

PART 1 - GENERAL

<u>1.1 SECTION INCLUDES</u>	.1	Materials and installation for water mains, hydrants, valves, valve boxes, and valve chambers, including service connections.
<u>1.2 RELATED SECTIONS</u>	.1	Section 31 23 10 - Excavating, Trenching and Backfilling.
<u>1.3 REFERENCES</u>	.1	<p>American Water Works Association AWWA</p> <p>.1 AWWA B300-04, Hypochlorites.</p> <p>.2 AWWA B301-04, Liquid Chlorine.</p> <p>.3 AWWA B303-05, Sodium Chlorite.</p> <p>.4 AWWA C104/A21.4-03, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.</p> <p>.5 AWWA C111/A21.11-00, Rubber-Gasket Joints for Ductile-Iron and Gray Iron Pressure Pipe and Fittings.</p> <p>.6 AWWA C110/A21.10-03, Ductile-Iron and Gray Iron Fittings.</p> <p>.7 AWWA C153/A21.53-00, Ductile-Iron Compact Fittings for Water Service.</p> <p>.8 AWWA C200-97, Steel Water Pipe 6 in. (150 mm) and Larger.</p> <p>.9 AWWA C205-00, Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inch (100 mm) and Larger - Shop Applied.</p> <p>.10 AWWA C206-03, 2005 edition, Field Welding of Steel Water Pipe.</p> <p>.11 AWWA C207-01, Steel Pipe Flanges for Waterworks Service, Sizes 4 Inch through 144 Inch (100 mm through 3,600 mm).</p> <p>.12 AWWA C208-01, Dimensions for Fabricated Steel Water Pipe Fittings.</p> <p>.13 AWWA C300-97, Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.</p> <p>.14 AWWA C500-02, Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95).</p> <p>.15 AWWA C504-00, Rubber-Seated Butterfly Valves.</p> <p>.16 AWWA C600-05, Installation of Ductile-Iron Water Mains and Their Appurtenances.</p> <p>.17 AWWA C602-00, Cement-Mortar Lining of Water Pipelines in place - 4 In. (100 mm) and Larger.</p> <p>.18 AWWA C651-99, Disinfecting Water Mains.</p>

1.3 REFERENCES
(Cont'd)

- .1 (Cont'd)
 - .19 AWWA C800-05, Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).
 - .20 AWWA C900-97, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Distribution.
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
 - .2 ASTM A307-04, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - .3 ASTM C117-04, Standard Test Method for Material Finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .4 ASTM C478M-08e1, Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).
 - .5 ASTM F714-08, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
 - .3 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.
 - .4 CGSB 41-GP-25M-77, Pipe, Polyethylene, for the Transport of Liquids.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA B137 Series-02, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
 - .1 CSA B137.1-02, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.
 - .2 CSA B137.3-02, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
- .5 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).

1.3 REFERENCES
(Cont'd)

- .6 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .7 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - March 1998(R2002).
- .8 Ontario Provincial Standard Specification (OPSS) and Ontario Provincial Standard Drawings (OPSD)
 - .1 OPSS 441, November 2010 (typical for all references to OPSS 701), Construction Specification for Watermain Installation in Open Cut.
 - .2 OPSS 442 (typical for all references to OPSS 702), November 2010, Construction Specification for Corrosion Protection of New and Existing Watermains.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Submit complete shop drawings and construction schedule for water mains. Include method for installation of water main.
- .3 Inform Departmental Representative of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work.
- .4 Submit Hydrostatic and leak test procedure identifying location of blow-offs and pressure gauge location 2 weeks prior to commencement.
- .5 Submit a flushing and disinfection plan 2 weeks prior to commencement.
- .6 Submit manufacturer's test data and certification that pipe materials meet requirements of this section at least 4 weeks prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.
- .7 Pipe certification to be on pipe.

1.5 CLOSEOUT
SUBMITTALS

- .1 Provide record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions in accordance with Section 01 78 00.
 - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

1.6 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material for recycling in accordance with Waste Management Plan.
- .3 Separate for reuse and recycling and place in designated containers waste in accordance with Waste Management Plan.
- .4 Place materials defined as hazardous or toxic in designated containers.
- .5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .6 Ensure emptied containers are sealed and stored safely.
- .7 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.
- .8 Divert unused concrete materials from landfill to local facility as approved by Departmental Representative.
- .9 Divert unused aggregate materials from landfill to facility for reuse as approved by Departmental Representative.
- .10 Dispose of unused disinfection material at official hazardous material collections site approved by Departmental Representative.

1.6 WASTE
MANAGEMENT AND
DISPOSAL
(Cont'd)

- .11 Do not dispose of unused disinfection material into sewer system, into streams, lakes, onto ground or in other location where they will pose health or environmental hazard.
- .12 Fold up metal banding, flatten and place in designated area for recycling.

1.7 SCHEDULING OF
WORK

- .1 Schedule Work to minimize interruptions to existing services. Maximum interruption time of 6 hours will be permitted.
- .2 Submit schedule of expected interruptions to Departmental Representative for approval and adhere to interruption schedule as approved by Departmental Representative.
- .3 Notify Departmental Representative minimum of 48 h in advance of interruption in service.
- .4 Do not interrupt water service for more than 6 h and confine this period between 10:00 and 16:00 hrs local time unless otherwise authorized.
- .5 Notify fire department of any planned or accidental interruption of water supply to hydrants.
- .6 Provide "Out of Service" sign on hydrant not in use.

PART 2 - PRODUCTS

2.1 PIPE, JOINTS
AND FITTINGS

- .1 Polyvinyl chloride pressure pipe (PVC): to ANSI/AWWA C900, pressure class 150, DR18, Mpa gasket bell end.
 - .1 CSA-B137.3, PVC Series 160, 1.1 MPa elastomeric gasket coupling.
 - .2 Joints shall be a gasket fitted to the bell groove. The pipe and or fittings shall be joined by push fitting bell and spigot joint to the depth indicated on pipe.

2.1 PIPE, JOINTS
AND FITTINGS
(Cont'd)

- .1 (Cont'd)
 - .3 Fittings shall conform to AWWA C907 "Polyvinyl Chloride (PVC) Pressure Fittings and be certified to CSA B 137.2. They shall be UL listed and FM approved. Ductile iron fittings may also be used. They shall be in accordance with ANSI/AWWA C153/A21.53. Mechanical joints shall conform to ANSI/AWWA C111/A21.11. Fittings shall be cement lined and in accordance with ANSI/AWWA C104/A21.4.
- .2 High Density Polyethylene (HDPE) pipe and fittings to ANSI/AWWA C900, DR11 (160 psi).
 - .1 Joints shall be made by either thermal butt fusion or approved socket fusion coupling.
 - .2 Fittings shall be plain end fittings and connected using thermal butt fusion or socket fusion fittings.

2.2 GATE VALVES AND
BOXES

- .1 Potable water gate valves shall be ANSI/AWWA C-509 resilient seat gate valve type with cast iron or ductile iron body.
- .2 Valves shall open counter-clockwise.
- .3 Valve box shall be a 130 mm diameter slide valve box complete with extension, cap, and cast iron lid.
- .4 Valves shall be equipped with "50 mm operating nuts".
- .5 Values shall have flanged ends.

2.3 CORROSION
PROTECTION

- .1 Cathodic protection must be to the OPSS 442 and OPSD 1109 Standard.
- .2 Anodes to be labelled as follows: "X-XX-XX ANODE".

2.4 TRACING WIRE

- .1 Tracing wire to be TWU or RWU, 10 gauge, 7 strands or more, copper, 60 C or higher, 600 V, plastic coated or approved equivalent.
- .2 C-Tap to be approved by CSA and to be sized to connect two tracing wires as specified above.

- | | | |
|---|----|--|
| <u>2.4 TRACING WIRE
(Cont'd)</u> | .3 | Tapes to be rugged, pressure-sensitive, PVC-based, minimum 0.25 mm thickness. Tapes must protect against water, salts and sewage and be suitable for direct burial applications. |
| <u>2.5 PIPE BEDDING
AND SURROUND
MATERIAL</u> | .1 | Granular material to: Granular 'A' as per OPSS 1010. |
| <u>2.6 BACKFILL
MATERIAL</u> | .1 | In accordance with Section 31 23 10. |
| <u>2.7 PIPE
DISINFECTION</u> | .1 | Contractor to proceed with disinfection only after written approval that disinfection plan has been approved by Departmental Representative. |
| | .2 | Sodium hypochlorite or Calcium hypochlorite in powder form or Liquid chlorine to disinfect water mains. |
| | .3 | Undertake disinfection of water mains in accordance with OPSS 441. |
| | .4 | Contractor is responsible for all sampling/testing costs. |
| <u>2.8 INSULATION</u> | .1 | HI-40 DOW rigid insulation, or approved equivalent, 50 mm thick insulation board installed as per manufacturer's specification. |

PART 3 - EXECUTION

- | | | |
|------------------------|----|--|
| <u>3.1 PREPARATION</u> | .1 | Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.
.1 Inspect materials for defects to approval of Departmental Representative.
.2 Remove defective materials from site as directed by Departmental Representative.
.3 Swab all pipes and fittings with liquid chlorine prior to installation. |
|------------------------|----|--|

3.2 TRENCHING

- .1 Do trenching work in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.
- .2 Trench depth to provide cover over pipe of not less than 1.7 m from finished grade or as indicated.

3.3 GRANULAR
BEDDING

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- .4 Shape transverse depressions in bedding as required to suit joints.
- .5 Compact each layer full width of bed to at least 95% SPD.

3.4 PIPE
INSTALLATION

- .1 Terminate building water service 1.0 m outside building footprint as indicated on the detail drawings and at location indicated by mechanical drawings.
- .2 Lay pipes to manufacturer's standard instructions and specifications. Do not use blocks except as specified.
- .3 Join pipes in accordance with manufacturer's recommendations.
- .4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
- .5 Lay pipes on prepared bed, true to line and grade.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .2 Take up and replace defective pipe.
- .6 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
- .7 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.

3.4 PIPE
INSTALLATION
(Cont'd)

- .7 (Cont'd)
 - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
 - .8 Position and join pipes with equipment and methods approved by Departmental Representative.
 - .9 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
 - .10 Align pipes before jointing.
 - .11 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .12 Avoid displacing gasket or contaminating with dirt or other foreign material.
 - .1 Remove disturbed or contaminated gaskets.
 - .2 Clean, lubricate and replace before jointing is attempted again.
 - .13 Complete each joint before laying next length of pipe.
 - .14 Minimize deflection after joint has been made.
 - .15 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
 - .16 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes.
 - .17 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
 - .18 Do not lay pipe on frozen bedding.
 - .19 Do hydrostatic test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.
 - .20 Backfill remainder of trench.
-

-
- | | | |
|--|-----|---|
| <u>3.4 PIPE
INSTALLATION
(Cont'd)</u> | .21 | Do not connect any new watermain to an existing watermain without consent of Departmental Representative. |
|
 | | |
| <u>3.5 VALVE
INSTALLATION</u> | .1 | Install valves to manufacturer's recommendations at locations as indicated. |
| | .2 | Support valves located in valve boxes by means of concrete located between valve and solid ground. Valves not to be supported by pipe. |
|
 | | |
| <u>3.6 THRUST BLOCKS
AND RESTRAINED
JOINTS</u> | .1 | Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated. |
| | .2 | Keep joints and couplings free of concrete. |
| | .3 | For restrained joints: only use restrained joints approved by Departmental Representative. |
|
 | | |
| <u>3.7 CORROSION
PROTECTION</u> | .1 | Cathodic protection shall be installed to the current standard of the OPSD. |
| | .2 | Spacing of anodes shall be:
.1 100-300 mmØ DI fittings/valves-Z-12-24 @ 1 per each. |
|
 | | |
| <u>3.8 TRACER WIRE</u> | .1 | Tracer wire shall be installed as per OPSS standards and shall be connected on all PVC/HDPE pipe, fittings, etc. to form a continuous loop. |
| | .2 | Test the loop of tracer wire and demonstrate to Departmental Representative that it functions properly after the backfill has been completed. |
|
 | | |
| <u>3.9 HYDROSTATIC AND
LEAKAGE TESTING</u> | .1 | Do tests in accordance with ANSI/AWWA C600 C603. |
| | .2 | Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described. |
| | .3 | Notify Departmental Representative at least 48 hours in advance of proposed tests. |
-

3.9 HYDROSTATIC AND
LEAKAGE TESTING
(Cont'd)

- .3 (Cont'd)
- .1 Perform tests in presence of Departmental Representative.
- .4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.
- .5 Open valves.
- .6 Expel air from main by slowly filling main with potable water from source and method approved by Departmental Representative.
- .7 Thoroughly examine exposed parts and correct for leakage as necessary.
- .8 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
- .9 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .10 Repeat hydrostatic test until defects have been corrected and leakage amount has been deemed acceptable in the opinion of the Departmental Representative.

3.10 PIPE SURROUND

- .1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to underside of backfill to 100% SPD.
- .6 If cover of 1.5 m is not maintained, insulation must be used.

3.11 BACKFILL

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Compact Backfill to 100% SPD.

3.12 FLUSHING AND
DISINFECTING

- .1 Contractor to supply hauled water for flushing and disinfecting.
- .2 Flushing and disinfecting operations: witnessed by Departmental Representative carried out by Contractor.
 - .1 Notify Departmental Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .3 All chlorinated water discharged to the natural environment shall be dechlorinated prior to release.
- .4 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.
- .5 Provide connections and pumps for flushing as required.
- .6 Open and close valves, hydrants and service connections to ensure thorough flushing.
- .7 At a point no more than 3 m downstream of the beginning of the watermain, water entering the watermain shall receive a dose of chlorine fed at a constant rate such that the water will not have less than 25 mg/L and not more than 80 mg/L of free chlorine. To ensure that this concentration is adequate, take samples at regular intervals. Samples to be tested by a certified lab to ensure chlorine levels. Measure the chlorine concentration at regular intervals.

3.12 FLUSHING AND
DISINFECTING
(Cont'd)

- .8 Allow chlorinated water to stay in watermain for a period of 24 hours. After the 24 hour retention period, a sample is to be tested by a certified laboratory to indicate the level of chlorine. Flush the chlorinated water from the watermain. Continue flushing the watermain until the chlorine residual of the discharge water matches that of the source water. A sample is to be tested by a certified lab to indicate the chlorine level matches the source water.
- .9 After final flushing, and prior to connecting the new watermain to the distribution system, the contractor shall advise the operating authority who will collect two consecutive sets of acceptable samples, taken at least 24 hours apart shall be collected from the main. At least one set of samples shall be collected from every 360 m of the new watermain, plus one set from the end of the line and at least one set from each branch. All samples shall be tested in accordance with Standard Methods for the examination of water and wastewater for E.Coli, total coliforms, and HPC.
- .10 Watermain disinfection laboratory tests to be paid by the Contractor.

3.13 SURFACE
RESTORATION

- .1 After installing and backfilling over water mains, restore surface to original condition as indicated and as directed by Departmental Representative.

3.14 AS-BUILT
DRAWINGS

- .1 Contractor shall supply to the Departmental Representative an "as-built" drawing indicating the horizontal and vertical alignment of the watermain and appurtenances. All anodes, valves, bends, hydrants tees, changes in material, etc. shall be noted.