

**1.0 GENERAL****1.1 Description**

- .1 This section specifies requirements for replacing and constructing water mains, and appurtenances, to lines, grades and dimensions as directed.

**1.2 Related Work Specified Elsewhere**

- .1 Trenching, Backfilling and Compaction for Utilities Section 02315
- .2 Building Services Section 02539

**1.3 Record Drawings**

- .1 Provide data to produce Record Drawings, including details of pipe material.

**1.4 Scheduling of Work**

- .1 Schedule work to minimize interruptions to existing services.

**1.5 Measurement and Payment**

- .1 Water Main Construction – Separate Trench: The payment for water supply line and water mains installed in separate trench will be at the rate tendered per metre which shall include excavation, bedding, supply and installation of pipe, initial backfilling, general backfilling and all other work required to install, swab and test the mains as specified. Measurement will be along the main with no deductions for valves, fittings or hydrants. The payment shall include placement of sand bedding and selected backfill.
- .2 Water Main Construction and Replacement - Separate Trench: The payment for water supply line and water mains installed in separate trench will be at the rate tendered per metre which shall include excavation, removal and disposal of existing pipe, bedding, supply and installation of pipe, initial backfilling, general backfilling and all other work required to install, swab and test the mains as specified. Measurement will be along the main with no deductions for valves, fittings or hydrants. The payment shall include placement of sand bedding and selected backfill.
- .3 Connection to Existing Water Mains: Connection to existing water mains will be paid for at the lump sum bid and shall include all labour, equipment and materials required to make the connection.
- .4 Boring Under Proposed Sidewalk for Fire Hydrant Leads: Boring under proposed sidewalk for fire hydrant leads will be paid for at the unit price tendered for each completed boring. The tendered price shall include all costs for labour, equipment and materials required to complete the boring.

- .5 Fittings, valves including boxes, hydrants shall be measured as each item installed and shall include the cost of excavation, backfilling and concrete thrust blocking.
- .6 Sand bedding material and placement to be included in water main and water supply main unit prices bid.
- .7 Unstable subgrade, imported granular backfill, and bedding stone where authorized by the Engineer, will be measured and paid for as outlined in Section 02315.

## **2.0 PRODUCTS**

### **2.1 Water Mains**

#### **.1 PVC Pipe**

Pipe shall be DR18, PR 235 to cast iron OD dimensions Polyvinyl Chloride conforming to AWWA Specification C900-07. Joints shall be rubber gaskets.

### **2.2 Valves**

- .1 Valves and boxes with lengths to suit for water mains and water supply line shall be Resilient Seat gate valves to suit pipe ends to AWWA Specification AWWA C509-01. Valves shall be fitted with stainless steel nuts and bolts on the bonnet.
- .2 Valve casings shall be adjustable cast iron casing to accommodate a 3 metre cover over the hood, top section with lid and stone disc in accordance with the Standard Drawing. The casing must rest on the bonnet of the valve and not on the stuffing box. The extension stem shall be made of 25 mm square mild steel with a bottom socket to fit a 50 mm square valve operating nut and shall extend to within 0.3 metres of the top of the casing when assembled.

### **2.3 Fittings for 300 mm and Smaller Pipe**

- .1 Fittings shall be PVC fittings for AWWA C900 pipe manufactured in one piece of injection molded PVC compound conforming to AWWA C-905-97.

### **2.4 Flanges, Bolts, Nuts and Washers**

- .1 Flanges shall comply with ANSI bolt circle. Securing bolts, nuts and washers shall be stainless steel, conforming to ASTM: A320/A320 M-93, Type B8M, Class 2. Hexagon heads shall be used.

**2.5 Hydrants**

- .1 Hydrants shall be Mueller Canada Valve three-way hydrant dry barrel. No alternates.
- .2 Hydrants shall be compression type shut off with cast iron body bronze mounted, 150 mm barrel diameter, O-Ring stem seals, for "on line" construction, and shall open with a counter-clockwise rotation conforming to AWWA Specification C502-05. The barrel shall be flanged at ground line and the barrel length shall be suitable for cover as indicated on drawings from flange at ground surface to crown of inlet pipe.
- .3 Hydrants shall have one 100 mm pumper nozzle and 2-65 mm hose connections conforming to AWWA C502-05 and threads shall conform to Sask. Mutual Aid Standards.
- .4 All hydrants are to be certified by Underwriters' Laboratory of Canada (ULC).
- .5 The operating nut shall be Pentagonal shaped. Hydrants shall be flanged at ground line. The colour of the hydrant above the ground shall be red.
- .6 Joints between hydrant and water main shall conform to the type of pipe supplied.
- .7 All nuts and bolts below grade shall be stainless steel. Hydrant barrels and tees shall be coated with Denso paste and tape.

**2.6 Pipe Foundation and Embedment Materials**

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| .1 | Granular Material for Final Backfill:  | As per Section 02315 |
| .2 | Common Backfill:                       | As per Section 02315 |
| .3 | Pipe Embedment Zone Materials          | As per Section 02315 |
| .4 | Bedding Stone for Foundation Material: | As per Section 02315 |
| .5 | Concrete:                              | As per Section 02315 |

**2.7 Chlorine**

- .1 Sodium hypochlorite to AWWA B300-04 to disinfect water mains.

**3.0 EXECUTION**

**3.1 Preparation**

- .1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

**3.2 Trenching and Backfill**

- .1 Do PVC C900 water main trenching and backfill work in accordance with ASTM D2321-04 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications except as modified in Section 02315 - Trenching, Backfilling and Compaction for Utilities, and herein.
- .2 Trench depth to provide minimum cover over pipe of 3.0 m below finished grade for water distribution mains and water supply line or to grades where deeper as indicated on drawings.
- .3 Do not allow contents of any sewer or sewer service connection to flow into trench.
- .4 Confirm trench line, grade and depth meet design requirements prior to placing bedding material and pipe.
- .5 Do not backfill trenches until pipe grade and alignment have been reviewed by the Engineer.

**3.3 Construction in the Pipe Embedment Zone**

- .1 Construct embedment zone for PVC water main in accordance with ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications except as noted herein.
- .2 If required and approved by the Engineer, replace unsuitable material in the foundation zone with granular backfill or bedding stone according to Section 02315.
- .3 Place granular bedding, haunch and initial backfill materials to details indicated in Section 02315 and as indicated on the drawings.
- .4 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks in bedding pipe.
- .5 Shape transverse depressions as required to make joints.
- .6 Compact the bedding to at least 90% standard proctor maximum dry density with the exception of the middle 1/3 of pipe diameter. Do not compact middle 1/3 of pipe diameter.
- .7 Place haunch and initial backfill to 300 millimetres above the crown of the pipe. Compact in maximum 150 millimetre lifts and compact to 90% standard proctor maximum dry density.

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- .8 Exercise caution and place and compact material for haunch and initial backfill area in such a manner that adverse vertical and horizontal deflection does not occur.
- .9 Place bedding stone in lieu of sand bedding material when requested.

**3.4 Pipe Installation for PVC Pressure Pipe**

- .1 Lay and join pipes in accordance with manufacturer's recommendations.
- .2 Handle pipe with approved equipment. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.
- .3 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .4 Commence laying and proceed in upstream direction with socket ends of pipe facing upgrade.
- .5 Do not exceed permissible deflection at joints recommended by pipe manufacturer.
- .6 Do not allow water to flow through pipe during construction, except as may be permitted by Engineer.
- .7 Whenever work is suspended, install a removable watertight bulkhead at open ends of last pipe laid to prevent entry of foreign materials.
- .8 Position and join pipes with approved equipment. Do not use excavating equipment to force pipe sections together.
- .9 Pipe Jointing:
  - .1 Install gaskets in accordance with manufacturer's recommendations.
  - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
  - .3 Align pipes carefully before joining.
  - .4 Maintain pipe joints free from mud, silt, gravel or other foreign material.
  - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
  - .6 Complete each joint before laying next length of pipe.

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- .7 Minimize joint deflection after joint has been made to avoid joint damage.
- .8 Apply sufficient pressure in making joints to assure that joint is complete as outlined in manufacturer's recommendations.
- .9 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipe or as otherwise approved by Engineer.
- .10 Block pipes when any stoppage of work occurs in such a manner as required by Engineer to prevent creep during down time.
- .11 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.
- .12 Upon completion of pipe laying place specified granular material to dimensions indicated or directed.
- .13 Hand place granular material in uniform layers of 150 mm thick or less. Dumping of material directly on top of pipe is not permitted.
- .14 Place layers uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

**3.5 Concrete Reaction Blocking**

- .1 Do concrete work to CSA A23.1-M90.
- .2 Place concrete reaction blocking between changes in pipe diameter, and fittings and solid ground as shown on drawings or as directed by Engineer.
- .3 Do not backfill over concrete for 24 hours after placing.

**3.6 Hydrostatic Leakage Testing for PVC Piping****.1 Test Procedure**

After backfilling is completed, a pressure test shall be carried out in the presence of the Engineer on all lines at the maximum rated operating pressure for the class of pipe installed. Hydrostatic leakage testing, cleaning and flushing of pressure mains shall not be conducted when the ambient air temperature is less than + 10° C.

The pressure shall be maintained for not less than one hour by pumping additional water into the test section from a measuring tank. The test section will not be accepted if the leakage in litres per hour measured by the above method exceeds the quantity determined by the following table.

Allowable Leakage in Litre/Hr. Per 100 Couplings Based on AWWA C605-05 Test Pressure (kPa)							
<b>Pipe Diameter</b>	<b>350</b>	<b>500</b>	<b>700</b>	<b>850</b>	<b>1000</b>	<b>1400</b>	<b>1550</b>
150 mm	2.2	2.6	3.0	3.4	3.6	4.3	4.5
200 mm	2.9	3.4	4.1	4.5	4.9	5.7	6.0
250 mm	3.6	4.3	5.1	5.6	6.1	7.2	7.6
300 mm	4.3	5.1	6.1	6.7	7.3	8.6	9.1
350 mm	5.0	6.0	7.1	7.8	8.5	10.0	10.6
400 mm	5.7	6.9	8.1	8.9	9.7	11.5	12.1

If the leakage exceeds the allowable, the Contractor shall locate and repair leaks and defects and repeat the test until the leakage does not exceed the allowable.

The Contractor shall provide all necessary labour, materials and equipment for the test including a suitable pump and measuring tank, pressure hoses and connection plugs, caps, gauges and all other apparatus necessary for filling the main, pumping to the required test pressure and recording the pressure and leakage losses. The Contractor shall provide evidence that the gauges used are accurate.

The test section of the pipeline shall be filled with water at a velocity not exceeding 0.3 metres per second, taking care to expel all air from the high points. If air valves, service connections, or other means of venting are not provided, the Contractor shall at his own expense drill and tap small holes for the purpose at high points. He shall also provide a suitable cock to vent air during tests. The hole shall be sealed by means of a tight fitting plug at the conclusion of the test.

**3.7 Flushing**

- .1 Flushing operations to be under direct control of Engineer. Notify Engineer at least 4 days in advance of proposed date when flushing and disinfection operations are to commence.
- .2 Flush water mains with a sufficient flow to produce a velocity of 0.9 m per second, for three volume changes in the flush section, or until foreign materials have been removed and flushed water is clear. Ensure flushed water drains to a suitable location at an appropriate flow and appropriate measures are employed to prevent erosion and flooding.
- .3 Flushing flows to be as follows:

<b>Pipe Size (mm)</b>	<b>=</b>	<b>Flow (L/s)</b>	
		<b>Minimum</b>	<b>Maximum</b>
200		30	40
250		45	60
300		65	75

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- .4 Provide all connections and pumps as required. Employ backflow prevention measures as required.

### 3.8 Swabbing

- .1 After the hydrostatic leakage testing and flushing and before disinfection has been completed, the pipe shall be swabbed with swabs as supplied by Full Kote Systems.

### 3.9 Disinfection

- .1 Disinfect all water mains, tie-ins and connections according to AWWA C651-05 except as specified herein.
- .2 If the tablet method of chlorination is utilized, the Engineer shall be informed and approve at least 15 days in advance of any leakage testing, flushing and swabbing.
- .3 When flushing, swabbing and pressure testing have been completed to satisfaction of Engineer, introduce a solution of chlorine into the water main utilizing the continuous feed method. Ensure the chlorine is distributed evenly throughout the entire test section.
- .4 Protect the remaining distribution system that is in use for potable water distribution or existing potable water systems from backflow from pipes undergoing disinfection.
- .5 Chlorine application to be within 3 m of filling water main and occur at same time. When application is complete, the free chlorine concentration shall be not less than 25 mg/L throughout the test section. The Contractor shall arrange for field testing and report test results, time of sample and test locations.
- .6 Chlorinated water shall be retained in the line for at least 24 hours. All appurtenances shall be operated during this time to ensure disinfection.
- .7 At the end of 24 hour period, the water shall be tested to ensure a free chlorine concentration of not less than 10 mg/L throughout the test section. The Contractor shall arrange for field testing and report test results including test sample locations and sample time.
- .8 Repeat disinfection processes until tests are satisfactory to the Engineer.
- .9 Flush pipes and appurtenances of chlorine solution after satisfactory disinfection. Flushing is complete when the total chlorine concentration is suitable for potable water use. Apply a neutralizing chemical to the chlorinated water being disposed to neutralize the chlorine to a level suitable to governing regulatory agencies.

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- .10 Take water samples at end of test section and submit to an accredited lab to test for chlorine concentration and the presence of bacteria. Submit two copies of the test results to the Engineer.

**3.10 Delivery and Stockpiling Materials**

- .1 The Contractor shall be responsible for arranging, stockpiling, and protecting the materials from damage and theft.
- .2 The Contractor shall be responsible for the delivery of material and the Owner will not pay for materials ordered by the Contractor and not used in the work, nor pay for shipping charges on the return of such material to the supplier.

**END OF SECTION**