

# City of Marshall – Water Main Specifications

## PART ONE - GENERAL

### 1.01 Description

A. The CONTRACTOR shall furnish all labor, materials, and equipment required to construct water main, and all necessary appurtenant work as herein specified. The water main shall be installed in the locations as shown on the plans and shall meet the line acceptance tests.

### 1.02 Testing

#### A. General

1. Furnish all equipment and personnel to conduct system acceptance tests as specified herein. All tests shall be conducted under the supervision of the ENGINEER. No acceptance tests shall be conducted until the entire system is constructed or just prior to placing the system in service, provided the water main has been installed and backfilled for not less than 30 days.
2. All water mains, branches, and valves shall be tested for pressure, leakage and disinfection.
3. Should the results of any test fail to meet the criteria established in this Specification, the CONTRACTOR shall at his own expense, locate and repair rejected section and retest until it is within specified allowance.
4. Provide all labor, supervision, pumps, measuring devices, power and other material and equipment necessary for conducting acceptance tests on all piping.

#### B. Preparation

1. After the pipe has been laid and backfilled as specified, the CONTRACTOR shall fill the line, or a valve section thereof, to be tested with water in such a manner as to expel all air from the pipe. This may be done through fire hydrants at the high points; or, if no hydrant is available at such point, the CONTRACTOR shall make the taps necessary to accomplish the expulsion of all air. At the close of the test all taps shall be satisfactory plugged with brass plugs.
2. Only City of Marshall personnel or the CONTRACTOR under direct supervision of City of Marshall personnel may fill or flush lines.

#### C. Sequence

1. All water mains connected to an existing water system shall be flushed, chlorinated and bacteriological tested prior to pressure testing. The sequence for acceptance testing shall be:
  - a. Flushing
  - b. Chlorination
  - c. Flushing
  - d. Bacteriological Testing

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### e. Pressure Testing

2. Where mains can be totally isolated from the existing water system with air gaps, pressure testing shall precede chlorination and bacteriological testing. The sequence for acceptance shall be:

- a. Pressure Testing
- b. Connect to system
- c. Flushing
- d. Chlorination
- e. Flushing
- f. Bacteriological Testing

### D. Flushing

1. Mains shall be flushed with clean potable water until the water runs clear. When flushing mains prior to chlorination; all hydrants heads, operating stems and hydrant valves mechanisms shall be removed.

### E. Chlorination

1. All disinfection of water mains shall be in conformance with AWWA standards 651-92.
2. All new mains and pipes and existing mains contaminated by the CONTRACTOR shall be chlorinated to a minimum residual chlorine concentration of fifty (50) parts per million with commercial liquid chlorine solution or approved equal. The chlorinated water shall be allowed to stand in the mains for 24 hours. At the end of the 24-hour period the chlorinated water at all parts of the mains shall show a free available chlorine residual of not less than twenty-five (25) parts per million. If less than twenty-five (25) parts per million residual is shown at the end of the first 24 hour period, additional chlorine shall be added until a residual of not less than twenty-five (25) parts per million at all parts of the system is shown after a subsequent 24 hour period. The chlorinated water shall then be removed from the mains and the mains flushed with potable water for bacteriological testing.

### F. Bacteriological Testing

1. The OWNER will take bacteriological samples of the water in the mains for analysis at two different times. The first samples will be taken 24 hours after the mains have been satisfactorily chlorinated, flushed and filled with potable water. The second sample will be taken 24 hours later. Each sample will be incubated for 24 hours.
2. The CONTRACTOR shall provide a sufficient number of corporation cocks and copper tubing for taking samples. Samples shall not be collected from hoses or fire hydrants.
3. Bacteriological testing will begin on Mondays to afford the City of Marshall personnel and the testing laboratory a full work week to conduct the testing.

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4. The CONTRACTOR shall not be permitted to put the water main into service until two consecutive satisfactory tests have been produced.

### G. Pressure Testing

1. All pressure testing shall be in conformance with AWWA standard C600-93.
2. All pipe laid under this contract shall be subject to a hydrostatic pressure of 150 psi on the elevation of the lowest point in the system. The main shall be maintained under the test pressure for a minimum continuous period of 2 hours by pumping potable water into the line at frequent intervals. The volume of water so added shall be measured and considered to represent the leakage from the main. No pipeline installed will be accepted until the leakage is measured over a 1 hour period is less than 0.092 gallons per inch diameter of the pipe per 100 feet. All visible leaks must be corrected. The maximum length of water main to be tested at one time shall be 2000 feet.
3. If the CONTRACTOR chooses to pressure test against an existing valve he assumes the responsibility of meeting the leakage requirements. The CONTRACTOR may at his discretion provide a physical break and cutting in sleeve for pressure test.

## PART TWO – PRODUCTS

### 2.01 Pipe and Fittings

A. Ductile iron pipe water main shall meet all the requirements of the latest revision of the American National Standard Institute (ANSI) Specifications, A21.51 and the American Water Works Association (AWWA) Specification C151. All joints excepting joints for valves and hydrants shall be “push on.” Pipe shall be furnished in 18 or 20 ft lengths, unless otherwise required. The pipe shall meet the thickness class requirements shown in the table below.

<u>Size Nominal inside Diameter Inches</u>	<u>Thickness Class</u>
4	52
6	52
8	52
10	52
12	52
14	54
16	54
18	54
20	54
24	54

B. Pipe shall withstand a working pressure of 125 psi plus a 100 psi surge pressure.

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C. Pipe shall be cement-lined and seal coated with an approved bituminous seal coat in accordance with ANSI Specification A21.4 (AWWA C-104).

D. Ductile iron or cast iron fittings shall meet all the requirements of the latest version of the ANSI specification A21.10 for a working pressure of 125 psi and be of the mechanical joint type. Plugs, where shown on the plans, shall be solid mechanical joint plug type.

E. Mechanical joints shall be in conformity with the requirements of the latest revision of the ANSI specification A21.11. The bolts shall be of high strength, low alloy steel type.

F. Push on joints shall meet all the requirements of the latest revision of AWWA specification C111. Push-on joints shall consist of a molded rubber gasket to affect the joint seal. A rubber gasket and sufficient lubricant to assemble the joints shall be furnished with each joint. The lubricant shall have deleterious effect upon the color, taste, or odor of potable water and shall not be corrosive to either the pipe or gasket. Pipe furnished with push-on type joints shall be equal in strength and leak tightness to pipe furnished with mechanical joints as specified when installed under identical conditions, and shall meet all other requirements of these specifications. In addition to the above mentioned requirements, the gasket and lubricant shall conform to the latest revision of the ANSI specification A21.11.

### G. PVC PRESSURE PIPE

1. PVC pressure pipe water main shall meet all the requirements of the latest revision of ANSI/AWWA C900 or ANSI/AWWA C905. PVC water main shall be manufactured from compounds conforming to PVC cell classification of 12454 as defined in ASTM D1784. PVC C900 pipe shall conform to DR14 and PVC C905 pipe shall conform to DR18. Pipe shall be furnished in twenty-foot lengths.
2. Restrained Joint PVC pipe shall utilize either JM Eagle Eagle Loc 900 restrained joint system or CertainTeed Certa-Lok restrained joint system. Fusible PVC pipe by Underground Solutions may also be used as an alternate to restrained joint pipe in open cut applications.
3. Fittings to be used with PVC pipe shall meet all the requirements of the latest revision of ANSI/AWWA C110/A21.10 for full body ductile iron fittings and ANSI/AWWA C153/A21.53 for compact ductile iron fittings and be of the mechanical joint type.
4. Mechanical restraint devices for PVC pipe shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10. Twist off nuts shall be used to insure proper actuating of the restraining device. Restrained mechanical joints for PVC pipe shall be Megalug, Series 2000PV by EBAA Iron, or approved equal. Bolts and nuts for buried service shall be made of non-corrosive, high-strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21.11.
5. PVC pipe shall incorporate a formed bell complete with a single rubber gasket conforming to ASTM F477. Joints shall be designed to meet the zero leakage test requirements of ASTM D3139.
6. Pipe shall be marked per AWWA C900 or AWWA C905, and shall include as a minimum:
  1. Nominal size
  2. PVC
  3. Dimension Ratio, Standard Dimension Ratio or Schedule
  4. AWWA pressure class or rating
  5. AWWA Standard designation number
  6. NSF-61 mark verifying suitability for potable water service

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7. Extrusion production-record code (if applicable)
8. Trademark or trade name
9. Cell Classification 12454 and/or PVC material code 1120 may also be included.

### 2.02 Valves

A. All valves installed under this Specification shall conform to the applicable requirements of AWWA C500, C504, and C509 standards governing construction materials and workmanship. Each valve shall carry the name or trademark of the manufacturer. All valves shall have operating nuts that turn to the left (counterclockwise) to open.

#### B. Resilient Seated Gate Valves

1. Gate valves shall be resilient seated type unless otherwise noted. Resilient seated gate valves shall have a cast or ductile iron body and bonnet. Valves shall have a minimum non-shock W.O.G. working pressure of 200 psi. The wedge shall be ductile iron encased in a bonded-in-place styrene-butadiene elastomer covering to form resilient seating surfaces. Stem shall be bronze of non-rising design with double o-ring packing.

2. Resilient seated gate valves shall be manufactured by Waterous, American Flow Control or Clow.

#### C. Butterfly Valves

1. Butterfly valves shall have a cast iron body, neck and top piece with a minimum non-shock W.O.G. working pressure of 150 psi. Seats shall be Hycarbuna "N" providing leak-proof shut-off with the disc and acting as a bodyliner to prevent corrosion. Disc shall be ni-resist cast iron with a 304 stainless steel shaft rotating in permanently lubricated bearings. Stem seal shall be Hycarbuna "N". Joints shall be flanged. Flanged to mechanical joint adapters shall be provided for each valve.

2. Butterfly valves shall be manufactured by Henry Pratt Company.

#### D. Swing Check Valves

1. Valves shall have a cast or ductile iron body and bolted cap with a minimum non-shock W.O.G. working pressure of 150 psi. Seats shall be bronze and shall be screwed into the valve body. The disc shall be bronze or cast iron with permanently rolled in bronze faces. The disc hinge pin shall be aluminum bronze or stainless steel riding in bronze busings, one on each side of the valve. Valves shall have ANSI 125 pound standard drill flat faced flanges unless otherwise specified or shown on the Plans. Valves shall have outside weighted arm.

#### E. Air Release Valves

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1. Air release valves when specified shall be designed to operate under a maximum operating pressure of 300 psi and capable of venting 200 CFFAS (cubic feet of free air per second). Valves shall be cast iron with bronze internal parts and Type 304SS float.

### F. Corporation Stops

1. One inch corporation stops shall be Mueller Type 3000. All stops shall have bronze cast bodies, keys, stem washers and nuts. Inlet threads shall conform to the latest revision of AWWA C800. The outlet connection shall be a compression fitting Q style.

### G. Valve Boxes

1. Valve boxes 5 ¼" shall be of cast iron construction. They shall be of three-piece, screw type adjustment design. All valve boxes shall be installed flush with the top of the proposed site grade. Covers shall be designed to be removed easily to provide access to the valve. The base shall not rest upon the valve assembly. All valve boxes shall be Tyler Pipe 6860 Item D with a number 6 base.

### H. Gatewells

1. Brick for grade adjustment of gatewells shall meet the requirements for "medium brick" of the Standard Specifications for Clay Sewer Brick, ASTM Serial Designation C32, or the latest revision thereof.
2. Mortar for masonry or plastering outside of gatewells shall be made of one part of Portland cement to two parts of sand. Mortar materials and mixing shall correspond, in general, to those for concrete.
3. Reinforced concrete gatewells shall conform to the latest revision of ASTM Specifications for Pre-cast Reinforced Concrete Manhole Sections, Serial Designation C478, with rubber gasket joints.
4. All gatewell component parts shall have the name of the manufacturer stenciled on the inside. The lettering shall be a minimum of 4 inches high.
5. Steps shall be plastic-coated steel. They shall be M.A. industries PSI-PF, or equal.
6. Frames and covers shall be cast iron conforming to the Standard Specifications Castings, Serial Designation A48, or the latest revision thereof, East Jordan No. 1040 with type C cover, Neenah No. R-1642, with type C solid cover with two (2) ¾ inch holes, or equal. They shall have machined bearing surfaces and suitable notches for convenient removal of the cover. Covers shall have the letters "Water System" cast integrally with the cover. All frames and covers shall be coated at the point of the manufacturer with coal tar pitch varnish or other approved asphaltum coating.

## 2.03 Service Leads

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A. Pipe for service leads 1 inch to 2 inch shall be soft annealed Type K copper or HPDE pipe SDR 11 with tracer wire similar to that laid with water main when approved by the City Engineer.

B. Curb Stop: One inch curb stops used for service connections shall be Mueller Type 300 or equal. All parts shall be cast from bronze. They shall have an inverted  $\frac{1}{4}$  turn key stop and compression connections on both ends.

C. Curb Boxes: All curb boxes shall be three pieces with a 2  $\frac{1}{2}$ " diameter top with an arched bottom. All curb boxes shall be coated inside and out with a tar base enamel.

### 2.04 Fire Hydrants Assembly

A. Fire hydrants shall comply with the latest revision of AWWA Standard, C502. Hydrants shall be compression type to open with the pressure. They shall have a 5  $\frac{1}{4}$ " valve opening and 6" mechanical joint inlet. Hydrants shall have two 2  $\frac{1}{2}$ " hose connections and one 4  $\frac{1}{2}$ " pumper connection.

B. Fire hydrants shall have inside barrel dimension of not less than 8  $\frac{1}{2}$ " I.D. from top to bottom. The 1  $\frac{1}{2}$ " pentagon operating nut shall open left (counter clockwise).

C. All nozzles shall be on a removable head with a flange so that they may be rotated by changing the position of the flange.

D. Hydrant shall be fully bronze mounted, including top of the operating stem where it passes through the double o-ring seal in the bronze packing gland. The forged operating stem in the base and the valve seat shall also be of bronze. The molded valve shall be of composition rubber and the cast iron valve clamps shall be packed with o-ring seals and held tight to the stem by a threaded bronze hex retainer ring and threaded bronze locknut, anchored with set screws.

E. Hydrant shall be designed for 150 psi working pressure and tested to 300 psi. Those portions of the hydrant above grade shall have two coats of red enamel. All unpainted surfaces shall have two coats of coal tar pitch varnish.

F. The hydrants shall be East Jordan type 5BR250 or similar approved by the Engineer.

G. All fire hydrants assemblies shall be equipped with a gate valve and box. The cost of the gate valve and box shall be included in the cost of the hydrant.

### 2.05 Tapping Sleeves and Valves

A. Tapping sleeves, when specified, shall be full length of heavy-duty stainless steel construction designed for use with the type of pipe to be tapped. Tapping sleeve body shall be 18-8 type 304 stainless steel. Flange shall be CF8 cast stainless steel. Gasket shall be full circumferential SBR compound for water service. Tapping sleeve shall contain a test plug to assure seal prior to tapping. Tapping sleeve shall be JCM Industries, type 432; Romac Industries type SST; or equal.

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B. Tapping valves shall meet the specification for gate valves except that the valve shall have a flange compatible with the tapping sleeve. Tapping valves shall be Waterous resilient wedge or equal.

### 2.06 Buy American

A. The material used in the construction of the project must be manufactured in the United States unless written exception is given by the engineer.

## PART THREE – EXECUTION

### 3.01 Pipe Installation

A. Any pipe damaged in transport or handling shall be rejected and removed from the site of the work.

B. In handling and placing ductile iron pipe and fittings, no metal shall be used in contact with the inside of the pipe to fit or support the pipe. The pipe shall be moved only through the use of belt slings or automatic release type pipe tongs. Care shall be taken not to injure the pip or pipe coating, and no damaged or imperfect pipe shall be used in the work except that minor damage to pipe coating may be repaired subject to the review of the ENGINEER.

C. The main shall be laid on a compacted sand cushion, 4 inches thick. Sand backfill material shall be placed around and above the main as per the trench detail included in the plans. Sand shall be compacted in 9 inch lifts to not less that 95 percent of the maximum unit density as determined at optimum moisture content. Sand shall conform to Class II granular as defined in 2003 MDOT 902. Pipe shall be laid with a minimum cover of 6 feet with a minimum 10 foot horizontal separation and 18 inch vertical separation from existing sewer.

D. All pipe and fittings shall be carefully lowered and moved into position in the trench or vault I a controlled manner such as will prevent damage to the pipe and its coating and lining.

E. In assembly of push-on or shove type joints, the bell socket recess and the gasket shall be wiped clean and the gasket placed properly in position. A thin film of lubricant shall then be applied to the surface of the gasket to come into contact with the entering pipe. The plain end of the entering pipe shall be cleaned and then entered and forced home to the base of the socket. Where pipe is cut, the entering end shall be beveled before being inserted in the joint. Where time permits drying, the cut and beveled end shall be coated with coal tar enamel.

F. To prevent trench water from entering the pipe, joints which for any reason may not be completed as the pipe is laid shall be thoroughly packed with approved material, in a manner to make them watertight. Open ends of fittings shall be tightly closed with approved plugs and well packed, as shall the end of the last pipe laid whenever work is not in progress.



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G. Each pipe shall be laid accurately to the live and grade shown on the Plans. Whenever it is necessary to deflect pipe from a straight line, either in the horizontal or vertical plane, to avoid obstructions, or where long radius curves are permitted, the amount of deflection allowed shall not exceed that required for satisfactory jointing and shall be reviewed by the ENGINEER. In no case shall deflection of joints exceed the manufacturer's recommended maximum deflection.

H. The CONTRACTOR shall not be entitled to any additional compensation because depth is more than specified at certain locations or due to clearances at manholes, or due to unforeseen obstacles, or occasioned in order to avoid undue changes in grade.

I. The trench shall be backfilled closely behind the pipe laying. Unless otherwise directed or permitted by the ENGINEER, the backfilling shall follow at least two lengths behind pipe laying and shall be completed to the top of the trench not more than ten lengths behind pipe laying.

J. External anchorage designed to hold the pipe to the proper line and grade against internal static and dynamic forces and external loads shall be provided at all tees, wyes and plugs, and wherever the pipe is deflected from a straight line and the resultant forces are not self-contained through the use of flanges, anchor ties and the like. Concrete thrust blocks or anchorage shall be 3000 PSI concrete.

K. Air release valve and manhole shall be constructed where shown on the Plans. All castings and manholes shall be as specified under gatewells. Gatewells shall be constructed in accordance with the details shown on the Plans. All castings shall be as specified under gatewells.

### 3.02 Service Leads

A. Service leads shall be installed where shown on the Plans. All service taps shall be the "wet" method type and no tap shall be made until the acceptance test has been conducted and the line is under pressure.

B. When crossing a paved street, the service lead shall be jacked under the pavement. Auguring and/or jacking requirements on paved streets for the installation of pipe less than 2 1/2" outside diameter shall be made by a "compactor" type machine or similar method without removing existing soil, if soil condition permit.

### 3.03 Hydrants

A. Fire hydrants shall be constructed in accordance with the details shown on the Plans. Finish grade level to center of nozzle caps shall measure between 24 and 30 inches unless shown otherwise on the Plans. A maximum of one hydrant barrel extension and one operating stem extension may be used to accommodate changes in grade. Under no condition shall extended hydrant have more than one coupling in the operating stem. Pumper connection shall point toward the street.

B. Fire hydrants shall be installed with barrel vertical and properly based. Concrete thrust blocks shall be placed behind the hydrant, tee, and every bend. Care should be taken to insure that the drain holes on the hydrant are not plugged by the thrust blocks. Hydrant shall be set in 1 yard of coarse gravel for drainage purposes. If ground water is encountered, the drain hole shall be plugged as directed by the

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manufacturer. The backfill shall be sand thorough tamped around the hydrant and valve box in 1 ft layers.

C. Fire hydrant and gate valve shall be set apart 14 inches. Gate valves and valve box shall be as specified under the valve paragraphs of the Section.

### 3.04 Connection to Existing Mains

A. When making a dry connection to an existing main, the existing main to which a connection is to be made shall be isolated by the closing of the necessary existing valves, and the water from the existing main shall then be piped out or removed by other means so the connection may be made in the dry. After the connection has been acceptably made, the portion of the new line to the nearest valve shall be satisfactorily tested and disinfected, along with the drained portion of the existing main, before the isolated existing main is placed back in service, except as the ENGINEER may otherwise direct. In as much as residents served by this isolated main will be temporarily out of water during this period, the work shall be prosecuted as rapidly as possible, and the time of , and the procedure in, making such connections shall be subject to the review of the ENGINEER. Such work may be required to be done at night in order to minimize inconvenience of water users. The CONTRACTOR shall not be entitled to any additional compensation because of night work or other special requirement in work under the Section.

B. The CONTRACTOR shall make particular effort, prior to bidding, to ascertain whether or not valves in the existing mains to be connected to the new mains are so located as to provide isolation. If valves are not found to be adequate, then the CONTRACTOR shall utilize other means to make the connection with a minimum of interruption to service.

C. When making a wet tap connection to an existing main, a tapping sleeve designed for the type of pipe being tapped shall be utilized and the tap shall be made in accordance with the manufacturer of the tapping equipment.

D. Wherever adapters are required to properly connect the pipe with existing pipe or other material or manufacturer, the nominal I.D. of adapter shall be the same size as the nominal diameter of pipe connected thereto. Adapter shall also be furnished and used as required by the manufacturer for connection to fittings.

### 3.05 Thrust Blocks

A. The Contractor shall furnish and place horizontal and/or vertical thrust blocks at all plugs, caps, tees and fittings whether or not indicated on the drawings unless otherwise specified. The cost of thrust blocks shall be included in the unit price bid per foot of water main. The inspector or Engineer shall approve all thrust blocks of any nature prior to backfilling.

B. In unstable soil conditions, the thrust blocks are to be supported by piling driven to solid foundations or by removal of the unstable soils and replacement with ballast of sufficient stability to resist the thrusts. The thrust blocks are to be approved by the Engineer before

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backfilling. The cost of piling or ballast at thrust blocks shall be included in the unit price bid per foot of water main.