

PART 1 GENERAL

1.1 WORK INCLUDED

- .1 This Section specifies requirements for construction of domestic water service connections and domestic water well. Work includes supply, installation and testing of water, pipe, valves, fittings and related appurtenances.

1.2 REFERENCES

- .1 AWWA A100-15 Water Wells
- .2 ANSI/AWWA B300-10 Hypochlorite's
- .3 ANSI/AWWA C500-09, Standard for Metal-Seated Gate Valves for Water Supply Service.
- .4 ANSI/AWWA C900-07, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. to 12 In. (100mm - 300mm) for Water Transmission and Distribution.
- .5 ANSI/AWWA C905-2010, Polyvinyl- Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In. Through 48 In.
- .6 ASME B16.1-2010 Cast Iron Pipe Flanges and Flanged Fittings
- .7 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .8 ASTM F876-10e1, Standard Specification for Polyethylene Crosslinked (PEX) Tubing.
- .9 ASTM F1282-10, Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.
- .10 AWWA C651-05 Disinfecting Water Mains
- .11 AWWA B301-10, Liquid Chlorine.
- .12 CAN/CSA B137 Series-09, Thermoplastic Pressure Piping Compendium.
- .13 Guidelines and Legislation:
 - .1 Guidelines for Canadian Drinking Water Quality.
 - .2 Water Well Regulation (Province of New Brunswick) 90-79 under the Clean Water Act.
 - .3 Clean Water Act (Province of New Brunswick) 1989
 - .4 On-site Sewage Disposal System Regulation (Province of New Brunswick) 09-137 under the Public Health Act.
 - .5 Public Health Act (Province of New Brunswick) 2009.

1.3 QUALIFICATIONS

- .1 New Brunswick "Clean Water Act" requires that all new well construction must be carried out by a licensed New Brunswick Water Well Contractor and licensed well driller.

1.4 SUBMITTALS

- .1 Provide shop drawings in accordance with Section 01 33 00 for all pipe, fittings, valves, well pump, well construction materials and all other items necessary for a complete installation. Include details showing dimensions and tolerances.
- .2 Submit to Departmental Representative three (3) copies of product data sheets or brochures.
- .3 On completion of work, submit to the Departmental Representative a report containing:
 - .1 Log of well drilling;
 - .2 Record drawing of well;
 - .3 Grouting details;
 - .4 Record of blow (pump) test.
 - .5 GPS coordinates of the well Products

1.5 CERTIFICATES

- .1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section and the latest Guidelines for Canadian Drinking Water Quality as published by Health Canada.

1.6 HANDLING AND STORAGE

- .1 Handle and store pipe, valves and fittings, in such manner as to avoid shock and damage. Do not use chains or cables passed through pipe bore. Do not damage coatings or linings.
- .2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.
- .3 Store valves to prevent retention of water and damage by freezing.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Watermain to be PVC DR-18, diameter as shown on the drawings. Class 150 for pipes, 150mm to 300mm and Class 235 for pipes 350mm to 900mm.
- .2 Water service lateral shall be "Q-Line" tubing or MUNICIPEX tubing.

2.2 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- .1 Pipe and Joints: to CAN/CSA B137.3-M, AWWA C900 or AWWA C905 cast-iron outside diameter, gasketed bell-end joint.
- .2 Fittings:
 - .1 Gray or ductile iron: to AWWA C110 and C153 cement motor lined, minimum pressure rating 1035 kPa for cast, 1720 kPa for ductile iron.
- .3 Lateral: to meet CSA B137.5 and ASTM F1282 or ASTM F876.

2.3 WELL

- .1 General
 - .1 Provide all materials, equipment and supplies to drill the water well.
 - .2 203mm nominal inside diameter carbon steel inner well casing with 4.7 mm wall thickness.
 - .3 Surface well casing to meet standard in 'Schedule A' of Well Construction Regulations, of sufficient casing diameter for placement of grout and packing.
 - .4 Use pipe fittings of same standard as pipe casing.
 - .5 Stainless steel, pipe size, well screens. Screen slot size to be determined by Departmental Representative in consultation with Contractor.
 - .6 Surface well casing shall have a driveshoe attached to bottom, suitable for providing a seal with the adjacent formation.
- .2 Pitless Adaptor: Provide a pitless adaptor rated for pipe diameter of riser pipe. Also include a lockable, sealed, vented, vermin proof, watertight cap, gasketed adapter assembly, pump torque arrester devices and conductor wire spud. The well cap shall have a sealing device to accommodate power cables to the well.
- .3 Submersible Pump: Provide a submersible pump suitable for installation based on the exact well yield. Submit shop drawings for approval.
 - .1 For the purposes of submitting a price for the work, the Contractor is to assume:
 - .1 Submersible pump capable of delivering 40-50 US gallons per minute at a delivered pressure of 60 psi at the well head.
 - .2 Pump riser to be 75mm polyethylene tubing and required couplings.
 - .3 Pump suitable for operation on 600V/3Ø/60Hz. 3 wire connected; complete with VFD and surge protector.
 - .4 The assumed well depth is 120m.
 - .2 Provide pump set complete with 61m of power cable to extend from pump motor to the pull box located adjacent to the wellhead.
 - .3 Equipment to be supplied with isolating switch, control box comprised of control relay, capacitor and overload protection. Turn control box over to electrical subcontractor for installation in the Control Room.
 - .4 Provide and install well level sensor complete with cable extending directly to pull box for integration into pump

controller.

.5 Acceptable material: Sta-Rite, Xylem, and Webtrol or approved equal.

.4 Discharge Pipe: The discharge pipe shall be ASTM A53 grade B standard weight steel pipe, in uniform lengths and connected by threaded sleeve type steel coupling. The ends of the pipes shall have ANSI B1.20.1 standard tapered pipe threads. Inside diameter of the pipe shall be such that the head losses shall not be more than 4%.

2.4 GATE VALVE

- .1 Standard buried type: to AWWA C500 or AWWA C590 up to and including 300mm, minimum working pressure rating 1380 kPa and as follows:
- .1 Body: cast-iron with mechanical joint ends.
 - .2 Mechanism: bronze mounted, solid or resilient wedge, epoxy coated, stainless steel bonnet, stainless steel packing gland nuts and bolts, non-rising spindle, and O-ring seals.
 - .3 Direction to close: clockwise.
 - .4 Operating nut: 50mm square.
- .2 Epoxy coat all gate valves with minimum 150 microns coating.

2.5 VALVE BOXES

- .1 Valve Boxes: to AWWA C500 and as follows:
- .1 Cast-iron, slide type, adjustable for depth of pipe below finished grade.
 - .2 Covers marked "Water", "Sprinkler" or "Service" as applicable.
 - .3 Lugged to prevent turning and rolling of cover, and cover notched to suit.
 - .4 Have clear opening of 135mm.
 - .5 Bonnet on the bottom section which is capable of enclosing the packing gland section of the gate valve.

2.6 INSULATION

- .1 Rigid insulation as specified in Section 31 23 10.

2.7 DISINFECTANT

- .1 Sodium hypochlorite or calcium hypochlorite: to AWWA B300.
- .2 Liquid Chlorine: to AWWA B301.

2.8 REDUCING AGENT

- .1 Hydrogen Peroxide, 35% by mass commercial grade.

2.9 BOLTS FOR BURIED SERVICE

- .1 T-head bolts and nuts: Low alloy Corten steel.

2.10 HOSE BIB

- .1 Hose bib shall be cast brass with backflow protection, 19mm male thread

nozzle, full circle handwheel, 125psi pressure rating, freezeless, and CSA approved.

.1 Backflow protection shall be dual check valve preventing backflow by either backpressure or back-siphonage.

PART 3 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.
- .2 Provide proper implements, tools and facilities approved by the Departmental Representative for the safe and convenient execution of the work. Take every precaution to prevent foreign material from entering the pipe.

3.2 TRENCHING, BEDDING AND BACKFILLING

- .1 Do trenching, bedding and backfilling to Section 31 23 10 and as specified on the drawings.
- .2 Bedding in accordance with Section 31 23 10, item 2.1.6.

3.3 BURIED PIPE INSTALLATION

- .1 Lay and join pipe, fittings, and valves as specified herein and according to manufacturer's published instructions
- .2 Do not lay pipe and fitting when trench bottom is frozen, underwater or when trench conditions or weather are unsuitable.
- .3 Lay pipe and fittings on prepared bed, true to line and grade indicated, within following tolerances:
 - .1 Horizontal Alignment: 150mm.
 - .2 Vertical Alignment: 75mm.
- .4 Face bell ends in direction of laying. On grade of 5% or greater, lay pipe upgrade. For grades exceeding 16%, install appropriately designed gradient thrust restraints.
- .5 Do not exceed maximum joint deflection recommended by manufacturer.
- .6 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipe laying is not in progress.
- .7 Do not use excessive force to joint pipe sections.
- .8 Install gaskets in accordance with manufacturer published instructions. Use only lubricant approved for potable water as supplied by manufacturer. During cold weather, store gaskets in heated

- area to assure that gaskets remain flexible.
- .9 Align pipes carefully before joining.
 - .10 Support pipes as required to assure concentricity until joint is properly completed.
 - .11 Keep pipe joints free of mud, silt, gravel or other foreign materials.
 - .12 Avoid displacing gasket or contaminating with dirt, petroleum products or other foreign material. Remove, clean, re-install and lubricate gaskets so disturbed.
 - .13 Complete each joint before laying next length of pipe.
 - .14 Where deflection at joints is permitted, deflect only after spigot is fully inserted in bell.
 - .15 At structures, provide a flexible joint not more than 300mm from outside face of structure.
 - .16 Cut pipe as required for fittings or closure pieces, square to centreline, and as recommended by manufacturer. Do not damage pipe lining or coating and leave smooth bevelled edge.
 - .17 For corrosion protection, install polyethylene tube or sheet on all ductile- iron fittings, as per manufacturer's instructions and to AWWA C105. Install zinc anodes.
 - .1 All services, curb stops, and main stops = 11kg.
 - .2 All fire hydrants = 11kg.
 - .3 All valves > 200mm = 11kg.
 - .4 All else = 5.5kg.
 - .18 Give sufficient notice so that appropriate installation inspection and approval of watermain pipe tapping can be undertaken by the authorities having jurisdiction.

3.4 WELL

- .1 Equipment, casing, screens, and grouting to be installed as per manufacturer's recommendations and per Provincial Guidelines.
- .2 Pump installation and start-up to be coordinated with Electrical Contractor.
- .3 Drill in general location indicated, a minimum 30 m from the septic tank and 6.1 m from the outer boundary of any road or public highway, and accessible for cleaning, treatment, repair, testing, inspection, and such other attention as may be necessary.
- .4 Drill hole round, plumb and true to line.
- .5 Log the hole as drilling proceeds including the following information:
 - .1 Depth of changes in formation.
 - .2 Description of formations encountered.
 - .3 Elevation at which aquifers are encountered, sudden changes in water level, loss of drilling fluid or other indications of permeable

strata.

- .6 The assumed well depth is 120m.
- .7 Prevent foreign matter from entering hole and prevent contaminated water or other objectionable fluids from reaching aquifer through borehole.
- .8 Be prepared to control, shut-off and seal hole should flowing artesian water or gas be encountered.
- .9 Develop well until water of acceptable clarity is produced.
- .10 Seal abandoned holes by approved methods with concrete, cement bentonite grout.

3.5 VALVES, VALVE BOXES, POST INDICATOR VALVES (PIVs)

- .1 Install valves at locations indicated. Joints and bedding as specified for pipe and fittings.
- .2 On direct buried valves, install valve boxes and PIVs plumb and centered over operating nut, and true to line and grade.
- .3 Install 11kg zinc anodes on all valves.
- .4 Place select backfill material, material, maximum size 50mm around valve box to subgrade.
- .5 Set PIV target plates in accordance with manufacturers published instructions.

3.6 DOMESTIC SERVICE LATERALS

- .1 Lay service pipe in a smooth trench bottom with gravel bedding 250mm below the pipe and a minimum 18 inches over the pipe.
- .2 Backfill with well graded select backfill.
- .3 Install new 11kg zinc anode on copper services.
- .4 Hose bib to be installed as indicated on the drawings.
- .5 Tapping into a water main shall be done with the use of proper tools and equipment and in accordance with pipe and service saddle manufacturer's specifications. The water main shall be tapped at 67.5° from top of center line of the pipe.

3.7 HYDROSTATIC TESTING

- .1 Provide labour, equipment and materials required to perform hydrostatic test.
- .2 The operation of any valve shall be done by Park Staff. Notify the Departmental Representative 24 hours prior to all filling, flushing or chlorination operations for new construction.
- .3 All services, mains and other appurtenances shall be included in the system test.

- .4 Testing shall not be carried out until, the access road base course (first lift of gravel) has been placed and compacted.
- .5 Perform tests in presence of a professional engineer or their representative
- .6 All valves must be pressure tested, including hydrant valves.
- .7 Open all valves in test section.
- .8 Expel air from main by slowly filling with potable water. Install corporation stops at high points where no air-vacuum release valves are installed.
- .9 The test shall be conducted at a minimum pressure of the greater of 1035 kPa or one and one-half (1.5) times the operating pressure at the lowest point of the system being tested. In any case, the test pressure shall not exceed 1035 kPa.
- .10 The test shall be conducted over a full two (2) hour period, maintaining a constant test pressure. Allowable leakage shall not exceed the amount given by the formula:

$$Q = \frac{(LD \text{ sq. root } P)}{795000}$$

Where,

Q= allowable leakage in L/hr,

L= length of pipe tested in m,

D= diameter of pipe tested in mm,

P= test pressure in kPa.

- .11 Locate and repair defects if test fails. Retest until results show remedial measures have been successful.
- .12 All water used for pipe testing including pressure testing, chlorination, flushing and dechlorination shall be the responsibility of the contractor, and shall be potable water.

3.8 FLUSHING AND DISINFECTION

- .1 After well has been completely constructed, thoroughly clean of foreign substances, including tools, timbers, rope, cement, oil, grease, joint dope and scum. Thoroughly swab casing pipe using alkalis if necessary to remove oil, grease or joint dope.
- .2 Fill well with chlorine solution and replenish as required so that a chlorine residual of 50 ppm is maintained in all parts of well for a minimum period of 2 hours. Provide and operate a visual comparator to determine chlorine residual as directed.
- .3 Dispose of chlorinated test water as per the requirements of the NBENV.

3.10 COMPLETION

- .1 The area immediately surrounding the well shall be filled with clay or clean earth for a distance of 4.5 m in all directions from the well, less if constrained by property line and well location relative to building and should be graded to an elevation of 61 cm above the highest known surface water level (or present grade level).
- .2 Final Cleaning:
 - .1 When the work is substantially performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining work.
 - .2 Remove waste materials and debris from site at regularly scheduled times or dispose of as directed by DEPARTMENTAL Representative. Do not burn waste materials on site.
 - .3 Leave work site clean before inspection process commences.
- .3 Documents
 - .1 Collect reviewed submittals and reports.
 - .2 Provide warranties fully executed and notarized as required by the Departmental Representative.
- .4 Inspection/Takeover Procedures
 - .1 Prior to application for certificate of Substantial Performance, carefully inspect the Work and ensure it is complete, that major and minor construction deficiencies are complete and defects are corrected. Notify Departmental Representative in writing, of satisfactory completion of the Work and request an inspection.
 - .2 During Departmental Representative inspection, a list of deficiencies and defects will be tabulated. Correct same.
 - .3 When Departmental Representative considers deficiencies and defects have been corrected and it appears requirements of Contract have been performed, make application for certificate of Substantial Performance.

END OF SECTION

PART 1 GENERAL

1.1 WORK INCLUDED

- .1 This section specifies requirements for constructing gravity sanitary sewers, precast septic tank and drainage field. Work includes supply, installation, low pressure testing of pipe, fittings and service connections.

1.2 REFERENCE STANDARDS

- .1 CAN/CSA A257 Series-09, Concrete Pipe and Manhole Sections.
- .2 CAN/CSA B1800-11, Thermoplastic Non-pressure Piping Compendium.
- .3 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
- .4 CAN/CSA-A23.4/A251, Precast Concrete-Materials and Construction/Qualification Code for Architectural and Structural Precast Concrete Products.
- .5 CAN/CSA-B66, Prefabricated Septic Tanks and Sewage Holding Tanks.
- .6 ASTM D4254-00(2006), Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
- .7 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- .8 On-site Sewage Disposal System Regulation (Province of New Brunswick) 09-137 under the Public Health Act.
- .9 Public Health Act (Province of New Brunswick) 2009.
- .10 Water Well Regulation (Province of New Brunswick) 90-79 under the Clean Water Act.
- .11 New Brunswick Technical Guidelines for On-site Sewage Disposal Systems

1.3 DESIGN REQUIREMENTS

- .1 System to be a conventional system designed and installed according to New Brunswick Technical Guidelines for On-site Sewage Disposal Systems.
- .2 Submit the completed application to install an on-site sewage disposal system to the NB Health Protection Branch, pay applicable fees.
- .3 System to be designed and installed by a licensed installer
 - .1 Licensed in New Brunswick
 - .2 Design precast concrete septic tank in accordance with CAN/CSAB66

.4 System to have minimum total working capacity of [4,500L/day].

.5 Submit for review:

.1 Design calculations for items designed by installer.

1.4 SHOP DRAWINGS

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

.2 Submit shop drawings for all pipe, concrete structures, and system configuration. Include details showing dimensions and tolerance of pipe and joint proposed.

1.5 CERTIFICATES

.1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section in accordance with Section 01 33 00 - Submittal Procedures.

.2 Ensure certification is marked on pipes and structures.

1.6 HANDLING AND STORAGE

.1 Handle and store pipe and fittings in such manner as to avoid shock and damage. Do not use chains or cables passed through pipe bore.

.2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.

1.7 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services and maintain existing flows during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

.3 Notify Departmental Representative 24 hours minimum in advance of any interruption in service.

PART 2 PRODUCTS

2.1 GENERAL

.1 Sanitary pipe is to be PVC DR-35, size as indicated on Drawings.

2.2 PLASTIC PIPE AND FITTINGS

.1 Type PSM Polyvinyl Chloride to CSA B1800. Perforated or unperforated

as required.

.2 Joints: bell and spigot with rubber gasket recommended by pipe manufacturer.

.3 Bend: PVC DR35, same manufacturer as the pipe.

2.3 SERVICE SADDLES

.1 PVC main: PVC strap-on saddle, in-line tee or wye, with gasket, all stainless steel strap and O-ring in branch end.

2.4 BEDDING MATERIAL

.1 As specified in Section 31 23 10, item 2.1.6.

2.5 SEPTIC TANK

.1 New pre-cast concrete dual-chamber septic tank.

.2 Concrete mixes and materials: to CAN/CSA-B66 and CAN/CSAA23.1/A23.2.

.1 Concrete Strength: 35 MPA

.2 Air Content: 5-7%

.3 Finish tanks to commercial grade to CAN/CSA-A23.4/A251.

.4 Siphon chamber to meet design requirements specified for septic tanks.

.1 Provide siphon chamber vents.

.5 Effluent filter: include primary and secondary filter to permit removal of primary filter for servicing.

.1 Filter material to be noncorrosive PVC, ABS and polyethylene.

.2 Filter container complete with primary and secondary pull rods, inlet and outlet, leg bosses to accept either NPS 32 mm or 38 mm SCH 40 PVC pipe and septic tank riser with cover.

.3 Capacity: filter area, slot diameter and flow rate as required.

.6 Provide access holes for clean and inspection.

.7 Backfill as specified in Section 31 23 10.

PART 3 EXECUTION

3.1 PREPARATION

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

.2 Obtain Departmental Representative's approval of pipes and fittings prior to installation.

- .3 Provide proper implements, tools and facilities approved by the Departmental Representative, for the safe and convenient execution of the work.
- .4 Take every precaution to prevent foreign material from entering the pipe.

3.2 TRENCHING, BEDDING AND BACKFILLING

- .1 Do trenching, bedding and backfilling to Section 31 23 10 and as specified on the Drawings.

3.3 SEWER PIPE INSTALLATION

- .1 Lay and join pipe and fittings as specified herein and according to manufacturer's published instructions.
- .2 Carefully lower pipe into the trench. Do not drop or dump materials into trench.
- .3 Lay pipe and fittings on prepared bed, true to line and grade indicated, within following tolerances:
 - .1 Horizontal Alignment: 50mm.
 - .2 Vertical Alignment: the lesser of 12mm or one half the rise per pipe length.
- .4 Commence laying at outlet and proceed in upstream direction with bell ends of pipe facing upgrade.
- .5 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipe laying is not in progress.
- .6 Do not lay pipe when the trench bottom is frozen or underwater or when trench conditions or weather are unsuitable.

3.4 DISPOSAL FIELD PIPE INSTALLATION

- .1 Scarify trench base and walls under dry conditions.
- .2 After surface is prepared do not operate construction equipment across disposal field.
- .3 Place 150mm of drainage stone in bottom of trench.
- .4 Install distribution box between septic tank and trenches. Installation to be water-tight construction.
- .5 Distribution box: set level as indicated. Provide access with removable cover for inspection.

- .6 Connect lengths and place distribution pipe on stone material as required and cover with minimum 50 mm of stone material.
- .7 Connect each distribution pipe individually to distribution box.
- .8 Cap or plug free ends of distribution lines.
- .9 Do not backfill trenches until pipe grade and alignment have been approved by Departmental Representative and authority having jurisdiction.
- .10 Backfill trenching with material as indicated. Do not compact. Overfill to 100mm above design finished grade to allow for settlement.

3.4 PIPE JOINTING

- .1 Install gaskets in accordance with manufacturers published instructions. During cold weather store gaskets in heated area to assure flexibility.
- .2 Align pipe carefully before joining. Do not use excessive force to join pipe sections.
- .3 Support pipes as required to assure concentricity until joint is properly completed.
- .4 Keep pipe joints free from mud, silt, gravel or other foreign material.
- .5 Avoid displacing gasket or contaminating with dirt, petroleum products, or other foreign material. Remove, clean, reinstall and lubricate gaskets so disturbed.
- .6 Complete each joint before laying next length of pipe.
- .7 Where deflection at joints is permitted, deflect only after joint is completed. Do not exceed maximum joint deflection recommended by manufacturer.
- .8 Cut pipe as required for fittings or closure pieces, square to centerline, and as recommended by manufacturer.
- .9 Make watertight connections to manholes. Use non-shrink grout when suitable gaskets are not available.
- .10 At structures provide flexible joint not more than 300mm from outside face of structure, or otherwise indicated.
- .11 Make inlet and outlet joints of septic tank watertight, using modular wall seals

3.5 PIPE CLEANING

- .1 Prior to testing, clean gravity sewer to remove foreign materials.

3.6 TESTING

- .1 Conduct leakage test on septic tank in presence of Departmental Representative, before backfilling. Fill tank to level of effluent pipe, and allow to stand for 24 hours. Allowable leakage is zero.
- .2 Test each section of sewer. A section is the length of pipe between successive manholes or termination points, including service connections to the street line or termination point.
- .3 Provide labour, equipment and materials required to perform testing.
- .4 Notify Departmental Representative at least 24 hours in advance of all proposed tests. Perform tests in presence of Departmental Representative.
- .5 Flush sewers and related appurtenances to remove foreign materials.
- .6 Before testing, ensure that all relevant open ends are blanked off with watertight plugs or caps.
- .7 Low Pressure Air Testing
CAUTION:
FOR SAFETY OF PERSONNEL AND PUBLIC, OBSERVE PROPER PRECAUTIONS DURING AIR TESTING. USE TEST EQUIPMENT DESIGNED TO OPERATE ABOVE GROUND. DO NOT PERMIT PERSONNEL IN TRENCH DURING TESTING. DO NOT AIR TEST PIPE WITH DIAMETER GREATER THAN 600MM (24 INCHES).
 - .1 Provide air testing equipment meeting the following requirements:
 - .1 Air Blower: 0.5 cfs, maximum pressure 10 psi continuous.
 - .2 Pressure Relief Valve: Sized to relieve full blower capacity at maximum blower pressure. Range 3-10 psi, adjustable.
 - .3 Pressure Gauges: Range 0 to 10 psi with accuracy +/- 0.04 psi.
 - .2 Provide plugs at each end of section, with one plug equipped for air inlet connection.
 - .3 Fill test section slowly until a constant pressure of 4 psi is reached. If ground water is above section being tested, Departmental Representative may recommend increase in air pressure.
 - .4 Allow minimum 2 minutes for air temperature to stabilize, adding only amount of air required to maintain pressure.
 - .5 After 2-minute period, shut off air supply.

.6 Decrease pressure to 3.5 psi. Measure time required for pressure to reach 2.5 psi. Minimum time allowed for pressure drop is as follows:

<u>Minimum time Min:Sec</u>	<u>Pipe Diameter (mm)</u>
1:53	100
2:50	150
3:47	200
4:43	250
5:40	300
7:05	375
8:30	450
9:55	525
11:20	600

- .7 Locate and repair defects if test fails. Retest.
.8 Repair visible leaks regardless of test results.

3.8 CLEAN-UP

- .1 Upon completion of testing of each section remove all ancillary equipment and plug holes. Do not backfill around test plugs until inspected by Departmental Representative.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3 Section 26 05 00 - Electrical General Requirements.
- .4 Section 31 23 10 - Excavating, Trenching and Backfilling.
- .5 Section 33 65 73 - Concrete Encased Duct Banks and Manholes.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No. 211.1, Rigid Types EBI and DB2/ES2 PVC Conduit.
 - .2 CSA C22.2 No. 211.3, Reinforced Thermosetting Resin Conduit RTRC and Fittings (Bi-national standard, with UL 1684).

1.3 SUBMITTALS

- .1 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada, and Health and Welfare Canada for solvent cement. Indicate VOC content.
- .2 Submit manufacturer's data and certification at least 2 weeks prior to commencing work.
- .3 Submit manufacturer's information data sheets and instructions.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and Handle materials in accordance with Section 01 61 00 - Common Product Requirements.

1.5 RECORD DRAWINGS

- .1 Provide record drawings, including details of pipe and cable duct materials, maintenance and operating instructions.

PART 2 PRODUCTS

2.1 PVC DUCTS AND FITTINGS

- .1 Rigid PVC duct: to CSA C22.2 No. 211.1, type rigid PVC for direct burial with minimum wall thickness at any point of 2.8 mm. Nominal length: 3.0 m plus or minus 12 mm. Type DB2 (thinwall) PVC conduits unacceptable.
- .2 Rigid PVC split ducts as required.
- .3 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make complete installation.

- .4 Rigid PVC 90° and 45° bends as required.
- .5 Rigid PVC 5° angle couplings as required.
- .6 Expansion joints as required.
- .7 Preformed, interlocking intermediate duct spacers for duct size as indicated.
- .8 Use epoxy coated galvanized steel conduit for sections extending above finished grade.

2.2 SOLVENT WELD COMPOUND

- .1 Solvent cement for PVC duct joints.

2.3 FRE CONDUITS AND FITTINGS

- .1 FRE conduits to CSA C22.2 No. 211.3.
- .2 Conduits to be composed of glass filaments encapsulated in an epoxy matrix. Each conduit to have an integral expanded coupling with urethane gasket for sealing. No threads or adhesives to be used for assembling joints.
- .3 Conduit to be suitable for continuous operation from -40° C to +100° C without change in mechanical properties.
- .4 FRE 90° Bends, 5° Bends, couplings, adaptors caps, etc to make complete installation as indicated on drawings.

2.4 CABLE PULLING EQUIPMENT

- .1 Use 6 mm stranded nylon pull rope tensile strength 5 kN.

2.5 MARKERS

- .1 Concrete type cable markers: as indicated, with words: "Cable", "Joint" or "Conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.
- .2 150 mm wide, 4 mil, polyethylene marker tape in all trenches. Use red colored tape. Install at depth as per drawings.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install duct in accordance with manufacturer's instructions.
- .2 Clean inside of ducts before laying.
- .3 Ensure full, even support every 1.5 m throughout duct length.
- .4 Slope ducts with 1 to 400 minimum slope.

- .5 During construction, cap ends of ducts to prevent entrance of foreign materials.
- .6 Pull through each duct wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling-in cables.
- .7 In each duct install pull rope continuous throughout each duct run with 3 m spare rope at each end.
- .8 Install markers as required.

END OF SECTION