



**CONSTRUCTION SPECIFICATION FOR
INSTALLATION OF ELECTRICAL CHAMBERS**

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602.01 SCOPE

This specification covers the requirements for the installation, adjustment, and rebuilding of electrical chambers.

602.02 REFERENCES

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

Ontario Provincial Standard Specifications, Construction

OPSS 206	Grading
OPSS 401	Trenching, Backfilling, and Compacting
OPSS 402	Excavating, Backfilling, and Compacting for Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers
OPSS 403	Rock Excavation for Pipelines, Utilities, and Associated Structures in Open Cut
OPSS 404	Support Systems
OPSS 407	Maintenance Hole, Catch Basin, Ditch Inlet, and Valve Chamber Installation

OPSS 408	Adjusting or Rebuilding Maintenance Holes Catch Basins, Ditch Inlets, and Valve Chambers
OPSS 490	Site Preparation for Pipelines, Utilities, and Associated Structures
OPSS 491	Preservation, Protection, and Reconstruction of Existing Facilities
OPSS 517	Dewatering of Pipeline, Utility, and Associated Structure Excavation
OPSS 609	Grounding
OPSS 610	Removal of Electrical Equipment and Materials
OPSS 904	Concrete Structures
OPSS 905	Steel Reinforcement for Concrete

Ontario Provincial Standard Specifications, Material

OPSS 1004	Aggregates - Miscellaneous
OPSS 1010	Aggregates - Base, Subbase, Select Subgrade, and Backfill Material
OPSS 1103	Emulsified Asphalt
OPSS 1301	Cementing Materials
OPSS 1302	Water
OPSS 1350	Concrete - Materials and Production
OPSS 1351	Precast Reinforced Concrete Components for Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers
OPSS 1440	Steel Reinforcement for Concrete
OPSS 1801	Corrugated Steel Pipe (CSP) Products
OPSS 1850	Frames, Grates, Covers, and Gratings
OPSS 2401	Electrical Handholes

CSA Standards

C22.2 No. 42-10 (R2015)	General Use Receptacles, Attachment Plugs and Similar Wiring Devices
C83-96 (R2016)	Communication and Power Line Hardware
G164-M92 (R2003)	Hot Dip Galvanizing of Irregularly Shaped Articles

ASTM International

A 48/A 48M-03 (2016)	Grey Iron Castings
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Bureau de Normalisation du Quebec (BNQ)

3624-115-2007-05-04	Polyethylene (PE) Pipe and Fittings - Flexible Pipes for Drainage - Characteristics and Test Methods
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602.03 DEFINITIONS

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

Electrical Chamber means a structure or chamber for placing and maintaining conductors, cables, ducts, or electrical equipment. Electrical chamber is a general name for electrical maintenance holes and handholes.

Rock means as defined in OPSS 206.

602.05 MATERIALS

602.05.01 Concrete

Concrete for cast-in-place electrical maintenance holes shall be according to OPSS 1350 with a nominal 28-Day compressive strength of 30 MPa.

602.05.02 Steel Reinforcement

Steel reinforcement shall be according to OPSS 1440.

602.05.03 Sand Bedding

Sand bedding shall consist of sand conforming to the gradation requirements of mortar sand according to OPSS 1004.

602.05.04 Precast Concrete Electrical Maintenance Holes

Precast concrete electrical maintenance holes shall be according to OPSS 1351 and the Contract Documents. The requirement for a Prequalification Certificate issued under the Plant Prequalification Program stated in OPSS 1351 does not apply to precast concrete electrical maintenance holes.

602.05.05 Electrical Handholes

Electrical handholes shall be according to OPSS 2401 and the Contract Documents.

602.05.06 Steps

Steps for electrical maintenance holes shall be according to OPSS 1351.

602.05.07 Adjustment Units

Precast adjustment units shall be according to OPSS 1351 and as specified in the Contract Documents.

602.05.08 Frames with Covers

Maintenance hole frames with covers shall be according to OPSS 1850 and the Contract Documents.

Frames with covers for handholes shall be cast ferrous alloy according to ASTM A 48, Class No. 30 C, and the Contract Document.

602.05.09 Pulling Irons

Pulling irons for cast-in-place maintenance holes shall be galvanized wrought steel according to CSA C83, Item C83.48.

Pulling irons for precast concrete maintenance holes shall be 20 mm diameter, 200 mm long galvanized steel straight thimble eye bolts with heavy square nuts, and 100 x 100 x 10 mm square washers according to CSA C83, Items C83.65 and C83.30, No. 3.

602.05.10 Drain Pipe and Fittings

Drain pipe and fittings shall be 100 mm diameter non-perforated, corrugated high density polyethylene, according to BNQ 3624-115.

Plugs shall be polyethylene according to C22.2 No. 42.

Corrugated steel end sections and fittings shall be according to OPSS 1801.

Rodent gates shall be galvanized according to CSA G164.

602.05.11 Mortar

Mortar shall consist of a mixture of one part Portland cement according to OPSS 1301 and two parts mortar sand according to OPSS 1004, wetted with sufficient water to make the mixture plastic. Water shall be according to OPSS 1302. Air entrainment shall be 12%.

602.05.12 Waterproofing

Waterproofing material shall be emulsified asphalt, anionic slow-setting type according to OPSS 1103.

602.05.13 Grounding Materials

Grounding materials shall be according to OPSS 609.

602.05.14 Granular Material

Granular material for bedding and backfill shall be according to OPSS 1010.

602.05.15 Flexible Utility Marker

Flexible utility marker shall be according to the Contract Documents.

602.07 CONSTRUCTION

602.07.01 General

General requirements for electrical work shall be as specified in the Contract Documents.

Electrical chambers of the type specified in the Contract Documents shall be installed on firm foundations at the locations and to the elevations specified in the Contract Documents and shall be constructed plumb and true to alignment.

The top of structures shall be installed below the final grade to allow for the placing of adjustment units to facilitate the placing of the top of the frame with grate or cover to the final grade.

Flexible utility markers for electrical chambers shall be installed at locations specified in the Contract Documents.

602.07.02 Removals

Removals shall be according to OPSS 610.

602.07.03 Site Preparation

Site preparation shall be according to OPSS 490.

602.07.04 Preservation and Protection of Existing Facilities

Preservation and protection of existing facilities shall be according to OPSS 491.

602.07.05 Cold Weather Work

All work shall be protected from freezing. Structures shall not be installed on frozen ground.

602.07.06 Transporting, Unloading, Storing, and Handling Materials

Manufacturer's recommendations for transporting, unloading, storing, and handling of materials shall be followed.

Materials that are unsound or damaged shall be rejected.

602.07.07 Excavating, Backfilling, and Compacting

Excavating, backfilling, and compacting for the installation of electrical chambers shall be according to OPSS 402.

Earth shall be excavated to accommodate at least 300 mm of granular backfill around the outer walls of the unit. When specified in the Contract Documents, a drainage pocket or drainage facilities lower than the electrical chamber floor shall be excavated and backfilled with 19 mm clear crushed rock.

Earth shall be excavated for separate drainage pockets and drain pipes as specified in the Contract Documents.

Backfill around the walls of units shall be according to OPSS 402, except that acceptable native material may be used when any part of the electrical chamber is 1.5 m or more beyond the outside edge of the shoulder.

Backfill for electrical chambers installed in grassed areas shall be native backfill.

Granular backfill or unshrinkable backfill, or material approved by the Contract Administrator shall be used for electrical chambers within 1.5 m of the outside edge of the shoulder.

602.07.08 Support Systems

Support systems shall be according to OPSS 404.

602.07.09 Dewatering

Dewatering shall be according to OPSS 517.

602.07.10 Electrical Chamber Drains

Drainage facilities shall be as specified in the Contract Documents.

The drain pipe shall be installed as specified in the Contract Documents and according to OPSS 401. Holes in electrical chamber drains shall be formed by core drilling or other approved methods.

Ends of cut steel bars shall be coated with epoxy paste and the drain pipe shall be mortared in place so that it does not protrude into the structure cavity.

The drain pipe shall have a formed trap in all cases when drainage is connected to a storm sewer system.

The drain pipe shall be provided with a 150 mm diameter corrugated steel end section and rodent gate in all cases when drainage is connected to an embankment slope or ditch is specified. The drain pipe shall be inserted at least 300 mm into the end section.

Drain pipes shall be laid in a trench between 300 and 400 mm wide, with a minimum grade of 400H 1V. Sand bedding and backfill of 150 mm each shall be placed when the drain pipe is installed in rock.

602.07.11 Installation

602.07.11.01 Electrical Maintenance Holes

Maintenance holes shall be oriented so that ducts and duct bank entries have an angle of 90° between the maintenance hole wall and the axis of the ducts and duct bank. If this is not possible, the angle shall not be less than 45°.

Maintenance holes shall be oriented so that maintenance hole steps are placed on the maintenance hole wall nearest to the travelled edge of pavement.

All inside wall protuberances shall be ground smooth prior to installation of wiring baffles and mechanical supports for cables.

All liquid and debris shall be cleaned from the electrical chambers upon completion and prior to the acceptance of work by the Contract Administrator.

When the Contract Documents specify that a maintenance hole is to be constructed on existing runs of rigid duct, either direct buried, in steel liner, or concrete encased; the ducts, concrete encasement, reinforcing steel, and steel liners shall be cut back and removed to suit the maintenance hole dimensions. The Contractor may,

- a) construct a cast-in-place electrical maintenance hole around the duct structure and modify the duct after placing the maintenance hole, or
- b) cut the duct structure back to a minimum of 300 mm beyond the outer maintenance hole walls, install a precast unit, and reinstate ducts into the maintenance hole.

Pulling irons shall be mounted on all maintenance hole walls opposite to the rigid duct entry and, when specified in the Contract Documents, in the floor of the units, and centred under the cover opening. Pulling irons shall be installed as specified in the Contract Documents and before waterproofing the unit. When pulling irons are installed after concrete has been poured, a 22 mm diameter hole shall be drilled in the wall and an eyebolt installed with a square washer and nut on each side of the wall.

602.07.11.01.01 Precast Electrical Maintenance Holes

Precast maintenance holes shall be supplied to the depth specified in the Contract Documents or to the depths necessary to accommodate the depths of ducts, duct banks, or cable required to enter the precast unit. When the vertical location of ducts are adjusted for Utility clearance or drainage and a deeper maintenance hole is required, the additional depth may be obtained by additional courses of brick or precast adjustment units up to 255 mm depth.

Precast maintenance holes shall be installed on a level surface and then backfilled and compacted to maintain the specified unit plumb and true to the required alignment and grades.

Precast or mono bases shall be placed level. Subsequent sections, complete with joint seal systems, shall be installed according to the manufacturer's recommendations.

During installation, all duct openings and drainage facilities shall be fitted to the required orientation and location and all segmental sections, gaskets, and PVC waterstops shall be firmly seated.

Adjustment of the structure shall be carried out by lifting the affected sections free of the excavation, re-leveling the base, if necessary, and re-installing the sections. Damaged sections and gaskets shall be replaced.

Lift holes shall be plugged with mortar.

602.07.11.01.02 Cast-In-Place Electrical Maintenance Holes

Cast-in-place maintenance holes shall be cast plumb and true to the alignment and grades specified in the Contract Documents.

Concrete shall be placed, cured, protected, and finished according to OPSS 904. Steel reinforcement shall be placed according to OPSS 905.

Formwork for duct openings shall be accurately located to the dimensions specified in the Contract Document and shall consist of either non-metallic or removable forms. Ducts, duct banks, duct end bells, and liners shall be set in the framework prior to pouring concrete and shall be installed to provide an opening for later installation of these items.

602.07.11.02 Electrical Handholes

Electrical handholes shall be cast-in-place concrete handholes, precast concrete handholes, or prefabricated handholes made of semi-concrete or non-concrete materials.

Electrical handholes shall be installed plumb, true to alignment and grade, and firmly bedded on the drainage pocket backfill.

During installation, the duct entry holes shall be oriented in the required direction. The enlarging of duct entry holes is prohibited.

602.07.11.02.01 Cast-In-Place Concrete Electrical Handholes

Formwork for cast-in-place electrical handholes shall be secured to form a concrete envelope of uniform wall thickness and shall be set plumb and firmly bedded on the drainage pocket backfill. The cast iron frame and all ducts shall be installed in the formwork prior to pouring concrete.

Concrete shall be poured, cured, protected, and finished according to OPSS 904.

Outside formwork shall be removed to at least 150 mm below finished grade.

602.07.12 Duct Entry Holes

Duct entry holes shall be provided in the walls of electrical chambers in the orientation and number specified in the Contract Documents.

Any unused duct entry holes shall be firmly plugged from the inside with plastic plugs or, when waterproofing is specified, with mortar to the full thickness of the concrete walls.

When concrete encased duct banks are installed in maintenance hole units, the steel reinforcement of the duct bank shall be inserted 75 mm into the maintenance hole wall. The duct bank encasement shall be completely surrounded and bonded to the concrete wall. When direct buried rigid ducts, rigid ducts by subsurface installation or steel liners are installed in maintenance hole units, they shall be completely surrounded with concrete or grouted in place with mortar to the full thickness of the maintenance hole wall.

602.07.13 Grounding

Grounding shall be according to OPSS 609.

Metal cable racks and maintenance hole frames shall be connected to the system ground wire. When a ground rod is required at a maintenance hole, the system ground wire shall exit and re-enter the maintenance hole to enable ground rod connection as specified in the Contract Documents.

Grounding for handhole and maintenance hole covers shall be as specified in the Contract Documents.

602.07.14 Waterproofing

When specified in the Contract Documents, waterproofing material shall be applied to the outside walls, top, and adjustment units of concrete electrical chambers. For precast electrical chambers, the underside of the floor slab shall have a similar application. For cast-in-place electrical chambers, 300 µm polyethylene sheeting shall be installed between the underside of the floor and the bedding prior to pouring concrete. All holes not used shall be grouted with mortar.

Waterproofing material shall be applied at the rate of 0.8 L/m² of surface.

602.07.15 Installation of Adjustment Units

The installation of precast adjustment units shall be according to OPSS 407 and as specified in the Contract Documents.

602.07.16 Installation of Frames and Covers

Frames with covers shall be installed according to OPSS 407 and as specified in the Contract Documents.

Maintenance hole covers and gaskets shall be secured as specified in the Contract Documents.

Cast iron frames for handhole covers shall be adjusted to the required elevation and crossfall. Mortar shall be used to smooth out any edges protruding above the concrete envelope.

Cast iron covers for handholes shall be secured as specified in the Contract Documents.

Covers for prefabricated handholes shall be firmly seated according to the manufacturer's instructions.

602.07.17 Adjusting and Rebuilding Electrical Chambers

The adjusting and rebuilding of existing electrical chambers shall be according to OPSS 408 and as specified in the Contract Documents.

602.07.18 Quality Control

602.07.18.01 Pre-Installation Testing and Inspection

Electrical chambers and chamber drain components shall be inspected prior to installation to ensure that they are according to the Contract Documents.

Certification from the manufacturer that the product is according to the Contract Documents shall be submitted to the Contract Administrator.

602.07.18.02 Pre-Installation Strength Testing of Semi-Concrete and Non-Concrete Handholes

Ten percent of the handholes shall be selected for strength testing. For each handhole selected, the handhole shall be placed on a flat surface with only the bottom of the handhole in contact with the ground. No external support shall be provided for the sides of the handhole. A weight of 2,000 kg shall be placed on top of the handhole for ten minutes. At the end of each test, the handhole shall be inspected. The handhole shall not exhibit any signs of cracking or deformation. If the handhole is deformed, cracked, or damaged in any way, it shall be considered failed and shall be replaced. If one or more handholes fail, then another 10% of the handholes shall be selected and tested. If one or more of those handholes fail, then all of the handholes shall be tested.

The results of the strength testing shall be submitted to the Contract Administrator.

602.07.18.03 Electrical Chamber Installations

The Contractor shall ensure that the following are according to the requirements specified in the Contract Documents:

- a) Properly seated and aligned to a plumb position.
- b) Type of backfill.
- c) Compaction of backfill.
- d) All unused holes and spaces are filled.
- e) Waterproofing has been correctly applied.
- f) All frames and covers are secured and adjusted to grade.

602.07.19 Temporary Electrical Work

The work for temporary electrical installations shall be the same as for permanent installations of the same type of work, except that the work shall include the removal of the installations when they are no longer required.

602.07.20 Management of Excess Material

Management of excess material shall be as specified in the Contract Documents.

602.09 MEASUREMENT FOR PAYMENT

602.09.01 Actual Measurement

**602.09.01.01 Electrical Maintenance Holes
Electrical Handholes**

For measurement purposes, a count shall be made of the number of complete electrical chambers installed.

602.09.01.02 Adjusting and Rebuilding Electrical Chambers

For measurement purposes, a count shall be made of the number of electrical chambers adjusted or rebuilt.

602.09.01.03 Electrical Chamber Drains

Measurement of electrical chamber drains shall be by length in metres along the horizontal centreline of the drain pipe from the centre of the electrical chamber to the centre of the drainage pocket, storm sewer structure, storm sewer pipe, or concrete culvert or outlet end of the drain terminating at an embankment slope or ditch.

602.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

602.10 BASIS OF PAYMENT

- 602.10.01 Electrical Maintenance Holes - Item**
- Electrical Handholes - Item**
- Adjusting and Rebuilding Electrical Chambers - Item**
- Electrical Chamber Drains - Item**

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work.

- 602.10.02 Electrical Maintenance Holes, Temporary - Item**
- Electrical Handholes, Temporary - Item**
- Electrical Chamber Drains, Temporary - Item**

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work.

Progress payment for temporary installation of above tender items shall be based on the following percentages of the Contract price:

80% for supply and installation

20% for removal

602.10.03 Rock Excavation for Trenches and Associated Structures

Payment for rock excavation for trenches and associated structures shall be according to OPSS 403.