

SECTION 02660

WATER DISTRIBUTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Provide labor and materials to complete the water distribution installations outside of building lines to the building foundation.
 - 1. Water mains and services.
 - 2. Valves and fittings.

1.02 RELATED WORK SPECIFIED IN OTHER DIVISIONS

- A. Section 03300: Cast-In-Place Concrete.

1.03 SUBMITTALS

- A. Submit manufacturer's product literature and Shop Drawings for approval on all materials in accordance with Division 1 Submittals section.

PART 2 PRODUCTS

2.01 GENERAL

- A. Materials and installation shall meet the requirements of the Portland Water District. Coordinate work within City right-of-way with the Water District, Public Works, City Engineering, and MDOT.

2.02 WATER PIPING

- A. Ductile iron pipe (D.I.), class 52 conforming to ANSI 21.51, with push-on single gasket joints. Pipe inside shall have a cement lining of twice the thickness specified in ANSI 21.4 and a double asphalt seal-coat that does not impart taste or odor to the water. Outside of pipe shall be bituminous coated.
- B. Pipe shall be designed for 250 psi working pressure, flat bottom trench without blocks and with compacted backfill, and with five feet of earth cover. Pipe thickness to be as specified in ANSI A21.50.
- C. Domestic service pipe of less than 4" diameter(2" min.) shall be PVC pressure pipe conforming to AWWA C-900, Class 200(SDR 21), rated for water service at 200 psi sustained pressure. Rubber gasket push-on joints. Use transition gaskets for mechanical joint valves.

2.03 VALVES AND FITTINGS

- A. Fittings shall be of ductile iron, cement-lined and seal-coated as described above, asphalt coated outside, with mechanical joints complete with joint accessories, including FM or UL approved ductile iron retainer glands, and shall conform to AWWA Standards C-509. Fittings shall be Class 350 and shall conform to the weights and dimensions shown in the latest edition of the Handbook of Cast Iron Pipe, and shall be furnished complete with all joint accessories.
- B. Mechanical joints on fittings and valves shall be restrained with Grip-Ring or Megalug retainer rings, conforming to ASTM A536-80; or approved equal. Use proper ring type for particular metal or plastic pipes.

- C. Gate valves shall be iron body, "O" ring sealed, bronze mounted, resilient seat gate with 2-inch operating nut and mechanical joint hubs with retainer glands, and shall conform to the latest AWWA Standard Specifications for gate valves. The valve shall be designed for 200 psi working and 400 psi test pressure, shall open right, and shall be equal to Waterors Series 500 or Mueller A 2370.
- D. Tapping valves shall conform to the above specifications for gate valves. Tapping sleeve shall be standard mechanical joint type in accordance with AWWA requirements. The Contractor shall check the dimensions of the pipe on which the tapping sleeve is to be installed prior to ordering the sleeve.
- E. Valve boxes shall be furnished and installed for buried valves, and shall be cast iron, asphalt coated, slide type, adjustable boxes together with cast iron covers. The bell end of the 36" lower section shall in all cases be sufficiently large to fit over the stuffing boxes of the valves. The smallest inside dimension of the shaft shall be not less than 5-1/4 inches. The upper section shall have no bottom flange. Each box, including cover, shall weigh at least 100 pounds. Extensions shall be provided as necessary to bring valve box covers to finish grade. Cover shall have the word "WATER" cast into the top.
- F. Curb stop valve shall be heavy duty brass body with Teflon-coated cast brass ball, conforming to AWWA C-800. Mueller, Ford, or equal.
- G. Service box shall be furnished and installed for buried curb stop valve, and shall be heavy duty cast iron, slide type, adjustable box, together with cast iron cover.

PART 3 EXECUTION

3.01 WATERLINE INSTALLATION

- A. No valves on existing mains shall be operated by the Contractor without permission of the Water District and Owner of the existing main.
- B. Place ductile iron pipe on a stable excavated trench bottom with coupling holes such that the full barrel length of the pipe bears upon the trench bottom; blocking will not be permitted.
- C. The first layer of suitable backfill material shall be brought half-way up the pipe and compacted to 95% maximum density. The next layer shall be brought to 12" above the pipe and compacted to 95% maximum density; and then the remainder of the trench shall be backfilled and compacted as specified. No length of pipe shall be laid until the previous length has had sufficient material tamped about it to firmly secure it in place so as to prevent any movement or disturbance.
- D. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work, except by permission of the Architect.
- E. Plugs or caps shall be furnished and installed where shown and as necessary to adequately test and disinfect the pipeline installed under this contract, and shall be of the same design classification as the pipe to which they are attached. The Contractor shall provide a temporary cap, designed for the purpose to be installed in the pipe opening at the end of each day's work and at any time the work is suspended.
- F. Cutting of iron pipe shall be done using an electrically or pneumatically operated machine. Taper the outside of the cut about 1/8 inch, at an angle of about 30° with the pipe centerline with a coarse file or portable grinder.
- G. Locate and confirm sizes and materials of existing mains, excavate, furnish and install tapping sleeves and valves, make the taps, and backfill the excavation. Provide all materials, including mechanical joint accessories, valve boxes, and other items necessary to make all joints to existing water mains watertight. No valves on existing mains shall be operated by the Contractor without permission of the Water District and Owner of the existing main. The location of the points of connection and the locations of the existing mains are approximate only, and the Contractor shall provide labor, equipment, and material for connections without extra charge. Pay the fees and expenses of the Water District for their assistance as they deem necessary.

- H. Surround water pipe with 6" concrete encasement, reinforced with #6 welded wire fabric, where sanitary sewerline crosses; with a 10 ft. encasement length each side of crossing pipe. Omit encasement if waterline is above sewer by 18-inch clearance.

3.02 INSTALLATION OF VALVES AND FITTINGS

- A. Locate the center of valves 3 feet from the center of tees and crosses. Leave valves closed after installation, and assure ease of operation.
- B. Provide Concrete Thrust Blocking at the Following Pipe Locations:
 - 1. Changes in direction as at tees, bends and crosses.
 - 2. Changes in sizes, as at reducers.
 - 3. Dead ends.
- C. Thrust blocks shall be constructed by placing concrete between the fittings and the undisturbed wall of the trench. A stiff mixture, with no more than a 3-inch slump, shall be used so that the concrete may be easily shaped into the desired form, a wedge with the wide end against the solid wall. Place 4-mil polyethylene sheeting between concrete and fitting to prevent bonding.
- D. Minimum thrust block area against the undisturbed trench wall shall be as shown on the drawing details.
- E. Where a fitting is used to make a vertical bend, anchor the fitting with steel rods to a thrust block braced against undisturbed soil. The thrust block should have enough resistance to withstand upward and outward thrusts at the fitting.

3.03 WATERLINE PRESSURE TEST

- A. Coordinate pressure test and flushing of lines with the Water District. Flush out new lines after the pipe has been laid and back-filled until the water runs clear. Following the initial cleaning, test lines in the presence of the Architect and a representative of the Water District. Tests shall be conducted at a time and in a manner to minimize as much as possible any interference with the operation of the existing water system. The Water District will supply water necessary for testing and placing the lines in service from an existing hydrant. The Contractor shall supply labor and equipment necessary to carry out the tests and chlorination.
- B. The pressure test shall be conducted using a hydrostatic test pressure of not less than 1.5 times the working pressure at the point of testing, or 200 pounds, which ever is greater.
- C. Each valved section of pipe shall be slowly filled with water and air expelled from the pipe. If permanent air vents are not located at high points, Contractor shall install corporation stops at such high points to bleed off air as the line is filled with water.
- D. The specified pressure shall be applied to each section of pipe by means of a pump. The test shall remain stationary at the specified pressure for at least two (2) hours. A pressure test will be deemed satisfactory if the pressure drop is less than 15 pounds over the test period. Cracked or defective pipe, valves or fittings discovered as a result of the test shall be removed and replaced by the Contractor at no additional cost to the Owner, and the test repeated until the results obtained are satisfactory to the Water District.

3.04 WATERLINE LEAKAGE TEST

- A. A leakage test shall be conducted after the pressure test has been satisfactorily completed, or may be conducted concurrently with the pressure test.
- B. The Contractor shall furnish labor and equipment and perform the leakage tests in the presence of the Architect and a Water District Representative.
- C. The section of line to be tested shall be filled with water and the entrained air within the line removed and pumped to the test pressure as stated above. The line shall be maintained under this pressure (+5 psi) for a continuous period of two hours by pumping water into the lines at frequent intervals.

D. The volume of water so added shall be measured and considered to represent the leakage from the line under test during the interval. Contractor shall provide a 5/8-inch water meter around a closed valve to measure the amount of water pumped into the line.

E. The leakage in gallons per hour under the conditions of test shall not exceed the length in feet times the nominal diameter in inches times the square root of pressure in psi divided by 133,200, as represented in the following chart:

ALLOWABLE LEAKAGE PER 1000 FT. (305 M) OF PIPELINE - RPHT - GAL./HOUR NOMINAL PIPE DIAMETER - IN.								
Avg. Test Press. psi (bar)	3	4	6	8	10	12	14	16
450 (31)	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55
400 (28)	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40
350 (24)	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25
300 (21)	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08
275 (19)	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99
250 (17)	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90
225 (16)	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80
200 (14)	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70
175 (12)	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59
150 (10)	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47
125 (9)	0.25	0.35	0.50	0.67	0.84	1.01	1.18	1.34
100 (7)	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20
Avg. Test Press. psi (bar)	18	20	24	30	34	42	48	54
450 (31)	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400 (28)	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350 (24)	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300 (21)	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275 (19)	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72

250 (17)	2.14	2.37	2.85	3.46	4.27	4.99	5.70	6.41
225 (16)	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200 (14)	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175 (12)	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150 (10)	1.66	1.84	2.21	2.76	3.31	3.46	4.41	4.97
125 (9)	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100 (7)	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

1. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal./hr./inch of nominal valve size shall be allowed.
2. When hydrants are in the test section, the test shall be made against the closed hydrant.

F. In the event the leakage exceeds the specified amount, the joints in the line shall be carefully inspected for leaks and repaired where necessary. Pipes, fittings, or special castings found to be defective shall be removed and replaced by new pieces by the Contractor. After this work has been done, the test shall be repeated.

3.05 WATERLINE FLUSHING AND CHLORINATION

- A. Coordinate flushing and chlorination with the Water District. Flush out new lines until the water runs clear. This shall be done before disinfection.
- B. Disinfect the pipe lines with chlorine applied either as a gas from cylinders or by introduction of a hypochlorite solution. Calcium hypochlorite in commercial grades contains about 65% to 70% of free chlorine. Should the hypochlorite method be used, then the chlorite powder shall be made into a paste, then thinned with water to about 7.50 gallons to each pound of powder, allowance made for the solids from the powder allowed to settle out and then the solution applied to the main through a rubber hose by gravity, siphonage or a suitable injection pump.
- C. The point of application of the chlorinating agent shall be at the beginning of the pipe line extensions or at any valved section thereof, either point being through a corporation cock inserted in the top of the newly laid pipe. If a hypochlorite solution is used, a spring-loaded injection valves is required.
- D. The water line system shall then be slowly filled with water. The chlorine residual in the water main shall be at least 50 ppm after filling, and after 24 hours shall be at least 20 ppm. Care shall be taken such that no chlorine-treated water may flow back into the line supplying the required water for filling the system.
- E. After the treated water has been allowed to stand in the system at least 24 hours, the lines shall be thoroughly flushed until all the chlorine-dosed water is removed.
- F. Bacteriological water samples shall be collected from the end-most outlet of the treated pipe line on each of two consecutive days. If at the end of this period, the samples show safe results, the new line may be placed in service. If the results are unsafe, the chlorine treatment shall be repeated until the samples show safe results. Bacteriological samples shall be submitted to the State Health Department for testing.
- G. Following chlorination, all treated water shall be thoroughly flushed from all construction, and upon testing be proven free from impurities and chlorine as required by the State Health Department.

END OF SECTION