



Part 1 General

1.1 DESCRIPTION OF WORK

- .1 The work described herein shall consist of the construction of sewers including: the supply and installation of pipe, saddles, tees, elbows, plugs, manholes, the connection of the sewer to the point of discharge; and the hydrostatic leakage or infiltration testing, mandrel testing and television inspection of the sewer as required.
- .2 'Tunnelling' shall mean auguring, boring, directional drilling, pushing or coring beneath the ground surface.

1.2 CLASSIFICATION OF WORK

- .1 SEWERS - Sewer mains shall be classified on the basis of size expressed as the nominal inside diameter, (nom. i.d.), on the basis of the class rating of the pipe (if applicable), on the basis of the installation depth, and on the basis of the class of trench backfill (in accordance with Clauses 2.4 and 3.8 of Section 02 21 80, Pipe Excavation, Bedding and Backfill):
 - .1 Common Backfill (if class of backfill is not specified, it shall be "common")
 - .2 Compacted Common Backfill
 - .3 Compacted Select Granular Backfill
 - .4 Unshrinkable Backfill
- .2 SEWER SERVICE CONNECTIONS - Sewer service connections shall be classified on the basis of size expressed as the inside diameter of the sewer service pipe.
- .3 FITTINGS - Fittings (saddles, sewer service, tees, elbows, and plugs) shall be classified on the basis of size expressed as the inside diameter.
- .4 MANHOLES - There are six types of precast concrete manholes, the use of types 1, 2, 3, 4, 5 and 6 being governed by the inside diameter of the largest sewermain in the manhole.
 - .1 Type 1 - Standard for all sewer lines 200 mm to 600 mm diameter.

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- .2 Type 2- Standard for all sewer lines 200 mm to 600 mm diameter.
 - .3 Type 3- For 600 mm to 900 mm diameter lines.
 - .4 Type 4 - For 1500 mm or larger diameter lines.
 - .5 Type 5 - For Intersecting or Deflecting sewer mains where sewer mains are greater than 600 mm diameter.
 - .6 Type 6 - Drop-Style for sewer lines 200 mm to 600 mm diameter where the difference in invert elevations exceeds one metre.
 - .7 Descriptions for each type of manhole may be found in Section 02 70 30 of the Standard Construction Drawings Appendix.
- .5 MANHOLE FRAME AND COVER UNITS - Frame and cover units shall be classified as either:
- .1 Solid
 - .2 Open
 - .3 Side Inlet
 - .4 Rolled Curb and Gutter
 - .5 Descriptions of each type may be found in Section 07 70 30 of the Standard Construction Drawings Appendix.
- .6 CONNECTION TO POINT OF DISCHARGE - The connection of the furthest downstream portion of the sewer to a point of discharge shall be classified as either a connection to an existing plugged sewer stub, to a manhole, or to a wetwell.

1.3 STANDARDS

The following organizations publish Standards which have been referred to in this Section:

- .1 CSA International
178 Rexdale Boulevard
Etobicoke, Ontario M9W 1R3
- .2 ASTM –American Society for Testing and Materials
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959 USA

The Standards referred to shall be the most recent edition

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1.4 REFERENCED STANDARD DETAILS

- .1 SD-07 Standard Sewer Service Connection
- .2 SD-08 Deep Sewer Service Connection
- .3 SD-09 Shallow Sewer Service Connection
- .4 SD-10 Type 1 Manhole
- .5 SD-11 Type 2 Manhole
- .6 SD-12 Type 3 Manhole
- .7 SD-13 Type 4 Manhole
- .8 SD-14 Type 5 Manhole
- .9 SD-15 Type 6 Manhole
- .10 SD-16 Manhole Cover Unit & Frame
- .11 SD-17 Cover Lift Rings

1.5 QUALITY ASSURANCE

- .1 CONCRETE - The Engineer shall carry out such tests on concrete (used to grout manholes and catch basins) as he considers necessary, in accordance with the current CSA Standard A23.2, Methods of Test for Concrete. Such tests shall be at the expense of the Owner, except that the Contractor shall furnish any and all test samples free of charge.

1.6 STORAGE AND HANDLING

- .1 Pipe, fittings and appurtenant materials associated with the construction of the sewers shall be stored and handled in accordance with the recommendations of the respective manufacturer or as directed by the Engineer.

1.7 INSPECTION

- .1 Inspection of the work described in this Section shall be performed by the Engineer.

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Part 2 PRODUCTS

2.1 PIPE

Unless otherwise specified in Section 01 00 10, Special Provisions, pipe, saddles, tees, elbows, plugs and joining products shall be as follows:

- .1 PVC - Pipe and fittings shall be manufactured of Type 1 Grade 1 Polyvinyl Chloride in accordance with the current ASTM Standard D2241, Standard for Polyvinyl Chloride Pipe, ASTM3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings, CSA B182.1 Plastic Drain and Sewer Pipe and Pipe Fittings and CSA B182.2 PVC Sewer Pipe and Fittings. Each length of pipe shall have a bell end with a rubber gasket as supplied by the pipe manufacturer. Pipe lengths shall not exceed 6 m. The pipe shall be either PVC SDR 35 or PVC SDR 28 for sewer mains, and PVC SDR 35 for sewer service connection pipe. Fusible PVC shall be manufactured in accordance to ASTM cell classification 12454, AWWA C900 and AWWA C905 and be CSA B137.3 and NSF 61 certified.
- .2 PROFILE PVC SEWER PIPE - Profile PVC sewer pipe shall conform to CSA B182.4 Profile PVC Sewer Pipe and Fittings and ASTM F-794 Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter. The pipe shall have a cell classification of 12454-B in accordance with ASTM D1784. Pipe fittings shall be injection moulded to ASTM D3034 and CSA B182.1. Fabricated fittings for larger size fittings shall be in accordance with ASTM D3034, ASTM F679 and CSA B182.4. Gaskets for pipe and fittings shall be CSA 182.4 and ASTM F477.
- .3 CONCRETE – Pipe and fittings shall be extra strength concrete conforming to the current ASTM C14, Standard for Non-reinforced Concrete Sewer, Storm Drain and Culvert Pipe, for pipe up to 450 mm in diameter. Concrete pipe and fittings 525 mm in diameter and larger shall be Class II reinforced concrete conforming to the current ASTM C76-11 Standard for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe. Each length of pipe of 150 mm to 525 mm in diameter shall be complete with a rubber gasket. Each length of pipe of 600 mm to 1.35 m shall be complete with either a rubber or "Ram-nek" flexible bituminous gasket. Each length of pipe with an inside diameter exceeding 1.35 m shall be complete with either a "Ram-nek" flexible bituminous gasket or with a mortar joint. Pipe shall not exceed 3 m in length.

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2.2 MANHOLES

- .1 Manholes shall be fabricated of precast reinforced concrete in accordance with the current ASTM C478, Standard Specification for Precast Reinforced Concrete Manhole Section. Joints shall be complete with a "Ram-nek" flexible bituminous gasket. Cement used in precast concrete manhole manufacture shall be sulphate resistant meeting the current CSA Standard A5, Portland Cement, Type 50. Aluminium ladder rungs shall be cast into the manhole sections.

2.3 MANHOLE FRAME AND COVER UNITS

- .1 Frame and cover units shall be cast iron in accordance with ASTM A48, Standard Specification for Gray Iron Castings, Strength Class 30B. Castings shall be true to the required pattern and shall be free from cracks, gas holes, flaws and excessive shrinkage. Casting surfaces shall be free from burnt-on sand and shall be reasonably smooth. Runners, risers, fins and other cast-on pieces shall be removed. Adjustment riser rings shall be used for adjusting the elevation of cover units. Composite manhole frames and covers are not approved for roadways and shall be WD Industrial Group WD50FC-6 and WD50SC or approved equal.

2.4 CONCRETE

- .1 Concrete used for grout and for forming benching channels in manholes shall have a 28 day compressive strength of not less than 15 MPa. Cement used in concrete shall be sulphate resistant meeting the current CSA Standard A5, Type 50 Portland cement. Water used for mixing concrete shall be clean and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances. It shall be equal to potable (suitable for drinking) water in both physical and chemical properties.

2.5 GASKETS AND LUBRICANTS

- .1 Gaskets and lubricant used to join pipes and fittings shall be of a type compatible with the particular pipe or fitting being used.

2.6 SEWERMAIN INSULATION (SHALLOW BURY)

- .1 When in areas of shallow trench it shall be necessary to provide insulation over the top and sides of the pipe. The required insulation shall conform to CAN ULC S701-97 or CGSB-51-GP-20M type 4 rigid extruded polystyrene foam HI-40 (blue in colour) as manufactured by DOW chemical or approved equal with a

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compression strength of 275 kPa. A typical pipe insulation detail is shown on SD-18 of the Standard Construction Drawing Appendix. In the case of two pipes insulated in a common trench the insulation shall envelope both pipes.

2.7 RUNGS

- .1 Rungs shall be cast into the manhole precast concrete sections every 305 mm and shall be made in accordance with CSA G30.18, No. 25M Billet steel deformed bars, hot dipped to ASTM A123/A123M, galvanized to CSA G164. Rungs shall be safety pattern (drop step type).

Part 3 EXECUTION

3.1 EXCAVATION AND BEDDING BACKFILL

- .1 This portion of the work shall be in accordance with Section 02 21 80, Pipe Excavation, Bedding and Backfill.

3.2 GRADE AND ALIGNMENT

- .1 Sewer pipe shall be installed to the benchmark and alignment shown on the Plans. Vertical variance from grade shall not exceed the following limits; the invert of the pipe shall not be more than 12 millimetres below the design grade nor more than 12 millimetres above the design grade and there shall be no dips which will allow ponding of water to a depth of more than 25 millimetres. Horizontal variance from line shall not exceed 100 millimetres. Sharp bends will not be permitted even though the sewer pipe remains within these tolerances.
- .2 Manholes, tees, wyes, reducers and bends shall be installed to the grades and at the locations shown on the Plans. The allowable tolerance from the line and grade shall not exceed those specified for sewer pipe.

3.3 CLEANING

- .1 Prior to installation, all interior and joining surfaces of all pipes and fittings shall be cleaned of dirt and foreign material and wiped dry.

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3.4 JOINING PVC PIPE

- .1 The pipe shall be installed with the bell end facing upstream unless otherwise specified by the Engineer. An integral rubber gasket shall be supplied in the bell end of the pipe. The manufacturer's recommended lubricant shall be applied to the bevelled spigot end. The spigot end shall be inserted into the bell end of the previously laid pipe to the stop mark which the manufacturer provides on the spigot end, such that a secure joint is obtained.

3.5 JOINING CONCRETE PIPE (BELL AND SPIGOT TYPE)

- .1 The pipe shall be laid with the bell end facing upstream unless otherwise specified by the Engineer. Lubricant shall be applied to the spigot and gasket in the bell end of the pipe. The spigot end of the pipe shall be inserted into the bell end of the previously laid pipe such that a secure joint is obtained.

3.6 JOINING CONCRETE (TONGUE AND GROOVE TYPE)

- .1 The pipe shall be laid with the groove end facing upstream unless otherwise specified by the Engineer. A gasket shall be placed on the tongue end of the pipe. The lubricant shall be applied to the tongue and groove ends of the pipe. The tongue end of the pipe shall be inserted into the groove end of the previously laid pipe such that a secure joint is obtained.

3.7 GENERAL JOINING PROCEDURE

- .1 Spigot or tongue ends of pipe may be inserted into the bell, coupling or groove ends of previously laid pipe by hand, or if additional force is required to effect complete insertion, the following may be used:
 - .1 **BAR AND BLOCK** - If a bar is used for leverage, a wooden block shall be placed between the bar and the end of the pipe being pushed.
 - .2 **LEVER-TYPE OR FRICTION PULLERS** - When pullers are used, the chains shall be employed in a manner which does not cause damage to the pipe.

3.8 TUNNELLING

- .1 Where the sewer is to be installed by means of auguring, coring, pushing, or directional boring rather than by open cut trenching, the tunnel shall be of a diameter large enough to enable the pipes to be pushed through without interference or obstruction. The pits at either end of the tunnel shall be of

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adequate length to allow each pipe length to be lowered in parallel to the tunnel and joined to the length of pipe installed previously. The bell, coupling or grooved end of the previously installed pipe shall extend clear of the tunnel opening and be completely exposed to facilitate joining. The pipe lengths shall be securely joined in accordance with Clause 3.4, 3.5, 3.6 and 3.7 of this Section; whichever is appropriate.

3.9 CUTTING PIPE

- .1 If it is necessary to shorten a length of sewer pipe, the pipe shall be cut with a fine toothed hand saw, power saw (quicky saw) or hack saw, but not with a chain saw. Cut ends of PVC pipe shall be bevelled to the correct outside diameter with a fine file to duplicate the factory bevel on the spigot end of the pipe.

3.10 MANHOLES

- .1 Manholes shall be constructed in accordance with SD-10 to SD-16 of the Standard Construction Drawing Appendix.
- .2 "Ram-nek" flexible bituminous gaskets shall be installed on each manhole section prior to lowering the section into the trench. Sections shall be lowered with care and properly aligned to ensure that all ladder rungs line up vertically.
- .3 A flat top ring shall be installed on the riser just prior to the frame and cover unit.
- .4 Subsequent to the installation of the precast concrete sections and frame and cover unit, all joints and holes for lifting lugs shall be sealed on the inside with grout.
- .5 The outside of the precast concrete manhole sections shall be wrapped with 0.15 mm (6 mil) thick polyethylene which shall be taped tightly with duct tape prior to the placement of backfill. The polyethylene wrapping shall extend from the top of the manhole to the manhole base section.
- .6 TYPE 1, 2 AND 5 MANHOLES - the sewer line shall be laid through the manhole. The line shall be cut lengthwise in the bottom of the manhole such that an outside semi-circular space shall be filled with concrete to the level of the middle of the semi-circular pipe. The concrete floor shall be graded at a 10:1 slope toward the channel formed by the pipe. When the Contractor installs PVC sewer pipe through cast-in-place manhole or precast concrete walls he shall ensure a water tight connection by coating the PVC pipe with an epoxy and apply a select granular material (i.e. sand) to the epoxy for a rough prepared surface prior to

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grouting the PVC sewer pipe in place, otherwise the Contractor shall install a "manhole adaptor" (i.e. GPK manhole adaptor) grouted into place to ensure a water tight connection.

- .7 TYPE 1, 2, 3 AND 4 MANHOLE - The joints of the manhole pipe and stack unit shall be grouted externally and internally.
- .8 TYPE 6 - DROP MANHOLES - Drop manholes shall be constructed with tee and elbow sections encased in concrete as shown on SD-15 of the Standard Construction Drawing Appendix.

3.11 CONNECTION TO POINT OF DISCHARGE

- .1 EXISTING PLUGGED SEWER - The plug shall be removed from the existing sewer. A new gasket shall be installed to join the existing pipe with the new pipe. Where the two pipes consist of different materials, a secure joint shall be made by placing sulphate resistant concrete around the joint between the two pipes or by installing an approved coupler or adaptor connecting the new to the existing sewer pipe.
- .2 EXISTING MANHOLE - The wall of the existing manhole shall be exposed by excavation. A jackhammer or coring shall be used to create an opening in the wall at the point where the new pipe invert is to be located. Care shall be taken to ensure that the opening in the manhole is restricted to the immediate vicinity of the proposed pipe entry. The reinforcing steel in the area of the opening shall be cut. All rubble resulting from these operations is unsuitable material and shall be disposed of by removing it from the manhole. If a semi-circular channel does not already exist in the bottom of the manhole, one shall be formed. Existing formed channel works shall be reformed (by jack hammering and placing concrete) if required. The new pipe shall be installed such that it forms a continuous channel in the manhole. The pipe shall be cut, concrete placed and all holes grouted. When the Contractor installs PVC sewer pipe through a cast-in-place manhole or precast concrete walls he shall ensure a water tight connection by coating PVC pipe with an approved cementing agent to which sand has been added prior to grouting the PVC sewer pipe in place, otherwise the Contractor shall install a "manhole adaptor" (i.e. GPK manhole adaptor) grouted into place to ensure a water tight connection or utilize a link seal complete with link seal sleeve.
- .3 EXISTING WETWELL - An existing wetwell may be either a lift station, a portion of a sewage treatment plant, or a chamber. An opening shall be made in

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the wall of the wetwell in the same manner as described for existing manholes in Clause 3.11.2. The pipe shall be inserted, grouted in, and cut flush with the inside wall.

3.12 SERVICE CONNECTIONS

- .1 Service lines shall be connected to the sewer mains by means of either an in-line tee or a saddle. Tees shall be installed by the same method as is used to join the sewer main pipe. All saddles except PVC saddles shall be installed on the main and grouted in place using sulphate resistant cement for concrete. Appropriate cutting tools shall be employed to cut a hole in the main for the service line prior to the installation of the saddle. PVC saddles shall be installed by means of the solvent-weld cement (in the case of solvent weld saddles) on PVC sewer main, complete with two all-stainless steel clamps. Saddles utilizing a gasket only, shall be installed in accordance with manufacturers' recommendations and two all-stainless steel clamps. Refer to SD-07 to SD-09 of the Standard Construction Drawing Appendix.
- .2 Elbows shall be used as required to connect service line pipe to the tee or saddle on the sewer main. Riser pipe shall be used as required to join sewer service lines to deep sewer mains.
- .3 The end of each service line (which normally terminates at the limit of the road right-of-way) shall be sealed with an appropriate plug and a marker post installed at the ground surface.

3.13 TEMPORARY PLUGS

- .1 During prolonged pauses in the construction, such as meal breaks and overnight, the sewer lines shall be temporarily plugged with an approved plug to prevent the entry of foreign matter.

3.14 HYDROSTATIC TESTING

Following the completion of construction, the appropriate hydrostatic test shall be performed as directed by the Engineer.

- .1 INFILTRATION TEST - All accumulated water shall be removed from the sewer main prior to the commencement of the test. The Engineer shall observe the amount of accumulated infiltration over a 24 hour period. The Engineer shall calculate the amount of infiltration by establishing the volume of the pipes and

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manholes below the static water level in the manhole which is furthest downstream. The maximum allowable rate of infiltration shall be 0.15 litres per millimetre of inside diameter per 100 metres of pipeline per hour. This amount shall include infiltration through the manhole.

- .2 EXFILTRATION TEST - The lines shall be filled with water and left to stand for 24 hours prior to commencing the test, in order to allow for absorption into the pipe and manhole walls. Thereafter, the manhole and sewermain shall be filled to the level determined by the Engineer. The Engineer shall observe the drop in level over a 2 hour period. The maximum rate of leakage shall be 0.20 litres per millimetre of inside diameter per 100 metres of pipeline per hour. An additional 3.0 litres per hour per metre of manhole riser above the invert shall be allowed for leakage through manholes.

If hydrostatic testing reveals excessive leakage, the Contractor shall repair the defective sewer mains at his own cost and the test shall be repeated until leakage falls within the prescribed limit.

3.15 MANDREL

- .1 At the discretion of the Engineer, the contractor shall subject PVC pipe sewers to a mandrel test with a rigid device sized to pass 5% or less deflection (deformation) after backfilling of the trench over the pipe. The Contractor may decide to test for pipe deflection following the consolidation of the trench backfill to be determined by the Engineer. The deflection following trench consolidation shall not be greater than 7.5 per cent. No allowance shall be made for pipe wall thickness tolerances or ovality (from heat, shipping, poor production, etc). The above shall be counted in as part of the deflection allowance. The mandrel shall be hand pulled by the Contractor through the sewer lines. Any sections of sewer not passing the mandrel test shall be excavated and the Contractor shall re-install or replace the sewermain to the satisfaction of the Engineer. The repaired sections shall be retested. The inspection shall be conducted no earlier than 30 days after reaching final trench backfill grade, provided in the opinion of the Engineer that sufficient water densification or rainfall has occurred to thoroughly settle the soil throughout the entire trench depth.
- .2 If densification cannot be achieved in the time after installation prior to the project completion date, then the mandrel size shall be increased so that the rigid mandrels device would be sized to pass 4 percent or less deflection (deformation of the pipe diameter).

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3.16 TELEVISION INSPECTION

The Contractor shall provide a television inspection when specified under Section 01 00 10 of the Special Provisions or requested on site by the Engineer. The television inspection shall be complete with video recording of all completed gravity sewer mains which have an internal diameter of 1200 millimetres or less. The television inspection shall be done by personnel skilled and qualified in the use of the television inspection equipment. All televising equipment shall be the most current video format. The Contractor shall supply two sets of videos and a summary report to the Engineer. The inspection shall be performed with the direction of the flow unless a reverse set up is required. Inspection shall be between manholes or other appropriate locations where the equipment may be installed or removed. The section to be inspected shall not be broken down into units smaller than the distance between manholes or other appropriate locations as detailed above. The sewer shall be cleaned before the television inspection is done.

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