# SECTION 33 14 00
# WATER DISTRIBUTION SYSTEM

## PART 1 - GENERAL

### 1.01 DESCRIPTION

A. This section specifies providing water mains.

B. Related Work Specified Elsewhere
   1. Grading, excavating and backfilling: Section 31 23 00.
   2. Utility Company - Maintenance, support and restoration of utility facilities.

### 1.02 SUBMITTALS:

Submit the following for approval in accordance with the General Requirements and with the additional requirements as specified for each:

A. Certification:
   1. Proof that the water sampling and testing laboratory satisfies the requirements of the American Council of Independent Laboratories' Recommended Requirements for Independent Laboratory Qualification. Laboratory need not be a member of the American Council of Independent Laboratories
   2. Proof that the independent laboratory is approved by the EPA or jurisdictional health authority.
   3. Certified results of the specified Post-Sterilization Water Test.

### 1.03 QUALITY ASSURANCE:

A. Codes, Regulations, Reference Standards and Specifications:
   1. Comply with codes and regulations of the jurisdictional authorities.
   2. AASHTO: M36, M153.
   3. ASTM: A36, A48, C33, C76.
   4. ANSI/AWWA: C151, C200.
   5. EPA: National Primary Drinking Water Standards.

B. Allowable Tolerances:
   1. Leakage not to exceed figures given in Table 33 14 00-1.
   2. Lead concentration in specified water samples less than 15 micrograms per liter of water, and water quality meets the requirements of EPA National Primary Drinking Water Standards.

C. Testing Laboratory:
   1. Furnish services of an EPA-certified or jurisdictional health agency-certified independent laboratory for sampling and testing water quality. Employment of an independent laboratory does not relieve Contractor of the obligation to perform work in accordance with Contract requirements.

**1.04 PRODUCT DELIVERY, STORAGE AND HANDLING:**

A. Upon approval of bill of materials, pick up material at designated storage facility and transport to job site.

B. To reduce handling to a minimum, coordinate pipe delivery with installation.

C. Distribute pipe along line of work and outside trench as near as practicable to point of placement. Do not deposit material on or against pipe.

D. Arrange and install skids and wedges to prevent damage to pipe. Do not roll or drag pipe.

E. Avoid damage to coating and lining; use handling equipment designed for the purpose. Where approved, pipe may be handled by hand.

F. When pipe installation is not actually in progress, place watertight caps or plugs on open pipe ends.

**PART 2 - PRODUCTS**

**2.01 MATERIALS:**

A. Aggregate for Subgrade Foundation: ASTM C33, coarse aggregate No. 4 or where directed No. 4 and No. 67 in combination and proportions to suit field conditions.

B. Aggregate for Fire Hydrant Dry Wells: ASTM C33, coarse aggregate, No. 67.

C. Ductile Iron Pipe:
   1. ANSI/AWWA C151/A21.51.With standard cement-mortar lining with bituminous seal coat conforming to ANSI/AWWA C104/A21.4.
   2. Furnished in uniform standard lengths. Short pipe lengths and fittings are permitted where line, grade and closure requirements necessitate.

D. Joints:
   1. ANSI/AWWA C151/A21.11.
   2. Where shown as DILM, use mechanical joint ductile iron pipe. Where shown as DILS, use push-on joint. Unless otherwise shown, ductile iron pipe joints may be either mechanical joints or push-on joints.

E. Fittings:
   1. ANSI/AWWA C110/A21.10 as modified.
   2. Suitable for use with ductile-iron pipe; designed for 250 psi working pressure.
   3. Furnished with coating and lining as for ductile iron pipe, with mechanical joint, except that offsets will have one plain spigot end.

F. Gasket Lubricant: For mechanical joints: Approved vegetable oil soap. For push-on joints: Approved gasket lubricant supplied by the pipe manufacturer and conforming to ANSI/AWWA C111/A21.11.

G. Concrete: Section 03 30 00, Class 3500.

H. Reinforcing Steel and Welded Steel Wire Fabric: Section 03 20 00.

I. Precast Concrete Elements: Section 03 40 00, Class 4000, air-entrained concrete.

J. Steps: ASTM A48, Class 30.

K. Manhole Frame and Cover; And Other Castings For Service With Utility Systems:
   1. Authority manhole: Cast-iron, ASTM A48, Class 30, with METRO logo.
   2. Utility company manhole: Manhole frame and cover furnished as part of the Contract or furnished by the utility as shown on the drawings.
   3. Rust-resistant cast iron or rust-resistant malleable cast iron.
   4. True to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blowholes and defects affecting strength.
   5. Fillets at angles in casting with arises sharp and perfect.
   6. Sandblasted to effectively remove scale and sand, presenting smooth, clean and uniform surfaces. Coated with bituminous coating.
   7. Metro logo: For utility components which will remain METRO property and are not within boundaries of utility easements as shown: Cast METRO logo as shown.
   8. Covers that receive paver tile:
      a. Omit bituminous coating.
      b. Provide positioning lug and lug receptor as a permanent part of the cover and frame rim so that the cover can only be installed (flush) in one position

L. Piling for Thrust Blocks and Steel for Structural Use: ASTM A36.

M. Resilient Material at Pipe Penetrations: AASHTO M153, Type II.

N. Vitrified Clay Pipe: Section 33 23 00.

O. Backfill: Section 31 23 00.

P. Valves: In accordance with requirements of the operating agency.

Q. Yard Hydrant: Cast-iron box with lid, freeze proof valve with removable handle and threaded hose connection, hose bib size 2-1/2 inches, service pipe size as shown, Josam Series 71600 or equal.

R. Bituminous Coating: ANSI/AWWA C151.

S. Casing pipe:
   1. Reinforced concrete: ASTM C76, Class IV.
   2. Corrugated metal: AASHTO M36, 8-gauge, galvanized, asphalt coated.
   3. Seamless steel: Black, welded, mill type, ANSI/AWWA C200.

T. Copper Tubing: ASTM B88, Class I, Type K, hard-drawn.

U. Oak Chock: Undressed, clear, four inches wide by 18 inches long, height variable, with recessed groove, 1-1/16 inches by 1/4-inch deep, centered across four-inch dimension.

V. Metal Band: Steel, one inch by 0.035 inch.

## PART 3 - EXECUTION

### 3.01 MAINTAINING WATER SERVICES:

A. Maintain water service: In furtherance of this requirement, conduct operations at times selected to minimize duration and inconvenience of service interruption.

B. At least 24 hours prior to cutting or abandoning an existing water main, notify the Engineer and operations division of operating agency and obtain approval of schedule for performance of work.

C. Keep existing water mains parallel to new water mains in service until new water mains are ready for service.

D. Where existing water main must be cut for connection to new water main, provide necessary facilities and prosecute work on 24-hour basis.

E. Water valves in service will only be operated by personnel of the agency owning main.

### 3.02 EXCAVATION:

A. Perform excavation to line and grade in accordance with Section 31 23 00 with the following additional requirements:

1. Excavate test pits sufficiently in advance of construction so that reasonable changes in line and grade can be made where the location of existing structures varies from that shown.
2. Excavate below horizontal plane extending two feet above top of water main structure to such width that construction may be properly performed, but not less than six inches nor more than nine inches from outside of proposed structure.
3. Excavation above such plane may exceed specified dimensions where approved.
4. If excavation exceeds permissible dimensions, install pipe of higher strength as directed.
5. Unless otherwise shown, install pipe in excavated trenches. Trench to have such depth that there will be at least two feet of trench of required width above top of pipe.
6. Where necessary to place backfill or embankment so that trench can be excavated, extend and compact backfill or embankment to full depth and laterally at least 2-1/2 times diameter of pipe on each side measured from centerline of pipe.

### 3.03 SUBGRADE:

A. Prepare subgrade so that pipe will rest solidly throughout its length. Excavate recesses to accommodate joints and fittings.

### 3.04 BACKFILL:

A. Backfill excavation upon completion of construction in accordance with Section 31 23 00.

B. Perform backfilling after inspection and approval of pipe laying.

### 3.05 LAYING PIPES:

A. Take proper measures to keep pipe clean. Immediately prior to placing, clean inside and ends of outside surfaces of pipe. Keep interior surfaces clean throughout construction.

B. Prior to placing pipe in trench, have interior and exterior inspected. Where there is damage that the Engineer determines repairable, make repairs as directed. Replace pipe damaged beyond acceptable repair.

C. Complete excavation and placing of subgrade before pipe is placed. Place pipe solidly true to line and grade shown. Do not subject pipe to blows or shocks to achieve solid bedding or proper line and grade.

D. Make change in line with fittings. Do not spring joints to effect change of direction.

E. Do not field cut pipe unless necessary. Make such necessary cuts by means of equipment designed for purpose, ensuring smooth square end.

F. For connection to existing pipe, provide pipe with suitable ends or adaptors, after verification of size and type of existing pipe.

G. For railroad and highway crossings, lay casing and water mains as shown.

H. Place oak chocks as shown, fasten metal band to chocks as approved. Space chock arrangements on water mains at six feet zero inches on center.

I. After water main is in place, fill void between main and casing with sand.

J. Close ends of casing pipe with brick masonry enclosure as approved.

**3.06 ASSEMBLING MECHANICAL JOINTS:**

A. Assemble mechanical joints to provide tight, flexible joints that safely permit expansion, contraction and ground movement.

B. Prior to assembling mechanical joints, wire brush surfaces of pipe sections in contact with gasket so that surfaces are clean, smooth and free of rust and other foreign substances. Clean and lubricate contact surfaces with vegetable oil.

1. Assemble mechanical joints in accordance with ANSI/AWWA C111/ A21.11.
2. Furnish to the Engineer calibrated torque wrenches in sufficient number to permit complete inspection of work. Provide satisfactory means of recalibration.
3. If satisfactory seating of joint is not obtained at maximum permissible torque, disassemble joint, reclean and reassemble with new gasket.

**3.07 ASSEMBLING PUSH-ON JOINTS:**

A. Assemble push-on joints to provide tight, flexible joints that safely permit expansion, contraction and ground movement.

B. Assemble joints using lubricant in accordance with recommendations by pipe manufacturer.

C. File or grind spigot of field-cut pipe lengths to resemble manufactured pipe so that spigot end will slip into socket without hindrance or gasket damage.

D. Place identifying mark on pipe not bearing depth mark on spigot to show depth of socket.

**3.08 VALVES:**

A. Install valves in accordance with recommendations of the valve manufacturer.

B. Where valves are provided by operating agency, provide suitable access for performance of work.

C. Where necessary, alter typical valve manhole to suit actual conditions.

**3.09 SUCTION OUTLETS:**

A. Construct suction outlets where shown.

B. Provide necessary materials not furnished by operating agency to complete installation.

**3.10 DEAD-END BLOWOFFS:**

A. Provide tapped and drilled caps for dead-end blowoffs where shown.

B. Complete construction of dead-end blowoffs. Provide materials not furnished by operating agency but necessary to complete installation.

**3.11 FIRE HYDRANTS:**

A. Construct fire hydrant installations as shown.

B. Provide necessary materials not furnished by operating agency to complete installation.

**3.12 THRUST BLOCKS AND HARNESSING:**

A. Make provision for counteracting thrust caused by static and dynamic forces including water hammer at bends, tees, reducers, valves and dead-ends by installing ductile iron retainer glands with mechanical joints. For other methods submit details for approval prior to use.

B. Install concrete thrust blocks as shown where harnessing is not practicable.

C. Where shown provide piles and reinforcing steel in concrete thrust blocks. Install piles for thrust blocks to bearing of 15 tons.

**3.13 CAST-IN-PLACE CONCRETE CONSTRUCTION:**

A. Conform to applicable requirements of Sections 03 10 00, 03 20 00 and 03 30 00.

**3.14 PRECAST CONCRETE CONSTRUCTION:**

A. When installing precast sections, prevent damage to seals and sealants.

**3.15 NOT USED**

**3.16 WATER SERVICE CONNECTIONS:**

A. Construct water mains and water service connections in accordance with the codes and regulations of the jurisdictional agency.

B. Pay the required by the jurisdictional agency, except the water availability charge, which will be paid by the Authority.

C. Pay the water consumption charges until the time of final substantial completion for this Contract.

**3.17 TUNNELING AND JACKING:**

A. Perform tunneling and jacking as approved.

B. Where open cut is specified and the Engineer permits work to be done by tunneling or jacking, perform such work as specified and as approved.

C. Make horizontal borings for laying pipe lines true to line and grade.

D. Where pipes are laid in borings, completely fill void between pipe and the boring with sand, using water pressure to ensure that voids are filled.

E. Methods of boring and filling of voids between pipe and boring and subject to approval.

**3.18 BONDING AND CATHODIC PROTECTION:**

A. Bond ferrous pipe in accordance with Section 16060.

B. Where cathodic protection of piping system is shown, apply coal-tar epoxy coating and test as specified.

**3.19 FIELD QUALITY CONTROL:**

A. Notice of Testing:
   1. Give two days notice of intention of testing to operating agency which will furnish, install and operate pumps, gauges, meters and individual pipe connections to test openings.
   2. Designate largest sections feasible for testing and sterilizing. One testing and sterilizing operation will be performed at no expense to the Contractor; the cost of subsequent testing and sterilizing, if necessary, will be borne by the Contractor.

B. Tests:
   1. General requirements:
      a. Prior to coating and backfilling, isolate system by use of approved valves, caps and plugs or other means.
      b. Maintain such isolation throughout performance of leakage and pressure testing.
      c. Where valves are used for isolation, eliminate leakage through such valves if it occurs. Maintain new work isolated from existing water mains, except for test connections, until testing and sterilization have been completed.
   2. Leakage test:
      a. For leakage tests, provide approved caps and plugs in sections to be tested and remove them after testing.
      b. Prevent leakage in pipes and fittings at openings.
      c. Block temporarily plugged and capped ends to prevent displacement.
      d. Install water source connection for testing isolated section; the Engineer may permit the use of tap which will be furnished and installed by operating agency. *9

e. Perform work and furnish materials incidental to leakage testing, including excavation for installation and removal of pumps, gauges, meters and water source connections. Operating agency will apply 125-psig test-pressure section under test for 24 hours minimum. *9

f. Where leakage exceeds the amount specified in Table 33 14 00-1, perform necessary corrective measures.

g. Pressure test:

3. After completion of leakage test, remove temporary caps and plugs and connect new water main into system. With new work valved off or otherwise isolated from system by approved means, assist with pressure test.

4. Operating agency will apply 175-psig test-pressure to section under test for one-hour minimum. *9

5. Take corrective measures necessary to provide system free of leaks.Remove and replace defective pipes, jointings, fittings, valves and other appurtenances. Reset such items, if displaced.

**3.20 STERILIZING:**

A. Operating agency will sterilize work during leakage test. *9

B. Provide access to opening used for sterilizing.

C. Provide Post-Sterilization Water Sampling and Testing Services: Have EPA-approved or jurisdictional health authority-certified laboratory sample and test water, and submit certified test results that water quality and lead concentration in samples meet EPA standards.

**3.21 COMPLETION:**

A. NOT USED

B. Bond ferrous pipe.

C. Have EPA-approved or jurisdictional health authority-certified laboratory sample and final proof-test water, and submit certified test results that water quality and lead concentration in samples meet EPA standards.

TABLE 33 14 00-1

MAXIMUM ALLOWABLE LEAKAGE IN CUBIC FEET PER 24 HOURS PER JOINT

| Test Pres-sure | Nominal Pipe Size | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| psi | 6" | 8" | 12" | 16" | 20" | 24" | 30" | 36" | 48" | 60" | 66" | 72" |
| 100 | .052 | .069 | .104 | .139 | .173 | .208 | .260 | .312 | .416 | .520 | .572 | .624 |
| 110 | .054 | .073 | .109 | .145 | .181 | .217 | .272 | .326 | .435 | .544 | .598 | .652 |
| 120 | .057 | .076 | .114 | .152 | .190 | .228 | .285 | .342 | .456 | .570 | .627 | .684 |
| 130 | .059 | .079 | .119 | .158 | .197 | .237 | .296 | .356 | .474 | .593 | .652 | .711 |
| 140 | .062 | .082 | .123 | .164 | .205 | .246 | .308 | .369 | .492 | .615 | .677 | .738 |
| 150 | .064 | .085 | .127 | .170 | .212 | .255 | .318 | .382 | .509 | .637 | .701 | .764 |
| 160 | .066 | .088 | .132 | .175 | .219 | .263 | .329 | .395 | .526 | .658 | .724 | .789 |
| 170 | .068 | .090 | .136 | .181 | .226 | .271 | .339 | .407 | .542 | .678 | .746 | .814 |
| 180 | .070 | .093 | .140 | .186 | .232 | .279 | .349 | .419 | .558 | .698 | .767 | .837 |
| 190 | .072 | .096 | .143 | .191 | .238 | .287 | .358 | .430 | .573 | .717 | .788 | .860 |
| 200 | .074 | .098 | .147 | .196 | .245 | .294 | .368 | .441 | .588 | .735 | .809 | .882 |
| psi | 6" | 8" | 12" | 16" | 20" | 24" | 30" | 36" | 48" | 60" | 66" | 72" |

Above tabulation is based on leakage at maximum rate of 23.3 gallons per inch of pipe diameter per mile per 24 hours at 150 psi for pipe in 18-foot lengths.

**END OF SECTION**