SECTION 300

WATER SYSTEMS

SECTION 301

WATER SYSTEMS

DESCRIPTION

301.20 General.

Work under this section shall consist of making alterations in existing municipal water main systems or constructing new sections of existing systems affected by highway and bridge construction. The work includes furnishing and installing new water pipe and appurtenances and removing and resetting existing materials in the same or new locations in accordance with these specifications and in close conformity with the lines and grades shown on the plans or established by the Engineer.

301.21 Workmen.

All personnel employed by the Contractor on this work shall be experienced and skilled in water main installation.

301.22 Protection of Underground Structures.

All conduits, pipes or structures uncovered during excavation, whether or not they are shown on the plans, shall be protected, and if damaged by the Contractor shall be repaired by him/her or the utility company at the expense of the Contractor.

The Contractor shall not abandon any existing conduits, pipes or structures without the prior approval of the Engineer.

301.23 Notices.

Prior written notice of at least 48 hours shall be given by the Contractor to affected Municipal Water and Fire Departments, with a copy of such notice submitted to the Engineer, before any water main is shut off and in no case shall a gate or hydrant be opened or shut without proper authorization.

MATERIALS

301.40 General.

Materials shall meet the requirements specified in the following Subsections of Division III, Materials.

Thrust Blocks	
Cement Concrete	M4.02.0
Water Pipe and Fittings	
Cast Iron for Water Systems	M5.05.1
Copper Tubing	M5.06.0
Ductile Iron Pipe and Fittings	M5.05.3

Insulation and Waterproof Jackets	M9.11.0
Cellular Glass	M9.11.1
Fiber Glass	M9.11.2
Expanded Polystyrene	M9.11.3
Urethane	M9.11.4
Jointing Materials for Pipes	M9.10.0
Waterproof Jackets	M9.11.5

Valve boxes, service boxes, corporation cocks, air relief valves, yokes and tie-rods, curb stops, plugs and any other materials which are required shall be the type used by the particular municipality involved or as specified in the Special Provisions. Air relief valves shall be installed at the high points of the main or where and as directed.

CONSTRUCTION METHODS

301.60 General.

The installation or removal and reinstallation of water systems or parts thereof shall conform to the following construction procedures:

A. Pipe Fittings, etc.

All pipe fittings, valves, hydrants and other heavy accessories shall be carefully handled by the use of hoists or skidways to avoid shock or damage. Pipe handled on skidways shall be not skidded or rolled against pipe already on the ground. The Contractor shall replace or repair, at his/her own expense, any materials that have been damaged due to his/her negligence.

Where pipes are required in less than standard lengths, the cutting shall be done in a neat and workman-like manner without damage to the pipe.

B. Excavation.

See Subsection 140.60.

C. Bedding Pipe.

See Subsection 230.61.

D. Bridging.

Where required, the Contractor shall provide suitable bridges for traffic to cross open trenches at streets and driveways.

E. Cleaning and Plugging Pipe.

The pipes and fittings shall be thoroughly cleaned before being laid and shall be kept clean until accepted in the finished work. The ends of all uncompleted lines shall be tightly closed with temporary plugs at all times when the pipe laying is not in progress, and no trench water or debris shall be permitted to enter the pipe.

F. Removal of Castings.

In the work of removing hydrants and other castings to be reset, or stacked for the municipality, the castings shall be exposed, care being taken that they are not damaged by excavating or other machinery, the joints shall then be opened and the castings carefully removed.

Any materials damaged during this work due to the Contractor's negligence shall be replaced by the Contractor at his/her own expense.

G. Laying Pipe.

Proper tools and equipment for the safe and convenient handling and laying of the pipes shall be used. The Contractor shall exercise reasonable caution during his/her operations in order to avoid damaging the pipes, castings, or fittings and any which are damaged shall be replaced by him/her at his/her own expense.

The Contractor shall furnish the necessary pumps and tools to handle any water encountered in the pipe trench, and shall maintain the trench in a satisfactory condition, free from water, during the laying of the pipe. The pipe, after being laid in place, shall not under any circumstances be used as a drain pipe for the trench.

Cast iron pipe sections shall be laid with the bell on the upgrade end, unless otherwise directed. Before laying the pipe, the outside of the spigot and the inside of the bell shall be wire brushed and wiped clean and dry. When placing a length of pipe, the yarning material for the joint shall be held around the bottom of the spigot so that it will enter the bell as the pipe is shoved into position.

H. Setting Gates and Hydrants.

Gates and gate boxes shall be set in the pipe lines as directed. Care shall be taken to see that the spigot ends are securely seated in the bell ends. Blocking or supports of a permanent nature shall be placed under each valve to insure against settlement. The blocking or permanent supports shall conform to Owner's Specifications. Each gate shall be tightly closed before being placed in the line and shall remain so until the joints on each side are completely made. Gate boxes shall be set for all gates. They shall be carefully fitted together and to the gate and securely held during backfilling. The earth around them shall be thoroughly tamped in place and the cover set to the finished grade.

New gate and service boxes, and existing gate and service boxes that are designated to be removed and reset or adjusted to line or grade, which are located in roadway pavement areas shall have concrete collars constructed around them. The concrete collars shall conform to the details of design shown in the Department's Standards for Concrete Collars.

Hydrants shall be properly supported and held plumb while the joints are being made and during backfilling. Crushed stone or screened gravel with a minimum volume of 0.03 cubic meters shall be placed to drain each hydrant drip. The hydrants shall be satisfactorily braced near the bottom of the stem.

I. Yarning.

The strands of yarn for cast iron bell-and-spigot joints shall be cut longer than the circumference of the pipe so that the ends will overlap a maximum of 50 millimeters.

The yarning material shall be thoroughly packed into the bell leaving a depth of not less than 60 millimeters for the sealing compound. Loose or frayed ends shall be left to protrude into the space left for the compound.

J. Jointing.

For cast iron bell-and-spigot joints the melting furnace shall be kept reasonably close to the point where the joints are being made. The joint material shall be melted in a pot, the top or flange of which will fit snugly into a furnace, so designed that heat from a low fire will completely surround the bottom of the melting pot.

The melting pot, ladle and pouring pot shall be thoroughly cleaned before melting the joint material. No dirt or foreign material of any kind shall be allowed to enter the melting pot while in use.

The joint material shall be brought to such temperature that when stirred it will show a rapid change of color and when poured into the joint space will insure a perfect joint. Before pouring, all scum shall be removed from the molten material.

The joint space shall be free from all dirt, water, mud, oil, grease or other deleterious material before placing the joint runner.

The joint runner, soaked in water and rubbed with clay to prevent adherence to the molten joint material shall be placed snugly against the face of the bell and the outside of the pipe. The joint runner and the pouring gate shall be clayed to prevent the material from breaking out.

The molten material shall be poured slowly but continuously through the gate until the joint is completely filled to the top of the gate.

After cooling, the filled joints shall be caulked with pneumatic tools, or hand tools, until thoroughly compacted to form watertight joints without overstraining the bells.

K. Thrust Blocks and Pipe Anchors.

Reaction or thrust blocks of concrete shall be constructed at all tees, plugs, and bends as directed or as detailed on the drawings with 20 MPa - 40 mm - 280 kg Cement Concrete Masonry. The blocks shall be poured against undisturbed original ground and shall be so placed that pipe joints will be accessible for any possible future repairs. Yokes and tie-rods shall be installed in addition to or in lieu of thrust blocks. Pipe anchors shall be used when and as directed.

L. Testing.

After completion, the trenches shall be partially backfilled leaving the joints exposed for examination, and the pipe line then subjected to a hydrostatic pressure of 50 percent above the normal operating pressure. The pipe shall be tested between points as designated by the Engineer by slowly filling the test section with water by means of a pump connected to the pipe but not before the pipe has been relieved of air through taps made where required. Any defects in the pipe or joints revealed by this pressure test shall be repaired or replaced and the pipe line again subjected to a hydrostatic pressure test as described above for possible leakage over the allowable limits. Pump, connections, gauges and a measuring device shall be furnished by the Contractor. The pressure test shall be maintained for at least 2 hours during which time all exposed joints, fittings, valves and hydrants will be carefully examined.

No pipe installation will be accepted until the leakage during a 2 hour test period measured by pumping at the specified test pressure from a calibrated container into the section of pipe being tested is less than that determined by the formula:

$$L = \frac{ND(P)^{0.5}}{32\ 595}$$

L = Allowable leakage in liters per hour
N = Number of joints
D = Nominal pipe diameter in millimeters
P = Average test pressure in kiloPascals

Any defective joints, and any defects in new pipe fittings, valves or hydrants revealed during the leakage test or before final acceptance of the project shall be removed and replaced with other new material and again tested until the work is satisfactory, with no additional compensation.

M. Disinfection.

After testing has been successfully completed, the water mains shall be disinfected in accordance with the AWWA Standard Procedure C601.

N. Adjusting Boxes.

Gate boxes and service boxes shall be adjusted to required grades and shall be securely held during backfilling – See Subsection 301.60H.

O. Backfilling.

Subsection 150.64.

P. Installing Insulation and Jacket.

1. General.

Where water pipe is installed or hung on structures, the insulating material shall be fiber glass, cellular glass, expanded polystyrene, or urethane. Section lengths and thickness shall depend on the pipe size and the recommendations of the insulation manufacturers. When urethane insulating material is used the total thickness shall be not less than 50 millimeters; when any other type of insulating material is used the total thickness shall be not less than 75 millimeters.

2. Construction Requirements.

a. Cellular glass pipe insulation for use on water pipes shall be applied as follows: Insulation shall cover all fittings, flanges and pipe clamps. The pipe shall be covered with the required thickness of cellular glass insulation of the premolded rigid type. It shall be molded and cut to conform to the size and shape of the pipe. All joints shall be tightly butted and sealed with adhesive as recommended by the manufacturer.

The cellular glass insulation shall be applied to clean dry pipe surfaces and secured with 20 millimeter x 0.40 millimeter stainless steel strapping spaced 250 millimeters on center. After insulation is in place, a tack coat of fibrated adhesive mastic shall be applied at the rate of 8 liters/10 square meters. Into this, a layer of asphalt coated 20 x 20 mesh glass fabric overlapping all edges at least 75 millimeters shall be embedded. A second layer of the same fabric shall then be applied together with additional adhesive mastic to completely embed the layer of fabric. Finally, apply another coating of mastic at the rate of 16 liters/10 square meters. A weatherproof seal shall be provided at the ends of the insulation. Insulation covering flanges, fittings, and pipe clamps shall be cut to make a tight fit with the pipe insulation overlapping 75 millimeters on each end.

b. Fiber glass insulation for use on water pipes shall be premolded with an integral vapor barrier jacket and applied as follows: The fiber glass insulation shall be applied to the clean, dry pipe surface. Adjoining sections shall be butted firmly together and taped. The tape shall be composed of a three-ply system consisting of 1 layer of creped kraft paper, 1 layer of aluminum foil and 1 layer of asphalt impregnated creped kraft paper. The three layers shall be tightly bonded together with an asphalt adhesive. The tape shall be applied so that it overlaps the butt joint a minimum of 50 millimeters on each side. The longitudinal seam of the vapor barrier shall be sealed with a suitable adhesive. All flanges, fittings and pipe clamps shall be insulated with cement applied to the same total thickness as the pipe insulation and covered with 25 millimeters galvanized wire netting stretched tightly over the surface and wired in place with 16

gage galvanized wire. A weather-proof jacket of 0.5 millimeter thick corrugated aluminum shall be placed over the insulation, all edges to lap a minimum of 50 millimeters. Longitudinal joints shall be placed in the most suitable direction for shedding water. An adhesive mastic cement shall be applied to all joints and seams, making them completely watertight. The aluminum jacket shall be secured with 20 millimeter x 0.40 millimeter stainless steel strapping and stainless steel clips spaced 300 millimeters on center.

c. Expanded polystyrene or urethane insulation for use on water pipes shall be premolded and applied as follows: The polystyrene or urethane insulation shall be applied to clean dry pipe surfaces. All joints shall be tightly butted and sealed with a suitable polystyrene or urethane adhesive. The insulation shall be secured with 20 millimeter x 0.40 millimeter stainless steel strapping and corrugated aluminum with integral vapor barrier shall be applied over the insulation, all edges to lap a minimum of 50 millimeters. Longitudinal joints shall be placed in the most suitable direction for shedding water. The jacket shall be secured with
20 millimeter x 0.40 millimeter stainless steel strapping and stainless steel clips spaced 300 millimeters on center. A suitable adhesive that is compatible with polystyrene or urethane shall be applied to all joints and seams of the aluminum jacket making them completely watertight. All flanges, fittings and pipe clamps shall be covered with the same insulating material remolded and sized to make a tight fit with the pipe insulation and overlapping the pipe insulation 75 millimeters on each end. Prior to the application of the aluminum jacket all open ends of insulation covering flanges, fittings and pipe clamps shall be covered with a layer of 20 x 20 mesh, asphalt coated glass fabric embedded in suitable adhesive mastic cement.

COMPENSATION

301.80 Method of Measurement.

Water pipe will be measured in place along the axis of the pipe without deduction for the space occupied by valves, excluding however, the length occupied by new fittings. Where two pipes join, measurement will be made to the intersection of the axes, excluding the length occupied by new cast iron fittings.

Fittings, consisting of bends, tees, caps, wyes, sleeves, reducers, increasers, blow-off fittings and other special fittings, applies only when new materials are necessary and which are not specifically provided for under other items in the Proposal. Fittings other than new will not be paid separately but only under the applicable linear meter items. When new fittings are measured for payment under the kilogram price for Item 308, the length occupied by the fittings will not be measured for payment under the linear meter items.

The fittings (excluding accessories comprising Rings, Gaskets, Bolts, Nuts, Washers and Clamps) will be measured by the kilogram and the quantity to be paid for shall be the weight stated on the invoice of the supplier or the manufacturer's rated weight as listed in the catalog whichever is the lesser.

For new special fittings not listed in the catalog the weight payable will be the invoice weight. The Contractor shall furnish a copy of the Manufacturer's catalog at the start of work. Concrete collars required for gate and service boxes shall be included in the contract unit price for the relevant gate and service box items.

Insulation will be measured by the meter under the applicable water pipe insulation item.

Trench excavation in excess of 1.5 meters in depth and rock excavation shall be measured as specified in Subsection 140.80 for Class B Trench Excavation and Class B Rock Excavation, respectively.

301.81 Basis of Payment.

Water system work will be paid for at the contract unit price under the respective items for the kind of work involved as set forth in the Proposal.

New yokes and tie-rods will be paid for at the contract unit price per kilogram under Item 308. Payment for fittings other than new will be paid for at the contract unit price per meter under the relevant pipe items.

The prices shall also include all excavation (except rock) to a maximum depth of 1.5 meters (as measured from the top of the trench to the bottom of the pipe barrel).

Trench excavation greater than 1.5 meters and rock excavation will be paid for as specified in Subsection 140.81 for Class B Trench Excavation and Class B Rock Excavation.

Backfill for trenches 1.5 meters or less in depth shall be included in the various items of pipe. Backfill for that part of a trench which is more than 1.5 meters in depth shall be included in the item for Class B Trench Excavation.

If the material for backfill is obtained from borrow, it will be paid for at the contract unit price per cubic meter of the kind of borrow required.

Payment for the restoration of surfaces over trenches shall be made at the contract unit price for the kind of materials used.

Thrust blocks, where required, will be paid for at the contract unit price per cubic meter under Item 903, 20 MPa - 40 mm - 280 kg Cement Concrete Masonry.

Insulation will be paid for at the contract unit price per meter under Item 373, Water Pipe Insulation, complete in place.

301.82 Payment Items.

300.*	Cast Iron Water Pipe (Rubber Gasket)	Meter
302.*	Ductile Iron Water Pipe (Rubber Gasket)	Meter
303.*	Ductile Iron Water Pipe (Mechanical Joint)	Meter
304.*	Cast Iron Water Pipe (Cement Lined)	Meter
308.	Cast Iron Fittings for Water Pipe	Kilogram
309.	Ductile Iron Fittings for Water Pipe	Kilogram
313.*	Cast Iron Water Main Removed and Relaid	Meter
315.*	Cast Iron Water Main Removed and Stacked	Meter
347.*	Copper Tubing Type K	Meter
349.*	Gate Valve	Each
350.*	Gate and Gate Box	Each
351.*	Gate and Gate Box Removed and Reset	Each
354.*	Gate Box Removed and Reset	Each
355.*	Gate and Gate Box Removed and Stacked	Each
357.*	Gate Box	Each
358.	Gate Box Adjusted	Each
363.*	Corporation Cock	Each
367.*	Cast Iron Plug	Each
373.*	Water Pipe Insulation	Meter
376.	Hydrant	Each
376.2	Hydrant Removed and Reset	Each
376.3	Hydrant Removed and Stacked	Each
381.	Service Box	Each
381.1	Service Box Removed and Reset	Each
381.2	Service Box Removed and Stacked	Each
381.3	Service Box Adjusted	Each
384.	Curb Stop	Each
384.1	Curb Stop Removed and Reset	Each
142.	Class B Trench Excavation	Cubic Meter
144.	Class B Rock Excavation	Cubic Meter
150.	Ordinary Borrow	Cubic Meter
151.	Gravel Borrow	Cubic Meter
156.	Crushed Stone for Drainage, Revetment or Water Work Foundations	Metric Ton
903.	20 MPa - 40 mm - 280 kg Cement Concrete Masonry	Cubic Meter

*Pipe or appurtenance size will be included as part of the item number in order to differentiate between the sizes.