

Lansing Charter Township
West Side Water Supply System
Special Provision
For
Water Mains

10/16/2014

- a. Description.** The work of Water Mains shall consist of furnishing all labor, equipment, and materials, unless otherwise stated, required for the installation of all water mains and appurtenances as shown on the plans and specified herein, including disinfection and testing.
- b. Materials**
1. Detailed material lists and specifications for all water system materials shall be submitted to the Engineer for review. All water system materials shall be new, meet the requirements of the AWWA, the standard specifications, forged and made in the U.S.A. unless prior approval from the Department or its authorized agent, and the following.
 2. Water main: Shall be Ductile-Iron (D.I.) in accordance with ANSI/AWWA C151/A21.51 Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids, unless otherwise specified in plans, and the following.
 - A. Class and Size: Pipe wall thickness shall be minimum pressure Class 52, unless otherwise noted on the plans.
 - B. Pipe Markings: All pipes delivered to the job site shall bear the marks required by ANSI/AWWA C151/A21.51.
 - C. Exterior Coating: Shall be bituminous, 1 mil thick.
 - D. Cement-Mortar Lining: Shall be in accordance with ANSI/AWWA C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 - E. Polyethylene Encasement: Shall be in accordance with ANSI/AWWA C105/A21.5 Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - F. Mechanical Joints and Push-on Joints: Shall be in accordance with ANSI/AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings. Bolts and nuts shall be high strength corrosion resistant alloy with hex head nuts.
 - G. Fittings: Shall be in accordance with ANSI/AWWA C153/A21.53 ductile-iron and gray-iron fittings, 3 in. through 48 in., for Water and Other Liquids.
 - H. Electrical Continuity: Shall be bronze wedges or continuity straps.
 3. Valves and Valve Boxes: Contractor shall verify the acceptability of the following materials with the Owner prior to submittal of shop drawings and materials lists to the Engineer.
 - A. General Requirements
 - 1) Working Pressure: 150 psi minimum.
 - 2) Joints: Shall be mechanical joints in accordance with ANSI/AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings, unless otherwise noted on the plans or in the valve schedule. End flanges, if specified, shall be ANSI B16.1 Class 125.
 - 3) Direction of Opening: Counterclockwise.
 - B. Resilient Seated Gate Valves: Shall be in accordance with ANSI/AWWA C509 Resilient-Seated Gate Valves for Water Supply Service and the following:
 - 1) Body Construction: ASTM A126 Class B, cast iron.

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- 2) Operator: Hex nut, unless otherwise noted on the plans or in the valve schedule.
Stainless Steel stem and assembly hardware.
- 3) Manufacturer: Waterous 500 Resilient Wedge; Mueller A-2370-20.
- C. Valve Boxes: Cast iron, screw type, three piece; cover shall be marked "Water".
 - 1) Tyler 6860 Series with No. 6 base; Bingham Taylor Size D.
4. Hydrants: Shall be in accordance with ANSI/AWWA C502 Dry-Barrel Fire Hydrants and the requirements listed below. Contractor shall verify the acceptability of the following materials with the Owner prior to submittal of shop drawings and materials list to the Engineer.
 - A. Type and Size: Breakaway traffic flange; 6 inch main valve seat.
 - B. Connections: Two 2 ½ inch hose connections and one 4 ½ inch Storz fitting pumper connection; National Standard threads, 4 threads per inch.
 - C. Direction of Opening: Counterclockwise.
 - D. Operating Nut: 1 ½ inch pentagon.
 - E. Manufacturer: Waterous WB 67.
5. Service Lead Pipe, Corporation Stop, Curb Stop Valve and Curb Box: Contractor shall verify the acceptability of the following materials with the Owner prior to submittal of shop drawings and materials lists to the Engineer.
 - A. Service Lead Pipe: ASTM B88 type K annealed seamless copper water tube unless otherwise noted on the plans.
 - B. Corporation Stop: Ford FB1000-Q; Mueller B-25008; A.Y. McDonald 4701b-22-T.
 - C. Curb Valve: Ford B44-33-MQ; Mueller B-25115; A.Y. McDonald 6104-22.
 - D. Curb Box: Mueller H10300; A.Y. McDonald 5615.

c. Methods of Construction

1. Water System Installation, including water mains and their appurtenances, shall be in accordance with ANSI/AWWA C600 Installation of Ductile-Iron Water Mains and their Appurtenances and the following.
 - A. Location, Grade and Alignment: Water main shall be constructed to maintain at least ten feet horizontal separation from any sewer. A minimum depth of cover of 5 feet shall be provided, unless otherwise noted on the plans. Water main shall also be constructed to maintain a minimum vertical clearance of 18 inches between water main and any sewer.
 - B. Laying Pipe: Pipe shall be laid with the bell ends facing the direction of laying, unless otherwise directed or allowed by the Owner or Engineer.
 - C. Wet Trench Laying: When the trench contains water, every effort should be made to dewater the trench. If dewatering is not possible, open ends of the pipe shall be closed by water tight plug. This provision shall apply during noon hour as well as overnight.
 - D. Pipe Bedding and Backfill: Shall be in accordance with the Michigan Department of Transportation Standard Plan R-83 (Series), Utility Trenches.

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- E. Pipe Encasement: All Ductile-Iron Pipe shall be fully encased in polyethylene encasement with all seams, cuts and/or tears taped and sealed with approved water main tape.
- F. Electrical Continuity: Shall be provided for all underground pipe unless otherwise noted on the plans.
- G. Joint Restraint: Where water to air pressure exerts a disjoining force, at all pipe deflections over 20 degrees, and to all tees and dead ends, joints shall be restrained, tied or harnessed in a manner approved by the Owner or the Engineer. The restraint shall be applied to joints in each direction from the deflection an adequate distance to resist the axial thrust of the test pressure as shown in Table 1: Pipe Restraint Schedule. Details of the proposed joint restraint, showing the type and location, shall be submitted to the Engineer for approval. All pipe and fitting restrained joints shall be rated for a minimum of 250 psi.

TABLE 1: PIPE RESTRAINT SCHEDULE
 GROUND BURIED PRESSURE PIPE-DUCTILE IRON PIPE

Pipe Diameter	Length (ft) of Pipe Restraint for Each Direction from Fitting						
	Tee,90° Bend	45° Bend	22½° Bend	11 ¼° Bend	Dead End	Reducer (One Size Reduction)	Reducer (Two Size Reduction)
4"	11	5	2	1	28	--	--
6"	16	7	3	2	41	21	--
8"	21	9	4	2	52	21	49
12"	30	12	6	3	75	40	81
16"	38	16	8	4	97	41	96
20"	46	19	9	5	118	42	94
24"	54	22	11	5	139	42	92
30"	65	27	13	6	169	59	117
36"	75	31	15	7	197	59	132

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Based Upon: Internal Pressure: 180 psi
Pipe Depth: 5'
Bedding Class: Type 4
Soil Type: Good Sand
Safety Factor: 2

For Pressure other than 180 psi, increase or decrease values proportionally.

For a tee, length of pipe restraint is for the branch/stem direction.

For tie rods, use four rods minimum and add 1/8-inch to bar diameter as corrosion allowance.

- 1) Retainer Glands: Mechanical joint pipe shall be restrained with EBAA Iron "Megalug Series" or Uni-Flange Block Buster 1400 retainers. Megalug or Uni-Flange Block Buster 1400 retainers may also be used to restrain joints for unanticipated deflection points, or where connections require a mechanical joint. Push-on joint pipe shall be restrained with American Lok-Ring, Flex-Ring or Fast-Grip Gaskets, U.S. Pipe TR Flex, Field Lok Gasket, or equal.
- 2) Thrust Blocks: Shall be constructed of Class B, poured-in-place concrete and installed at all bends, dead ends, tees, reducers, hydrants and valves. The area in square feet of concrete thrusting against undisturbed earth shall be computed by dividing the total thrust by the safe bearing load of the soil; refer to Tables 2 and 3. For larger sizes, details shall be shown on the plans.

TABLE 2: THRUST TABLE

Thrust Main Size	Total Thrust (Lbs)				
	Plug	90° Bend	45° Bend	22 ½° Bend	11¼° Bend
4"	2840	400	2100	1100	600
6"	5800	8200	4300	2300	1100
8"	8900	14000	7400	3900	2000
10"	14800	21000	11000	5800	2900
12"	20900	30000	15500	8200	4100
14"	28000	40000	21000	11000	5500

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16"	36200	51000	27000	14200	7100
18"	45400	64000	34000	17800	8900
20"	55800	79000	37500	21800	11000

TABLE 3: SAFE BEARING LOADS FOR SOILS (HORIZONTAL THRUST)

Type of Soil	Safe Bearing Load (Lbs/SqFt)
Muck, Peat, Etc.	0
Soft Clay	1000
Sand	2000
Sand	3000
Sand and Gravel Cemented w/Clay	4000
Hard Compacted Clay	5000

- 3) Thrust blocks in unstable soil conditions: Thrust shall be resisted by piling driven to solid foundations or by removal of unstable soil material and replaced with ballast of sufficient stability to resist thrust. Thrust block size and method of thrust resistance shall be approved by the Engineer before construction.
 - 4) Special Thrust Containment: Use of joint ties, containing thrust within the pipe, will be considered by the Owner and/or the Engineer upon a definite proposal of methods submitted by the Contractor. Only methods retaining the freedom of joint bend will be considered.
2. Valve and Valve Box Installation: Shall be in accordance with ANSI/AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings and ANSI/AWWA C509 Resilient-Seated Gate Valves for Water Supply Service.
 3. Hydrant Installation
 - A. Hydrant: Shall be in accordance with ANSI/AWWA C502 Dry-Barrel Fire Hydrants and the detail shown on the plans.
 - B. Depth of Cover: Hydrant leads shall be installed to provide a minimum depth of cover of 5 feet, including crossing through ditch sections.
 - C. Hydrant Drain Ports: Shall remain unplugged unless otherwise noted on the plans.
 - D. Hydrant Thrust Restraint: Shall be restrained from the main line to the hydrant in accordance with 1.G Joint Restraint.
 4. Service Lead Installation

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- A. General: Open cutting of existing hard surfaced pavement will not be allowed. Service leads may be bored, drilled or jacked; jetting of water or air will not be allowed. Under normal conditions, casings will not be required except where probable damage to the roadbed or the service lead exists. Service leads shall be installed to provide a depth of cover of 5 feet.
 - B. Installation without Casing: In stable soils, the diameter of the auger head shall not exceed the diameter of the service lead by more than one inch. Service lead pipe shall be pushed or pulled through after the hole has been augured. Pipe ends shall be examined after installation for damage. If damaged, the service pipe shall be replaced.
 - C. Installation with Casing: In unstable soils, as determined by the Engineer, the combination of boring and jacking simultaneously shall be utilized providing the cutting edge of the auger does not advance ahead of the casing. Casing diameter shall not exceed the diameter of the service lead by more than one inch. Casing pipe may be removed at the Contractor's option.
 - D. Boring Installation: Shall be in accordance with the requirements of the local agency/utility.
 - E. Connection to Existing Services: Connections to existing water services with like material shall be made with standard, no lead, couplings; connections of dissimilar materials shall be made with appropriate couplings complete with Nylon dielectric bushings.
 - F.
5. Hydrostatic Testing Requirements
- A. General: Upon completion of installation of the water main and appurtenances, the Contractor shall furnish all apparatus, materials, labor and water required to perform the pressure tests in accordance with Section 4-Hydrostatic Testing, ANSI/AWWA C600 Installation of Ductile-Iron Water Mains and Their Appurtenances and the following.
 - B. Pre-Test Procedures: Contractor shall open all valves, including hydrant auxiliary valves, and completely fill the line with water to remove all air from the pipe, valves or hydrants. If necessary, the Contractor shall install additional corporation stops at high points to allow air to be expelled.
 - C. Preliminary Test: A preliminary pressure test shall be accomplished by the Contractor. Any leaks encountered shall be corrected and the test shall be rerun until results are satisfactory.
 - D. Final Pressure and Leakage Test: Shall be conducted in the presence of the Engineer or authorized representative, who shall receive 24 hours notice prior to testing. If it necessary for the Engineer or authorized representative to observe more than one test on any section on mainline, the Contractor shall be liable for the additional cost involved for observation of subsequent tests.

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- E. Leak Repair: The Contractor shall provide all labor and materials, etc. as required to repair leaks, or otherwise required to meet these tests. Any leakage over the allowable design calculations in AWWA C600 shall be repaired at Contractors cost. Water damage resulting from flushing or testing procedures shall be the responsibility of the Contractor.
- 6. Disinfection Requirements
 - A. General: Shall be in accordance with ANSI/AWWA C651 Disinfecting Water Mains and the following.
 - B. Preliminary Flushing: After the pressure test and before disinfection, the Contractor shall flush the new pipe until the water runs clear. Each valved section of the newly laid pipe shall be flushed separately with potable water from the public water supply.
 - C. Disinfection: The Contractor shall disinfect the new mains flushing in approximate 1000 foot intervals at a minimum velocity of 2.5 feet per second until the water runs clear. Sufficient chlorine should be applied for 25 ppm chlorine residual and allowed to remain in the water main for 24 hours. The chlorine residual shall not drop below 10 ppm after 24hrs. Samples shall be taken from corporation stops only or location approved by the Owner or its authorized agent. If mains dead end at hydrants, with no adjacent valve the Contractor shall install an additional corporation stop for sampling.
 - D. Bacteriological Water Samples: Shall be collected by the Contractor, in the presence of an authorized Municipal Employee or its authorized agent and in accordance with ANSI/AWWA C651 Disinfecting Water Mains. Each test shall consist of one set of two samples per site. Two successive safe tests taken 24 hours apart are required; analysis shall be made by a State approved laboratory. Chlorine residuals are required to be tested with each bacteriological sample and must indicate less than 0.5 ppm or system residual to allow for a bacteriological test.
 - E. Failing Tests: In the event of an unsafe test, all procedures described in Section 6 Disinfection Requirements shall be repeated. The Contractor shall be responsible for the tests and shall be liable for any costs when more than one treatment or set of tests is necessary.
- d. Measurement and Payment.

Water Main, _____, ___ inch, Tr Det _____	Foot
Additional Water Main Fittings, Not Shown on Plans.....	Pound
Connect to Existing Water Main, ___ inch.....	Each
Water Main, Cut/Cap, ___ inch.....	Each
Valve and Valve Box, ___ inch.....	Each
Tapping Sleeve, ___ inch by ___ inch.....	Each
Valve, Rem.....	Each
Valve, Abn.....	Each

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Fire Hydrant Assembly.....	Each
Hydrant, Rem.....	Each
Water Service, ___ inch.....	Foot
Connect to Existing Water Service.....	Each

Water Main of the type, size and trench detail specified will be measured in place, by length in feet, along the centerline of the pipe, with no deductions for valves or fittings. Payment for **Water Main** will include furnishing all labor, equipment and materials required to perform the work as shown on the plans and specified herein, include fittings, gaskets, polyethylene enhancement bracing or sheeting, blocking, flushing and chlorinating, hydrostatic testing and all miscellaneous items. Payment for all labor, equipment and materials necessary to remedy an unsatisfactory hydrostatic test, including locating and repairing defect, and removing and replacing any backfill, will be included in the contract unit price for **Water Main**.

Dewatering operations (trench and/or pipe) for water main installation will not be paid for separately, but will be included in the contract unit price for **Water Main**.

The cost of excavation, disposal of excess material, and furnishing, placing and compacting backfill will be included in the contract unit price for **Water Main**.

Removal or abandonment of the existing water main as required to provide clearance to construct the proposed water main will be included in the contract unit price for **Water Main**.

Additional Water Main Fittings, Not Shown on Plans will be measured on a per pound basis. Payment for **Additional Water Main Fittings, Not Shown on Plans** will include furnishing all labor, equipment and materials required to install the fittings and thrust blocks/joint restraint. Payment for **Additional Water Main Fittings, Not Shown on Plans** will only be made when installation of additional fittings is required to accommodate changes in the plans, as required by the Engineer.

Connect to Existing Water Main of the size specified will be measured by each. Payment for **Connect to Existing Water Main** will include furnishing all labor, equipment and materials required to complete the connection, including fittings, cutting/capping the existing water main and installing thrust blocks/joint restraint.

Water main, Cut/Cap of the size specified will be measured by each. Payment for **Water Main, Cut/Cap** will include furnishing all labor, equipment and materials required to cut/cap the existing water main and install thrust blocks/joint restraint.

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Water Main, Rem will be measured by length in feet along the centerline of the pipe. Payment for **Water Main, Rem** will include furnishing all labor, equipment and materials required to remove and dispose of the water main, including excavation and backfill. Water main, which is located within the influence of the proposed water mains or sewers and is scheduled for removal, will not be paid for as **Water Main, Rem**; rather, the cost for removal of this main will be included with other water main or sewer items.

Valve and Valve Box of the size specified will be measured by each. Payment for **Valve and Valve Box** will include furnishing labor, equipment and materials required to install the valve and valve box complete and ready to use.

Tapping Sleeve of the size specified will be measured by each. Payment for **Tapping Sleeve** will include furnishing all labor, equipment and materials required to install the tapping valve ready to use. Tapping sleeves, valves and valve boxes, if used at the Contractor's option to expedite connecting to an existing water main, will be included in the contract unit price for **Water Main**.

Valve, Rem will be measured by each. Payment for **Valve, Rem** will include furnishing all labor, equipment and materials required to remove the valve and valve box or manhole, and backfill with suitable material.

Valve, Abn will be measured by each. Payment for **Valve, Abn** will include furnishing all labor, equipment and materials required to close the valve, remove the box or valve manhole, and backfill with suitable material.

Fire Hydrant Assembly of the size specified will be measured by each. Payment for **Fire Hydrant Assembly** will include furnishing all labor, equipment and materials required to install the hydrant assembly, the 6-inch auxiliary gate valve and valve box, and 15 feet of 6-inch pipe between the tee and hydrant complete and ready for use. Payment for hydrant leads in excess of 15 feet will be in accordance with the **Water Main** pay item. Hydrant extensions required to maintain proper depth of cover over the hydrant lead and height of the hydrant above grade are the responsibility of the Contractor. No separate payment will be made for hydrant extensions.

Hydrant, Rem will be measured by each. Payment for **Hydrant, Rem** will include furnishing labor, equipment and materials required to remove the hydrant assembly, auxiliary gate valve and valve box, cut/cap the opening in the existing water main left by the removal of the hydrant, and backfill with suitable material.

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Water Service of the size specified will be measured in place, by length in feet, along the centerline of the pipe. Payment for **Water Service** will include furnishing labor, equipment and materials required to perform the work as shown on the plans and specified herein, including the corporation stop.

Connect to Existing Water Service of the size specified will be measured by each. Payment for **Connect to Existing Water Service** will include furnishing labor, equipment and materials required to complete the connection, including the curb valve and curb box and cutting/capping the existing water service.