

SECTION 02660

WATER DISTRIBUTION

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water Main Construction

1.2 RELATED SECTIONS

- A. Section 02211 - Rough Grading: Top soil removal.
- B. Section 02223 - Backfilling: Fill material.
- C. Section 02225 - Trenching: Excavation and backfilling.
- D. Section 02755 – Horizontal Directional Drilling (HDD)

1.3 REFERENCES

- A. ANSI/AWWA C151/A21.51 Ductile-Iron Pipe, Centrifugally Cast, for Water
- B. ANSI/AWWA C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
- C. ANSI/AWWA C105/A21.5 Polyethylene Encasement for Ductile-Iron Pipe Systems.
- D. ANSI/AWWA C111/A21.11 Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- E. ANSI/AWWA C153/A21.53 Ductile-Iron Compact Fittings.
- F. ANSI B16.1 Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
- G. ANSI/AWWA C509 Resilient- Seated Gate Valves for Water Supply Service
- H. ANSI/AWWA C502 Dry-Barrel Fire Hydrants
- I. ASTM B88 Standard Specification for Seamless Copper Water Tube
- J. ANSI/AWWA C600 Installation of Ductile-Iron Water Mains and their Appurtenances
- K. ANSI/AWWA C651 Disinfecting Water Mains
- L. ANSI/AWWA C800 Underground Service Line Valves & Fittings
- M. NSF/ANSI 14: Plastic Piping System Components and Related Materials
- N. NSF/ANSI 61: Drinking Water System Components – Health Effects
- O. NSF/ANSI 372: Drinking Water System Components – Lead Content
- P. Michigan Department of Transportation Standard Plan R-83 (Series), Utility Trenches.

1.4 GENERAL

- A. The work of performed under Water Distribution shall consist of furnishing all labor, equipment, and materials, unless otherwise stated, required for open-cut the installation of water mains and appurtenances as shown on the plans and specified herein, including disinfection and testing. Construction and testing shall meet the current ANSI/AWWA, NSF/ANSI, and ASTM standards.
- B. Water main disinfection shall be in compliance with ANSI/AWWA C651.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01300 - Submittals.
- B. Submit shop drawings and product data for all items to be installed and/or constructed within this Section.
- C. Product data shall include data on pipe materials, pipefittings, and accessories. Provide manufacturer's catalog information.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 01700 - Contract Closeout.
- B. Record actual locations of valves.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 01700 - Contract Closeout.
- B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.8 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Pipe: Marked according to ANSI/AWWA 151/A21.51 and NSF Standards.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.
- B. Contractor/Installer: Company specializing in performing the work of this Section with minimum five years experience.

1.10 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with Charter Township of Lansing West Side Water Supply System standards.
- B. Brass fittings shall comply with the Safe Drinking Water Act, as amended, and the U.S. Environmental Protection Agency (EPA).

1.11 CONTROL OF VALVES AND HYDRANTS

- A. Coordinate the shutdown of the water main with Charter Township of Lansing West Side Water Supply System.
- B. Possess in tool inventory, the proper valve and hydrant wrenches.
- C. Use of pipe wrench, monkey wrench, or open-end type wrench is prohibited on valves and hydrants.
- D. Only operate valves in case of emergency. All other times, valves shall only be operated by Charter Township of Lansing West Side Water Supply System personnel.

2. PART 2 PRODUCTS

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.

2.1 WATER MAIN

- A. 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.
 - 1. Class and Size: Pipe wall thickness shall be minimum Pressure Class 350, unless otherwise noted on the plans.
 - 2. Pipe Markings: All pipes delivered to the job site shall bear the marks required by ANSI/AWWA C151/A21.51.
 - 3. Exterior Coating: Shall be bituminous, 1 mil thick.
 - 4. Cement-Mortar Lining: Shall be in accordance with ANSI/AWWA C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 - 5. Polyethylene Encasement: Shall be in accordance with ANSI/AWWA C105/A21.5 Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - 6. 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.
 - 7. 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.
 - 8. Electrical Continuity: Shall be bronze wedges or continuity straps.

2.2 VALVES AND VALVE BOXES

- A. Contractor shall verify the acceptability of the following materials with the Owner prior to submittal of shop drawings and materials lists to the Engineer.
 - 1. General Requirements
 - a. Working Pressure: 150 psi minimum.
 - b. 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.

- c. Direction of Opening: Counterclockwise.
2. Resilient Seated Gate Valves: Shall be in accordance with ANSI/AWWA C509 Resilient- Seated Gate Valves for Water Supply Service and the following:
 - a. Body Construction: ASTM A126 Class B, cast iron.
 - b. Operator: Hex nut, unless otherwise noted on the plans or in the valve schedule. Stainless Steel stem and assembly hardware.
 - c. Manufacturer: Waterous 500 Resilient Wedge; Mueller A-2370-20, or approved equal.
3. Valve Boxes: Cast iron, screw type, three piece; cover shall be marked "Water".
 - a. Tyler 6860 Series with No. 6 base; Bingham Taylor Size D, or approved equal.

2.3 HYDRANTS

- A. 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.
 1. Type and Size: Breakaway traffic flange; 6 inch main valve seat.
 2. Connections: Two 2 ½ inch hose connections and one 4 ½ inch Storz fitting pumper connection; National Standard threads, 4 threads per inch.
 3. Direction of Opening: Counterclockwise.
 4. Operating Nut: 1 ½ inch pentagon.
 5. Manufacturer: Waterous WB 67, or approved equal.

2.4 SERVICE LEAD PIPE, CORPORATION STOP, CURB STOP, VALVE AND CURB BOX

- A. Brass components that are designed to be in contact with potable water must comply with ANSI/AWWA C800 and have a maximum lead content of .25% by weight.
- B. Contractor shall verify the acceptability of the following materials with the Owner prior to submittal of shop drawings and materials lists to the Engineer.
 1. Service Lead Pipe: ASTM B88 type K annealed seamless copper water tube unless otherwise noted on the plans.
 2. Corporation Stop: Ford FB1000-Q; Mueller B-25008; A.Y. McDonald 4701b-22-T, or approved equal.
 3. Curb Valve: Ford B44-33-MQ; Mueller B-25115; A.Y. McDonald 6104-22, or approved equal.
 4. Curb Box: Mueller H10300; A.Y. McDonald 5615, or approved equal.

2.5 MISCELLANEOUS FITTINGS

- A. Contractor to verify existing pipe material and dimensions prior to making connections.
 1. Couplings and reducer couplings for connection to cast iron pipe are to be specifically made for such purpose, Romac 501/RC501, or approved equal, fusion bonded epoxy coating (12 mil minimum thickness).
 2. Mechanical Joint Restraints: Mechanical joint restraints are to be fusion bonded epoxy coated and selected based on appropriateness of pipe material and size meeting the following criteria.
 - a. PVC pipe to DIP MJ Fitting: 2000PV Megalug by EBAA Iron, Inc.,

- or approved equal.
- b. DIP to DIP MJ Fitting: 1100 Megalug by EBAA Iron, Inc., or approved equal.

3. PART 3 EXECUTION

3.1 WATER SYSTEM INSTALLATION

- A. 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.
1. 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 5.50 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 storm or sanitary sewer.
 2. 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.
 3. 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.
 4. Pipe Bedding and Backfill: Shall be in accordance with the Michigan Department of Transportation Standard Plan R-83 (Series), Utility Trenches.
 5. 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 tape.
 6. Electrical Continuity: Shall be provided for all underground pipe unless otherwise noted on the plans.
 7. Do not disturb existing mains except at tie-in locations noted on the plans. Coordinate with the Owner for operating valves to isolate the existing water main tie-in point. Coordinate with the Owner on scheduling the tie-in at times of low demand and minimize the interruption of service time.
 8. Abandon old water main in place by blocking ends with concrete.
 9. 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-(PE ENCASED) 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"	14	14	7	3	35	--	--
6"	33	22	11	5	53	--	--
8"	51	30	14	7	71	31	70
12"	85	43	21	10	105	32	104
16"	116	56	27	13	136	32	135
20"	145	68	33	16	164	31	164
24"	172	79	38	19	191	58	190
30"	209	94	45	22	228	82	228
36"	242	108	52	26	261	80	261

Based Upon: Internal Pressure: 180 psi
 Pipe Depth: 5.50'
 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.

- 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.
- Thrust Blocks: Shall be constructed of Grade S2, 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"	2,300	3,200	1,800	900	500
6"	5,100	7,200	3,900	2,000	1000
8"	9,100	12,800	7,000	3,600	1,800
10"	14,200	20,000	10,900	5,600	2,800
12"	20,400	28,800	15,600	8,000	4,000
14"	27,800	39,200	21,300	10,900	5,500

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

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

- 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.
- 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.

3.2 VALVE AND VALVE BOX INSTALLATION

- A. 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.

3.3 HYDRANT INSTALLATION

- A. Hydrant installation shall be in accordance with ANSI/AWWA C502 Dry-Barrel Fire Hydrants and the detail shown on the plans.
1. Depth of Cover: Hydrant leads shall be installed to provide a minimum depth of cover of 5 feet, including crossing through ditch sections.
 2. Hydrant Drain Ports: Shall remain unplugged unless otherwise noted on the plans.
 3. Hydrant Thrust Restraint: Shall be restrained from the main line to the hydrant by mechanical joints in accordance with plan detail.

3.4 SERVICE LEAD INSTALLATION

- A. General: Open cutting of existing hard surfaced pavement will not be allowed. Service leads are to be installed by guided boring, drilling or jacking; 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 minimum 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.

3.5 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 Hydrostatic Testing requirements of 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 hour 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.
- 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.

3.6 DISINFECTION REQUIRMENTS

- 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 3.0 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.

END OF SECTION