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REVISION INFORMATION SHEET

ONTARIO PROVINCIAL STANDARDS FOR ROADS AND PUBLIC WORKS

VOLUME 2 MUNICIPAL AND PROVINCIAL COMMON MATERIAL SPECIFICATIONS

MANUAL REVISION #51

November 2015

UPDATING ONTARIO PROVINCIAL STANDARDS FOR YOUR USE

Each roads and public works owner (Owner) is responsible for determining implementation dates and directions for use of Ontario Provincial Standards; therefore, manual holders are cautioned about immediately discarding superseded and cancelled standards.

ACCESSING AND OBTAINING ONTARIO PROVINCIAL STANDARDS

The Ontario Provincial Standards for Roads and Public Works (OPS) manuals and the latest published updates for each of the eight OPS manuals are available as follows:

- Available electronically on the OPS/MTO website. Online access to the current, updated, and archived standards; indexes; OPS User Notes; and publication Revision Information Sheets are available free of charge at the site.
(<http://www.rags.mto.gov.on.ca/techpubs/ops.nsf/OPSHomepage>)
- Hard-copy format available from Publications Ontario by telephone at 1-800-668-9938 or online. Updates and OPS manuals are available for a cost-recovery fee.
(www.publications.serviceontario.ca)
- The eight OPS manuals of standards are available on one CD in PDF format. The OPS drawings published in Volumes 3 and 4 are available in AutoCAD format on a separate CD. These CDs are available from Publications Ontario or by telephone at 1-800-668-9938 or online for a cost-recovery fee. The updates are not available on CDs as an update package.
(www.publications.serviceontario.ca)

At the Publications Ontario web page, you can type "Ontario Provincial Standards," "OPS," "OPSS," or "OPSD" in the search box, and all related products for the Ontario Provincial Standards will be listed, click on the item you wish to purchase, add the item to your cart, then follow the instructions to complete your order. If trying to order an OPS product online from Publications Ontario and it is shown as Out of Stock, you can backorder the product by telephone at 1-800-668-9938.

In order to receive the Municipal Engineers Association (MEA) purchase price, MEA members should visit the MEA website (www.municipalengineers.on.ca/) for the MEA Publications Ontario order form for hard-copy manuals and CDs.

MTO employees should contact Simon Leung, Account Representative at Publications Ontario, by email (simon.leung@ontario.ca) to set up an account in order to receive the MTO purchase price for technical publications, including the Ontario Provincial Standards.

Links to Publications Ontario and the Ontario Provincial Standards on the MTO Library website are available on the OPS website (www.ops.on.ca). Also on this site under News and Activities are notices for updates and changes in OPS.

Questions should be directed by email to Ontario.Prov.Standards@ontario.ca.

YOU SHOULD REGISTER YOUR OPS MANUALS AND CDs

Users of OPS do not receive notices of OPS updates as they had in the past. Methods of notification from Publications Ontario for the future are being investigated, and you will be informed of them as they become available. In the interim, an email will be sent to OPS users who have registered their OPS manuals and CDs with OPS.

Owners of OPS manuals, who have not yet done so, are requested to register their OPS hard-copy manuals and CDs with OPS by email at Ontario.Prov.Standards@ontario.ca. The registration form and submission instructions are available on the OPS website (www.ops.on.ca), Miscellaneous Info, OPS Forms.

WAITING TO HEAR FROM YOU

If you have a suggestion to revise a standard or you have a standard that works in your ministry, municipality, or area, send it to the Head, OPS Administration, for review and possible inclusion into the Ontario Provincial Standards.

THIS MANUAL IS REVISED AS FOLLOWS:

Index Pages Volume 2

Remove the entire index and replace with the attached revised index.

Standard Specifications Volume 2

Superseded/Cancelled (Remove)		Revised/New (Insert)		Remarks
OPSS	Dated	OPSS	Dated	
1802	November 2008	1802	November 2015	“MATERIAL SPECIFICATION FOR SMOOTH WALLED STEEL PIPE” See Summary of Revisions.
1821	April 2013	1821	November 2015	“MATERIAL SPECIFICATION FOR PRECAST REINFORCED CONCRETE BOX CULVERTS” See Summary of Revisions.
1840	November 2014	1840	November 2015	“MATERIAL SPECIFICATION FOR NON-PRESSURE POLYETHYLENE PLASTIC PIPE PRODUCTS” See Summary of Revisions.
1841	Notice to Users of OPSS 1841	1841	November 2015	“MATERIAL SPECIFICATION FOR NON-PRESSURE POLYVINYL CHLORIDE PIPE PRODUCTS” Supersedes OPSS.PROV 1841 in OPS Volume 5 and OPSS.MUNI 1841 in OPS Volume 7. See Summary of Revisions.
1842	November 2008	1842	November 2015	“MATERIAL SPECIFICATION FOR PRESSURE POLYETHYLENE PIPE PRODUCTS” See Summary of Revisions.
2410	November 2000	2410	November 2015	“MATERIAL SPECIFICATION FOR EXTRA LOW-VOLTAGE CABLE” Section 2410.02, References, IMSA 19-5 and IMSA 50-2 updated. This specification has been reaffirmed. No changes to technical information.
2432	November 2014	2432	November 2015	“MATERIAL SPECIFICATION FOR HIGH PRESSURE SODIUM LUMINAIRES FOR HIGHWAY LIGHTING” See Summary of Revisions.

Superseded/Cancelled (Remove)		Revised/New (Insert)		Remarks
OPSS	Dated	OPSS	Dated	
2479	November 2011	2479	November 2015	“MATERIAL SPECIFICATION FOR FLOODLIGHT LUMINAIRES USED IN HIGH MAST LIGHTING” See Summary of Revisions.
2485	November 2006	2485	November 2015	“MATERIAL SPECIFICATION FOR PHOTOELECTRIC CONTROLLERS” See Summary of Revisions.
2510	April 2012	2510	November 2015	“MATERIAL SPECIFICATION FOR TALL OIL PITCH EMULSION” See Summary of Revisions.

SUMMARY OF REVISIONS TO OPSS 1802

MATERIAL SPECIFICATION FOR SMOOTH WALLED STEEL PIPE

- Section 1802.02, References, CSA standard updated to latest version.
- Table 1, updated to show the latest CSA Z662-11.

SUMMARY OF REVISIONS TO OPSS 1821

MATERIAL SPECIFICATION FOR PRECAST REINFORCED CONCRETE BOX CULVERTS

- Outside Face – Elevation view, addition of B-B labels.
- Section A-A view, 50mm, Typ label added.
- Section A-A view, “Cope corner” label added.
- Section A-A view, three welding point labels added, two near the top and one near the bottom.
- Section A-A view, 75 and 25 labels added.
- Section A-A view, 45° label added.
- Section A-A view, “Fitted condition” and “Connection PL 14x120” added.
- Section B-B view, added.
- Detail A view, 12mm changed to 14mm on “100x14mm min transverse stiffener label”.
- Notes: 1, addition of “hot-dip” and, removal of “according to CSA G164” and “according to ASTM A 325M, Type 3”.
- Notes: 2, moved “bolts shall be ASTM A325M, Type 3” to Notes: 3.
- Notes: 3, added.

SUMMARY OF REVISIONS TO OPSS 1840

MATERIAL SPECIFICATION FOR NON-PRESSURE POLYETHYLENE PLASTIC PIPE PRODUCTS

- Title, “(PE)” removed from the title.
- FIGURE 3, Updated NSF logo and provided clarification that different variations of this particular logo are possible.

SUMMARY OF REVISIONS TO OPSS 1841

MATERIAL SPECIFICATION FOR NON-PRESSURE POLYVINYL CHLORIDE PIPE PRODUCTS

- Title, "(PVC)" removed from the title.
- Section 1841.01, Scope, PVC added to the scope.
- Section 1841.02, References, CSA and ASTM references updated.
- Section 1841.05.01, Polyvinyl Chloride Pipe Products, Reference to CSA B182.7 removed.
- Section 1841.07.01, Production Requirements, CSA reference in item-c updated.
- Section 1841.07.01, Production Requirements, Rejection by CA due to unacceptable quality removed.
- FIGURE 3, Updated NSF logo added and with clarification that different variations of this particular logo are possible.

SUMMARY OF REVISIONS TO OPSS 1842

MATERIAL SPECIFICATION FOR PRESSURE POLYETHYLENE PIPE PRODUCTS

- Section 1842.02, References, CSA and AWWA references updated to latest.

SUMMARY OF REVISIONS TO OPSS 2432

MATERIAL SPECIFICATION FOR HIGH PRESSURE SODIUM LUMINAIRES FOR HIGHWAY LIGHTING

- Section 2432.02, References, CAN/CSA C863 added.
- Section 2432.03, Definitions, definition for Engineer deleted.
- Clause 2432.04.01.02, 1st and 3rd paragraphs revised, existing 7th paragraph deleted, new 7th and 8th paragraphs added.
- Clause 2432.04.02.01, requirement for 4 copies of approved Working Drawings revised to 3 copies of accepted Working Drawings.
- Subsection 2432.05.01, Marking, 3rd paragraph revised.
- Subsection 2432.09.01, Packaging and Shipment, requirement for data sheets revised from 4 to 3 copies.
- Table 1 deleted.
- Appendix, related Ontario Provincial Standards Drawings added.

SUMMARY OF REVISIONS TO OPSS 2479

MATERIAL SPECIFICATION FOR FLOODLIGHT LUMINAIRES USED IN HIGH MAST LIGHTING

- Section 2479.02, References, C22.2 No. 9.0 updated and CAN/CSA C863 added.
- Clause 2479.04.01.02; 1st, 3rd, and 6th paragraphs revised; existing 7th paragraph deleted; and new 7th paragraph added.
- Clause 2479.04.02.01, requirement for 4 copies of approved Working Drawings revised to 3 copies of accepted Working Drawings.
- Existing subsection 2479.05.01, General, deleted.
- Existing subsection 2479.05.02, renumbered to 2479.05.01, 2nd paragraph revised, and new 4th paragraph added.
- Subsection 2479.08.01, Inspection, 2nd paragraph revised.
- Subsection 2479.09.01, Packaging and Shipment, 1st and 2nd paragraphs revised.

SUMMARY OF REVISIONS TO OPSS 2485

MATERIAL SPECIFICATION FOR PHOTOELECTRIC CONTROLLERS

- Section 2485.02, References, CSA C239 and ANSI C136.10 updated.
- Subsection 2485.07.01, General, 2nd paragraph, operational temperature range revised from “-40 to 70 °C” to “- 40 to 65 °C”.
- Subsection 2485.09.01, Packaging and Shipment, 2nd paragraph, Business Days revised to Working Days.

SUMMARY OF REVISIONS TO OPSS 2510

MATERIAL SPECIFICATION FOR TALL OIL PITCH EMULSION

- Subsection 2510.05.02, Water, 1st paragraph rewritten.
- Subsection 2510.05.04, Tall Oil Pitch Emulsion, 4th paragraph modified with removal of “within 6 Days of delivery”.
- Subsection 2510.07.01, Storage, 1st paragraph modified with removal of “prior to shipping”. 2nd paragraph modified with addition of “If stored more than 60 Days” and “weekly” replaced with “prior to use”.
- The following clauses were renumbered
 - Clause 2510.07.03.02 replaced with 2510.07.03.01.01
 - Clause 2510.07.03.03 replaced with 2510.07.03.01.02
 - Clause 2510.07.03.04 replaced with 2510.07.03.01.03
 - Clause 2510.07.03.05 replaced with 2510.07.03.01.04
 - Clause 2510.07.03.05.01 replaced with 2510.07.03.01.04.01
- Clause 2510.07.03.01.04.01, 1st paragraph modified removal of “ready and inherent biodegradability... shown in Table 2”.
- Table 2 Environmental Testing, Addition of Section C. Moved test Daphnia magna LC50, Leachate Testing: Metals Non-Metals, Metalloids and Rainbow Trout LC50 from Section B to Section C.

MANUAL REVISION RECORD

Municipal and Provincial Common

Volume 2 – Material Specifications

This record should remain in the manual at all times. Revisions are numbered sequentially. This sheet should be filled in after each revision has been placed into the manual. It will quickly indicate to users whether the contents of the manual are up-to-date.

REVISION NUMBER	REVISION DATE	ENTERED BY	REVISION NUMBER	DATE	ENTERED BY
32	APRIL 2005	Included in new manuals	58		
33	NOV 2005	Included in new manuals	59		
34	APRIL 2006	Included in new manuals	60		
35	NOV 2006	Included in new manuals	61		
36	APRIL 2007	Included in new manuals	62		
37	NOV 2007	Included in new manuals	63		
38	NOV 2008	Included in new manuals	64		
39	NOV 2009	Included in new manuals	65		
40	APRIL 2010	Included in new manuals	66		
41	NOV 2010	Included in new manuals	67		
42	APRIL 2011	Included in new manuals	68		
43	NOV 2011	Included in new manuals	69		
44	APRIL 2012	Included in new manuals	70		
45	NOV 2012	Included in new manuals	71		
46	APRIL 2013	Included in new manuals	72		
47	NOV 2013	Included in new manuals	73		
48	APRIL 2014	Included in new manuals	74		
49	NOV 2014	Included in new manuals	75		
50	APRIL 2015	Included in new manuals	76		
51	NOV 2015	Included in new manuals	77		
52			78		
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DATE	SPEC. NO. OPSS	TITLE
DIVISION 10 - AGGREGATES		
NOV 2013	1001	Aggregates - General
APR 2013	1002	Notice to Users of OPSS 1002 (Aggregates - Concrete)
APR 2013	1003	Notice to Users of OPSS 1003 (Aggregates - Hot Mix Asphalt)
NOV 2012	1004	Notice to Users of OPSS 1004 (Aggregates - Miscellaneous)
NOV 2014	1005	Aggregates - Streambed Material
APR 2013	1006	Notice to Users of 1006 (Aggregates - Surface Treatment)
APR 2013	1010	Notice to Users of OPSS 1010 (Aggregates - Base, Subbase, Select Subgrade, and Backfill Material)
DIVISION 11 - BITUMENS		
APR 2007	1101	Notice to Users of OPSS 1101 (Performance Graded Asphalt Cement)
NOV 2007	1102	Liquid Asphalt
NOV 2012	1103	Emulsified Asphalt
NOV 2010	1150	Hot Mix Asphalt
APR 2007	1151	Notice to Users of OPSS 1151 (Superpave and Stone Mastic Asphalt Mixtures)
NOV 2007	1152	SC-800 Patching Material
NOV 2007	1153	Emulsified Asphalt Patching Material
DIVISION 12 - SEALS, BEARINGS, WATERSTOPS		
NOV 2008	1202	Bearings - Elastomeric Plain and Steel Laminated
NOV 2008	1203	Bearings - Rotational and Sliding Surface
NOV 2003	1204	Polyvinyl Chloride Waterstops
APR 2015	1205	Notice to Users of OPSS 1205 (Clay Seal)
NOV 2014	1210	Notice to Users of OPSS 1210 (Deck Joint Assemblies)



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DATE	SPEC. NO. OPSS	TITLE
NOV 2003	1212	Hot Poured Rubberized Asphalt Joint Sealing Compound
MAR 1998	1213	Hot Applied Rubberized Asphalt Waterproofing Membrane
MAR 1998	1215	Protection Board

DIVISION 13 - CEMENT AND CONCRETE

NOV 2007	1301	Cementing Materials
SEPT 1996	1302	Water
NOV 2014	1303	Notice to Users of OPSS 1303 (Admixtures for Concrete)
NOV 2005	1304	Packaged Silica Fume Dry Grout Mixture for Post Tensioning
NOV 2008	1305	Moisture Vapour Barriers
NOV 2011	1306	Burlap
NOV 2003	1308	Joint Filler in Concrete
NOV 2008	1312	Latex Modifiers for Use in Concrete
NOV 2008	1315	White Pigmented Curing Compounds for Concrete
APR 2007	1350	Notice to Users of OPSS 1350 (Concrete - Materials and Production)
NOV 2014	1351	Precast Reinforced Concrete Components for Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers
NOV 1989	1352	Precast Concrete Barriers
NOV 2006	1359	Unshrinkable Backfill

DIVISION 14 - METAL

NOV 2012	1430	Gabion Baskets and Mats
NOV 2014	1440	Notice to Users of OPSS 1440 (Steel Reinforcement for Concrete)
NOV 2008	1441	Load Transfer Assemblies
NOV 2007	1442	Epoxy Coated Reinforcing Steel Bars for Concrete
NOV 2007	1443	Organic Coatings for Reinforcing Steel Bars for Concrete

DIVISION 15 - SAFETY RELATED

NOV 2010	1503	Cable Guide Rail
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DATE	SPEC. NO. OPSS	TITLE
NOV 2010	1504	Steel Beam Guide Rail
NOV 2010	1505	Channel Components for Steel Beam Guide Rail
NOV 2014	1540	Notice to Users of OPSS 1540 (Standard Highway Fence Components)
NOV 2012	1541	Chain-Link Fence Components

DIVISION 16 - WOOD AND PLASTICS

NOV 2014	1601	Notice to Users of OPSS 1601 (Wood, Preservative Treatment, and Shop Fabrication)
NOV 2010	1605	Extruded Expanded Polystyrene Pavement Insulation

DIVISION 17 - COATINGS

NOV 2014	1704	Notice to Users of OPSS 1704 (Paint Coating Systems for Structural Steel)
FEB 1991	1712	Organic Solvent Based Traffic Paint
FEB 1991	1713	Thermoplastic Pavement Marking Materials
FEB 1991	1714	Field Reacted Polymeric Pavement Marking Materials
FEB 1991	1715	Preformed Plastic Pavement Marking Tape
FEB 1991	1716	Water-Borne Traffic Paint
DEC 1983	1750	Traffic Paint ReflectORIZING Glass Beads

DIVISION 18 - PIPES AND ASSOCIATED DRAINAGE ITEMS

NOV 2014	1801	Corrugated Steel Pipe (CSP) Products
NOV 2015	1802	Smooth Walled Steel Pipe
NOV 2014	1820	Notice to Users of OPSS 1820 (Circular and Elliptical Concrete Pipe)
NOV 2015	1821	Precast Reinforced Concrete Box Culverts
NOV 2015	1840	Non-Pressure Polyethylene Plastic Pipe Products
NOV 2015	1841	Non-Pressure Polyvinyl Chloride Pipe Products
NOV 2015	1842	Pressure Polyethylene Pipe Products
NOV 2013	1843	Non-Pressure Polypropylene (PP) Plastic Pipe Products



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DATE	SPEC. NO. OPSS	TITLE
APR 2013	1850	Frames, Grates, Covers, and Gratings
NOV 2007	1853	Rubber Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers
NOV 2014	1854	High Density Polyethylene (HDPE) and Expanded Polystyrene (EPS) Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers
APR 2012	1860	Geotextiles

DIVISION 19 - ENVIRONMENTAL

CURRENTLY NO SPECIFICATIONS

DIVISION 20 - SIGNS AND SIGN SUPPORTS

NOV 2014	2001	Signs
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DIVISION 21 - CLOTHING, CLOTH AND THE LIKE

CURRENTLY NO SPECIFICATIONS

DIVISION 22 - UNASSIGNED

CURRENTLY NO SPECIFICATIONS

DIVISION 23 - MISCELLANEOUS

CURRENTLY NO SPECIFICATIONS

DIVISION 24 - ELECTRICAL

NOV 2010	2401	Electrical Handholes
NOV 2014	2409	Traffic Signal Cable
NOV 2015	2410	Extra Low-Voltage Cable
NOV 2014	2414	Power Supply Equipment
NOV 2010	2420	Wooden Poles
NOV 2012	2421	Spun Concrete Poles
NOV 2008	2422	Heavy Class Steel and Sectional Steel Poles, Base Mounted
NOV 2010	2423	Steel Poles, Base Mounted
NOV 2007	2426	Steel Truss Brackets



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DATE	SPEC. NO. OPSS	TITLE
NOV 2007	2428	Aluminum Tapered Elliptical Brackets
NOV 2015	2432	High Pressure Sodium Luminaires for Highway Lighting
NOV 2002	2434	Underpass Luminaires
NOV 2010	2452	Aluminum Poles, Base Mounted
NOV 2011	2453	Sectional Steel Poles
NOV 2009	2460	Traffic Signal Arms, Brackets, Hangers, Fittings and Hardware
NOV 2007	2461	Signal Heads
NOV 2008	2471	Sectional Steel High Mast Lighting Poles
NOV 2003	2474	Anchorage Assembly - High Mast Lighting Pole
NOV 2010	2476	Raising and Lowering Equipment for High Mast Lighting Poles
NOV 2015	2479	Floodlight Luminaires Used in High Mast Lighting
NOV 2015	2485	Photoelectric Controllers

DIVISION 25 - CHEMICALS

APR 2015	2501	Calcium Chloride
NOV 2010	2502	Sodium Chloride Solid and Sodium Chloride Solution
NOV 2011	2503	Magnesium Chloride Solid and Magnesium Chloride Solution
NOV 2015	2510	Tall Oil Pitch Emulsion



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MATERIAL SPECIFICATION FOR SMOOTH WALLED STEEL PIPE

TABLE OF CONTENTS

1802.01	SCOPE
1802.02	REFERENCES
1802.03	DEFINITIONS - Not Used
1802.04	DESIGN AND SUBMISSION REQUIREMENTS - Not Used
1802.05	MATERIAL - Not Used
1802.06	EQUIPMENT - Not Used
1802.07	PRODUCTION
1802.08	QUALITY ASSURANCE
1802.09	OWNER PURCHASE OF MATERIAL

APPENDICES

1802-A	Commentary
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1802.01 SCOPE

This specification covers the requirements for smooth walled steel pipe to be used for the installation of pipes or casings.

1802.01.01 Specification Significance and Use

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

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

1802.01.02

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.

1802.02

REFERENCES

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

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:

CSA Standards

Z662-11 Package Consists of Z662-11, Oil and Gas Pipeline Systems, and Z662.1-07, Commentary on CSA Z662-11, Oil and Gas Pipeline Systems

ASTM International

A 252-98e1 Welded and Seamless Steel Pipe Piles

American Water Works Association (AWWA)

C200-05 Steel Water Pipe-6 in. (150 mm) and Larger

1802.07 PRODUCTION

1802.07.01 Requirements

All pipe shall be new and manufactured from steel according to ASTM A 252, Grade 2, with a minimum yield strength of 240 MPa.

Production welding shall be according to AWWA C200.

Pipe ends shall be bevel edged on the outside to an angle of 30°.

Pipe wall thickness shall be according to Table 1, except as amended below:

- a) The least nominal wall thickness for pipe with outside diameters from 88.9 to 141.3 mm shall be 4.8 mm.
- b) When protective coating or cathodic protection for steel casing or carrier pipe is not specified in the Contract Documents, the pipe wall thickness shall be increased to the nearest standard size that is a minimum of 1.6 mm greater than the least nominal wall thickness shown.

1802.07.02 Identification

The following information shall be clearly marked by stencilling, stamping, or painting of each section of pipe:

- a) Name or trademark of the manufacturer.
- b) Heat number.
- c) Outside diameter.
- d) Nominal wall thickness.
- e) Length of pipe.
- f) Weight per unit length.
- g) Standard designation.
- h) Grade of steel.

1802.08 QUALITY ASSURANCE

1802.08.01 Certificate

Upon request, suppliers shall provide a certificate to indicate that the product was produced and tested according to the appropriate standard requirements.

1802.08.02 Inspection and Testing

Owner reserves the right to make inspections and tests at such time as the Owner may consider necessary to ensure the materials supplied are in accordance with this specification. All materials failing to comply with the requirements of this specification shall be rejected.

1802.09 OWNER PURCHASE OF MATERIAL

1802.09.01 Measurement and Payment

Measurement of smooth wall steel pipe shall be by length in metres along the centreline of the pipe.

Payment at the price specified in the purchasing order shall be for supply of the pipe and jointing devices 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
Least Nominal Wall Thickness for Steel Casing Pipe
in Cased Crossings and Carrier Pipe in Uncased Crossings

Pipe Outside Diameter mm	Least Nominal Wall Thickness mm	
	Roads	Railways
88.9	3.2	3.2
101.6	3.2	3.2
114.3	3.2	3.2
141.3	4.0	4.0
168.3	4.8	4.8
219.1	4.8	4.8
273.1	4.8	4.8
323.9	4.8	4.8
355.6	4.8	5.6
406.4	4.8	5.6
457.0	4.8	6.4
508.0	4.8	7.1
559.0	5.6	7.9
610.0	6.4	8.7
660.0	6.4	9.5
711.0	6.4	10.3
762.0	6.4	10.3
813.0	6.4	11.1
864.0	6.4	11.9
914.0	6.4	11.9
965.0	7.9	12.7
1016.0	7.9	12.7
1067.0	7.9	12.7
1118.0	7.9	14.3
1168.0	7.9	15.9
1219.0	8.3	15.9
1270.0	8.7	15.9
1321.0	9.5	19.1
1372.0	9.5	19.1
1422.0	9.5	19.1
1524.0	10.3	20.6

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Appendix 1802-A, November 2008
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

Designer should specify if the steel pipe is to be cathodically protected or coated or uncoated in the Contract Documents. (1802.07.01)

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

No information provided here.



MATERIAL SPECIFICATION FOR PRECAST REINFORCED CONCRETE BOX CULVERTS

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1821.01	SCOPE
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This specification covers the requirements for materials, design and fabrication of single-cell precast reinforced concrete box culverts not exceeding 3 m in span.

1821.01.01 Specification Significance and Use

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

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

1821.01.02 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.

1821.02 REFERENCES

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

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 422	Precast Reinforced Concrete Box Culverts In Open Cut
OPSS 904	Concrete Structures

Ontario Provincial Standard Specifications, Materials

OPSS 1002	Aggregates - Concrete
OPSS 1350	Concrete - Materials and Production
OPSS 1440	Steel Reinforcement for Concrete

Ontario Ministry of Transportation Publications

Structural Manual, Division 1, Exceptions to the Canadian Highway Bridge Design Code

MTO Laboratory Testing Manual:

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

A23.1/A23.2-00 Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete
S6-14 Canadian Highway Bridge Design Code

ASTM International

C457-98 Standard Test Method for Microscopical Determination of Parameters of the Air-Void System
in Hardened Concrete

Ontario Concrete Pipe Association

Prequalification Requirements for Precast Concrete Drainage Products

1821.03 DEFINITIONS

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

Box Unit means as defined in OPSS 422.

Distribution Slab means as defined in OPSS 422.

Dry Cast Concrete means concrete with a slump equal to or less than 20 mm at the time of placing.

Engineer means a professional engineer, licensed by the Professional Engineers of Ontario to practice in the Province of Ontario.

Height of Fill means the smallest elevation difference, between the top slab of a box culvert and the top of pavement or finished grade, from edge of shoulder to edge of shoulder.

Joint Annular Space means the design clearance between the tapered surface of the bell and spigot ends of adjacent box units.

Longitudinal Steel means steel reinforcement aligned parallel to the longitudinal axis of the box unit.

Perimeter Steel means steel reinforcement aligned perpendicular to the longitudinal axis of the box unit.

Wet Cast Concrete means concrete with a slump greater than 20 mm at the time of placing.

1821.04 DESIGN AND SUBMISSION REQUIREMENTS

1821.04.01 Design Requirements

All box units shall be designed according to CSA S6 and the Structural Manual, Division 1. For box units reinforced with welded wire fabric (WWF), the manufacturer's Working Drawings shall be according to Table 1 and the Contract Documents.

Box culverts with a height of fill less than 0.60 m require additional reinforcing and shall include a distribution slab. When a distribution slab is required it shall cover the entire top of box unit. The distribution slab shall be as specified in the Contract Documents.

1821.04.02 Submission Requirements

The box unit manufacturer's Working Drawings shall be submitted to the Owner upon request. All Working Drawings shall bear the seal and signature of an Engineer certifying they are according to the Contract Documents.

1821.05 MATERIALS

1821.05.01 Concrete

1821.05.01.01 General

Concrete shall be according to OPSS 1350 except as specified herein.

1821.05.01.02 Strength

The concrete shall have a nominal 28-Day compressive strength of 35 MPa.

1821.05.01.03 Water-Cement Ratio

All concrete shall have a water-cement ratio not exceeding 0.40 by mass.

1821.05.01.04 Wet Cast Concrete

For wet cast concrete, the air void system of the hardened concrete, when tested according to ASTM C 457, shall be as follows:

- a) Air Content 3.0 % Minimum
- b) Spacing Factor 0.200 mm Maximum

1821.05.01.05 Dry Cast Concrete

For dry cast concrete, the salt scaling resistance when tested according to laboratory method LS-412 and this specification shall have a mass loss of not more than 0.8 kg/m².

1821.05.02 Aggregates

Aggregates shall be according to OPSS 1002.

1821.05.03 Steel Reinforcement

Steel reinforcement shall be according to OPSS 1440.

In addition, WWF shall achieve minimum 4% elongation at ultimate strength measured over a 100 mm gauge length that includes at least one cross wire.

1821.05.04 Associated Hardware

All support systems shall be capable of withstanding the loads to be placed on them. All embedded hardware within 35 mm of exposed faces shall be coated with an acceptable material or be of an acceptable non-metallic material.

Tie wire shall be 1.5 mm diameter annealed wire.

1821.07 PRODUCTION

1821.07.01 Prequalification Requirements for Box Units

Manufacturers producing box units must possess a current Prequalification Certificate, issued under the Plant Prequalification Program as outlined in the publication, Prequalification Requirements for Precast Concrete Drainage Products.

1821.07.02 Box Units

1821.07.02.01 Placement of Reinforcement

The concrete cover to the WWF shall be 40 mm $\pm$ 5 mm, and the cover to reinforcing bars shall be 50 mm $\pm$ 15 mm.

The clear distance of the end perimeter reinforcement shall not be less than 35 mm or greater than 50 mm from the ends of the box unit. Box units reinforced with WWF may be assembled using any combination of single or double layers of the fabric. Box units using reinforcing steel bars shall be assembled with single layers of reinforcement in each face in each direction.

The areas of steel reinforcement shall be the steel areas as shown in Table 1. Steel areas greater than those required, shall not be cause for rejection.

1821.07.02.02 Laps, Welds, and Spacing of Reinforcement

Splices in the perimeter reinforcement shall be made by lapping. Reinforcement shall not be lapped in tension zones. Sheets of the WWF shall be tack welded at lap locations. The overlap measured between the outermost longitudinal wires of each WWF sheet, shall not be less than the spacing of the longitudinal wires plus 50 mm or 250 mm, whichever is greater. The centre to centre spacing of the perimeter wires shall not be less than 50 mm or more than 105 mm. The centre to centre spacing of the longitudinal wires shall not be more than 205 mm.

1821.07.02.03 Joints

The box units shall be produced with bell and spigot ends. The ends shall be of such design that when the box units are laid together they will make a continuous box culvert with a smooth interior, free of irregularities in the flow line.

1821.07.03 Curing

Except for exposed ends, wet cast box units shall be cured by leaving the box units in the form or by low pressure steam. Dry cast box units and the exposed ends of the wet cast box units shall be covered and cured by low pressure steam or other system that will maintain a moist atmosphere. Curing compounds are not an acceptable method of curing. Box units shall be cured until a minimum strength of 25 MPa is achieved or for four days, whichever occurs first.

1821.07.04 Forms

The forms used in the production process shall be sufficiently rigid and accurate to maintain the specified box unit dimensions. All casting surfaces shall be of smooth, nonporous, and non-staining material. Insulated forms shall not be used.

1821.07.05 Handling

Devices or holes will be permitted in each box unit for the purpose of handling and installing.

1821.07.06 Marking

The following information in the order listed, shall be embossed on the top haunch of each box unit using numbers and letters 3 mm wide, 35 mm high, and 5 mm deep:

- a) Name or trademark of the manufacturer.
- b) Identification of plant, if manufacturer has more than one plant.
- c) Date of manufacture.
- d) Specification designation.
- e) Minimum and maximum height of fill over box units.

The word "Top" shall be lettered with waterproof paint on the top surface of each box unit.

Each box unit shall also be marked with the Prequalification Stamp as outlined in the publication, Prequalification Requirements for Precast Concrete Drainage Products.

1821.07.07 Surface Finish for Formed Surfaces

All surfaces shall be finished according to the Surface Finish sub-section in OPSS 904.

1821.07.08 Repairs

Box units may be repaired, provided the repaired box unit meets the requirements of this specification.

1821.07.09 Tolerances

1821.07.09.01 Dimensions

The span and rise dimensions shall not vary by more than 20 mm from the manufacturer's design dimensions.

The haunch dimensions shall not vary by more than 8 mm from the manufacturer's design dimensions.

1821.07.09.02 Slab and Wall Thickness

The slab and wall thickness shall not vary by more than 5 mm from the manufacturer's design dimensions.

1821.07.09.03 Squareness

Variations in the lengths of two opposite surfaces of the box unit shall not exceed 10 mm in each box unit along its length, except where special box units are specified by the Owner. The ends of the box units shall be perpendicular to the wall and centreline of the box unit within the tolerances specified elsewhere in this subsection, except where special box units are specified by the Owner.

1821.07.09.04 Length of Box Unit

The underrun in length of each box unit shall not exceed 15 mm.

1821.07.09.05 Straightness of Joints

The joint edge shall not deviate from straight, when measured around the perimeter of the box unit by more than the manufacturer's design joint annular space.

1821.07.10 Quality Control

1821.07.10.01 General

A production run shall be considered continual provided any interruption is not more than three consecutive Days and there is no change in materials, material proportions, source of materials, production or curing methods, or equipment.

Tests on concrete for compressive strength, box unit dimensions, and concrete cover over reinforcement shall be performed for each group of 15 box units or fraction thereof, for each continual production run of a single size.

Tests for air void system parameters of wet cast concrete and salt scaling resistance of dry cast concrete shall be performed on box units representing a lot size of 1,000 m² of box unit floor area or two months of production, whichever is more frequent. In addition, when there is a change in materials, source of materials, production or curing methods, or equipment, the concrete shall be tested for air void system or salt scaling resistance as specified herein.

All results shall be retained by the manufacturer for a period of two years from the date of manufacture and shall be provided to the Owner upon request.

1821.07.10.02 Concrete Compressive Strength

A set of two cylinders shall be made for determining the 28-Day strength of the concrete. The cylinders shall be made, cured, sampled, and tested according to OPSS 1350, except both cylinders shall be either 150 x 300 mm or 100 x 200 mm in size.

The cylinders shall be made by a:

- a) concrete testing technician employed by a laboratory certified according to the requirements of CSA A283, or
- b) ACI Concrete Field Testing Technician-Grade 1.

Compressive strength testing shall be carried out by a laboratory certified according to the requirements of CSA A283. In addition, the laboratory shall meet any pre-qualification requirements specified by the Owner.

The compressive strength result shall be the average of a set.

If the specified requirements of the concrete have not been reached after 28 Days, three cores shall be taken from a member at locations approved by the Contract Administrator. Cores shall be moisture conditioned and tested according to test method CAN/CSA A23.2-14C and evaluated according to CAN/CSA A23.1. The cores shall be tested no later than 35 days after manufacture of the box units represented by the failed results.

1821.07.10.03 Dimensional Verification

The box unit dimensions shall be verified by measuring one box unit for wet cast concrete or two box units for dry cast concrete selected at random from each group of box units.

1821.07.10.04 Concrete Cover Measurement

Concrete cover measurements shall be made on two box units, selected at random from each group of box units.

The measurements shall be obtained on a one metre grid on all interior and exterior surfaces of the box units, including the ends of the unit.

Cover measurements shall be carried out by a method acceptable to the Contract Administrator and shall be reported in writing to the Contract Administrator prior to installation of the box units.

1821.07.10.05 Testing of Air Void System of Hardened Concrete in Wet Cast Concrete

For evaluation of the air void system parameters, the manufacturer shall remove cores from hardened concrete and test the cores according to ASTM C 457, except that a magnification of 100 to 125 times shall be used. Testing shall be carried out by a laboratory and operators that are acceptable to the Owner.

As a minimum, two 100 x 200 mm cores from each lot of box units shall be removed and tested. All cores shall be taken when the concrete is a minimum of 7 Days of age. Cores shall be cut lengthwise into two halves with one half to be tested by the manufacturer and the other half to be forwarded to the Owner. Both halves shall be marked with a unique identification number. The half core forwarded to the Owner shall have an information sheet securely attached to it detailing the Contract number and concrete mix design for the box units. It shall also clearly identify which lot of box units it represents.

Air void samples shall be retained by the manufacturer for a period of one year from the date of testing and shall be provided to the Contract Administrator on request.

1821.07.10.06 Salt Scaling Resistance in Dry Cast Concrete

For evaluation of the salt scaling resistance of the dry cast concrete, the manufacturer shall cut a set of two specimens, each measuring 300 x 300 mm from each lot of the finished and cured box units. The specimens shall be tested according to LS-412 without further curing.

The salt scaling result shall be the average of a set.

1821.07.10.07 Plugging Core Holes

Core holes shall be plugged full depth with concrete by the manufacturer in a manner such that the box unit will be according to this specification.

1821.08 QUALITY ASSURANCE

1821.08.01 Acceptance

The latest test results of the manufacturer's quality control procedures specified in the subsection for Quality Control shall be submitted to the Owner.

Acceptance of the compressive strength shall be based on the average 28-Day compressive strength of the cylinders or, when required, from the compressive strength of the cores taken from the finished product.

Acceptance of air void system parameters shall be based on individual core results for air content and the average of each pair of cores for spacing factor.

Acceptance of salt scaling resistance shall be based on the average of a set.

The Owner may request submission of samples for testing.

The Owner shall be provided access to the manufacturer's plant, at times and locations determined by the Owner, to perform independent inspection, sampling, and testing.

1821.08.02 Rejection

A group of box units represented by failed compressive strength or failed air void system or failed salt scaling resistance results shall be rejected.

Individual box units may also be rejected for any of the following:

- a) Inadequate concrete cover to reinforcement.
- b) Defects resulting from incorrect proportioning, mixing, and forming.
- c) Cracks greater than 0.3 mm or full depth cracks.
- d) Honeycombed or open surface texture.
- e) Damaged ends, where such damage would prevent making a satisfactory joint.
- f) Out of tolerance.

1821.09 OWNER PURCHASE OF MATERIAL

1821.09.01 Inspection

The quality of materials, the process of manufacture, and the finished box units shall be subject to inspection by the Owner.

1821.09.02 Measurement for Payment

Box units shall be measured in metres along the centerline of the invert of the box unit. Payment at the price specified in the purchasing order shall be full compensation for the supply and delivery of the box units and jointing devices, to the destination at the times specified.

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

TABLE 1
Welded Wire Fabric Reinforcement Areas

Height of Fill m	As1 mm ² /m	As2 mm ² /m	As3 mm ² /m	As4 mm ² /m	As5 mm ² /m	As6 mm ² /m
SPAN 1800(1829) X RISE 900(914) WALLS AND SLABS 200(203)mm Thick						
<0.6	552	980	480	400	300	402
0.6	400	400	400	400	63	-
0.9	400	400	400	400	63	-
1.2	400	400	400	400	63	-
1.5	400	400	400	400	63	-
1.8	400	400	400	400	63	-
2.4	400	400	400	400	63	-
3.0	400	400	400	400	63	-
3.6	386	407	418	400	63	-
4.3	445	469	480	400	63	-
4.9	498	524	535	400	63	-
5.5	552	580	591	400	63	-
SPAN 1800(1829) X RISE 1200(1219) WALLS AND SLABS 200(203)mm Thick						
<0.6	456	1040	480	400	300	426
0.6	400	440	457	400	63	-
0.9	400	400	400	400	63	-
1.2	400	400	400	400	63	-
1.5	400	400	400	400	63	-
1.8	400	400	400	400	63	-
2.4	400	400	400	400	63	-
3.0	400	403	420	400	63	-
3.6	400	459	476	400	63	-
4.3	400	527	545	400	63	-
4.9	422	589	607	400	63	-
5.5	467	652	670	400	63	-
SPAN 2400(2438) X RISE 1200(1219) WALLS AND SLABS 200(203)mm Thick						
<0.6	741	1280	567	400	300	448
0.6	663	690	712	400	63	-
0.9	488	509	530	400	63	-
1.2	448	467	488	400	63	-
1.5	455	475	497	400	63	-
1.8	476	499	520	400	63	-
2.4	536	564	586	400	63	-
3.0	614	648	670	400	63	-
3.6	702	741	763	400	63	-

Height of Fill m	As1 mm ² /m	As2 mm ² /m	As3 mm ² /m	As4 mm ² /m	As5 mm ² /m	As6 mm ² /m
SPAN 2400(2438) X RISE 1500(1524) WALLS AND SLABS 200(203)mm Thick						
<0.6	677	1315	630	400	300	460
0.6	603	762	793	400	63	-
0.9	446	560	591	400	63	-
1.2	410	514	544	400	63	-
1.5	415	522	552	400	63	-
1.8	434	546	577	400	63	-
2.4	487	617	648	400	63	-
3.0	556	707	738	400	63	-
3.6	633	808	839	400	63	-
SPAN 2400(2438) X RISE 1800(1829) WALLS AND SLABS 200(203)mm Thick						
<0.6	677	1445	677	400	300	506
0.6	552	825	867	400	63	-
0.9	412	606	647	400	63	-
1.2	400	554	595	400	63	-
1.5	400	564	602	400	63	-
1.8	400	587	628	400	63	-
2.4	448	660	702	400	63	-
3.0	510	755	797	400	63	-
3.6	579	861	904	400	63	-
SPAN 3000(3048) X RISE 1500(1524) WALLS AND SLABS 250(254) mm Thick						
<0.6	738	1250	620	500	300	400
0.6	797	825	858	500	79	-
0.9	592	612	664	500	79	-
1.2	544	564	595	500	79	-
1.5	552	573	604	500	79	-
1.8	577	600	632	500	79	-
2.4	648	678	709	500	79	-
3.0	739	775	807	500	79	-
3.6	841	884	917	500	79	-
SPAN 3000(3048) X 1800(1829) WALLS AND SLABS 250(254)mm Thick						
<0.6	777	1280	643	500	300	410
0.6	740	896	939	500	79	-
0.9	552	664	706	500	79	-
1.2	508	610	652	500	79	-
1.5	515	620	661	500	79	-
1.8	537	648	690	500	79	-
2.4	602	730	772	500	79	-
3.0	684	834	877	500	79	-
3.6	776	950	994	500	79	-

Height of Fill m	As1 mm ² /m	As2 mm ² /m	As3 mm ² /m	As4 mm ² /m	As5 mm ² /m	As6 mm ² /m
SPAN 3000(3048) X RISE 2100(2133) WALLS AND SLABS 250(254)mm Thick						
<0.6	639	1340	686	500	300	429
0.6	691	959	1014	500	79	-
0.9	519	711	764	500	79	-
1.2	478	652	705	500	79	-
1.5	485	661	715	500	79	-
1.8	505	691	744	500	79	-
2.4	563	776	830	500	79	-
3.0	638	884	939	500	79	-
3.6	723	1006	1062	500	79	-
SPAN 3000(3048) X RISE 2400(2438) WALLS AND SLABS 250(254)mm Thick						
<0.6	769	1380	744	500	300	442
0.6	648	1018	1087	500	79	-
0.9	490	754	821	500	79	-
1.2	453	691	757	500	79	-
1.5	456	699	766	500	79	-
1.8	479	729	796	500	79	-
2.4	531	816	884	500	79	-
3.0	601	928	997	500	79	-
3.6	678	1054	1124	500	79	-
Notes: 1. The dimensions in brackets are soft metric conversions of the actual imperial dimensions. 2. Yield strength of WWF is $F_y = 500$ MPa. 3. Area of steel reinforcement is per metre length of box unit. 4. Area of steel As5 minimum longitudinal reinforcement is per face. 5. Area of steel As6 is required when height of fill over box unit is less than 600 mm. 6. Reinforcement was proportioned using the loading, load factors, and resistance factors. 7. This design is according to CSA S6 and the Structural Manual, Division 1 for installation B-1 only.						

Appendix 1821-A, November 2015
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

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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 3920.100	Precast Reinforced Concrete Box Culvert With Height Of Fill $\geq 0.6\text{m}$
OPSD 3920.110	Precast Reinforced Concrete Box Culvert With Height Of Fill $< 0.6\text{m}$



MATERIAL SPECIFICATION FOR NON-PRESSURE POLYETHYLENE PLASTIC PIPE PRODUCTS

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APPENDICES

1840-A	Commentary
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1840.01 SCOPE

This specification covers the requirements for non-pressure polyethylene (PE) plastic pipe products to be used for sanitary or storm sewers, pipe culverts, and subdrains.

1840.01.01 Specification Significance and Use

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

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

1840.01.02

Appendices Significance and Use

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1840.02

REFERENCES

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

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

CSA Standards

- B182.6-11 Profile Polyethylene (PE) Sewer Pipe and Fittings for Leak-Proof Sewer Applications
[Part of B1800-11, Thermoplastic Nonpressure Pipe Compendium]
- B182.8-11 Profile Polyethylene (PE) Storm Sewer and Drainage Pipe and Fittings
[Part of B1800-11, Thermoplastic Nonpressure Pipe Compendium]

ASTM International

- F 405-13 Corrugated Polyethylene (PE) Pipe and Fittings
- F 667-12 3 Through 24 in. Corrugated Polyethylene Pipe and Fittings
- F714-13 Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
- F 894-13 Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe

American Association of State Highway and Transportation Officials (AASHTO)

- M252-09 Corrugated Polyethylene Drainage Pipe
- M294-13 Corrugated Polyethylene Plastic Pipe, 300 to 1,500 mm Diameter

Bureau De Normalisation Du Quebec (BNQ)

3624-115 (2007) Polyethylene (PE) Pipe and Fittings - Flexible Corrugated Pipes for Drainage - Characteristics and Test Methods.

1840.03 DEFINITIONS

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

Certification Body means an independent 3rd party agency, accredited by the Standards Council of Canada that has the qualifications, skills, and expertise required to confirm that a pipe manufacturer produces pipe products to the quality and requirements of an accepted standard and that has the mandate to certify the pipe products produced.

Certified means pipe products that have been marked with a certification body's logo confirming that the production of the pipe product is in accordance with the quality and requirements of CSA B182.6, CSA B182.8, AASHTO M294 Type S, or ASTM F 894.

Closed Profile Pipe means a pipe product that has a hydraulically smooth waterway reinforced circumferentially or spirally with corrugations that are joined integrally by an essentially smooth outer wall.

Corrugated Pipe means a single-walled pipe where the wall is formed into a series of alternating crests and valleys.

Delivered Quality means the pipe products' physical condition upon arrival at the construction site in terms of the extent and degree of dents, scratches, cracks, pipe coating integrity, etc., that appear on the pipe products delivered.

Open Profile Pipe means a pipe product that has a hydraulically smooth waterway reinforced circumferentially or spirally with outside corrugations.

Polyethylene Plastic means plastics based on virgin polymers made with ethylene as essentially the sole monomer.

Profile means a pipe wall construction that presents an essentially smooth surface in the waterway but includes ribs or other shapes, which can be either solid or hollow that helps brace the pipe against diametrical deformation.

1840.05 MATERIALS

1840.05.01 Polyethylene Plastic Pipe Products

The moulding and extrusion material shall be polyethylene plastic according to:

- a) ASTM F 405, ASTM F 667, or BNQ 3624-115 for corrugated sub-drainage tubing.
- b) AASHTO M252 for corrugated interior flexible culvert pipe.
- c) CSA B182.6, CSA B182.8, or AASHTO M294 Type S for open profile sewer and drainage pipe.
- d) ASTM F 714 or ASTM F 894 for closed profile sewer and drainage pipe.

1840.07 PRODUCTION

1840.07.01 Requirements

The pipe diameter, stiffness, material, and type for all polyethylene plastic pipe products shall be as specified in the Contract Documents.

Polyethylene plastic pipe products shall be produced according to the following:

- a) ASTM F 405, ASTM F 667, or BNQ 3624-115 for corrugated sub-drainage tubing and fittings.
- b) AASHTO M252 for corrugated interior flexible culvert pipe.
- c) CSA B182.6, CSA B182.8, or AASHTO M294 Type S for open profile sewer and drainage pipe and fittings.
- d) ASTM F 714 or ASTM F 894 for closed profile sewer and drainage pipe.

All polyethylene plastic pipe products used on the Contract for sewers and culverts shall be certified and supplied from a manufacturer that produces the polyethylene plastic pipe products according to CSA B182.6, CSA B182.8, AASHTO M294 Type S, ASTM F 894 or ASTM F 714.

When the delivered quality of certified polyethylene plastic pipe products is deemed to be unacceptable by the Contract Administrator, the products shall be rejected.

1840.08 QUALITY ASSURANCE

1840.08.01 Testing

Test methods for corrugated polyethylene plastic pipe products shall be according to ASTM F 405, ASTM F 667, BNQ 3624-115 or AASHTO M252, as applicable.

Test methods for open and closed profile polyethylene plastic pipe products shall be according to CSA B182.6, CSA B182.8, AASHTO M294 Type S, ASTM F 894, or ASTM F 714 as applicable.

1840.08.02 Markings

Markings for certified polyethylene plastic pipe products shall be according to CSA B182.6, CSA B182.8, AASHTO M294 Type S, ASTM F 894, or ASTM F 714 as applicable.

As a minimum, the following markings shall be placed, notwithstanding any other required markings, in accordance with the applicable standard:

- a) Pipe nominal size.
- b) Pipe or ring stiffness.
- c) Standard designation (e.g., CSA B182.6).
- d) Manufacturer.
- e) Accredited certification body's logo.

Accepted certification body logos confirming certified polyethylene plastic pipe products shall be as shown in Figures 1, 2, and 3.

1840.08.03**Certificate of Compliance**

When requested by the Owner, the Contractor shall provide a certificate of compliance for subdrains to indicate that the product was produced and tested according to the appropriate specification requirements.

When requested by the Owner, the Contractor shall provide a copy of the certificate of compliance from the manufacturer for storm sewers and pipe culverts. The manufacturer's certificate of compliance shall be issued by the certification body confirming that the manufacturer produces certified polyethylene plastic pipe products.

1840.09**OWNER PURCHASE OF MATERIAL**

Measurement of non-pressure polyethylene plastic pipe shall be by length in metres along the centreline of the pipe.

For measurement purposes, a count shall be made of the non-pressure polyethylene plastic pipe fittings supplied and delivered as noted on the purchasing order.

Payment at the price specified in the purchasing order shall be for the supply of non-pressure polyethylene plastic pipe products delivered to the destination on the date and time specified.

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



FIGURE 1
CSA Standards Certification Logo



FIGURE 2
Warnock Hersey - Intertek Certification Logo



FIGURE 3
NSF International Certification Logo
(Note: Different variations of the NSF logo will also be accepted)

Appendix 1840-A, November 2014
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:

- Pipe diameter, stiffness, material, and type. (1840.07.01)

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 802.010	Flexible Pipe Embedment and Backfill, Earth Excavation
OPSD 802.013	Flexible Pipe Embedment and Backfill, Rock Excavation
OPSD 802.014	Flexible Pipe Embedment in Embankment, Original Ground: Earth or Rock
OPSD 806.020	Height of Fill Table, Dual Wall Corrugated Polyethylene Gravity Sewer Pipe, 210 and 320 kPa
OPSD 806.021	Height of Fill Table, Closed Profile Wall Polyethylene Pipe, RSC 160 and RSC 250
OPSD 806.022	Height of Fill Table, Dual Wall Corrugated Polyethylene Gravity Sewer Pipe RSC 100 and RSC 160



MATERIAL SPECIFICATION FOR NON-PRESSURE POLYVINYL CHLORIDE PIPE PRODUCTS

TABLE OF CONTENTS

1841.01	SCOPE
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1841.04	DESIGN AND SUBMISSION REQUIREMENTS - Not Used
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1841.07	PRODUCTION
1841.08	QUALITY ASSURANCE
1841.09	OWNER PURCHASE OF MATERIAL

APPENDICES

1841-A	Commentary
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1841.01 SCOPE

This specification covers the requirements for non-pressure polyvinyl chloride (PVC) plastic pipe products to be used for sanitary and storm sewers, service connections, and pipe culverts.

1841.01.01 Specification Significance and Use

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

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

1841.01.02 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.

1841.02 REFERENCES

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

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:

CSA Standards

- B182.1-11 Plastic Drain and Sewer Pipe and Pipe Fittings
[Part of B1800-11, Plastic Nonpressure Pipe Compendium]
- B182.2-11 PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings
[Part of B1800-11, Plastic Nonpressure Pipe Compendium]
- B182.4-11 Profile Polyvinylchloride (PVC) Sewer Pipe and Fittings
[Part of B1800-11, Plastic Nonpressure Pipe Compendium]

ASTM International

- D 3034-14 Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- F 679-13a Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
- F 794-03 (2009) Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
- F 949-10 Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

F 1760-01(2011)	Coextruded Poly (Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
F 1803-06	Poly (Vinyl Chloride) (PVC) Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter

Uni-Bell PVC Pipe Association

UNI-B-9-90	Polyvinyl Chloride (PVC) Profile Wall Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter (Nominal Pipe Sizes 4 - 48-inch)
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1841.03 DEFINITIONS

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

Certification Body means an independent 3rd party agency, accredited by the Standards Council of Canada that has the qualifications, skills, and expertise required to confirm that a pipe manufacturer produces pipe products to the quality and requirements of an accepted standard and that has the mandate to certify the pipe products produced.

Certified means pipe products that have been marked with a certification body's logo confirming that the production of the pipe product is in accordance with the quality and requirements of CSA B182.1, CSA B182.2, or CSA B182.4.

Delivered Quality means the pipe products' physical condition upon arrival at the construction site in terms of the extent and degree of dents, scratches, cracks, pipe coating integrity, etc., that appear on the pipe products delivered.

Pipe Products means pipe lengths and associated pipe fittings that are needed to construct a pipe sewer run or a pipe culvert.

1841.05 MATERIAL

1841.05.01 Polyvinyl Chloride Pipe Products

The extruded, moulded, and fabricated material shall be polyvinyl chloride plastic according to CSA B182.1, CSA B182.2, CSA B182.4, ASTM D 3034, ASTM F 679, ASTM F 794, ASTM F 949, ASTM F 1760, ASTM F 1803, or UNI-B-9, as applicable, for the appropriate type of polyvinyl chloride plastic pipe products.

1841.07 PRODUCTION

1841.07.01 Requirements

The pipe diameter, stiffness, material, and type of all polyvinyl chloride plastic pipe products shall be as specified in the Contract Documents.

The requirements for profile polyvinyl chloride plastic pipes and associated fittings shall be according to CSA B182.4, ASTM F 794, ASTM F 949, ASTM F 1803, or UNI-B-9, as applicable.

The requirements for smooth interior and exterior walled polyvinyl chloride plastic pipe and associated fittings shall be according to either:

- a) ASTM D 3034 or ASTM F 679 for pipes manufactured without reprocessed-recycled material.

- b) CSA B182.2 for pipes manufactured that may have multilayer construction and the middle layer may have reprocessed-recycled material.
- c) CSA B182.2 or ASTM F 1760 for pipes manufactured having reprocessed-recycled material.

Polyvinyl chloride service connection pipe shall be according to CSA B182.1 and have bell and spigot joints with elastomeric gaskets.

All polyvinyl chloride plastic pipe products used on the Contract shall be certified and supplied from a manufacturer that produces the polyvinyl chloride plastic pipe products according to CSA B182.1, CSA B182.2, CSA B182.4, ASTM D 3034, ASTM F 679, ASTM F 794, ASTM F 949, ASTM F 1760, ASTM F 1803, or UNI-B-9, as applicable, for the appropriate type of polyvinyl chloride plastic pipe products.

1841.07.02 Testing

Testing of polyvinyl chloride plastic pipe products shall be according to the appropriate standard for which the product was produced.

1841.08 QUALITY ASSURANCE

1841.08.01 Inspection and Testing

The Owner reserves the right to make inspections and tests at such times as the Owner may consider necessary to ensure that the materials supplied are in accordance with this specification.

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

1841.08.02 Markings

Markings for certified polyvinyl chloride plastic pipe products shall be according to the appropriate standard for which the product was produced.

As a minimum, the following markings shall be placed, notwithstanding any other required markings, in accordance with the applicable standard:

- a) Pipe diameter.
- b) Pipe stiffness.
- c) Standard designation (e.g., CSA B182.2).
- d) Manufacturer.
- e) Accredited certification body's logo.

Accepted certification body logos confirming certified polyvinyl chloride plastic pipe products shall be as shown in Figures 1, 2 and 3.

1841.08.03 Certificate of Compliance

When requested by the Owner, the Contractor shall provide a copy of the certificate of compliance from the manufacturer for sanitary and storm sewers, service connections, and pipe culverts. The manufacturer's certificate of compliance shall be issued by the certification body confirming that the manufacturer produces certified polyvinyl chloride plastic pipe products.

1841.09 OWNER PURCHASE OF MATERIAL

1841.09.01 Measurement and Basis of Payment

Measurement of non-pressure polyvinyl chloride plastic pipe shall be by length in metres along the centreline of the pipe.

For measurement purposes, a count shall be made of the non-pressure polyvinyl chloride plastic pipe fittings supplied and delivered as noted on the purchasing order.

Payment at the price specified in the purchasing order shall be for the supply of non-pressure polyvinyl chloride plastic pipe products 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
CSA Standards Certification Logo



FIGURE 2
Warnock Hersey - Intertek Certification Logo



FIGURE 3
NSF International Certification Logo
(Note: Different variations of the NSF logo will also be accepted)

Appendix 1841-A, November 2015
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 pipe diameter, stiffness, material, and type in the Contract Documents.
(1841.07.01)

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

No information provided here.



MATERIAL SPECIFICATION FOR PRESSURE POLYETHYLENE PIPE PRODUCTS

TABLE OF CONTENTS

1842.01	SCOPE
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1842.04	DESIGN AND SUBMISSION REQUIREMENTS - Not Used
1842.05	MATERIALS
1842.06	EQUIPMENT - Not Used
1842.07	PRODUCTION
1842.08	QUALITY ASSURANCE
1842.09	OWNER PURCHASE OF MATERIAL

APPENDICES

1842-A	Commentary
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1842.01 SCOPE

This specification covers the requirements for pressure polyethylene pipe products to be used for sewage forcemains, watermains, and associated service connections.

1842.01.01 Specification Significance and Use

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

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

1842.01.02

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.

1842.02

REFERENCES

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

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:

Canadian Standards Association (CSA)

B137.1-13 Polyethylene (PE) Pipe, Tubing, and Fittings for Cold Water Pressure Services
[Part of B137 Series-05, Thermoplastic Pressure Piping Compendium]

American Water Works Association (AWWA)

C901-08 Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service
C906-15 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission

1842.05 MATERIALS

1842.05.01 Polyethylene Pipe Products

The moulding and extrusion material used to manufacture polyethylene pipe shall be polyethylene according to the requirements of AWWA C901 or AWWA C906.

The moulding and extrusion material used to manufacture polyethylene fittings shall be polyethylene according to the requirements of AWWA C906 for fittings 100 mm through 1,600 mm and CSA B137.1 for fittings less than 100 mm diameter.

1842.07 PRODUCTION

1842.07.01 Requirements

The requirements for the production of polyethylene pipe and tubing shall be according AWWA C901 or AWWA C906.

The requirements for the production of polyethylene pipe fittings shall be according to AWWA C906 for fittings 100 mm through 1,600 mm diameter and CSA B137.1 for fittings less than 100 mm diameter.

1842.07.02 Markings

Markings for polyethylene pipe and tubing shall be placed so that the intervals between markings are no greater than 1.5 m.

For polyethylene pipe and tubing according to AWWA C901, minimum markings shall be as follows:

- a) Nominal size.
- b) Standard material code designation (e.g., PE 2406).
- c) On pipe, the dimension ratio and diameter base (e.g., DR 11).
- d) On tubing, the word "Tubing" and dimension ratio.
- e) Pressure class (e.g., PC 160).
- f) Standard designation (e.g., AWWA C901).
- g) Manufacturer's name or trademark.
- h) Production record code.

For polyethylene pipe according to AWWA C906, minimum markings shall be as follows:

- a) Nominal size and OD base.
- b) Standard material code designation (e.g., PE 3408).
- c) Dimension ratio (e.g., DR 17).
- d) Pressure class (e.g., PC 100).
- e) Standard designation (e.g., AWWA C906).

- f) Manufacturer's name or trademark.
- g) Production record code.

Markings shall be applied in a manner that will not reduce the strength or damage the pipe and shall remain legible during normal handling and storage.

1842.08 QUALITY ASSURANCE

1842.08.01 Certificate

Upon request, suppliers shall provide a certificate to indicate that the product was produced and tested according to the appropriate specification requirements.

1842.08.02 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 materials failing to comply with the requirements of this specification shall be rejected.

1842.09 OWNER PURCHASE OF MATERIAL

Measurement of pressure polyethylene pipe and tubing shall be by length in metres along the centreline of the pipe.

For measurement purposes, a count shall be made of the pressure polyethylene pipe fittings 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 pressure polyethylene pipe products 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.

Appendix 1842-A, November 2015
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

No information provided here.



MATERIAL SPECIFICATION FOR EXTRA LOW-VOLTAGE CABLE

TABLE OF CONTENTS

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2410.06	EQUIPMENT - Not Used
2410.07	PRODUCTION
2410.08	QUALITY ASSURANCE - Not Used
2410.09	OWNER PURCHASE OF MATERIAL

APPENDICES

2410-A	Commentary
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2410.01 SCOPE

This specification covers the requirements for extra low-voltage cables suitable for underground or aerial installation.

2410.01.01 Specification Significance and Use

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

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

2410.01.02 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.

2410.02 REFERENCES

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

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:

International Municipal Signal Association

- 19-5 1997 Polyethylene Insulated, Polyethylene Belted, Copper Shielded, Polyvinyl Chloride Jacketed Signal Cable
- 50-2 1997 Polyethylene Insulated, Polyethylene Jacketed, Loop Detector Lead-in Cable

2410.05 MATERIALS

2410.05.01 Conductors

Conductors of all cables shall be according to IMSA 19-5 and shall be #14 AWG stranded tinned copper. The number of conductors shall be as specified in the Contract Documents.

2410.05.02 Communication Cables

2410.05.02.01 General

Communication cable shall be polyethylene insulated, polyethylene belted, and polyvinyl chloride jacketed.

2410.05.02.02 Insulation

Insulation and inner belt insulation shall be according to IMSA 19-5.

2410.05.02.03 Shielding

Shielding shall be according to IMSA 19-5.

2410.05.02.04 Jacket

Overall jacket shall be according IMSA 19-5.

2410.05.02.05 Fillers

Fillers shall be according to IMSA 19-5.

2410.05.03 Lead-In Cables

2410.05.03.01 General

Lead-in cables shall be polyethylene insulated and polyethylene jacketed.

2410.05.03.02 Insulation

Insulation shall be according to IMSA 50-2.

2410.05.03.03 Shielding

Shielding shall be according IMSA 50-2.

2410.05.03.04 Jacket

Overall jacket shall be according to IMSA 50-2.

2410.05.03.05 Drain Wire

Drain wire shall be according to IMSA 50-2.

2410.07 PRODUCTION

2410.07.01 Communication Cables

Communication cables shall be according to IMSA 19-5.

2410.07.01.01 Marking

Cable shall be permanently marked according to IMSA 19-5, at intervals not exceeding one metre, showing the following:

- a) Size of conductor.
- b) Voltage rating.
- c) Temperature rating.
- d) Type of insulation.

2410.07.02 Lead-In Cables

Lead-in cables shall be according to IMSA 50-2.

2410.07.02.01 Marking

Cable shall be permanently marked according to IMSA 50-2, at intervals not exceeding one metre, showing the following:

- a) Size of conductor.
- b) Voltage rating.
- c) Temperature rating.
- d) Type of insulation.

2410.09 OWNER PURCHASE OF MATERIAL

2410.09.01 Packaging and Shipment

Extra low-voltage cable shall be shipped on returnable reels, in continuous lengths specified in the purchasing order. Each reel of cable shall be tagged to indicate the length of the cable and information shown under the Production, Marking clause.

The supplier shall advise the Owner of the shipping date 3 Business Days prior to delivery.

2410.09.02 Measurement and Payment

Measurement of extra low-voltage cable shall be by metres along the cable length.

Payment at the price specified in the purchasing order shall be for the supply of the extra low-voltage cable 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.

Appendix 2410-A, November 2015
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

For Owner purchase of material, the following information should be given to the supplier in the purchasing order:

- a) Number of conductors.
- b) Colour of conductors.
- c) Length of cable.
- d) Length per reel.

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

None.



MATERIAL SPECIFICATION FOR HIGH PRESSURE SODIUM LUMINAIRES FOR HIGHWAY LIGHTING

TABLE OF CONTENTS

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2432.02	REFERENCES
2432.03	DEFINITIONS - Not Used
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2432.05	MATERIALS
2432.06	EQUIPMENT - Not Used
2432.07	PRODUCTION
2432.08	QUALITY ASSURANCE
2432.09	OWNER PURCHASE OF MATERIAL

APPENDICES

2432-A	Commentary
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2432.01 SCOPE

This specification covers the requirements for highway lighting luminaires with integral ballasts for use in conventional and high mast lighting.

2432.01.01 Specification Significance and Use

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

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

2432.01.02 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.

2432.02 REFERENCES

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

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:

CSA Standards

C22.2 No. 9.0-96 (R2011)	General Requirements for Luminaires
C653-13	Photometric Performance of Roadway and Street Lighting Luminaires
C811-13	Performance of Highmast Luminaires for Roadway Lighting
C863-11	Energy Efficiency of High-Intensity Discharge (HID) and Low-Pressure Sodium (LPS) Lamp Ballasts

2432.04 DESIGN AND SUBMISSION REQUIREMENTS

2432.04.01 Design Requirements

2432.04.01.01 Photometric Requirements

As a minimum, the photometric performance of the luminaires for conventional lighting shall be according to CSA C653.

As a minimum, the photometric performance of the luminaires for high mast lighting shall be according to CSA C811.

Photometric test results shall be provided for the luminaires supplied and shall include the following data:

- a) Isolux curves and mounting height correction factors.
- b) Utilization charts or graphs.
- c) Candlepower distribution curves indicating peak intensity.
- d) Luminous intensity tables to Illuminating Engineering Society format (I-tables).
- e) Luminaire efficiency values.
- f) Luminous outputs above and below horizontal.
- g) Lamp lumen outputs and wattages.

2432.04.01.02 Electrical Requirements

All electrical components and assembled luminaires shall be according to CSA C22.2 No. 9.0.

Ballasts, lamp sockets, ground connectors, internal wiring, and all other components shall be suitable for the supply voltage as specified in the Contract Documents and the maximum temperature encountered in totally enclosed outdoor weatherproof luminaires.

Ballasts shall be constant wattage auto-transformer or isolated secondary transformer type for grounded systems. Auto-transformer type ballasts shall have a maximum tolerance of 12% variation in lamp wattage for a 5% variation in line voltage. Isolated secondary transformer type ballasts shall have a maximum tolerance of 12% variation in lamp wattage for a 10% variation in line voltage.

Ballasts shall be Class H, 180 °C insulation; 60 hertz; and low temperature, -35 °C with a power factor not less than 0.90.

The minimum nominal secondary open circuit voltage of the ballast for various lamps shall be sufficient to provide reliable starting at -35 °C.

Ballasts shall be suitable for the lamp's nominal operating voltage. Terminal blocks shall be held rigidly and shall provide a positive connection for terminating the field wiring.

The current crest factor of the ballast shall not exceed 1.8 for high pressure sodium lamps.

Energy efficiency of lamp ballasts shall be according to CAN/CSA C863.

2432.04.01.03**Mechanical Requirements**

The luminaire shall be comprised of a cast aluminum ballast housing, spun or formed aluminum optical housing with a glass lens or refractor, and stainless steel hardware.

The ballast housing shall form a watertight enclosure for the ballast components that shall be readily interchangeable without removing the luminaire from the mounting bracket. The ballast housing shall be either integral or modular design. If it is of modular design, it shall be attached to the housing using stainless steel hardware.

Mounting arrangements shall consist of a slip fitter assembly for a 50 mm diameter internal pipe size tenon. The slip fitter shall be secured using stainless steel hardware with an independent levelling device. Adjustment of the luminaire in the vertical plane shall be 3 degrees minimum.

The lamp socket shall be a mogul type with a porcelain-enclosed, nickel-plated brass shell rated for 4,000 volts, and spring-loaded centre contact. The lamp holder shall have an electrically insulated lamp stabilizer and shall hold the lamp's outer envelope to precise alignment with suitable means for vibration damping.

The optical assembly shall consist of a precision formed specular aluminum reflector with an anodized finish and accurately positioned within the luminaire outer housing. The assembly shall be sealed at the top by a high temperature neoprene or silicone rubber gasket between the ballast casting and reflector and at the bottom by a hinged door assembly.

Alternatively, the optical assembly shall consist of a pressed borosilicate glass reflector and refractor of open ventilated design. The reflector shall have a smooth non-porous inner surface and be encased within the luminaire outer housing. The refractor shall be attached to the reflector using stainless steel hardware. The reflector or refractor assembly shall be readily removable without removing the luminaire from the mounting bracket.

The door assembly shall consist of a gasketed doorframe and a clear tempered shock-resistant glass lens and shall be attached to the reflector housing using stainless steel toggle latches, one of which shall be hinged.

2432.04.02**Submission Requirements****2432.04.02.01****Working Drawings**

Three copies of Working Drawings shall be submitted to the Contract Administrator a minimum of 14 Days prior to the commencement of fabrication.

As a minimum, the Working Drawings shall include the following information:

- a) All mechanical details, including dimensions, layouts, weights, and mounting arrangements for components.
- b) All electrical details, including wiring diagrams and component ratings.
- c) All photometric information regarding the luminaires, including, but not limited to lamp position and photometric data sheets.
- d) Shield details.
- e) Certification by an Engineer that the luminaires for conventional lighting comply with CSA C653.
- f) Certification by an Engineer that the luminaires for high mast lighting comply with CSA C811.

Each Working Drawing shall be sealed and stamped by an Engineer certifying that the Working Drawings comply with the Contract Documents.

One copy of the final accepted Working Drawings shall be returned to the supplier, along with written notification to commence fabrication. Within 14 Days of receipt of notification to commence fabrication, the supplier shall submit 3 copies of all final accepted Working Drawings to the Contract Administrator.

Fabrication of the equipment shall not commence until the Working Drawings have been accepted by the Contract Administrator.

Once fabrication of the equipment has commenced, materials and dimensions shown on the final accepted Working Drawings shall not be changed.

2432.05 MATERIALS

2432.05.01 Marking

A permanent label shall be attached to the interior of the luminaire indicating the manufacturer's name or trademark, catalogue number, date of manufacture, and the American National Standards Institute (ANSI) or Illuminating Engineering Society (IES) photometric classification and distribution type; the suitable supply voltage and frequency; the lamp type; the lamp wattage; and the nominal operating voltage of the lamp so that it is clearly visible during maintenance operations.

A label including a wiring diagram shall be attached to each ballast showing the ballast schematic wiring diagram and shall be visible during maintenance operations.

For asymmetrical luminaires with adjustable optical systems, a permanent embossed identification mark shall be located on the luminaire that is clearly visible and identifiable as an orientation mark.

2432.07 PRODUCTION

2432.07.01 Ballast Assemblies

Ballast assemblies shall be factory pre-wired with all connections clearly marked and identified.

2432.07.02 Lamp Socket Positions

The lamp socket position shall be pre-set at the factory for the specified distribution.

2432.08 QUALITY ASSURANCE

2432.08.01 Inspection

The supplier shall notify the Owner of the date that the fabrication of the luminaires is to commence.

The Owner's representative shall have free access to the place of fabrication for the purpose of inspecting and examining plant records, certificates, materials used, fabrication process, and to make any tests as may be considered necessary, while the luminaires are being fabricated.

All luminaires are subject to an inspection by the Owner's representative prior to shipment.

2432.09 OWNER PURCHASE OF MATERIAL

2432.09.01 Packaging and Shipment

The supplier shall provide 3 copies of the luminaire ballast engineering data and shielding data such as material type, gauge thickness, and mounting arrangement to the Owner.

Each luminaire shall be shipped complete with hardware suitably packaged to ensure that all parts are delivered as an entity. A complete parts list shall be included in the shipment. All cartons shall be marked with the ANSI or IES luminaire classification and distribution types.

The supplier is responsible for loading, delivery, and off-loading of luminaires to designated areas. Luminaires shall be subject to inspection during and on completion of off-loading. If any damage to the luminaires is encountered during the inspection, the supplier shall be responsible for the necessary corrective measures subject to the approval of the Owner.

The supplier shall advise the Owner 3 Working Days prior to the shipping date of the intent to deliver and confirm that arrangements for off-loading have been made.

2432.09.02 Measurement and Payment

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

Payment at the price specified in the purchasing order shall be full compensation for the supply and delivery of the luminaires to the destination at the date and time specified.

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

Appendix 2432-A, November 2015
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:

- Supply voltage to the luminaires. (2432.04.01.02)

For Owner purchase of material, the following technical information should be given to the supplier in the purchasing order:

- a) Nominal line voltages.
- b) Lamp wattages.
- c) Lamp types and ANSI designations.
- d) Ballast types.
- e) ANSI or IES luminaire classifications and distribution types.
- f) Photometric curves or test report numbers.
- g) Shielding requirements.

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 2418.010	1.8m and 2.7m Steel Truss Bracket For Steel Poles
OPSD 2420.01	1.8m and 2.4m Aluminum Tapered Elliptical Bracket
OPSD 2421.010	Lamp Wattage Label For Luminaire
OPSD 2453.000	High Mast Lighting Pole, Luminaire And Handhole Orientation
OPSD 2453.070	High Mast Lighting Pole, Luminaire Support Ring
OPSD 2453.080	High Mast Lighting Pole, Head Frame And Ring Assembly
OPSD 2453.090	High Mast Lighting Pole, Luminaire Shroud
OPSD 2453.091	High Mast Lighting Pole, Luminaire Shroud Details



MATERIAL SPECIFICATION FOR FLOODLIGHT LUMINAIRES USED IN HIGH MAST LIGHTING

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2479-A	Commentary
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2479.01 SCOPE

This specification covers the requirements for high mast floodlight luminaires with integral ballast for use in high mast lighting.

2479.01.01 Specification Significance and Use

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

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

2479.01.02

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.

2479.02

REFERENCES

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

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:

CSA Standards

C22.2 No. 9.0-96 (R2011)	General Requirements for Luminaires
C863-11	Energy Efficiency of High-Intensity Discharge (HID) and Low-Pressure Sodium (LPS) Lamp Ballasts

2479.04 DESIGN AND SUBMISSION REQUIREMENTS

2479.04.01 Design Requirements

2479.04.01.01 Photometric Requirements

Photometric test results shall be provided for the floodlight type luminaire supplied and shall include the following data:

- a) Isolux curves and mounting height correction factors.
- b) Utilization charts or graphs indicating the total beam utilization.
- c) Candlepower distribution curves indicating peak intensity.
- d) Luminous intensity tables to Illuminating Engineering Society format (I-tables).
- e) Luminaire efficiency values.
- f) Lamp lumen outputs and wattages.

2479.04.01.02 Electrical Requirements

All electrical components and assembled luminaires shall be according to CSA C22.2 No. 9.0.

Ballasts, lamp sockets, ground connectors, internal wiring, and all other components shall be suitable for the supply voltage as specified in the Contract Documents and the maximum temperature encountered in totally enclosed, outdoor, weatherproof luminaires.

Ballasts shall be constant wattage auto-transformer or isolated secondary transformer type for grounded systems. Auto-transformer type ballasts shall have a maximum tolerance of 12% variation in lamp wattage for a 5% variation in line voltage. Isolated secondary transformer type ballasts shall have a maximum tolerance of 12% variation in lamp wattage for a 10% variation in line voltage.

Ballasts shall be of Class H, 180 °C insulation; 60 hertz; and low temperature, -35 °C with a power factor not less than 0.90.

The minimum nominal secondary open circuit voltage of the ballast for various lamps shall be sufficient to provide reliable starting at -35 °C.

Ballasts shall be suitable for the lamp's nominal operating voltage. Terminal blocks shall be held rigidly and shall provide a positive connection for terminating the field wiring.

Energy efficiency of lamp ballasts shall be according to CAN/CSA C863.

2479.04.01.03 Mechanical Requirements

The luminaire housing shall be cast aluminum or heavy-duty sheet aluminum. The ballast shall be integral. All external fasteners and associated hardware shall be stainless steel. The luminaire shall be provided with a built-in aiming device.

Mounting arrangements shall be trunnion type or slip fitter for a 50 mm diameter internal pipe size tenon with provisions for vertical and horizontal adjustment. The luminaire shall be complete with all external fasteners and associated hardware required for the aiming of the luminaire and attachment to the slip fitter or mounting pad.

The optical assembly shall consist of a specular high purity anodized aluminum reflector. The reflector shall be precision formed and assembled in a way that the formed contour is maintained when it is removed from the luminaire housing. The optical assembly shall be sealed with a high temperature neoprene or silicone rubber gasket located between the door frame and luminaire housing.

When required and as specified in the Contract Documents, a secondary reflector or louvre shall be provided inside the sealed optical assembly. The louvre shall effectively screen the lamp from direct view and provide a cut-off 10° above the peak intensity on the vertical plane.

The door assembly shall consist of a gasketed door frame and a clear tempered shock-resistant glass lens and shall be hinged to the luminaire housing. The luminaire shall be accessible with tool-less entry.

The lamp socket shall be a mogul type with a porcelain-enclosed, nickel-plated brass shell rated for 4,000 volts, and spring-loaded centre contact. The lamp holder shall have an electrically insulated lamp stabilizer and shall hold the lamp's outer envelope in precise alignment with suitable means for vibration damping.

The luminaire assembly when closed and in the operating position shall not be subject to damage by vibration.

2479.04.02 Submission Requirements

2479.04.02.01 Working Drawings

Three copies of Working Drawings shall be submitted to the Contract Administrator a minimum of 14 Days prior to the commencement of fabrication.

As a minimum, the Working Drawings shall include the following information:

- a) Detailed dimensioned layout, including plans, elevations, and weight.
- b) Photometric curve data.
- c) Details of optical system.

Each Working Drawing shall be sealed and stamped by an Engineer certifying that the Working Drawings comply with the Contract Documents.

One copy of the final accepted Working Drawings shall be returned to the supplier, along with written notification to commence fabrication. Within 14 Days of receipt of notification to commence fabrication, the supplier shall submit 3 copies of all final accepted Working Drawings to the Contract Administrator.

Fabrication of the equipment shall not commence until the Working Drawings have been accepted by the Contract Administrator.

Once fabrication of the equipment has commenced, materials and dimensions shown on the final accepted Working Drawings shall not be changed.

2479.05 MATERIALS

2479.05.01 Marking

A permanent non-corrosive nameplate shall be attached to the exterior of the luminaire and located so that the marking is clearly visible during relamping. The nameplate shall indicate the manufacturer's name or trademark, catalogue number, electrical rating, input amperes, luminaire voltage, date of manufacture, and the vertical and horizontal beam distribution.

A permanent label shall be attached to the interior of the luminaire indicating the manufacturer's name or trademark, catalogue number, date of manufacture, and the American National Standards Institute (ANSI) or Illuminating Engineering Society (IES) photometric classification and distribution type; the suitable supply voltage and frequency; the lamp type; the lamp wattage; and the nominal operating voltage of the lamp so that it is clearly visible during maintenance operations.

A label including a wiring diagram shall be attached to each ballast showing the ballast schematic wiring diagram and shall be visible during maintenance operations.

For asymmetrical luminaires with adjustable optical systems, a permanent embossed identification mark shall be located on the luminaire that is clearly visible and identifiable as an orientation mark.

2479.07 PRODUCTION

2479.07.01 Ballast Assemblies

Ballast assemblies shall be factory pre-wired with all connections clearly marked and identified.

2479.07.02 Lamp Socket Positions

The lamp socket position shall be pre-set at the factory for the specified distribution.

2479.08 QUALITY ASSURANCE

2479.08.01 Inspection

The supplier shall notify the Owner of the date that the fabrication of the luminaires is to commence.

The Owner's representative shall have free access to the place of fabrication for the purpose of inspecting and examining plant records, certificates, materials used, fabrication process, and to make any tests as may be considered necessary, while the luminaires are being fabricated.

All luminaires are subject to an inspection by the Owner's representative prior to shipment.

2479.09 OWNER PURCHASE OF MATERIAL

2479.09.01 Packaging and Shipment

The supplier shall provide 3 copies of the luminaire ballast engineering data and shielding data such as material type, gauge thickness, and mounting arrangement to the Owner.

Each luminaire shall be shipped complete with hardware suitably packaged to ensure that all parts are delivered as an entity. A complete parts list shall be included in the shipment. All cartons shall be marked with the ANSI or IES luminaire classification and distribution types.

The supplier is responsible for loading, delivery, and off-loading of luminaires to designated areas. Luminaires shall be subject to inspection during and on completion of off-loading. If any damage to the luminaires is encountered during the inspection, the supplier shall be responsible for the necessary corrective measures subject to the approval of the Owner.

The supplier shall advise the Owner 3 Working Days prior to the shipping date of the intent to deliver and confirm that arrangements for off-loading have been made.

2479.09.02 Measurement and Payment

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

Payment at the price specified in the purchasing order shall be full compensation for the supply and delivery of the floodlight luminaires to the destination at the date and time specified.

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

**Appendix 2479-A, November 2015
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:

- Supply voltage to the luminaires. (2479.04.01.02)

The designer should determine if the following is required and, if so, specify it in the Contract Documents:

- Secondary reflector or louvre requirements. (2479.04.01.03)

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

For Owner purchase of material, the following technical information should be given to the supplier in the purchasing order:

- a) Nominal line voltages.
- b) Lamp wattages.
- c) Lamp types and ANSI designations.
- d) Ballast types.
- e) Mounting arrangements.
- f) Luminaire classifications and distribution types.
- g) Photometric curves or test report numbers.
- h) Luminaire vertical and horizontal beam distribution.
- i) Contract layout drawings.

Related Ontario Provincial Standard Drawings

OPSD 2453.060 High Mast Lighting Pole, Flood Light Luminaire Mounting Details



MATERIAL SPECIFICATION FOR PHOTOELECTRIC CONTROLLERS

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APPENDICES

2485-A	Commentary
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2485.01 SCOPE

This specification covers the requirements for electronic photoelectric controllers rated for 1,800 VA for use with 105 to 305 volt power supply at 60 Hz.

2485.01.01 Specification Significance and Use

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

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

2485.01.02

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.

2485.02

REFERENCES

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

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:

CSA Standards

C239-02 (R2011) Performance Standard for Dusk-to-Dawn Luminaires

American National Standards Institute (ANSI)

C136.10-2010 Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacle - Physical and Electrical Interchangeability and Testing

2485.07 PRODUCTION

2485.07.01 General

Photoelectric controllers shall be electronic and according to CAN/CSA C239.

Photoelectric controllers shall be of weatherproof construction and operational within a temperature range of -40 to 65 °C.

Photoelectric controllers shall be factory preset at 16 lux switch-on light level and 50 lux switch-off light level.

2485.07.02 Electrical Requirements

Photoelectric controllers shall be provided with three locking type blades according to ANSI C136.10.

Photoelectric controllers shall be supplied with contacts normally closed at nighttime or under failure conditions. Photoelectric controllers shall have an internal lightning arrester with a minimum spark over of 2.0 kV. The power consumption of the photoelectric controller itself shall be 5 watts or less.

2485.07.03 Marking

A permanent type of identification shall be provided on the outside of the photoelectric controller indicating the manufacturer's name or trademark, catalogue number, voltage, VA rating, and date coding.

2485.09 OWNER PURCHASE OF MATERIAL

2485.09.01 Packaging and Shipment

Each photoelectric controller shall be shipped complete with hardware and individually packaged and identified on the outside of the package.

The supplier shall advise the Owner 3 Working Days prior to the shipping date of the intent to deliver.

2485.09.02 Measurement and Payment

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

Payment at the price specified in the purchasing order shall be for the supply of the photoelectric controllers delivered to the destination on the date and time specified.

Appendix 2485-A, November 2015
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

No information provided here.



MATERIAL SPECIFICATION FOR TALL OIL PITCH EMULSION

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APPENDICES

2510-A	Commentary
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2510.01 SCOPE

This specification covers the requirements for tall oil pitch emulsion suitable for use as granular sealer.

2510.01.01 Specification Significance and Use

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

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

2510.01.02

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.

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2510.02

REFERENCES

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

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 Standards Specifications, Material

OPSS 1004 Aggregates - Miscellaneous

ASTM International

D 244-09 Standard Test Methods and Practices for Emulsified Asphalts

Ontario Ministry of the Environment and Climate Change Publications

Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act

Protocol for Analytical Methods Used in the Assessment of Properties Under Part XV.1 of the Environmental Protection Act

Environmental Protection Act, Ontario Regulation 347, General - Waste Management - R.R.O. 1990

Environment Canada Publications

- EPS 1/RM/13 Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout, Second edition, 2000 with May 2007 amendments
- EPS 1/RM/14 Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to *Daphnia magna*, Second edition, 2000

Organisation for Economic Co-operation and Development (OECD) Publications

- Method 301B Ready Biodegradability: CO₂ Evolution, OECD Guidelines for the Testing of Chemicals, 1992
- Method 302B Inherent Biodegradability: Zahn-Wellens/EMPA Test, OECD Guidelines for the Testing of Chemicals, 1992

United States Environmental Protection Agency Publications

- SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, July, 1992

Other

- ISO/IEC 17025-2005 General Requirements for the Competence of Testing and Calibration Laboratories

2510.03 DEFINITIONS

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

Effluent means any liquid waste that may be discharged to the aquatic environment.

Tall Oil means a mixture of rosins and fatty acids produced from the processing of pulp and paper.

Tall Oil Pitch (TOP) means the residue formed during the distillation of tall oil. Major components consist of fatty acids, resin acids, esters, and neutral materials.

Tall Oil Pitch Emulsion (TOP emulsion) means a tall oil pitch homogeneously dispersed in a water-emulsifier solution.

2510.04 DESIGN AND SUBMISSION REQUIREMENTS

2510.04.01 Submission Requirements

Valid test results from an acceptable laboratory showing complete conformance of the TOP emulsion with the requirements of this specification shall be made available upon request.

2510.05 MATERIALS

2510.05.01 Tall Oil Pitch

TOP shall be produced from distilled tall oil from the processing of pulp and paper not associated with the use of chlorine-based chemical to bleach pulp for the production of white paper.

2510.05.02 Water

Water shall be clean and free of contaminants that could adversely affect TOP emulsion and the environment.

2510.05.03 Emulsifier

Emulsifier shall be according to the manufacturer's requirements.

2510.05.04 Tall Oil Pitch Emulsion

TOP emulsion shall meet the physical property requirements of Table 1 and the environmental testing requirements of Table 2.

Components used to produce the TOP emulsion shall not contain any petroleum based products, calcium chloride, magnesium chloride, lignosulphonate, or lignan derivatives.

Addition of any asphalt products, solvents, polymers, or other additives during or after the manufacture of TOP emulsion shall not be permitted.

TOP emulsion shall show no signs of separation.

2510.07 PRODUCTION

2510.07.01 Storage

TOP emulsion that is to be stored longer than 7 Days shall be kept out of direct sunlight and maintained at a temperature of not less than 5 °C.

If stored more than 60 Days, the TOP emulsion shall be circulated prior to use using a low speed mechanical impeller or a pump rated at 5 hp or less. When a pump is used, the TOP emulsion shall be drawn from the bottom of the storage tank and fed to the top of the same tank with a submerged hose to avoid bubbling.

2510.07.02 Shipment

TOP emulsion shall be shipped in sealed containers of a size that minimizes the air space between the surface of the liquid and the top of the container.

All shipping containers shall be clean and reusable. Reused containers shall be free of any form of contamination and, if required, cleaned prior to loading.

TOP emulsion shall be protected from freezing.

A bill of lading or an invoice, as applicable, shall be supplied in as many copies as required by the Owner for each container of TOP emulsion delivered.

2510.07.03 Sampling and Testing

2510.07.03.01 General

Samples shall be collected, handled, prepared, and tested in accordance with the requirements of Table 1 and Table 2, except as noted below.

2510.07.03.01.01 Laboratory Requirements

Solids content testing of TOP emulsion shall be carried out in a laboratory that is acceptable to the Owner.

An acceptable laboratory for conducting environmental testing listed in Table 2, Section A, shall be one that has been certified by an organization accredited by the Standards Council of Canada in accordance with ISO/IEC 17025 and participates in mandatory proficiency testing programs for the applicable parameter in Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act.

An acceptable laboratory for conducting environmental testing listed in Table 2, Section B, shall be one that has been certified by an organization accredited by the Canadian Association for Environmental Analytical Laboratories (CAEAL) or by the Standards Council of Canada (SCC).

2510.07.03.01.02 Solids Content

Solids content shall be determined by measuring the mass of the residue remaining after drying a representative sample of TOP emulsion using the following procedure:

- a) Obtain a minimum 500 ml sample of TOP emulsion following thorough mixing or circulation of the contents of the shipping or storage container.
- b) Measure and record the mass of a suitable clean dry specimen container on a balance readable to 0.1 g and accurate to within 0.1% of the test load. A suitable container shall be one that is resistant to corrosion and change in mass upon heating, cooling, and exposure to materials of varying pH.
- c) Decant approximately 100 ml from the representative sample into the specimen container. Measure and record the mass of the container and TOP emulsion.
- d) Place the specimen and container in an oven maintained at $110\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ and dry to a constant mass. Specimens may be dried at higher temperatures with a hot plate or burner provided that steam is allowed to escape freely.
- e) Allow the container and remaining residue to cool to room temperature. Measure and record the dried mass and container using the same balance as above.
- f) Calculate the percent solids as follows:

$$\text{Percent solids} = [(M_{\text{CR}} - M_{\text{C}}) / (M_{\text{CT}} - M_{\text{C}})] \times 100 = M_{\text{R}} / M_{\text{T}} \times 100$$

where: M_{C} = mass of container, *g*
 M_{CT} = mass of container and TOP emulsion, *g*
 M_{CR} = mass of container and residue, *g*
 M_{T} = mass of TOP emulsion specimen, *g*
 M_{R} = mass of residue, *g*

- g) Report the solids content as percent solids to the nearest 0.1%.

2510.07.03.01.03 Particle Charge

The particle charge of the TOP emulsion shall be determined according to ASTM D 244 in the same manner as required for an asphalt emulsion.

2510.07.03.01.04 Environmental Testing

2510.07.03.01.04.01 Sample Preparation

Sample preparation for *Daphnia magna*, and Rainbow Trout testing shall be as follows:

- a) Obtain a sufficient amount of inert, non-absorptive material for the substrate meeting the gradation requirements of 9.5 mm clear stone according to OPSS 1004.
- b) Prepare the substrate by applying the TOP emulsion at a rate of 1,000 ml per 1,000 g of substrate distributed evenly in 4 coats (i.e., 250 ml per 1,000 g substrate per coat).
- c) Stir the mixture after each coat has dried to ensure that substrate particles do not adhere to each other.
- d) Allow each coat of the TOP emulsion to dry completely prior to the application of the next coat.
- e) To prepare the effluent for testing, expose a maximum of 1,000 ml of dechlorinated tap water for each 100 g of prepared substrate for a minimum of 24 hours.
- f) Decant sufficient effluent as required for each test.

2510.07.04 Marking

Bill of lading or invoice, as applicable, shall be legibly marked with the following information:

- a) Product name.
- b) Name of the manufacturer.
- c) Date shipped (i.e., yyyy-mm-dd).
- d) Product type.
- e) Net content mass in tonnes or volume in litres, as applicable.
- f) Solids content in percent.
- g) Particle charge (i.e., cationic).

2510.08 QUALITY ASSURANCE

2510.08.01 Inspections, Sampling, Testing, and Acceptance

The Owner reserves the right to make inspections, take samples, and perform tests at times and locations as the Owner may consider necessary to ensure that the materials supplied are in accordance with this specification.

2510.09 OWNER PURCHASE OF MATERIAL

TOP emulsion shall be measured by mass in tonnes or by volume in litres as specified in the purchasing order. When weighing by railway tank car, railway scales shall be as specified in the purchasing order.

When weighing by truck tank, the mass shall be determined as specified in the purchasing order.

When volumetric measurement is used, the Owner shall be provided with an invoice for each container of solution delivered. The invoice shall contain a note signed by the delivery person as the official representative of the supplier of TOP emulsion indicating the total volume in litres of solution in each container delivered.

Payment at the price specified in the purchasing order shall be for the supply of the TOP emulsion delivered to the destination on the date and time specified.

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

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

TABLE 1
Physical Requirements

Solids content, % Minimum	Particle Size, µm Maximum (Note 1)	Particle Charge
8 (Note 2)	5.0	Cationic or non-ionic

Notes:

1. As determined by a particle size analyzer capable of resolution below 10 µm.
2. When the TOP emulsion is supplied at a higher concentration, it may be diluted with water to meet the solids content of this specification.

TABLE 2
Environmental Testing

Section	Test	Requirement	Test Method
A	Full Metal Scan	Less than or equal to the concentrations for Agriculture or Other Property Use shown in Table 1 of Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act.	As described in Protocol for Analytical Methods Used in the Assessment of Properties Under Part XV.1 of the Environmental Protection Act.
	Inorganic Anions		
	Polychlorinated Biphenyls (PCBs)		
	Dioxins and Furans		
	Polyaromatic Hydrocarbons (PAHs)		
	Acid / Base / Neutral Extractable Organics		
B	Inherent Biodegradability	Minimum 20% biodegradation in 28 Days	OECD Method 302B
	Ready Biodegradability	Maximum 60% ThCO ₂	OECD Method 301B
C	<i>Daphnia magna</i> LC50	No greater than 50% impairment or mortality after continuous exposure for 48 hours.	EPS 1/RM/14
	Leachate Testing: Metals Non-Metals, Metalloids	Less than the concentration shown in Schedule 4 of Ontario Regulation 347 as amended by Ontario Regulation 558/00, under the Environmental Protection Act	SW - 846, Toxicity Characteristic Leaching Procedure, Method 1311
	Rainbow Trout LC50	No greater than 50% impairment or mortality after continuous exposure for 96 hours.	EPS 1/RM/13

Appendix 2510-A, November 2015
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

No information provided here.

