metropolitan 250, Model 94. No substitutions shall be allowed. Hydrants shall have barrel sections of 5-1/4-inch diameter, five-foot-six-inch bury, two 2-1/2-inch hose nozzles, one 4-1/2-inch pumper outlet, replaceable brass nozzles, breakaway flange, six-inch mechanical joint shoe and shall open counter-clockwise (left). Hydrant color shall be red.

Hydrant drainage pit shall be approximately three feet in diameter and filled with compacted crushed stone. An additional six inches of crushed stone shall be placed above the hydrant drain ports. Thrust blocking shall be placed behind the shoe of the hydrant, taking care not to block the drain outlets. The hydrant shall be set plumb and to the proper grade and shall remain properly supported until it is backfilled. After the hydrant has been set, it shall be entirely draped with burlap and remain covered until the water distribution system has been accepted and put into service.

### 6. THRUST BLOCKS AND JOINT RESTRAINTS:

Concrete thrust blocks strength shall be 4,000 psi after 28 days and shall be provided at all hydrants and fittings. Backs shall be placed against undisturbed earth, felt roofing paper shall be placed to protect pipe joints and concrete shall not be placed over bolts or nuts.

Mechanical joint restraints shall conform to ASTM A536 and shall be Megalug 1100 Series as manufactured by EBAA Iron Sales Inc., Eastland Texas or approved equal. The joint restraints shall have ductile iron wedges heat treated to a minimum hardness of 370 BHN, shall have a minimum working pressure of 350 psi for pipe diameters up to 16 inches with a minimum safety factor of 2:1 and shall be twist-off nuts. Mechanical joint restraint devices shall be installed at all fittings in accordance with the manufacturer's written instructions.

## FURNISHING AND INSTALLING WATER SERVICES

### 1. MATERIALS:

Service tubing shall conform to AWWA C901 Polyethylene Pressure Pipe and Tubing. Service tubing shall be Endopure polyethylene tubing as manufactured by Endot Industries



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Inc. or approved equal, shall be rated for 200 psi, have an outside diameter of copper size tube, stainless steel inserts at connection points, blue exterior and lifetime guarantee. Service tubing between the corporation stop and the curb stop shall be one piece installed with No. 12 trace wire. Service tubing between the curb stop and the house shall be one piece.

Corporation stops shall comply with C800, Underground Service Line Valves and Fittings, and shall be manufactured by Mueller, Ford or Cambridge Brass or approved equal.

Corporation stops shall have cast brass alloy body, ball type, double O-ring seals and be rated for 300 psi working pressure.

Curb stops shall comply with AWWA C800, Underground Service Line Valves and Fittings, and shall be manufactured by Mueller, Ford, or Cambridge Brass or an approved equal. Curb stops shall have cast brass alloy body, ball type, polytetrafluoro ethylene (PTFE) coated ball, quarter-turn check, double O-ring seals, compression ends for copper tubing size (CTS) outside diameter (OD) tubing, non-draining type, rated for 300 psi working pressure and shall open counter-clockwise (left). Tubing shall be connected to the curb stop and compression joints tightened. Duct tape shall be installed over the outlet end of curb stops to be left for future connections.

Curb boxes shall be of domestic manufacture by Mueller, Ford, Hayes or approved equal. Curb boxes shall be 2 1/2 inches buffalo-style slide-type boxes, tar coated, cast iron arch pattern base with flush-mounted covers, brass pentagon nut, and cover with the word "WATER" cast into the cover.

Service Saddles shall meet all applicable parts of ANSI/AWWA C800 and shall be manufactured by Smith-Blair or approved equal. Service saddles shall have ductile iron body, double stainless steel strap design and AWWA threads with Buna-N rubber gasket. Service saddles shall be used on all corporations larger than one inch installed in water mains smaller than 12 inches in diameter.

### 2. INSTALLATION:

For services outside paved areas, trench excavation shall be utilized, with tubing being carefully laid in the bottom of the trench, backfilled and compaction completed. Care shall be taken to protect against kinks or crushed areas. Backfill around and to one foot over the tubing shall not contain stones greater than one inch in diameter. For services to be installed beneath paved surfaces, a pneumatic drive device such as "Hole Hog" or approved equal trenchless method shall be utilized to drive the new service beneath the pavement. No. 12 tracer wire shall be installed on all water service lines.

## **BACKFILLING AND COMPACTING**

### 1. MATERIALS:

Suitable materials for trench backfill shall be the material excavated during the course of construction, but excluding debris, pieces of pavement, frozen materials, organic matter, silt, topsoil, ledge excavation and rocks over six inches in diameter. If material excavated

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from the trench is determined to be unsuitable, it shall be removed from the construction site and replaced with suitable backfill material at the Contractor's expense. The use of flowable fill will be required at the discretion of the DPW Superintendent or as outlined in the special conditions of the Permit to Disturb Surface. All pipes and structures are to be laid on a stable foundation. If material at grade is determined to be unsuitable, it shall be excavated to a further depth and/or width, and refilled with an approved material. Refill material shall be structural fill, gravel borrow or crushed stone. All surplus excavated material and any material unsuitable for use shall be disposed of in disposal areas designated by the Water Division.

### 2. INSTALLATION:

Backfill shall be placed in twelve-inch-deep loose measure uniform layers. Each layer shall be thoroughly compacted by rolling, tamping or vibrating with approved mechanical or pneumatic compacting equipment so that pipe, structures, paving and other construction will not settle at the time of construction or in the future. Care shall be taken to compact the backfill materials throughout the full width of the excavation beneath all pipes and structures. The backfilling of trenches shall proceed as soon as the laying of pipe or installation of structures will allow. Compaction tests may be required at the discretion of the Water Division.

## ASPHALTIC CONCRETE PAVEMENT

### 1. MATERIALS:

Binder and Top Course: shall be Class I asphaltic concrete pavement conforming to Section 420, 460 and M3 of the Standard Specifications.

Asphaltic Tack Coat: shall consist of either emulsified asphalt, Grade RS-1 conforming to Section M3.03.1, or cutback asphalt, Grade RC-70 or RC-250 conforming to Section M3.02.0 of the Standard Specifications.

Pavement Marking Paint: shall be High Heat Rapid Drying Traffic Marking Material conforming to Section M7.01.09 (Yellow High Heat Rapid Drying Traffic Marking Material) of the Standard Specifications.

### 2. INSTALLATION:

Temporary trench pavement shall be installed over 12 inches of gravel sub-base to a compacted thickness of two inches.

Permanent trench pavement shall include removal of temporary trench pavement to the gravel sub-base if applicable. The gravel sub-base shall be recompacted before the installation of permanent pavement. The binder course shall be laid and compacted to a thickness of two inches and the top course shall be laid and compacted to a thickness of two inches, for a total compacted permanent pavement thickness of four inches.

Full-width pavement overlay shall be installed at the discretion of the Water Division and may or may not require the existing road surface to be cold planed prior to application. Full-width pavement compacted thickness is also at the discretion of the Water Division.

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All pavement activities shall be in accordance with the Commonwealth of Massachusetts Department of Transportation Standard Specifications for Highways and Bridges, and the Marion Highway Division.

### **PRESSURE TESTING OF WATER MAINS**

1. MATERIALS:

The Water Division shall furnish water to the Contractor for flushing and testing the water main if hydrants or other connection points are convenient to the work. Fees for water usage may apply.

2. PROCEDURE:

A formal pressure/leakage test shall be required of the water mains, valves and appurtenances in the system constructed and shall be conducted in accordance with AWWA C600, Section 4.

2.1 Where any section of a water main is provided with concrete thrust blocks, the test shall not be made until at least five days have elapsed since the concrete was placed.

2.2 If high-early-strength cement is used in the concrete thrust blocks, the test shall not be made until at least two days have elapsed since the concrete was placed.

2.3 Prior to testing the pipe line, the line to be tested shall be thoroughly flushed and all air expelled. All air shall be expelled by appropriate methods including the use of corporation stops installed by the contractor at high points along the water main.

2.4 After all the air has been expelled and the corporation stops closed, the test pressure shall be applied by means of a pump connected to the pipe.

2.5 The pump, pipe connections, gauges and all necessary equipment shall be furnished by the contractor.

2.6 Unless otherwise specified, the test pressure shall be 150 psi or 150% to the working pressure, whichever is greater, up to a maximum pressure of 250 psi.

2.7 Pressure shall be maintained for two hours.

2.8 Should the pipe line not come within the permissible leakage limits, the Contractor shall be required to excavate and locate the source of leakage and make repairs.

2.9 After the Contractor has notified the Water Division that repairs have been made, the test shall be repeated until the pipeline is within the allowable leakage.

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### DISINFECTION OF WATER MAINS

#### 1. MATERIALS:

Water for flushing of water mains, preparation of chlorine solutions and filling of water mains for disinfection shall be potable drinking water.

Chlorine for preparation of chlorine solutions for disinfection shall be sodium hypochlorite or calcium hypochlorite and shall conform to the requirements of ANSI/AWWA B300. Chlorine solutions shall be neutralized using sodium bisulfate, sodium sulfate or sodium thiosulfate prior to disposal.

Sterile water sample bottles shall be obtained from a state-certified laboratory. Sterile bottles for bacteriological analyses shall be treated with sodium thiosulfate to neutralize any residual chlorine.

#### 2. PROCEDURE:

2.1 Water Main Disinfection: After completion of all water-main-related construction, except water service connection installation, all water mains, valves, hydrants, hydrant connections and other appurtenances installed shall be disinfected in accordance with AWWA Standard C651, Section 4.4.3 (Continuous Feed Method) as modified herein:

- 2.1.1 The Contractor, at no additional expense to the Owner, shall install taps for flushing, chlorination and sampling.
- 2.1.2 Flush the new water mains with potable water to remove any contaminants and debris that may have entered the water mains during construction.
- 2.1.3 The flushing velocity in the new water main shall not be less than 2.5 feet per second. In the absence of a flow meter, flow rate shall be determined either by placing a pitot gauge at the discharge or by measuring the time to fill a container of a known volume.
- 2.1.4 Prepare a chlorine solution that will be continuously fed into the potable water that is used to fill the new water mains.
- 2.1.5 The chlorine solution shall be applied to the new water mains with a chemical feed pump designed to feed chlorine solutions.
- 2.1.6 Completely fill the new water mains with the chlorinated, potable water or remove any air pockets. The point of application shall be no more than 10 feet downstream from the beginning of the new water mains.
- 2.1.7 The chlorine solution shall be of sufficient strength to provide a minimum residual chlorine concentration of 25 milligrams per liter (mg/l) in the filled water mains.

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- 2.1.8 New valves and hydrants shall be operated to allow for proper disinfection.
  - 2.1.9 Isolation valves shall be maintained in a closed position to prevent chlorinated water from entering the existing water distribution system.
  - 2.1.10 Chlorinated water shall remain in the main for a minimum of 48 hours.
  - 2.1.11 The minimum residual chlorine concentration at the end of the forty-eight-hour holding period shall be 10 mg/l.
  - 2.1.12 After the forty-eight-hour retention period, chlorinated water shall be flushed from every hydrant branch on the main until the chlorine concentration leaving the main is no higher than that generally in the system or less than 1.0 mg/l.
  - 2.1.13 Chlorinated water shall be discharged in a manner that will not adversely affect flora and fauna or drainage courses and shall conform to applicable state regulations for waste discharge.
  - 2.1.14 Chlorinated water that is flushed from the mains shall be neutralized by the addition of dechlorinating agent so that the residual chlorine concentration is zero.
- 2.2 Bacteriological Tests: A minimum of 24 hours after flushing and before the new water mains are placed in service, the Contractor shall collect water samples for testing the bacteriological quality of the water.
- 2.2.1 No hose or fire hydrant shall be used in the collection of samples.
  - 2.2.2 A sampling tap shall consist of a standard corporation stop installed in the main with a PVC gooseneck assembly. Samples for bacteriological testing shall be collected in sterile bottles treated with sodium thiosulfate and furnished by the state-certified laboratory that will perform the tests. Unless otherwise directed, the minimum number of samples for bacteriological analysis shall be as follows:
    - 2.2.2.1 One sample every 1,200 linear feet of newly installed water mains.
    - 2.2.2.2 One sample at the end of the newly installed water mains.
    - 2.2.2.3 One sample at each branch.
  - 2.2.3 Two rounds of sampling shall be conducted. The second round of sampling shall be conducted at a minimum of 24 hours after the first round of samples is taken.
  - 2.2.4 All bacteriological tests shall be performed by a state-certified laboratory.

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- 2.2.5 Two bacteriological tests shall be performed on all samples:
  - 2.2.5.1 One coliform bacteria; and
  - 2.2.5.2 One heterotrophic plate count (HPC) bacteria.
- 2.2.6 The results on all samples and a copy of the chain of custody shall be mailed directly to the Water Division from the laboratory.
- 2.2.7 The disinfection procedure shall be considered satisfactory only if the results of all tests confirm the following:
  - 2.2.7.1 The absence of coliform bacteria in all samples taken; and
  - 2.2.7.2 The HPC bacteria are less than 500 colony-forming units per milliliter (cfu/ml) in all samples taken or less than or equal to the HPC bacteria count in the existing water system.
- 2.2.8 The new water mains may be placed in service if the results of the disinfection procedure are satisfactory and the Water Division has granted permission.
- 2.2.9 If the initial disinfection procedure fails to produce satisfactory results, the new water mains shall be flushed and re-sampled as described above. If the test results from the re-sampling also fail to produce satisfactory results, the entire disinfection procedure shall be repeated.