

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

1.2 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, for Water Distribution.
 - .2 AWWA C907.91, Polyvinyl Chloride (PVC) Pressure Fittings for Water.
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM F 714-01, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
 - .2 ANSI/AWWAC651, Disinfecting Water Mains.
 - .3 ASTM D2241, Poly (Vinyl Chloride) (PVC) Pressure-rated Pipe (SDR Series).
- .3 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 B137.2, PVC Injection Molded Gasketed Fittings for Pressure Applications.
 - .3 CSA B137.3-02, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
 - .4 CSA B137.3, Large Diameter Fabricated Fittings.
 - .5 CSA B137.3-02, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).

1.3 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

PART 2 - PRODUCTS

2.1 PIPE, JOINTS
AND FITTINGS

- .1 Non-buried pipes:
- .1 Stainless steel pipes, equivalent to those from Douglas Barwick inc. for the surface supply of fresh and salt water.
- .1 Stainless steel pipe.
- Manufacturer: stainless steel piping and accessories described shall be as fabricated by Douglas Barwick inc.
 - Description: 316L stainless steel meeting ASTM A 240 standard requirements.
 - Thickness: Schedule 40
 - Finish: surfaces finish type 1.
- .2 Accessories:
- Stainless steel fittings for grooved joints such as Victaulic series 89.
 - 316L stainless steel elbows, lateral, reducers, tees, unions, etc., with same thickness as equivalent pipe from Victaulic.
 - Valves are specified in drawings.
- .2 Buried pipes
- .1 PVC pipes with blue ends, IPEX type DR-18 equivalent for 6in. conduits; 2in.pressurized pipes will also be in PVC type DR-21 from IPEX. Fittings will be of bell type (Tyton).
- .2 High-pressure coupling accessories will also be from IPEX, corresponding to supply pipes in order to connect Tyton.
- .3 Unions, if required, will be CLOW brand, 40 series.
- .4 Restraining collars on fittings where there is a change in diameter will be CLOW brand, 300, 350 and 360series.
- .5 Underground valves installed on the supply network are specified on drawings.

2.2 VALVE CHAMBERS

- .1 Precast concrete sections to ASTM C 478M. Cast ladder rungs integral with unit; field installation not permitted.
- .2 Jointing materials:
 - .1 Manufacturer's rubber ring gaskets.
 - .2 Mastic joint filler.
 - .3 Mortar Cement.
 - .4 Combination of above types.
- .3 Mortar:
 - .1 Aggregate in accordance with Section 04 05 12 - Mortar and Masonry Grout.
 - .2 Masonry cement to CAN/CSA-A8.
- .4 Ladder rungs for valve chambers: 20 mm diameter non-slip steel bars to CAN/CSA-G30.18, post-fabrication hot-dipped galvanized to CAN/CSA-G164. Rungs to be non-slip.

2.3 PIPE BEDDING
AND BACKFILL
MATERIAL

- .1 Granular material to: Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Crushed or screened stone, gravel or sand.
 - .2 Gradations to be within specified limits when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1 and CAN/CGSB-8.2.
 - .3 Table

Sieve Designation	% Passing	
	Stone/Gravel	Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	[100]	-
19 mm	-	-
12.5 mm	[65-90]	[100]
9.5 mm	-	-
4.75 mm	[35-55]	[80-100]
2.00 mm	-	[50- 90]
0.425 mm	[10-25]	[10- 50]
0.180 mm	-	-
0.075 mm	[0- 8]	[0- 10]

- .2 Concrete mixes and materials required for bedding cradles, encasement, supports and thrust blocks: to Section 03 30 00 - Cast-in-Place Concrete.
- 2.4 BACKFILL MATERIAL .1 As indicated, Type 3, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- 2.5 PIPE DISINFECTION .1 Sodium hypochlorite or Calcium hypochlorite to ANSI/AWWA B300 to disinfect water mains.
- .2 Undertake disinfection of water mains in accordance with ANSI/AWWA C651.
- PART 3 - EXECUTION
- 3.1 PREPARATION .1 Clean pipes, fittings, valves, and hydrants of accumulated debris and water before installation.
- .1 Inspect for defective material.
- .2 Remove defective material from site as directed by Department's Designated Representative.
- 3.2 TRENCHING .1 Dig trenches in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.
- .2 Dig trenches to a depth depending of the piping slope.
- .3 Trench alignment and depth require Department's Designated Representative's approval prior to placing bedding material and pipe.
- 3.3 GRANULAR BEDDING .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness.
- .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 support joints.

3.4 PIPE
INSTALLATION

- .5 Compact full width of each layer to a minimum of 95% of the corrected maximum dry density; 95% maximum density to ASTM D 698.

- .1 Lay pipes according to manufacturer's recommendations, instructions and specifications prescribed.
- .2 Bevel or taper ends of PVC pipe to match fittings.
- .3 Handle pipe by pipe manufacturer's recommended methods only. Do not handle pipes using chains or cables passed through the pipes because the weight of the pipes will bear on the ends.
- .4 Lay pipes on prepared bed, true to line and grade.
 - .1 Ensure each pipe lays in full contact with shaped bed throughout its full length.
 - .2 Remove and replace defective pipes.
 - .3 Correct pipe alignment or grade which shows more than 0.5% differential settlement after installation.
- .5 Position bell end of pipe in direction of laying.
- .6 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
- .7 Keep jointing materials and installed pipe free of dirt, water and other foreign materials.
 - .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 methods and equipment approved by the Department's Designated Representative.
- .9 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and leaving a smooth end at a 90 degree angle to the pipe axis.
- .10 Align pipes before joining.
- .11 Install gaskets to manufacturer's recommendations.
- .12 Avoid displacing gasket or contaminating with dirt or other foreign material.

- .1 Remove displaced or contaminated gaskets.
- .2 Clean, lubricate and replace before joining is attempted again.
- .13 Complete each joint before laying next length of pipe.
- .14 Minimize joint deflection after joint has been made.
- .15 Apply sufficient pressure while making joining 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 or as otherwise approved by the Department's Designated Representative.
- .17 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .18 Recheck pipe joints assembled above ground after placing in trench to ensure that no joint movement has taken place.
- .19 Do not lay pipe on frozen bedding.
- .20 Do hydrostatic and leakage test and have results approved by Department's Designated Representative before backfilling and covering joints and fittings with granular material.
- .21 Backfill remainder of trench.

3.5 INSTALLATION OF
STAINLESS STEEL PIPES

- .1 Install pipes according to specifications and as shown on drawings.
- .2 Crack detection test:
 - .1 Apply Dubli-Chek penetrating from Weldco on pipe surface and let penetrate for a few minutes.
 - .2 Remove penetrating surplus in surface using a Dubl-Chek solvent.
- .3 Piping alignment:
 - .1 Piping linked with inlets and outlets of equipment or with wall-mounted couplings shall be aligned adequately in order to avoid stress and constraint.

- 3.6 VALVE CHAMBERS
- .1 Use precast units as approved by the Department's Designated Representative as shown on drawings.
 - .2 Install units as indicated, plumb and centered over the valve nut, true to alignment and grade and not resting on pipe.
 - .3 Set precast concrete slab on 150 mm of compacted granular bedding minimum.
 - .4 Plug lifting holes with precast concrete plugs set in mortar cement.
 - .5 Install frame and cover on top section to indicated level. If adjustment is required use concrete ring.
 - .6 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.
- 3.7 INSTALLATION OF VALVES
- .1 Install valves to manufacturer's recommendations at locations as indicated.
- 3.8 THRUST BLOCKS AND RESTRAINED JOINTS
- .1 For thrust blocks: proceed to concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
 - .2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Department's Designated Representative and Consultant.
 - .3 Keep joints and couplings free of concrete.
 - .4 Do not backfill over concrete within 24 hours after placing.
 - .5 For restrained joints: only use restrained joints approved by Department's Designated Representative.
- 3.9 HYDROSTATIC AND LEAKAGE TESTING
- .1 Provide labor, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
 - .2 Notify the Department's Designated Representative at least 24 hours in advance of proposed tests.
 - .1 Perform tests in presence of Department's Designated

Representative.

- .3 Upon completion of pipe laying and after Department's Designated Representative has inspected Work in place, backfill and cover pipes between joints with approved granular material.
- .4 No testing shall be performed when temperature is below freezing point.
- .5 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .6 Open valves.
- .7 Expel air from main by slowly filling main with potable water.
- .8 Thoroughly examine exposed parts and correct for leakage as necessary.
- .9 Apply hydrostatic test pressure of 775 kPa based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hour.
- .10 Examine exposed pipe, joints, fittings and accessories while system is under pressure.
- .11 Remove joints, fittings and accessories found defective and replace with new sound material and make watertight.
- .12 Repeat test until leakage is within specified allowance for full length of water main.

3.10 PIPE BACKFILL

- .1 Upon completion of pipe laying and after Department's Designated Representative has inspected Work in place, backfill and cover pipes as indicated.
- .2 Hand place backfill material surrounding pipes in uniform layers.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.

3.11 BACKFILL

- .1 Place backfill material, above pipe backfill, in uniform layers.
- .2 Do not place backfill in frozen condition.

3.12 FLUSHING AND
DISINFECTING

- .1 Flushing and disinfecting operations: under direct control of Department's Designated Representative and carried out by specialized contractor.
 - .1 Notify Department's Designated Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .2 Flush water mains through available outlets with a sufficient flow producing a velocity of 1.5 m/s, for minimum 10 minutes or until foreign materials have been removed and flushed water is clear.
- .3 Flushing flows as follows:

Pipe Size NPS	Flow (L/s) Minimum
6 and below	38
- .4 Provide connections and pumps for flushing as required.
- .5 When flushing has been completed, introduce strong solution of chlorine into water main, as approved by Department's Designated Representative, and make sure it is distributed throughout entire system.
- .6 Disinfect water mains according to requirements from the local authority.
- .7 Rate of chlorine application to be proportional to rate of water entering pipe.
- .8 Chlorine application to be close to point of filling water main and to occur at same time.
- .9 Operate valves, hydrants and accessories while main contains chlorine solution.
- .10 Flush line to remove chlorine solution after 24 hours.
- .11 Measure chlorine residuals at extreme end of pipe-line being tested.
- .12 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
 - .1 Take samples daily for minimum of two days.
 - .2 Should contamination remain or recur during this period, repeat disinfecting procedure.

- .3 Specialized contractor to submit certified copy of test results.
- .13 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
- .14 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.
 - .1 After 24 hours, take further samples to make sure that there is still not less than 10 ppm of chlorine residual remaining throughout system.
- 3.13 SURFACE RESTORATION
 - .1 After installing and backfilling over water mains, restore surface to original condition as directed.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 This section covers electrical conduit PVC and fibre glass, polyethylene pipe used as underground electrical conduits, terminals detection and installation of all these elements.
- 1.2 REFERENCES 1. CSA International:
1. CSA C22.2 number 211.1, rigid ducts EBI and DB2/ES2 in PVC.
 2. CSA C22.2 number 211.3, ducts (CRTR) and joints reinforced thermosetting resin (binational standard – UL 1684).
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
1. Submit documents and samples required in accordance with sections 01 33 00 - Documents and samples to submit and 26 05 00 - General Requirements.
 - .2 Datasheets:
 1. Submit the required data sheets, specifications, and manufacturer's literature. The sheets must indicate the product characteristics, performance criteria, dimensions, constraints, and finishing.
 2. Submit two (2) copies of MSDS requirements under WHMIS (Information System Hazardous Materials Information System), in accordance with section 02 81 01 - Hazardous Materials.
 3. Quality Insurance: Submit the following documents in accordance with Section 01 45 00 - Quality control.
 1. Certificates: Submit documents signed by the manufacturer certifying that products, materials, and equipment meet the requirements as to the physical characteristics and performance criteria.
 2. Manufacturer's instructions: where required, submit manufacturer's instructions, including any indication of specific methods for handling, implementation, and cleaning.
- 1.4 DELIVERY, STORAGE AND HANDLING 1. Packaging, transportation, handling and unloading:
1. Transporting, storing and handling materials and equipment, in accordance with Section 01 61 00 - General requirements for products.
 2. Transporting, storing, and handling materials and equipment according to manufacturer's instructions.

2. Management and Disposal
 1. Separate waste materials for reuse/reuse and recycling, in accordance with Section 01 74 21 - Management and disposal of construction / demolition
 2. Do not burn wood that has been treated with a preservative.
 3. Wood treated with preservative shall be separated from materials and equipment to be recycled or reused. Direct waste, and sawdust from treated wood to a landfill proposed by the contractor, but approved by the Department's Designated Representative.
 4. Direct the unused wood preserving chemicals to an approved hazardous waste collection.
 5. It is forbidden to discharge unused preservatives in a drain, in a river, a lake, on land or at any other place where it could pose a risk to health or the environment.
 6. Run the solvent cement to an approved unencumbered collection of hazardous materials proposed by the contractor, but approved by the Department's Designated Representative.
 7. It is forbidden to discharge unused solvent cement in sewage, in a river, a lake, on land or at any other place where it could pose a risk to health or the environment.

PART 2 - PRODUCTS

- 2.1 SUSTAINABLE DEVELOPMENT
 1. Materials / equipment and products: in accordance with Section 01 47 15 - Sustainable Development - Construction.
 2. The requirements of sustainable development on the control must comply with Section 01 47 17 - Sustainable development - Testing.
- 2.2 PVC CONDUITS AND FITTINGS
 1. Rigid PVC conduits with flared ends and with prefabricated fittings used for direct burial and sized as indicated. Note that it is forbidden to use PVC pipes in soils that may contain harmful substances for certain polymers (eg. oils or solvents). Consult the pipe manufacturers for additional chemicals that could be harmful. Use fibreglass or other suitable conduit, where the soil contains such substances.
 2. Rigid PVC fittings, opaque, flared-tipped, solvent weld elbows, couplings, reducers, plugs, caps and adapters necessary to achieve a complete installation.
 3. Rigid PVC elbows, 90 degrees and 45 degrees.

4. Rigid PVC elbows, angle of 5 degrees.
 5. Expansion joints according to manufacturer's recommendations and as indicated.
- 2.3 SOLVENT WELD COMPOUND
1. Solvent cement for joining PVC conduit.
- 2.4 FIBREGLASS DUCTS
1. Thermoset reinforced fiberglass conduits conform to CSA C22.2 No. 211.3, type AG or BG, waterproof, self-extinguishing and sized as indicated. Note that the AG type can be used for both above and underground installation. The BG type is only suitable underground installation. AG type has a higher compressive strength than the BG type.
 2. Couplings, reducers, caps, adapters and brackets needed to achieve a complete installation.
 3. Expansion joints according to manufacturer's recommendations and as indicated.
- 2.5 PLASTIC POLYETHYLENE PIPE
1. Polyethylene flexible or rigid hoses with couplings and fittings approved and required to perform a full installation.
- 2.6 CABLE PULLING EQUIPMENT
1. Nylon or polypropylene stranded 6mm tensile strength of 5 kN pull cord in one length in each conduit with 3 m beyond each end of it.
- 2.7 MARKERS
1. Supply and install marker according to requirements. If several types of marker are required, indicate or specify the places where each type should be installed.
 1. Markers locating cables, concrete 600 mm x 600 mm x 100 mm, with appropriate inscriptions "cable", "joint" or "conduit" engraved on the top, and arrows indicating a change of direction in the course of these feeders and / or ducts.

PART 3 - EXECUTION

- 3.1 MANUFACTURER'S INSTRUCTIONS
1. Compliance: comply with the requirements, recommendations and manufacturer's written specifications, including all technical bulletin available, instructions on handling, storage and installation of products, and technical information sheets.

3.2 INSTALLATION

1. Group underground conduits or pipes as indicated and in accordance with the manufacturer's requirements.
2. Install groups of pipes on a 150 mm thick layer of sand compacted to 95% of Proctor maximum dry density.
3. Dig the trench across the whole distance between two points before you start laying pipes and make sure no obstructions are present that could cause a change in the level of the conduits.
4. In case of unstable soils (clay), pour a 75 mm thick concrete slab at the bottom of the trench before placing conduits.
5. Install conduits leveled and/or sloped as indicated, giving them a minimum slope of 1:400.
6. Maintain conduits spacing as indicated.
7. Proceed to transpositions, deviations and changes of direction using 5 degree elbows; the total deviation should not exceed 2 degrees.
8. Use conduit adapters to connect non-metallic conduits to steel conduits.
9. Terminate the very end of each pipe network by a connection cap flush with the end (wall and / or floor), in anticipation of a possible extension.
10. When cutting, boring and facing the end of the conduits during construction, obtain the the Department's Designated Representative's authorization and follow the manufacturer's recommendations so that the ends are identical to factory-prepared ends.
11. Clean the inside of the conduits before installation. Plug the end with PVC caps to prevent foreign matter from entering, during and after installation.
12. Immediately after installation, run a 300 mm long and 6 mm smaller than the inside diameter of the conduit wood chuck, followed by a stiff bristle brush to remove sand, dirt or other foreign material. Brush with a stiff bristle brush in each conduit immediately before cable pulling.
13. In each pipe, install a single length pull cord, full length of the conduit and 3 m beyond the two ends of the conduit.

- 3.3 MARKER LOCATION
- .1 Install concrete tracking marker above the ends of these groups of conduits. Install these markers flush with the finished ground level.
 - .2 Install markers at 50 m intervals along the straight conduits groups and at each change of direction.
 - .3 When necessary to remove the tracking markers for other work, reinstall the markers once the work is completed.
 - .4 Lay concrete tracking markers flat and flush with the finished ground surface, while centered over the conduits.
 - .5 Provide drawings showing the location of the tracking markers.
- 3.4 CLEANING
- .1 Perform cleanup in accordance with Section 01 74 11 - Cleaning.
 - .2 Remove excess construction material and equipment, waste, tools and equipment once the installation work and performance monitoring are completed,
- 3.5 INSPECTIONS
- .1 Notify the Department's Designated Representative and the owner's representative before cleaning and sealing of the conduits to allow them to inspect the conduits.