ONTARIO PROVINCIAL STANDARD SPECIFICATION

OPSS 1854
NOVEMBER 2019

MATERIAL SPECIFICATION FOR HIGH DENSITY POLYETHYLENE (HDPE) AND EXPANDED POLYSTYRENE (EPS) ADJUSTMENT UNITS FOR MAINTENANCE HOLES, CATCH BASINS, AND VALVE CHAMBERS

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1854.01 SCOPE

This specification covers the material and performance requirements for high density polyethylene (HDPE) and expanded polystyrene (EPS) adjustment units used for maintenance holes, catch basins, and valve chambers.

1854.01.01 Specification Significance and Use

This specification has been developed for use in municipal-oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by many municipalities in Ontario.

Use of this specification or any other specification shall be according to the Contract Documents.

1854.01.02 Appendices Significance and Use

Appendices are 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.

1854.02 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, Construction

OPSS 905	Steel Reinforcement for Concrete

CSA Standards

S6-14	Canadian Highway Bridge Design Code

ASTM International

C 578-12b	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
D 543-06	Evaluating the Resistance of Plastics to Chemical Reagents
D 638-10	Standard Test Method for Tensile Properties of Plastics
D 1308-02 (2013)	Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
D 1248-05	Polyethylene Plastics Extrusion Materials for Wire and Cable

1854.03 DEFINITIONS

For the purpose of this specification, the following definition applies:

Flat Surface means not having more than 0.25 mm deviation lineally in 305 mm.

1854.04 DESIGN AND SUBMISSION REQUIREMENTS

1854.04.01 Design Requirements

Both high density polyethylene (HDPE) and expanded polystyrene (EPS) adjustment units shall meet the following requirements, unless otherwise specified.

Adjustment rings shall not be adversely affected by exposure to salt, gasoline, antifreeze, or motor oil when tested for resistance to chemical reagents.

The maximum allowable deviation from dishing or bowling, as measured at the outer edge with the adjustment ring turned top down on a known flat surface shall be 6 mm.

The thickness of the adjustment units shall be within 3 mm of the manufacturer's stated dimension. All other dimensions shall be within 5 mm of manufacturer's specified dimension.

The appearance of the adjustment units shall be such that it shall have no voided areas, cracks, separations, or protrusions. Ripples or sags on vertical walls shall not cover more than 10% of the surface area. The colour of the adjustment ring shall be consistent.

1854.05 MATERIALS

1854.05.01 High Density Polyethylene (HDPE)

The injection molding material shall be either recycled or virgin high density polyethylene or a combination of both. The properties of the injection molding material shall be according to ASTM D 1248, Type III, Class B, Category 3.

Adjustment units shall be manufactured from injection molding material that is recyclable as a high density polyethylene product.

The maximum allowable bulging between webs as measured around the largest outside diameter and the points where the outer wall intersects the web sections shall be 3 mm.

The HDPE material shall be tested for resistance to chemical reagents according to ASTM D 543, Practice A.

1854.05.02 Expanded Polystyrene (EPS)

EPS adjustment units shall be manufactured using high density expanded polystyrene with minimum density of 80.1 kg/m^3. Core material of both round and square adjustment units shall be made of virgin expanded polystyrene that is polymerized during pre-expansion and aging. Recycled EPS material shall not be used.

EPS adjustment units shall be coated with a highly cross linked plural component polyurea sprayable system. The coating shall be 0.0762 to 0.127 mm thick.

The polyurea coating shall be tested for resistance to chemical reagents according to ASTM D 1308.

1854.07 PRODUCTION

1854.07.01 General

Adjustment units shall be manufactured using production type injection moulding, tooling, and manufacturing practices consistent with current technology being used for the type of material.

All rough edges shall be trimmed prior to shipping.

1854.07.02 Testing During Production

Testing shall be conducted on production run units not less than 24 hours old and not more than 60 Days old.

For each production run, the tests to confirm dimensions, flatness, and to ensure consistent appearance shall occur at a minimum rate of once every 500 adjustment units with the first test being conducted between the 5th and 10th adjustment ring.

1854.07.03 Markings

Each adjustment ring shall be clearly marked on the inside or top surface with the following information:

a) Manufacturer's name or logo.

b) Product trade name or catalogue number, if applicable.

c) Location of manufacture.

d) Date of manufacture (i.e., yyyy-mm-dd).

e) Dimensions of the adjustment units, including:

   i. Thickness
   ii. Inside dimensions
   iii. Outside dimensions

f) If the top and bottom surfaces are different, the side that is to be installed upwards.

1854.07.04 Proof Testing Procedures

1854.07.04.01 General

The adjustment ring shall meet or exceed the design load requirements as specified in CAN/CSA S6, for a CL-625-ONT Truck.

This testing procedure is intended to determine if a product line of similar material strength and structural design meets the performance requirements of Ontario Provincial Standards for Roads and Public Works (OPS) by testing the catch basin units, which are usually one of the smallest adjustment units and therefore under the greatest stress. If the catch basin ring passes, it can then be assumed that larger maintenance hole units of equal material strength and structural design shall also pass. If there are material or structural differences between the sizes, separate tests shall then need to be conducted for the different materials and types.

Proof testing shall be conducted on production run units not less than 24 hours old and not more than 60 Days old.

1854.07.04.02 Sample Sizes

The manufacturer shall have the option of conducting tests on either a full size 50 mm high catch basin adjustment units for a 600 x 600 mm precast concrete catch basin or 50 mm high mini specimens cut from these units.

When mini specimens are used, the stress that would have been applied to the full size ring shall be the same as applied to the mini specimen.

1854.07.04.03 Maximum Bearing Surface Area

For the purpose of determining the maximum bearing surface area, only the area of the catch basin adjustment ring in contact with the top of a 600 x 600 mm precast concrete catch basin shall be used. Any excess material not in contact shall be removed.

The area of the full size catch basin adjustment ring in contact with the top of a 600 x 600 mm precast concrete catch basin box after removal of excess shall not exceed 0.28 m^2, which is the calculated area of the top of the catch basin box.

1854.07.04.04 Static Design Full Load Testing Procedure

The static design full load shall be the design load requirements as specified in CAN/CSA S6, determined to be 166.6 kN, as per the calculations below.

CSA S6-14 (CHBDC) states in clause 3.8.4.3 to design manhole covers to axle number 2 of the CL-625-ONT truck. The wheel associated with axle number 2 of the CL-625-ONT truck is 70 kN. Applying a dynamic load allowance of 1.4 for single axle loading (CHBDC clause 3.8.4.5.3) and a live load factor of 1.7:

Design Live Load = 70 kN x 1.4 x 1.7
= 166.6 kN

This load shall be used for full size testing or the steps for equivalent stress for specimens shall be followed.

1854.07.04.04.01 Specimens

For testing, a minimum of 9 full size 50 mm catch basin adjustment units for specimens or a minimum of 9 mini test specimens cut from a 50 mm catch basin adjustment ring shall be selected. These specimens shall be the same size and be divided into 3 specimens for each of the 3 temperature groupings. The same samples for each temperature groupings shall be used for the compression deformation and compression set testing. For adjustment units using a web design, each mini specimen shall be cut as close to opposing sides of adjacent webs as possible without removing mass from those webs and shall be full thickness of the adjustment ring. The top and bottom surfaces shall not be larger than the plates of the compression equipment.

1854.07.04.04.02 Equivalent Stress and Design Load for Mini Specimens

A_f = the area of the full size catch basin adjustment unit in contact with the top of the catch basin.

A_{ms} = load bearing surface area of the mini specimens

S_i = initial stress on the adjustment ring = 14 kN / A_f

S_f = final stress on the adjustment ring = 166.6 kN / A_f

L_{mi} = initial load on the mini specimens = S_i X A_{ms}

L_{mf} = final load on the mini specimens = S_f X A_{ms}

1854.07.04.04.03 Testing Procedure

Compression deformation and compression set testing shall be as shown in Table 1.

All specimens shall be tested for initial compression deformation, final compression deformation, and compression set. Three samples shall be tested for each of the 3 temperature groupings: -20 °C, +23 °C, and +30 °C.

The specimens shall be maintained at the specified test temperatures for a minimum of 2 hours, immediately prior to the test period.

1854.07.04.04.04 Initial Compression Deformation

The initial compression deformation for each specimen shall be tested in the following manner:

a) The thickness of each specimen in 4 equally spaced locations around the frame shall be recorded to the nearest 0.02 mm prior to being subjected to any testing. The average of these values shall be recorded as average thickness prior to test (D_0). If D_0 is not between 47 and 53 mm, the specimen shall be replaced.

b) The specimen shall be placed in the compression equipment using care to place it exactly in the centre between the plates to avoid tilting.

c) An initial constant load of 14 kN shall be applied on the full size specimens or initial load (L_{mi}) on the mini specimens. Immediately, determine the thickness of the specimen by measuring the distance between the frame and bottom plate in the same 4 equally spaced locations around the frame. The average of these values (D_1) represents the initial thickness of the specimen prior to compression.

d) Over a period of 30 seconds or less, apply and maintain a constant load of 166.6 kN on the full size specimen or final load (L_{mf}) on a mini specimen.

e) Immediately after the required load has been achieved, determine the initial compression deformation thickness of the specimen by measuring the distance between the frame and bottom plate in the same 4 locations. Using the average of these measurements (D_2) calculate the average initial compression deformation as follows:

   $C_{d1} = D_1 - D_2$

   Where:

   C_{d1} = average initial compression deformation
   D_0 = average thickness prior to test
   D_1 = average initial thickness
   D_2 = average initial compression deformation thickness

1854.07.04.04.05 Final Compression Deformation

The final compression deformation for each specimen shall be tested in the following manner:

a) Maintain the load of 166.6 kN in step d) of the Initial Compression Deformation clause for a period of 30 minutes.

b) At the end of the 30-minute period, determine the final compression deformation thickness of the specimen by measuring the distance between the top and bottom plates at the same 4 locations, average the measurements, and calculate the average final compression deformation as follows

$C_{d2} = D_1 - D_3$

Where:

C_{d2} = average final compression deformation
D_1 = average initial thickness, as determined in step c) of the Initial Compression Deformation clause
D_3 = average final compression deformation thickness

1854.07.04.04.06 Compression Set

The average compression set for each specimen shall be tested in the following manner:

a) Remove the load on the specimen and allow it to rest undisturbed for a period of 30 minutes.

b) At the end of the 30-minute rest period, apply a constant 14 kN load to the specimen. Immediately determine the compression set thickness of the specimen by measuring the distance between the frame and bottom plates at the same 4 locations, average the measurements, and calculate the average compression set as follows:

$C_s = D_1 - D_4$

Where:

C_s = average compression set
D_1 = average initial thickness, as determined in step c) of the Initial Compression Deformation clause
D_4 = average compression set thickness

1854.07.04.05 Fatigue Load Test

A single full size catch basin ring of area A_f shall be tested to 1,000,000 cycles of 1 second duration for the fatigue load requirements as specified in CAN/CSA-S6, determined to be 98 kN at 23 °C.

At the end of the fatigue testing, the adjustment ring shall perform without failure. Failure of this test is defined as deformation or cracking that would compromise the structural integrity or water tightness of the installation when it is subjected to the specified loads, seasonal temperatures, and placement of hot mix asphalt.

1854.08 QUALITY ASSURANCE

1854.08.01 Certificate

Suppliers shall provide a certificate upon request to indicate that the product was produced and tested in accordance with this specification. Included with the certificate shall be reports from qualified independent third party laboratories proving that the product meets the requirements of this specification.

1854.08.02 Inspection and Testing

The Owner may make inspections and tests at such times as considered necessary to ensure that the material supplied is according to this specification.

All material failing to comply with the requirements of this specification shall be rejected.

1854.09 OWNER PURCHASE OF MATERIAL

For measurement purposes, a count shall be made of the high density polyethylene and high density expanded polystyrene adjustment units supplied and accepted as specified on the purchasing order.

Payment at the price specified in the purchasing order shall be for the supply of the high density polyethylene and high density expanded polystyrene adjustment units 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.

TABLE 1
Maximum Allowable Percentage Compression Deformation and Compression Set
For a Single 50 mm Thick Adjustment Unit or Equivalent Sample

Temperature of Adjustment Ring °C	Maximum Average Initial Compression Deformation $(C_{d1} / D_1)*100\%$ %	Maximum Average Final Compression Deformation $(C_{d2} / D_1)*100\%$ %	Maximum Allowable Average Compression Set $(C_s / D_1)*100\%$ %
30	3.3	7.4	1.3
23	1.9	3.0	0.8
-20	1.1	0.8	0.5

Appendix 1854-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 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 704.011	High Density Polyethylene Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers
OPSD 704.012	Expanded Polystyrene (EPS) Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers
OPSD 705.010	Precast Concrete Catch Basin, 600 x 600 mm