Underground Residential Distribution

Installation of Civil Work

(Construction Detail)

REVISION SHEET

Revision	Description	Date	Initial
0	Original Document	2002-09-25	cm/csm.
1	Changed Ref. Dwg. OPS0001 to UDS0023	2007-11-12	cp/csm
2	References modified. Schedule 1 added. Various minor changes	2020-05-20	ak/kp/mw

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1. Introduction

This specification sets down the general requirements for installation of civil works for Underground Residential Distribution (URD) not requiring a manhole system or main electrical trunk circuits.

2. References

CSA C22.3 No.7 - Underground Systems
CSA C22.2 No. 211.1 - Rigid types EB1 and DB2/ES2 PVC conduit
Ottawa UCC - Joint Use Utility 3 and 4 Party Trench Guidelines
Ottawa UCC - Road Right-of -Way Cross Sections
Ottawa UCC - Pedestal Guidelines
HOL Standards (refer to Schedule 1)

3. Definitions

'Approved Contractor' refer to HOL Conditions of Service (ECS0012) for definition

'Boulevard' is the area between the property line and the curb of a municipal road cross section.

'CUP' means composite utility plan

'Ditch' means a long narrow excavation beside a road for water drainage that cannot be driven across with a standard vehicle due to its depth and/or slope.

'HOL' means Hydro Ottawa Limited

'Main Trench' in the context of URD means the underground electrical distribution trench that contains multiple secondary services and/or primary electrical cables within the road right of way or easement. The Main Trench may contain direct buried conduit, concrete encased duct bank.

'Qualified Contractor' refer to HOL Conditions of Service (ECS0012) for definition

'Service Trench' in the context of URD means the underground electrical secondary distribution trench on private property that services the individual residence/customer.

'URD' means underground residential distribution.

'Utility' refers to natural gas, telecommunications, street lighting, and electrical distribution.

4. Location of Plant

Main line trenches for Hydro Ottawa cables are to be located within the standard municipal right of way as indicated on the municipal cross sectional drawing (Public Utility Coordinating Committee) applicable to the project. For rural subdivisions where the sloping of ditches does not provide adequate space for trenches, they shall be installed in a 3-meter easement on private property (refer to GCG0005).

In general, Service Trenches for single homes shall be on the side of the home opposite the driveway. Town homes are serviced from the end-wall of the building. In each case, the standard service conductor/duct location shall be centered 500mm from the side property line and shall be straight between the angle points indicated on the Hydro Ottawa drawing.

Where specified by Hydro Ottawa, trenches for primary and secondary cables shall be located on easements granted to Hydro Ottawa.

It is the developer's responsibility to establish and maintain all grades and locate all iron bars required to delimit the property and to ensure proper location of Hydro Ottawa plant.

Trees shall maintain the minimum clearances from Hydro Ottawa plant as described in GCS0038.

5. Trenches

Prior to excavating any trench, the first lift of base course asphalt shall be installed and the Boulevard grade shall be within 150 mm of final elevation. If the developer is not able to install the first lift of asphalt due to winter shutdown, then the developer shall provide a signed Grading Letter and any costs associated with deviations from the agreed upon grade shall be borne by the developer.

The trenches shall be excavated to the required depth and sand bedding (see Appendix "A") shall be in place before any duct is installed. After the duct is installed, the required sand cushion shall be placed prior to general backfilling. Clean Native material may be used as a general backfill, if it meets the requirements of GCS0005. In any case, the nature of the general backfill material must be such as to permit easy access to the cable by hand excavation methods during future maintenance. Hydro Ottawa shall approve all native backfill. In the event that the native backfill material is not approved, the developer shall import backfill acceptable to Hydro Ottawa. **NO TRENCH SHALL BE BACKFILLED WITHOUT APPROVAL FROM THE HYDRO OTTAWA INSPECTOR**. Reasonable notice is required for Hydro Ottawa to complete on-site inspections. Moreover, concrete encased duct(s) and manhole system shall be constructed as per section 6.

5.1. Three Party Joint Utility Trench

- Joint Utility 3 party trenching (hydro, telecommunication, and streetlight) is alternative standard Main Trench configuration for underground residential servicing
- Where the design specifies direct buried duct installation for primary and secondary cables, the joint Utility 3 party trench shall be constructed as per Hydro Ottawa Engineering Specification No. UDS0045
- Secondary Service Trenches shall be constructed as per Hydro Ottawa Engineering Specification No. UDS0003. When multiple services are required, the Service Trenches shall be constructed as per UDS0043
- Gas pipelines running separately and parallel to main residential trenches shall maintain a minimum horizontal separation of 1000mm from all Hydro Ottawa underground cables
- Gas pipelines running separately and parallel to service residential trenches shall maintain a minimum horizontal separation of 300mm from all Hydro Ottawa cables
- Where underground gas pipelines intersect with Hydro Ottawa underground cables, a minimum 300mm vertical separation is required
- Three party road crossing trenches shall be constructed as per UDS0046

5.2. Four Party Joint Utility Trench

- Joint Utility 4 party trenching (hydro, telecommunication, streetlight, gas) is the standard Main Trench configuration for underground residential subdivision
- Where the design specifies direct buried duct installation for primary and secondary cables, the joint Utility 4 party trench shall be constructed as per Hydro Ottawa Engineering Specification No. UDS0037

- Secondary Service Trenches shall be constructed as per Hydro Ottawa Engineering Specification No. UDS0016

- Four party road crossing trenches shall be constructed as per UDS0047

6. Installation of Ducts and Cables

All concrete encased, steel reinforced duct banks shall be installed as per Hydro Ottawa Engineering Specification No. GCS0005.

Hydro Ottawa primary cable shall be placed in 100 mm PVC DB2 duct that is either encased in reinforced concrete or direct buried, as specified in the Hydro Ottawa design. Secondary cables shall be placed in 100 mm PVC DB2 duct that is either encased in reinforced concrete or direct buried or placed directly in the trench in sand bedding, as specified on the Hydro Ottawa design.

Where secondary cable is installed in duct to the lot line, the duct shall be capped until the cable is installed then sealed with a clean rag after cable installation

All ducts shall be according to CSA Standard C22.2 No. 211.1. All duct accessories shall be of PVC solvent weld type i.e. couplings, cement, etc. All 45 and 90 degree bends shall be FRE type (915 mm radius) or PVC type (915mm or 1500 mm radius) as specified on the design drawing. For duct banks, bends made of 5 degree couplings as per UDS0032 shall be used.

Concrete encased road crossings shall extend a minimum of 1 meter beyond the curb, or where there is a sidewalk beyond the sidewalk, or when meeting a perpendicular trench under a hard surface, to the radius of the duct bend.

All completed ducts shall be rodded by the site contractor in the presence of a Hydro Ottawa inspector and shall be clear of all extraneous material. A wire brush and mandrel, to nominal diameter of duct, supplied by Hydro Ottawa will be passed through each duct. In the event of ducts blocked by ice, the developer's representative shall be responsible for clearing the ducts prior to the cable installation. One 9.5 mm polypropylene rope shall be installed in each duct for cable pulling.

Any underground cable terminating at a line pole may require a pole lateral as specified by Hydro Ottawa Engineering Specification No. UDS0023. Hydro Ottawa will determine in the field the location of the riser on the line pole.

Any civil work shall be completed by contractors that meet the requirements of GQS0002. All work on HOL plant must be performed in accordance with the appropriate safety acts and regulations, HOL standards (refer to Schedule 1) and be approved by an HOL inspector.

Secondary service cables to both single and multi-unit dwellings shall be direct buried from the property line to the meter base unless noted otherwise on the Hydro Ottawa design drawing. Where secondary cables are installed in duct, the end of the duct shall be sealed with a clean rag to prevent the ingress of dirt.

On high density private sites, Hydro Ottawa owned primary and secondary cables shall be installed in concrete encased ducts.

Hydro Ottawa shall inspect all duct formations prior to placing concrete or in the event of direct buried duct or cables, before backfilling the trench. Reasonable notice is required for Hydro Ottawa to complete on-site inspections. Unless otherwise instructed by an HOL inspector, pictures and thorough documentation shall be provided if HOL inspector is not present. If the contractor takes the risk of performing this task without the presence of HOL inspector or without providing proper documentation, then they assume the risk that Hydro Ottawa may refuse the duct or trench installation.

7. Single Phase Padmounted Transformer Base

Details for the installation of a transformer base, transformer grounding and protective bollards are detailed on Hydro Ottawa Engineering Specifications UCS0003, UCS0004, UGS0002 and UFS0001. Transformer ground connections, cable training, equipment tagging and signage are detailed on GCS0012, UTS0004, UTS0005, UTS0006 and UTS0008.

The transformer base shall be located within the road allowance on front lots (in the green space opposite driveways, centered on lot lines) or easement as indicated on the Hydro Ottawa design drawing. Transformer bases shall not be installed on side lots. The front of the transformer shall face the street. An iron survey bar and grade marker must be in place before installation of the transformer base. On a private site the transformer base can be installed wherever Hydro Ottawa installation and clearance standards are met.

The developer shall ensure transformer bases are installed at the proper grade and location. Bedding for the concrete base shall be placed on undisturbed soil and shall consist of 300 mm of Granular "A" compacted to 95% standard proctor density. The base and slab shall be flat, level and free from rocking without the aid of shimming; see Hydro Ottawa Specification UCS0004.

Ducts entering the transformer base shall be cut perpendicular and shall terminate 25 mm inside the base. Spaces left between the ducts or around conductors and the exterior of the concrete base shall be sealed with expanding foam from outside the concrete base.

The transformer grounding system is to be completed in accordance with Ontario Electrical Safety Code (OESC) and as per Hydro Ottawa Engineering Specification No. UGS0002. The developer shall supply and install a minimum of four 3050 mm galvanized ground rods with 2/0 AWG copper conductor connecting all rods together in a loop system at a depth of 300 mm below final grade. Connections to the ground loop must enter the base at two separate locations (opposite sides) and have a 3 m coil for each of the conductors in the bottom of the transformer base. The transformer base excavation shall not be backfilled until a satisfactory ground resistance of < 25 ohms is obtained (additional ground rods or ground plates may be required). If the ground resistance value is not met in a JUT situation, a bare 2/0 AWG Cu cable shall be installed between transformer ground grids as per the JUT standards. Communication or cable pedestals located within 2 m of the transformer ground grid shall be solidly bonded to this ground grid.

Clearances as per UTS0038 and UTS0012 must be followed.

The following minimum clearances must be maintained from transformers whenever possible:

a. 3 m from a driveway (driveway measured as being perpendicular from the house),
b. 0.85 m from sidewalks,
c. 2 m from roadway curbs,
d. 3 m from a building,
e. 600 mm from telephone and cable pedestals,
f. operating clearances are indicated on Hydro Ottawa Engineering Specification UTS0038,
g. outside the 15 m sight line triangle at road intersections,
h. 1 m from street light poles,
i. 3 m from fire hydrants,
j. 2.4 m from tree centreline,

Where the above clearances are not achieved and there is a threat of damage to the transformer from stray vehicles, snowploughs or heavy equipment; protective bollards shall be installed as per Hydro Ottawa Engineering Specification No. UFS0001. Where protective bollards are installed, they shall be radially bonded to the transformer ground grid as per Hydro Ottawa Engineering Specification No. UGS0002.

All landscaping or shielding around transformers must be installed in consultation with Hydro Ottawa. Hydro Ottawa will complete a site visit to indicate transformer clearances, the location of underground cables, ground wires and ground rods

8. Metering

Metering in subdivisions shall be in accordance with the most current edition of Hydro Ottawa's Metering Specification No. GCS0008.

Meters shall be installed in a location where there is clear access to the meter from the street at all times. Clearances for meters shall be as per MCS0106.

9. As Built Drawing

As-built drawings shall be provided for each project in accordance with Hydro Ottawa Working Procedure Doc. No. DFS0002.

Appendix A. Sieve Size and Percentage

All sand used for bedding and cover over direct buried ducts and cables shall meet or exceed the sieve size and percentage of material passing (rejected) as listed in the following table:

Table A.1

SIEVE SIZE (mm)	PERCENTAGE OF MATERIAL PASSING
4.75	100.0
2.36	99.9
1.18	99.8
0.60	95.3
0.30	71.9
0.150	24.5
0.075	5.9

Schedule 1. Related HOL Standards & Specifications

Table S.1

Number	Description
ECS0002	Res UG 120V/240V, 1PH, 3W, ≤200A Secondary Service
ECS0012	Conditions of Service
GCG0005	Rural Estate Lot XFMR and Trench Location
GCS0004	Underground Primary & Secondary Cable Installation
GCS0005	Installation of Civil Works for Underground Distribution
GCS0008	Revenue Metering Specification
GCS0012	Cable Tagging Identification
GCS0038	Trees in Proximity to Hydro Ottawa Underground Structures
GDS0011	Underground Residential Distribution Design Guidelines
GDS0013	Underground Civil Design Guidelines
GQS0001	Electrical Contractor Qualifications To Work On Hydro Ottawa Electrical Underground Electrical Distribution System
GQS0002	Civil Contractor Qualifications To Work On or Around Hydro Ottawa Electrical Underground Distribution System
GQS0003	Fibre Optic Cable Contractor Qualifications to Work Around Hydro Ottawa Electrical Underground & Overhead Distribution Systems
GQS0007	Minimum Contractor Qualifications to Work at Hydro Ottawa Substations
GQS0008	Contractor Qualifications To Work On or Around Hydro Ottawa Electrical Overhead Distribution System
MCS0106	AGR/COM/ERF/RES Minimum Clearance next to Revenue Metering Equipment
UCS0003	Transformer Base & Pad 1 Phase 25kVA-167kVA
UCS0004	Transformer or Switchgear Base & Pad
UDS0001	Duct Concrete Cross Sections
UDS0002	Trench Joint Utility 3 Party Main Residential (3X3)
UDS0003	Trench Joint Utility 3 Party Service Residential
UDS0014	Trench Joint Utility 4 Party Main Residential (3X3)
UDS0016	Trench Joint Utility 4 Party Service Residential
UDS0021	Trench Joint Utility 3 Party Service Residential in Rock
UDS0023	Duct Pole Lateral for Wood Pole
UDS0024	Trench Joint Utility 4 Party Residential Road Crossing Duct Bank (3x3)
UDS0025	Trench Joint Utility 3 Party Residential Road Crossing Duct Bank (3X3)
UDS0037	Trench Joint Utility 4 Party Main Residential (2X5)
UDS0043	Three-Party Service Trench with Multiple Services
UDS0044	Direct Buried Duct to Offset Single Phase Transformer (3x3)
UDS0045	Trench Joint Utility 3 Party Main Residential (2X5)
UDS0046	Trench Joint Utility 3 Party Residential Road Crossing Duct Bank (2X5)
UDS0047	Trench Joint Utility 4 Party Residential Road Crossing Duct Bank (2x5)
UDS0050	Direct Buried Duct to Offset Single Phase Transformer (2x5)
UFS0001	Protective Bollards
UGS0002	Grounding Transformer or Switchgear Base
UTS0004	Transformer Secondary Wiring 1 Phase Padmount
UTS0005	Transformer Primary Wiring 1 Phase Padmount
UTS0006	Transformer Signage 1 Phase Padmount
UTS0008	Transformer Grounding 1 Phase Padmount
UTS0038	Transformer Clearances Transformer & Switchgear Pad