



**MATERIAL SPECIFICATION FOR PRECAST REINFORCED CONCRETE
COMPONENTS FOR MAINTENANCE HOLES, CATCH BASINS, DITCH INLETS,
AND VALVE CHAMBERS**

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1351.01 SCOPE

This specification covers the requirements for precast reinforced concrete components for the construction of maintenance holes, catch basins, ditch inlets, and valve chambers, maintenance hole steps, and aluminum safety platforms.

1351.01.01 Specification Significance and Use

This specification is written as a municipal-oriented specification. Municipal-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of many municipalities in Ontario.

Use of this specification or any other specification shall be as specified in the Contract Documents.

1351.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

1351.02 REFERENCES

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Materials

OPSS 1002	Aggregates - Concrete
OPSS 1302	Water
OPSS 1303	Admixtures for Concrete
OPSS 1315	White Pigmented Curing Compounds for Concrete
OPSS 1350	Concrete - Materials and Production
OPSS 1440	Steel Reinforcement for Concrete

Ontario Ministry of Transportation Publications

MTO Laboratory Testing Manual:

LS-412 Scaling Resistance of Concrete Surfaces Exposed to De-icing Chemicals

MTO Structural Manual

Canadian Standards Association

A23.1-09	Concrete Materials and Methods of Concrete Construction [Part of CAN/CSA A23.1-09/ A23.2-09, Concrete Materials and Methods of Concrete Construction / Methods of Test for Concrete]
A257.3-09	Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections, and Fittings Using Rubber Gaskets [Part of A257 Series-09, Standards for Concrete Pipe and Manhole Sections]
A257.4-09	Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings [Part of A257 Series-09, Standards for Concrete Pipe and Manhole Sections]

A3000-13 Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004, and A3005)
S6-14 Canadian Highway Bridge Design Code
S157-05 Strength Design in Aluminum / Commentary on CSA S157-05, Strength Design in Aluminum

ASTM International

B 221-13 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
C 990-09 (2014) Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

Canadian Food and Drug Regulations

Division 23 Food Packaging Materials

United States Federal Specifications

United States Code of Federal Regulations
Section 177.1520, Olefin Polymers

CPCQA Certification Program Requirements Document

Prequalification Requirements for Precast Concrete Drainage Products

1351.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Hoop Steel means a continuous ring of steel wire reinforcement.

1351.04 DESIGN AND SUBMISSION REQUIREMENTS

1351.04.01 Design Requirements

1351.04.01.01 Circular Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers

Circular precast concrete components shall be designed according to CAN/CSA A257.4, CAN/CSA S6, and the Structural Manual.

1351.04.01.02 Square or Rectangular Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers

Square or rectangular precast maintenance holes, catch basins, ditch inlets, and valve chambers shall be designed according to CAN/CSA S6 and the Structural Manual.

1351.04.01.03 Precast Concrete Adjustment Units

Precast concrete adjustment units shall be designed according to CAN/CSA A257.4.

1351.04.01.04 Steps

Steps that are cast, mortared, or attached by mechanical means into the walls of risers or tapered top sections shall be designed according to CAN/CSA A257.4, except that:

- a) The steps shall be evenly spaced at a distance of 300 mm centre to centre.
- b) The steps shall be located a minimum of 150 mm from the ends of the sections.
- c) The clearance between the wall face and the centre of the inside surface of the step shall not be less than 150 mm.

1351.04.01.05 Aluminum Safety Platforms

Aluminum safety platforms shall be designed according to CAN/CSA S157.

1351.04.01.06 Joints

Joints shall be designed as to be formed by a spigot end of a precast concrete section joining with a bell end on the adjoining section.

All joints of precast concrete sanitary sewer maintenance holes and valve chambers shall be provided with a joint seal system that shall be the sole element depended upon to make the joint watertight.

Joints shall be designed so that when joined they shall withstand, without cracking and fracturing, the forces caused by the compression of the joint seal system and any stresses resulting from the hydrostatic test specified in this specification.

1351.04.01.07 Precast Base Slabs and Monolithic Base Sections

Structural design, including minimum steel reinforcement requirements, shall be based on worst condition installation for standard precast maintenance hole bases. Live load, dead load, hydrostatic uplift, and other possible forces shall be considered for a burial depth of 10 m. Depth of bury shall be measured from grate elevation at the top of the precast maintenance hole to the bottom of its base. When greater depth of bury is required, a specially designed base slab shall be used.

1351.04.01.08 Precast Transition Slabs

Structural design, including minimum steel reinforcement requirements, shall be based on worst condition installation for standard precast maintenance hole transition slabs. Live load, dead load, hydrostatic uplift, and other possible forces shall be considered for a burial depth of 8.0 m for tapered transition slabs and transition slabs 1,500 mm and larger in diameter. Depth of bury for the transition slab shall be measured from grate elevation at the top of the precast maintenance hole to the top of its transition slab. When greater depths of bury are required, a specially designed transition slab shall be used.

1351.04.02 Submission Requirements

1351.04.02.01 Special Design Drawings

When the Contract Documents do not include Drawings for precast concrete components, the Contractor shall submit 2 sets of detailed structural design drawings of the components to the Contract Administrator 2 weeks prior to the commencement of work, for information purposes only. Prior to making a submission, the seals and signatures of a design Engineer and a design-checking Engineer shall be affixed on the detailed structural design drawings verifying that the drawings are consistent with the Contract Documents.

When multi-discipline engineering work is depicted on the same detailed structural design drawings and the design or design-checking Engineer or both are unable to seal and sign the detailed structural design drawings for all aspects of the work, the drawings shall be sealed and signed by as many additional design and design-checking Engineers, as necessary.

Details of precast concrete adjustment units and maintenance hole steps, including the name of the step manufacturer, shall also be included on the Drawings.

1351.05 MATERIALS

1351.05.01 Aggregates

Aggregates shall be according to OPSS 1002, except that the requirement for gradation need not apply.

1351.05.02 Cement

Cement shall be Portland cement or a commercial blend of Portland cement and blast furnace slag or fly ash, or both. Ground granulated blast-furnace slag or fly ash may also be added separately to Portland cement. Whether added separately or in the form of blended cement, ground granulated blast-furnace slag shall constitute not more than 70% by mass of the total cementing materials and fly ash shall constitute not more than 40% by mass of the total cementing materials.

Portland cement, blended cement, ground granulated blast furnace slag, and fly ash shall be according to CAN/CSA A3000.

1351.05.03 Water

Water for concrete shall be according to OPSS 1302.

1351.05.04 Chemical and Air Entraining Admixtures

Chemical and air entraining admixtures shall be according to OPSS 1303.

1351.05.05 Steel Reinforcement

Steel reinforcement shall be according to OPSS 1440 and as specified in the Contract Documents.

Steel reinforcement for precast concrete components shall be:

- a) Steel bars, 400 MPa minimum yield strength.
- b) Welded steel wire, 500 MPa minimum yield strength.
- c) Welded deformed steel wire, 500 MPa minimum yield strength.
- d) Hoop steel, cold drawn steel wire, 500 MPa minimum yield strength.

Steel reinforcement for precast concrete adjustment units shall be according to CSA A257.4.

1351.05.06 Steps

Steps shall be made of stainless steel, plastic encased steel, or plastic encased or unencased aluminum. Aluminum steps shall be according to ASTM B 221, Alloy 6351, Temper T6. Stainless steel steps shall be made of stainless steel, Type 304.

For plastic encased steps, the casing shall be of a solid, low-density virgin polyethylene material that has been deemed non-objectionable by the Health Protection Branch of Health and Welfare Canada based on the Canadian Food and Drug Act and Regulations, Division 23. In addition, the polyethylene material shall be in compliance with Title 21 of the United States Code of Federal Regulations, Section 177.1520, Olefin Polymers.

The minimum thickness of the polyethylene material shall be 3 mm along the top wearing surface of the step, excluding anchor portion. The bottom part of the step and the entire anchor portion shall have a minimum polyethylene coating thickness of 2 mm.

1351.05.07 Concrete

Concrete for precast concrete components, including circular valve chambers and all adjustment units shall be according to OPSS 1350 with a nominal 28-Day compressive strength of 30 MPa, except that the nominal 28-Day compressive strength for precast rectangular valve chambers shall be 40 MPa.

1351.05.08 Aluminum Safety Platforms

Aluminum safety platforms shall be according to ASTM B 221, Alloy 6351, Temper T6.

1351.05.09 Joint Seal System

Joint seal system for circular precast components for maintenance holes, catch basins, ditch inlets, and valve chambers shall be a dense homogeneous rubber according to CAN/CSA A257.3, Clauses 8 and 9.

Joint seal system for square or rectangular precast components for maintenance holes, catch basins, ditch inlets, and valve chambers shall comply with one of the following requirements:

- a) A dense homogeneous rubber according to CAN/CSA A257.3, Clauses 8 and 9.
- b) A flexible preformed gasket according to ASTM C 990.

1351.05.10 Membrane Curing Compound

Membrane curing compound shall be according to OPSS 1315.

1351.07 PRODUCTION

1351.07.01 General

A manufacturer producing precast reinforced concrete components for maintenance holes, catch basins, and ditch inlets shall be pre qualified and possess a current plant certificate issued under the Canadian Precast Concrete Quality Assurance (CPCQA) Certification Program.

1351.07.02 Production Method

Production of all precast reinforced concrete components shall be according to CAN/CSA A257.4.

1351.07.03 Marking

Markings shall be according to CAN/CSA A257.4 and be permanently marked on all precast components in a position readily visible for inspection. The following information shall also be marked on maintenance hole, catch basin, and ditch inlet components:

- a) The term HOOP on precast concrete riser sections using hoop steel reinforcement.
- b) The prequalification stamp as shown in Figure 1.

1351.08 QUALITY ASSURANCE

1351.08.01 General

Acceptance of the precast reinforced concrete components shall be based on the results of the step testing; concrete testing; hydrostatic testing, when specified in the Contract Documents; and salt scaling acceptance test for dry-cast concrete or air voids testing for wet-cast concrete.

Precast reinforced concrete components, equipment, other material, and labour used to perform the testing shall be supplied by the component manufacturer without any charge to the Owner.

When specified in the Contract Documents, the Owner shall be notified in writing at least 72 hours before testing is carried out. In the event that the Owner is unable to be present during the test, the manufacturer shall provide an affidavit affirming the actual recorded test results.

1351.08.02 Step Testing

1351.08.02.01 Horizontal Load Testing

The horizontal load testing of steps shall be according to CAN/CSA A257.4, except that a load of 1.3 kN shall be applied on the tread over the width of 90 mm, next to the point the step turns into the wall to form the anchorage. If the step sustains a permanent set of 6 mm or less after application of the horizontal load, the test is then acceptable.

1351.08.02.02 Vertical Load Testing

The vertical load testing of steps shall be according to CAN/CSA A257.4. If the step sustains a permanent set of 13 mm or less after application of the vertical load, the test is then acceptable.

1351.08.02.03 Integrity of Plastic Encased Steps to be Installed in New Maintenance Holes and Valve Chambers

This test applies only to steps to be installed in new concrete, less than 1 hour old for dry cast and less than 12 hours old for wet cast. Three steps of the same type shall be tested for integrity of the plastic coating in the following manner:

- a) The steps shall be maintained at $-23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for 24 hours.
- b) The steps shall then be left at $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for 24 hours.
- c) The steps shall then be cut in half, vertically, at the midpoint of the tread and the coating removed at the cut end of each step half to expose approximately 10 mm of metal.
- d) A water solution shall be prepared containing sodium chloride, 3% by mass, and a wetting agent (e.g., liquid detergent), 0.25% by volume.

- e) A wire shall be connected from an anode in the salt and detergent solution to an ohm meter.
- f) Each step half shall then be tested separately for integrity of the plastic coating by connecting the exposed end to the ohm meter and placing the sample in the salt and detergent solution to within 50 mm of the exposed metal end for at least 5 minutes.

For acceptance of the steps, the following criteria shall apply:

- a) There shall be no cracking, fracturing, or openings through the plastic encasement. An unacceptable casing shall be indicated by a resistance of less than 1 megaohm after 5 minutes in the salt and detergent solution. An acceptable coating shall be indicated by a near infinite resistance greater than 1 megaohm after 5 minutes in the salt and detergent solution.
- b) If any single step half of the three complete steps tested proves to be unacceptable, three additional complete steps of the same type shall then be tested according to the above procedures. If any of these additional steps do not meet the requirements of this specification, the product shall then be deemed to be unacceptable.

1351.08.02.04 Integrity of Plastic Encased Steps to be Installed in Existing Maintenance Holes and Valve Chambers

This test applies only to steps to be installed in existing concrete, older than 1 hour for dry cast and older than 12 hours for wet cast. Three steps of the same type shall be tested for integrity of the plastic coating in the following manner:

- a) The steps shall be maintained in a cold room at $-23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for 24 hours.
- b) Within 5 minutes of removing them from the cold room, the steps shall be driven into 25 mm diameter holes drilled in 30 MPa concrete using a standard 1.45 kg rubber mallet. The concrete shall have been cured at least 28 Days.
- c) Taking care to avoid damage to the casing, the concrete shall be chipped away from around the steps and the steps maintained at room temperature at $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for 24 hours.
- d) The steps shall be cut in half vertically at the midpoint of the tread and the coating removed at the cut end of each step half to expose approximately 10 mm of metal.
- e) A water solution shall be prepared containing sodium chloride, 3% by mass, and a wetting agent (e.g., liquid detergent), 0.25% by volume.
- f) A wire shall be placed from an anode in the salt and detergent solution to an ohm meter.
- g) Each step half shall then be tested separately for integrity of the plastic coating by connecting the exposed end to the ohm meter and placing the sample in the salt and detergent solution to within 50 mm of the exposed metal end for at least 5 minutes.

For acceptance of the steps, the following criteria shall apply:

- a) There shall be no cracking, fracturing, or openings through the plastic encasement. An unacceptable casing shall be indicated by a resistance of less than 1 megaohm after 5 minutes in the salt and detergent solution. An acceptable coating shall be indicated by a near infinite resistance, greater than 1 megaohm after 5 minutes in the salt and detergent solution.

- b) If any single step half of the three complete steps tested proves to be unacceptable, three additional complete steps of the same type shall then be tested according to the above procedures. If any of these additional steps do not meet the requirements of this specification, the product shall then be deemed to be unacceptable.

1351.08.03 Concrete Testing

1351.08.03.01 Concrete Compressive Strength

Concrete compressive strength shall be according to CAN/CSA A257.4, except cylinders shall be cast and tested monthly.

If the specified strength requirement of the concrete has not been reached after 28 Days, two cores shall be taken from a component at locations approved by the Owner. Cores shall be moisture conditioned and tested according to CAN/CSA A23.1. Repairs to the core holes shall be to the satisfaction of the Owner.

1351.08.03.02 Salt Scaling Acceptance Test

The Salt Scaling Acceptance Test shall be according to LS-412, except as noted below.

Compliance with the test requirement is based upon a loss of mass of not more than 0.8 kg/m² from the surface after 50 cycles of freezing and thawing. If the specimens fail the salt scale resistance test, the manufacturer shall submit proposals of remedial action to the Owner for consideration.

Salt scale resistance testing shall be done at least once a year per mix design. If any mix design components or component suppliers change or component mix design proportions change by more than 10%, the mix design shall then be considered new.

Specimens, at least 300 x 300 mm in size, shall be selected from finished and cured product. Specimens shall be representative of the manufacturer's production. Test specimens supplied from the finished and cured product are considered fully cured, and salt scale resistance testing can start immediately on these specimens. Specimens do not need to be saturated with moisture before testing.

A dyke may be made of any material that shall adhere to the specimen and serve to maintain the salt solution on the surface of the specimen throughout the period of the test. The dyke shall be applied during the dry period. The dyke shall not affect the test results. If a dyke is a precast mortar dyke, an air entrained paste shall be applied to the edges around the perimeter of the test specimen and any excess paste shall be removed. After allowing the paste to harden for 24 hours, epoxy sealant shall be applied to the inside, top, and outside of the dyke extending the outside surface epoxy treatment to 25 mm below the joint.

1351.08.03.03 Air Voids Testing

Air voids testing in hardened concrete shall be done at least once a year per mix design according to OPSS 1350.

1351.08.03.04 Hydrostatic Testing

When specified in the Contract Documents, hydrostatic tests shall be carried out on any of the sizes of precast sections or bases to be supplied for the Contract. Such tests shall be carried out by the precast maintenance hole supplier in the presence of the Owner's representative according to the following requirements:

- a) A minimum of two maintenance hole riser sections shall be assembled according to the manufacturer's instructions.

- b) When testing is performed in such a manner that the joint is closed, the restraining force exerted on the joint shall not exceed the force represented by the weight of a precast maintenance hole 9 m in height of the size being tested.
- c) The ends of the test sections shall be bulkheaded and the section filled with water.
- d) The maintenance hole sections shall be subjected to an internal hydrostatic pressure of 60 kPa for a period of ten minutes.
- e) All joints shall be tested. When only two maintenance hole riser sections are tested, the bulkhead joints shall also be tested.
- f) There shall be no leakage through the maintenance hole joints or walls. Damp spots and beads of moisture adhering to the walls of the sections shall not be considered as leakage.
- g) As an option, the 2 test riser sections may be allowed to soak for a period of 24 hours prior to proceeding with the hydrostatic test.
- h) Up to 1.0% of the number of each size included in the Contract shall be tested, but in no case shall less than 2 riser sections be tested for each maintenance hole size. Riser sections supplied for testing shall be sound full-size sections.

1351.08.04 Inspection and Testing

The Owner's representative shall be permitted free access to all portions of the plant engaged in the production of the precast maintenance hole, catch basin, and ditch inlet components, steps, and adjustment units and shall be provided with all reasonable facilities to secure the required samples and be satisfied that the components supplied are according to this specification.

1351.09 OWNER PURCHASE OF MATERIAL

For measurement purposes, a count shall be made of the number of complete structures delivered and accepted.

For measurement purposes, a count shall be made of the number of concrete adjustment units delivered and accepted.

Payment at the price specified in the purchasing order shall be for supply of the complete structure, individual components, steps, concrete adjustment units, or safety platforms delivered to the destination on the date and time specified.

The cost of all testing, except that performed in the Owner's laboratory, shall be included in the price.



FIGURE 1 Prequalification Stamp

**Appendix 1351-A, November 2019
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS**

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

The designer should specify the following in the Contract Documents:

- Precast reinforced concrete component drawings. (1351.04.01.01)

The designer should determine if the following are required and, if so, they should be specified in the Contract Documents:

- If Owner wishes 72 hours notice prior to quality assurance testing being carried out. (1351.08.01)
- If the Owner requires hydrostatic testing. For deeper maintenance hole test sections, higher hydrostatic test pressures to 90 kPa may be requested. (1351.08.03.03)

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

OPSD 404.010 to 404.022	Aluminum Safety Platforms
OPSD 405.010 to 405.020	Maintenance Hole Steps
OPSD 701.010 to 701.015	Precast Concrete Maintenance Holes, 1,200 to 3,600 mm Diameter
OPSD 701.021	Maintenance Hole Benching and Pipe Opening Alternatives
OPSD 701.030 to 701.081	Precast Concrete Maintenance Hole Components, 1,200 to 3,600 mm Diameter
OPSD 702.040	Precast Concrete Ditch Inlet Maintenance Hole Type A, 1,200 x 1,200 mm
OPSD 702.050	Precast Concrete Ditch Inlet Maintenance Hole Type B, 1,200 x 1,200 mm
OPSD 703.011 to 703.015	Precast Concrete Single Inlet Flat Cap, 1,500 to 3,600 mm Diameter
OPSD 703.021 to 703.024	Precast Concrete Twin Inlet Flat Cap, 1,500 to 3,600 mm Diameter
OPSD 704.010	Precast Concrete Adjustment Units for Maintenance Holes and Catch Basins
OPSD 705.010	Precast Concrete Catch Basin, 600 x 600 mm
OPSD 705.020	Precast Concrete Twin Inlet Catch Basin, 600 x 1,450 mm
OPSD 705.030	Precast Concrete Ditch Inlet, 600 x 600 mm
OPSD 705.040	Precast Concrete Ditch Inlet, 600 x 1,200 mm
OPSD 706.010 to 706.041	Precast Concrete Ditch Inlets 600 x 1,200 mm with 1,500 to 3,000 mm Diameter Flat Caps
OPSD 1101.010	Precast Valve Chamber, 1,200 mm and 1,500 mm Diameter
OPSD 1101.012 to 1101.015	Precast Concrete Valve Chamber with Poured-In-Place Thrust Blocks, 1,800 x 2,400 mm
OPSD 1101.016 to 1101.019	Precast Concrete Valve Chamber with Poured-In-Place Thrust Blocks, 2,400 x 3,000 mm
OPSD 1101.030 to 1101.033	Precast Concrete Valve Chamber with Poured-In-Place Thrust Blocks, 3,000 x 3,000 mm
OPSD 1101.040 to 1101.043	Precast Concrete Valve Chamber with Poured-In-Place Thrust Blocks, 3,600 x 3,600 mm