



**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.

**602.01.01 Specification Significance and Use**

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

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

## **602.01.02 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.

## **602.02 REFERENCES**

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

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

### **Ontario Provincial Standard Specifications, Construction**

|          |   |
|----------|---|
| OPSS 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 |
|----------------------|--------------------|

## **Bureau de Normalisation du Quebec (BNQ)**

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

### **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/m<sup>2</sup> 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.

The Contractor shall submit to the Contract Administrator certification from the manufacturer that the product is according to the Contract Documents.

##### **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 Contractor shall submit the results of the strength testing 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.

**Appendix 602-A, November 2017  
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 the following in the Contract Documents:

- Type, location, and elevations of electrical chambers. (602.07.01)
- Flexible utility marker locations. (602.07.01)
- Precast electrical maintenance hole depths. (602.07.11.01.01)
- Alignment and grade of cast-in-place electrical maintenance holes. (602.07.11.01.02)
- Duct opening locations and dimensions in cast-in-place electrical maintenance holes. (602.07.11.01.02)
- Orientation and number of duct entry holes in electrical chambers. (602.07.12)

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

- Drainage pockets and drain pipes. (602.07.07)
- Pull irons in the floor of maintenance holes. (602.07.11.01)
- Waterproofing of concrete electrical chambers. (602.07.14)

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

**Related Ontario Provincial Standard Drawings**

|               |   |
|---------------|---|
| OPSD 704.010  | Precast Concrete Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers |
| OPSD 2111.020 | Electrical Maintenance Hole, Precast Concrete, 600 mm x 1450 mm                           |
| OPSD 2111.030 | Electrical Maintenance Hole, Precast Concrete, 1200 mm Dia.                               |
| OPSD 2111.040 | Electrical Maintenance Hole, Precast Concrete, 1200 mm x 1650 mm                          |
| OPSD 2111.050 | Electrical Maintenance Hole, Precast Concrete, 1800 mm x 2400 mm                          |
| OPSD 2112.010 | Electrical Handhole, Precast Concrete with Cover, 300 mm Dia.                             |
| OPSD 2112.020 | Electrical Handhole, Precast Concrete with Cover, 460 mm Dia.                             |
| OPSD 2112.030 | Electrical Handhole, Precast Concrete - 675 mm Diameter                                   |
| OPSD 2112.040 | Electrical Handhole, Precast Concrete - 600 x 600 mm                                      |
| OPSD 2112.050 | Electrical Handhole, Precast Concrete with Cover, 300 x 500 mm                            |
| OPSD 2113.010 | Electrical Handhold, Non and Semi-Concrete, General Requirements                          |
| OPSD 2116.010 | Drainage Facilities for Electrical Maintenance Holes                                      |
| OPSD 2116.020 | Electrical Maintenance Hole, Drains to Drainage Pockets, Embankment Outlets, and Ditches  |
| OPSD 2116.030 | Electrical Maintenance Hole, Drains to Storm Sewer Systems                                |

## **Appendix 602-A**

|               |   |
|---------------|---|
| OPSD 2117.010 | Electrical Maintenance Holes, General Installation Requirements |
| OPSD 2117.020 | Electrical Handholds, General Installation Requirements         |
| OPSD 2118.010 | Electrical Chamber, Installation in Median                      |
| OPSD 2118.020 | Electrical Chamber, Installation in Slope                       |
| OPSD 2123.010 | Electrical Maintenance Holes, Entry of Direct Buried Ducts      |
| OPSD 2123.020 | Electrical Maintenance Holes, Entry of Encased Ducts            |
| OPSD 2123.030 | Electrical Handholds, Entry of Direct Buried and Encased Ducts  |