

## **800 WATER SUPPLY & DISTRIBUTION**

### **ITEM 801 - FURNISHING AND LAYING PIPE AND FITTINGS**

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**801.01 Description.** The Contractor shall provide all work for the furnishing and laying of the various sizes of water mains. This work comprises excavating the trench, furnishing and laying pipe in the trench and jointing it, placement of concrete thrust blocks, back-filling the trench, repairing or replacing head walls, drains, sewer, gas, electric and water connections, and any other structures *or facilities* that may be disturbed or damaged by the Contractor's operations; disposing of surplus excavation; testing; *and any work needed to assist the City's effort in chlorinating the water line*; and all other work required for the furnishing and laying of the pipe lines and connections complete and ready for service as shown on the plans and covered in the specifications. Included is the furnishing and installation of all required fittings including bends, reducers, blow-offs, tees, sleeves, chlorination taps, small diameter branch connections; connections at the ends of mains to other lines or fittings, and special castings required for the installation of the valves, and steel strapping, all as called for on the drawings.

**801.02 Design Criteria.** All pipe shall be designed to meet the following:

1. **Design Specifications.**
  - A. Ductile Iron - AWWA C150
  - B. Concrete - AWWA C301
2. **External Loads.**

- A. Dead Loads: 8 feet (2.4 m) of cover or 2.5 feet (0.8 m) of cover whichever produces greatest load in conjunction with live load.
  - B. Live Loads: AASHTO H-20 truck
3. **Internal Pressure.**
- A. 150 psi (1034 kPa) normal operating pressure
  - B. 100 psi (689 kPa) surge pressure (water hammer)
4. **Factor of Safety.**
- A. 2.0 Minimum
5. **Laying Condition.**
- A. Flat-Bottom trench with bell holes
  - B. No blocks
  - C. Tamped backfill
  - D. Load factor for Concrete pipe shall be 1.2
  - E. Bedding coefficient for Ductile Iron pipe shall be 0.2

**801.03 Ductile Iron Pipe.** Pipe shall be manufactured in accordance with AWWA C151 except as herein modified:

Hardness: Rockwell B-90 maximum

Corrosion Allowance: .08 (2 mm) inches minimum

Wall Thickness and Class as follows:

<b>Size</b>	<b>Wall Thickness</b>	<b>Thickness Class</b>
3 Inches (76 mm)	.31 (7.9 mm)	53
4 Inches (102 mm)	.32 (8.1 mm)	53
6 Inches (152 mm)	.34 (8 mm)	53
8 Inches (203 mm)	.36 (9.1 mm)	53
10 Inches (254 mm)	.38 (9.7 mm)	53

12 Inches (305 mm)	.43 (10.9 mm)	54
16 Inches (406 mm)	.46 (11.7 mm)	54
20 Inches (508 mm)	.48 (12.2 mm)	54
24 Inches (610 mm)	.50 (12.7 mm)	54
30 Inches (762 mm)	.55 (14.0 mm)	54
36 Inches (914 mm)	.63 (16.0 mm)	54
42 Inches (1067 mm)	.71 (18.0 mm)	54
48 Inches (1219 mm)	.79 (20.0 mm)	54

All pipe shall have a bituminous coated cement lining complying with AWWA C104 Specifications and shall have an outside coating of bitumastic enamel or approved equal.

**801.04 Fittings For Use With Ductile Iron Pipe.** Fittings shall be Class 250, manufactured in accordance with AWWA C110. Fittings 24 inches (610 mm) in diameter and larger shall be manufactured of ductile iron. Fittings *48 inches (1220 mm)* and smaller in diameter may be manufactured according to AWWA C-153 Specifications. All fittings shall be provided with ends made in accordance with AWWA C111. *All fittings shall be coated inside and outside with a bituminous coating complying with AWWA C110.*

**801.05 Concrete Pipe and Fittings.** Prestressed concrete pipe and fittings meeting AWWA Specification C301 may be used in sizes 20 inches (508 mm) or larger in diameter. Prior to manufacture of the pipe or fittings the Contractor shall submit design sheets in sufficient detail to enable the Engineer to check the proposed design for conformance to these specifications.

Steel cylinder for fittings shall be designed in conformance to Section 8.6 of AWWA Steel Pipe Manual, M11, (1964) so that allowable deflection of the pipe under combined dead and live loads shall not exceed 2 percent of the internal diameter of the steel cylinder.

Unless otherwise noted waterline plans have been detailed using ductile iron pipe. If concrete pipe is used, the Contractor shall furnish equivalent fittings or a combination of fittings to match those specified or shown. Methods for tying pipe joints, anchorage and special backing shall be submitted to the Engineer for approval before installation.

Bevel pipe, outlet connections on straight pipe, closure pipe assemblies and other accessories required for prestressed concrete cylinder water pipe may not necessarily be called out on the drawings, but shall be furnished as required to satisfactorily install the new water main as shown on the plans. Payment for these piping items shall be included in the unit price bid for *furnishing and laying the concrete pipe and fittings.*

Prior to the start of the work 4 copies of a tabulated layout and laying schedule shall be furnished by the Contractor to the Engineer. The Contractor shall be responsible for the completeness and accuracy of the laying schedule conforming to the construction plans. The

Contractor shall also stock, at the job site, additional bevel adapters and short lengths of pipe to permit field adjustment of the alignment.

Any iron pipe and fittings furnished and installed with concrete pipe and fittings shall conform to Sections 801.03 and 801.04 of these specifications. No separate payment will be made for such iron pipe and fittings as all costs are to be a part of the unit price bid for furnishing and laying the concrete pipe and fittings.

**801.06 Joints.** All ductile iron pipe and cast iron or ductile iron fittings shall be provided with either mechanical joint ends or push-on joint ends. Joints for iron pipe and fitting shall be in accordance with AWWA C111.

Joints for prestressed concrete pipe and fittings shall conform to AWWA Specification C301. Approved restrained joints are permitted on concrete pipe *as a temporary joint restraint. Concrete blocking will be required even if approved restrained joints are used.*

If special joints are to be provided, design and installation details shall be submitted for approval.

Joints shall be furnished with all accessories.

**801.07 Water Lines Appurtenances.** The Contractor shall furnish and install, prior to testing, all fittings, blow offs, air vents and water service taps in the number of sizes shown on the plans, or at locations selected by the Engineer. The connection outlets are designed for attaching valves and other appurtenances as shown on the plans where appurtenances are to be furnished and installed by the Contractor under other items.

The Contractor in connection with the laying of the water main shall furnish and install all valves as shown or as directed by the Engineer. The cost of furnishing and installing valves will be paid for under other items. Such valves will be provided with mechanical joint ends, unless otherwise shown or approved by the Engineer, and the Contractor shall furnish and lay, under this item, any special casting necessary to make the valve installation as shown on the plans. The Contractor shall furnish and lay all closure pieces, special bends and fittings necessary for the constructing of the pipe line, along the route as shown on the plans.

**801.08 Excavation and Pipe Laying.** *The pipe shall be laid according to the proposed horizontal and vertical locations as shown on the plans. Connections to the existing pipe lines shall be made at the locations shown on the plans. If, during the course of the work, unforeseen conditions arise, the horizontal or vertical alignment of the pipe line or location of the connection to the existing pipe may be changed as directed by the Engineer. If the water line grade is not shown on the plans, the water line shall be installed with a minimum of 4 feet (1.2 m) of cover from the existing ground, or the top of the existing or proposed curb grade to the top of the water line, whichever is deeper.*

If it is necessary to change the grade of the water line it shall be lowered unless specific approval to raise the grade is given by the Engineer. In any areas where the water line is to be installed in an embankment area the embankment shall be placed and compacted as required by Section 203.05 prior to the water line trench being excavated.

The cutting and removal of *pavement, curbs, and sidewalk* is *to be* included in *the bid item* for their replacement. The excavation and preparation of the trench and the laying of the pipe shall be done to conform to the applicable parts of the Standard Specifications for Installing Ductile Iron Pipe AWWA C600, or the latest revision thereof, except as herein modified.

*All pipe shall be laid as per the manufacturer's specifications.*

Concrete blocking, supports and/or buttresses shall be provided at all tees, bends and valves and at any other locations shown on the plans or directed by the Engineer. Concrete blocking will be required *even* if approved restrained joints are used. *No separate payment for the blocking, supports and/or buttresses will be made as their cost is to be included in the unit price for furnishing and laying the water pipe and appurtenances.*

These concrete structures shall be built to the lines, grades and dimensions shown on the Standard Detail Drawings, *L-6310, L-6311, L-6312*, or as ordered by the Engineer, and constructed with Class "C" concrete as per Item 499. The cost of temporary timber backers and the cost of excavating to line and grade shown for the supports shall be included in the unit price bid per foot for furnishing and laying the various sizes of pipe and valves.

During any construction where the outside temperature is below 40°F (4°C) rubber gaskets and lubricants shall be kept in a heated area at least 40°F (4°C) until needed. No gasket or lubricant shall be out of the heated area more than 5 minutes before being placed in the bell or on the spigot of the pipe. The Contractor shall lubricate all joints according to the manufacturer's recommendations.

**801.09 Backfill Within Street or Highway Right-of-Way.** Backfilling, cleaning up and maintaining of surfaces shall be done in accordance with the provisions of Section 4.2 of AWWA Specification C600, except as otherwise provided herein.

Unless otherwise shown, specified, or ordered, all backfill shall be either approved material excavated from the trench or granular material meeting the requirements of Section 304.02 or Item 310 Modified.

*Where controlled density fill (CDF) is to be used as a backfill material and to ensure compatibility with ductile iron pipe, a polyethylene encasement shall be required conforming to AWWA C105. In addition to the polyethylene encasement, granular material meeting the requirements of Section 304.02 or Item 310 Modified shall be placed and compacted from the bottom of the trench to 1 foot (0.3 m) above the top of the water*

*line. In all cases where controlled density fill (CDF) is to be used as an alternate backfill material, the approval of the Division of Water is required.*

The backfill under pavement and/or within the influence line shall be compacted the full width of the trench by means of approved mechanical devices to meet the requirements of Section 203.05 of these specifications. The compacted backfill shall extend from the bottom of the trench to the top of the pavement subgrade for trenches within traveled areas, and to within 6 inches (152 mm) of the existing ground in all other areas.

The backfill for a water main parallel to the centerline and within proposed or dedicated rights-of-way, but outside the influence line for support of pavement or berms, shall be compacted to at least the density of the surrounding ground.

The remaining depth of trench within traveled areas shall be backfilled with material specified for pavement replacement. The base and pavement materials shall be placed and compacted as specified under the applicable repaving item. The pavement base shall be struck off at the proper depth to accommodate the specified thickness of temporary or permanent pavement.

The remaining depth of trench outside traveled areas shall be backfilled as specified under the seeding or sodding items.

The Contractor will be required to uniformly wet or dry the backfill as may be necessary to obtain the specified density. No sod, debris, frozen earth, foreign objects or large rocks or stones will be permitted in the backfill. No extra payment will be made for hauling away and disposing of the excavated material, as such payment shall be included in the unit price bid for furnishing and installing the various sizes of valves, water mains and constructing the structures.

Restoration of *pavement*, sidewalks, curb and gutter, temporary pavement and all maintenance of surfaces shall be paid for under other items of the Contract.

**801.10 Backfill Outside Street or Highway Right-of-Way.** Backfill outside the street or highway right-of-way shall conform to the requirements of Section 801.09 above except as herein modified.

In areas outside traveled areas the backfill shall be compacted, *from the bottom of the trench to within 6 inches (152 mm) of the existing ground*, by approved methods to obtain a soil density at least equal to that of the undisturbed soil in the area. The remaining *6 inches (152 mm)* of excavation shall be backfilled *with approved material* without mounding of fill. Up to the time of acceptance of the work the Contractor shall maintain the trenches in good and safe condition.

In traveled areas the backfill shall comply with Section 801.09.

**801.11 Water Main Cleaning and Flushing.** Before a hydrostatic test is applied to any newly constructed water main the main shall be flushed or cleaned and flushed as herein prescribed. During the construction operations, workers shall use care to assure that the interior surfaces of all pipe and fittings are maintained in a sanitary condition. Every effort shall be made to keep loose foreign material out of all pipe and fittings. Exposed open ends of pipe must be temporarily blocked or capped during construction. Particular care shall be taken to protect the main whenever work is temporarily interrupted.

All main sizes 8 inches (203 mm) and smaller shall be flushed through available fire hydrants as directed and witnessed by a designated Division of Water representative. Valving operations may be required to assure that all sections of the main are thoroughly cleaned. Flow rates for adequate flushing velocities shall be 1000 gallons (3785 L) per minute for 6 inch (152 mm) mains and 1600 gallons (6056 L) per minute for 8 inch (203 mm) mains or maximum available flows from the system. Sections of main which cannot be flushed by valving and hydrant operations shall be cleaned as directed by the Engineer.

All mains 12 inches (305 mm) and larger shall be cleaned by passing a properly sized poly pig through the pipe. The poly pig shall have a minimum density of 5 pounds per cubic foot (30 kg per cubicmeter), be coated with a double spiral wrap without wire brushes or scrapping tools. *Acceptable* poly pigs include: Pipeline Pigging Products Model B4, Girard Model RCC, and Knapp Model 1-C *or approved equal*.

The Contractor shall prepare the main for the insertion and removal of the poly pig at points identified by the Engineer as insertion ports, if required, and exit ports. In general, this will consist of providing all material, equipment and labor to insert the poly pig and construct a sanitary exit port. Where practical, the poly pig shall be inserted into the first length of pipe during the initial installation. At the exit port the Contractor shall prevent the backflow of purged water into the main by the temporary installation of mechanical joint bends and pipe joints to provide a riser out of the trench. On larger pipe additional excavation of the trench may serve the same purpose.

Where trench is used, the excavation shall be lined with polyethylene. Pumps and/or ditches shall be provided to prevent contaminated water from reentering the main. After the main is cleaned to the satisfaction of the Division of Water representative, the Contractor shall remove all temporary constructions and complete all work necessary to secure the system prior to backfilling insertion and exit sites. Additional poly pig runs may be required by the Engineer when water purged from the main indicates the presence of excessive dirt or debris.

**801.12 Hydrostatic Tests.** A hydrostatic test as required in Section 5 of the Standard AWWA Specification C600 shall be applied to the mains and fire hydrant leads. *Each valved section of water main shall be tested independently of one another unless otherwise approved by the Engineer. Pressure test shall be conducted with all watch*

*valves open and hydrant foot valves closed.* The pressure during the test shall be maintained at 150 psi (1034 kPa) in any section being tested. The duration of each pressure test shall be at least one hour. The City will furnish gauges for the test, but the Contractor shall furnish all materials, make all taps required and furnish a pump, piping, other equipment and all necessary assistance for conducting the tests.

If there are indications of leaks under this pressure test, the Contractor shall locate them at his cost and expense. Any cracked or defective pipes, fittings, valves, joints, or other appurtenances discovered as a consequence of this pressure test shall be removed and replaced by the Contractor with approved material, at his cost and expense and the test shall be repeated until satisfactory to the Engineer.

A test shall be made to determine the quantity of water lost by leakage under the specified test pressure as provided in Section 5 of the Standard AWWA Specifications above. No pipe installation will be accepted until or unless this leakage (evaluated on a pressure basis of 150 psi (1034 kPa)) is less than *specified per Standard Detail Drawing L-6640.*

Before applying the specified pressure, all air shall be expelled from the pipe. To accomplish this, *air release outlets* shall be *installed* by the Contractor as indicated on the plans, or as required by the Engineer. *Cost for air release outlets shall be paid for under Item 812.*

Should any test of combined sections of pipe laid disclose leakage greater than that specified, or if individual sections show leakage greater than the specified limit, the Contractor shall at his own expense locate and repair the leaks until the leakage is within the specified allowance.

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi (34.5 kPa) of the specified test pressure after the air in the pipe line has been expelled and the pipe has been filled with water.

Any testing performed against existing valves shall be at the Contractor's risk and in strict compliance with the requirements of the Engineer. If unable to achieve the required test the Contractor shall disconnect from the existing valve, plug and re-test until satisfactory results are obtained. Any damage caused to existing facilities shall be repaired at the Contractor's expense.

**801.13 Chlorination of Completed Pipe Line.** After satisfactory hydrostatic testing, the completed pipe will be chlorinated *by the City* in accordance with AWWA C651. The City will furnish the chlorine, pumping equipment necessary to introduce the chlorine into the chlorination tap and one man. All other labor, material and equipment including chlorination taps and blow-off taps will be furnished and paid for by the Contractor. Taps shall include

tapping valves, sufficient tubing or pipe to extend outside the trench and an operable valve above ground. *Blow-offs shall have sufficient tubing to extend to an approved drainage facility. The blow-offs shall also be provided with adequate protection from pedestrian and vehicular traffic.* Blow-offs shall be installed where shown on the plans or as directed. The time and section of line to be chlorinated shall be approved by the Division of Water. The Division of Water will notify the Contractor when to remove the temporary blow-offs and removal shall be in accordance with Section 816.04.

*The Contractor shall hand swab all pipes and fittings that are not otherwise disinfected. The amount of chlorine to be used during hand swabbing operations will be determined by the Division of Water.*

**801.14 Certification.** The Contractor shall furnish a sworn statement from the material manufacturer certifying that all the required tests have been made and that the pipe and fittings comply with the requirements specified.

**801.15 Method of Measurement.** The lengths for which payment will be made for furnishing and laying will be measured lengths along the center line of the main or connecting pipe lines in place, from the end of spigots, or shoulder of hub ends at which the new lines terminate, including the lengths of all pipe, fittings and valves in the various lines. The length at bends or curves will be measured along the center lines to the point of intersection thereof.

*Compensation for any fitting changes ordered by the Engineer shall be adjusted to reflect an increase or decrease in payment equal to the weight difference between the fitting shown and the fitting ordered.*

The number of cubic yards (cubic meters) of concrete blocking, supports or buttresses shall be computed from dimensions shown on the standard drawings therefore or as measured in the field if special blocking is ordered by the Engineer. No allowance will be made for blocking poured larger than *the dimensions shown on the standard drawings* unless advance approval has been given by the Engineer.

*Compensation for any blocking changes ordered by the Engineer shall be adjusted to reflect an increase or decrease in payment equal to the cubic yard (cubic meter) difference between the volume of blocking shown on the standard drawings and that ordered by the Engineer.*

**801.16 Basis of Payment.** The payment for all work done under these items shall be at the unit price *specified*, which payment shall be full compensation for all labor, material and equipment required to furnish and lay the pipe *and appurtenances* as herein specified.

Payment will be made at the contract price for:

<b>Item</b>	<b>Unit</b>	<b>Description</b>
801	Linear Foot (Meter)	____ Inch (mm) Ductile Iron Water Pipe and Fittings
801	Linear Foot (Meter)	____ Inch (mm) Prestressed Concrete Water Pipe and Fittings
801	Cubic Yard (Cubic Meter)	Concrete Blocking Class C, <i>Increase or Decrease</i>
801	Pound (Kilogram)	Fittings, Increase or Decrease