

avoid any unnecessary delays. If primary metering is required, the Customer should co-ordinate in-service dates with Hydro One well in advance to ensure long lead-time equipment can be delivered on time. Work associated with the installation of equipment should start only after the metering design has been reviewed and accepted by Hydro One. Hydro One will provide Customers with an electrical service layout that refers to the Hydro One approved distribution standards and the installation shall be constructed to the defined standards. The electrical service layout provides details on how to construct the service connection and outlines Customer responsibilities.

2.1.3 Complete Construction

Where Hydro One requires the Customer to perform specific work on the Customer's premises, the Customer will do so as a prerequisite to Connection. For more information on approved construction standards refer to section on [Hydro One Distribution Standards](#).

2.1.4 Service Connection

After construction, and once ESA has provided connection authorization, Hydro One will connect the Customer's service on the condition that the installation meets Hydro One requirements.

2.2 Hydro One Distribution Standards

Hydro One uses standard materials and drawings to construct distribution systems. The focus of this document is on the metering installation portion of the distribution standards.

Hydro One provides access to these standards drawings and can be viewed on the external webpage: [Hydro One - Builders and Contractors Webpage](#).

Each Standard document available (the "Standard"), and all information and any other standards referenced or linked therein, is provided as a public service by Hydro One Networks Inc. ("Hydro One"). Information and material contained within the Standard carries no representation, warranty or guarantee of any kind, express or implied.

2.3 General Requirements

2.3.1 Metering Installation Accessibility

To facilitate the access and maintenance of Metering Installations by Hydro One employees, equipment shall be installed in a safe location subject to approval by Hydro One based on standards established by the OESC, the Conditions of Service, the Ontario Building Code, and the layout and/or subdivision design drawings.

2.3.1.1 Space & Access

Please see Space & Access in the [Hydro One Conditions of Service](#).

Lighting in spaces containing metering equipment shall be controlled by a wall switch at the room entrance.

2.3.2 Mobile Homes, Trailer Parks & Campgrounds

Please see Mobile Homes, Trailer Park & Campgrounds in the [Hydro One Conditions of Service](#).

2.3.3 Un-Metered Service Connections

For more information please see Unmetered Connections in the [Hydro One Conditions of Service](#).

2.3.4 Metering Output for Load Management

Please see Metering Pulses in the [Hydro One Conditions of Service](#).

Metering interface for Customer monitoring equipment which uses pulse outputs shall meet the following additional requirements:

- Wetting voltage shall be a maximum of 120V DC or 120V RMS AC
- Current shall not exceed 100 mA DC.

2.3.5 Totalized Metering

Please see Totalized Metering in the [Hydro One Conditions of Service](#).

2.3.6 Protective Bollards for Metering Equipment

Where metering is installed in a location with moving vehicles or machinery the Customer shall supply, install, and maintain protective bollards around the metering equipment to act as mechanical protection for Hydro One personnel against passing vehicles or machinery.

Bollards shall be required if the Metering Installation:

1. Is in an area that can be accessed by motor vehicles easily achieving speeds more than 20km/hr, regardless of posted speed limits.
2. Is in an area that will be subject to grounds maintenance equipment operating within 1m of the metering equipment such as snow clearing equipment and riding lawn mowers.

Table 1 - Construction Drawings - Protective Bollards

Drawing	Description
<u>DU6-107-0500</u>	PROTECTIVE BOLLARDS INSTALLATION

2.3.7 Meter-Mounting Devices

Hydro One requires the use of Meter-Mounting Devices (MMD) that meet build and construction standards for use in Hydro One service territory. For general requirements and examples of

MMD that meet Hydro One requirements, please refer to [CSA-Approved Meter-Mounting Devices](#).

2.3.8 Transformer-Rated Meter-Mounting Enclosure

Hydro One supplies a NEMA Type 3R Transformer-Rated (T/R) Meter-Mounting Enclosure that houses a T/R Meter, fusing, test switches, a modem, and a receptacle. This meter enclosure is often referred to as a “P-Base” enclosure.

The T/R Meter-Mounting Enclosure shall be:

1. Supplied, owned, and maintained by Hydro One.
2. When used for Secondary Metering <750V:
 - Installed by the Customer as per [Metering Installation Accessibility](#).
 - All conduit connected to the T/R Meter-Mounting Enclosure shall be supplied, owned, and maintained by the Customer.
 - No elbows with covers or pull boxes for conduits between the IT Enclosure and the Meter-Mounting Enclosure.
 - No knockouts above the test switch.
 - Be installed to Hydro One standard, visible, and accessible from all sides along with all conduits.
 - Be installed in a location approved by Hydro One within 10m of the IT Enclosure or UMC.
3. When used for [Primary Metering](#) >750V:
 - Installed by Hydro One.

2.3.9 Suite Metering

In March 2006, the Ontario Government passed Bill 21, the Energy Conservation Responsibility Act, which enables implementation of the smart metering initiative in Ontario homes and small businesses. As part of the review of its energy policies, the government implemented additional measures to enable installation of AMI meters in condominiums. Thus, under the Distribution System Code 5.1.9, Hydro One shall install suite metering that meet the specifications stated by Ontario Regulation 389/10 to all multi-unit complexes when it is requested. This may include metering after second stage of transformation.

To allow Hydro One to meter individual units downstream of Customer owned transformation:

1. The installation shall use conventional ANSI style meters installed in Meter Centre's and which abide by Hydro One Distribution Standards and this Guide.
2. The existing rate structure shall be sufficient for this installation and a transformer loss adjustment factor will not be considered.

3. Service Connection Types

This section is divided into two types of services – “Secondary Metered” below 750V and “Primary Metered” above 750V. Services metered below 750V with a service size less than 200A are described as “Self-Contained” (S/C) Metering Installations. A S/C meter is connected directly to the supply voltage and is in series with the Customer load. Services metered below 750V with load or generation above 200A are described as “Transformer-Rated” Metering Installations. A T/R Metering Installation unlike a S/C Metering Installation requires external instrument transformer(s) to isolate and step down the current and, if necessary, the voltage. If the secondary service size is larger than 4000A, the installation may be primary metered at a service voltage above 750V. The section requirements apply to both load and generation Customers eligible for Hydro One’s secondary metering for over-head & under-ground connections after a single stage of transformation, where the interface transformers shall be designed to meet the energy efficiency standards in CSA C802.1 Minimum Efficiency Values for Power Transformers. For additional requirements pertaining to generation connections, see section on [Embedded Generation](#).

Note: Hydro One may choose to install a T/R Metering Installation for services under 200A.

Hydro One supports a variety of metering configurations to meter Customer services. The configuration used to meter a Customer service will be determined by Hydro One. The metering configuration Hydro One chooses may depend on the following:

- Service Voltage (V)
- Service Size (A)
- Number of Metering points on a property
- Electrical Room Equipment:
 - a. Switchgear
 - b. Meter-Centres, Meter Stacks

3.1 Services Metered Under 750V – Secondary Metering

A service is “secondary metered” when the metering installation is located on the secondary side of a distribution transformer. Secondary metering is Hydro One’s preferred metering arrangement. Hydro One will supply a single stage of transformation to the Customer’s utilization voltage at standard voltages only. Hydro One will determine how the installation shall be metered.

3. Install the supplied T/R Meter-Mounting Enclosure:
 - Refer to [T/R Meter-Mounting Enclosure](#) for installation requirements.
4. Supply and install conduit between the LV Switchgear UMC and the Meter Enclosure.
5. Install the LV Switchgear with UMC and Metering Enclosure such that it meets the requirements indicated in [Metering Installation Accessibility](#).
6. If there is generation connected after the Service Box, refer to section on [Distributed Generation](#) for additional requirements.

Hydro One shall:

1. Supply Measurement Canada approved IT's for revenue metering.
2. Supply, own and maintain the T/R Meter-Mounting Enclosure.
3. Make the IT connections within the UMC.
4. Install VT secondary fusing within the UMC.
5. Install, own, and maintain the test switch, meter, and all meter wiring and terminations.

3.2 Services Metered Over 750V – Primary Metering

3.2.1 General Requirements

Services exceeding 750V or 4000A may require the service to be metered by a Hydro One supplied and installed Primary Metering Unit (PMU). A primary metered Customer is eligible to be metered at the Hydro One supplied primary voltage present in the vicinity of the connection. Customers requesting primary metering shall contact Hydro One prior to commencing work for site eligibility confirmation and review.

PMU installations are subject to Hydro One approval and include the following considerations:

- The PMU is installed on the Customer property in a location approved by Hydro One.
- Hydro One has a line side disconnecting device at or near the Customer property line (demarcation point).
 - Ensure a minimum of 30m is maintained between the line side service disconnecting device and the PMU.
- Customer owned disconnecting device load side of PMU.
- For Large Distribution Accounts (equal to or greater than 2MVA of transformation capacity), with the exception of Wholesale Market Participants, Hydro One will supply and install a power quality meter (e.g. ION meter).
- The Customer should co-ordinate in-service dates with Hydro One well in advance to ensure long lead-time equipment can be delivered on time.
- Where minimal Customer loading makes Primary Metering impractical, Hydro One will only meter at a standard Secondary voltage. See [Services Metered Under 750V – Secondary Metering](#).

3.2.1.1 Primary Metering Requirements

A typical primary metering service will be required in the following situations:

1. The Customer's main service box exceeds 4000A.
2. Secondary metering is considered impractical due to:
 - Economic evaluation
 - Site conditions that prohibit a secondary metering installation
 - Site location that poses safety hazards, environmental concerns, or lack of ease of access
 - Other factors and considerations requiring further assessment such as presence of neutral ground resistors, two or more stages of transformation and/or others
3. The Customer requests a primary metering service:
 - A Customer will be invoiced for the incremental cost of a PMU over secondary metering.
 - A Customer will be invoiced for the incremental cost of a pad-mount PMU over a pole-mount PMU if the Customer has requested the upgrade.

3.2.2 Primary Metering – Pole-Mounted

3.2.2.1 Construction Guidelines

The location of the PMU and its ancillary equipment shall be determined in consultation with, and subject to approval by, Hydro One. Typically, the PMU is to be located on the first pole on the Customer property. The location shall be accessible by Hydro One to install and maintain this PMU.

Table 13 – Construction Drawings – Typical Primary Metering Pole-Mounted

Drawing	Description
<u>DL-11-301-0500/0501</u>	RETAIL METERING, O/H PRIMARY 1-PH., GROUNDED PRIMARY, (1-EL.) 2.4 kV - 16kV (SHEETS 1 & 2)
<u>DL-11-302-0500/0501</u>	RETAIL METERING, O/H PRIMARY 3-PH., 4W, GROUNDED WYE (3-EL.) 2.4/4.16kV-16/27.6kV (SHEETS 1 & 2)
<u>DL-11-302.1-0500/0501</u>	RETAIL METERING, SUBTRANSMISSION, 3PH, 3W, (2-EL.), 27.6kV & 44kV (SHEETS 1 & 2)
DL-12-301-0500	GROUNDING FOR OVER-HEAD INSTALLATIONS ON WOOD POLES, GROUND PLATE OR ROD UNDER-GROUND

3.2.2.2 Responsibilities

The Customer shall:

1. Be responsible for the purchase and installation of any poles, platforms, or other supporting structures required for Hydro One equipment.

2. Ensure that the distance between the PMU pole and any adjacent poles on the line/load side are at least 7m in order to allow direct vehicle access to the overhead metering point and the Customer's load break disconnect switch.
3. Install the PMU in a location that is 30m from the HONI disconnect switch.
4. Ensure the metering installation meets the requirements indicated in [Metering Installation Accessibility](#).

Hydro One shall:

1. Supply and install an approved pole-mount PMU.
2. Be responsible for making the connection from the supply
3. Install the service line disconnect and line and load side arresters.
4. Supply and install the [T/R Meter-Mounting Enclosure](#) on the PMU pole.

3.2.3 Primary Metering – Pad-Mounted

3.2.3.1 Construction Guidelines

A pad-mount PMU is intended for use where the service is fed from underground, and the metering is measured at the primary voltage supplied by Hydro One. The pad-mount PMU shall be installed as per Hydro One Distribution Standards on Customer owned property.

Table 14 – Construction Drawings – Typical Primary Metering Pad-Mounted

Drawing	Description
DU-12-101-0500	GROUNDING FOR PAD-MOUNTED EQUIPMENT – TYPICAL CONCRETE FOUNDATION INSTALLATIONS WITH GROUND ROD OR GROUND PLATE
DU-12-102-0500	GROUNDING FOR PAD-MOUNTED EQUIPMENT – TYPICAL ALUMINUM BASE INSTALLATION WITH GROUND ROD OR GROUND PLATE
DU15-121-0500	EQUIPMENT FOUNDATION INSTALLATION CONCRETE FOUNDATION FOR DIRECT BURIED INSTALLATIONS

3.2.3.2 Responsibilities

The Customer shall:

1. Be responsible for the purchase and installation of any poles, foundations, platforms, or other supporting structures required for Hydro One equipment.
2. Supply primary cables with concentric neutral subject [to Hydro One approval](#).
Note: The Customer to ensure primary cables are of sufficient length to allow operation of the elbows with live line tools. Primary cables are to be coiled at the bottom of the Pad-mount vault as per Hydro One standard.
3. Supply and install the load break switch on the load side of the pad-mount PMU.

4. Supply and install a concrete foundation (vault) for the metering pad-mount in a location that is minimum 30m from the HONI disconnect switch and subject to Hydro One standards.
5. Ensure the metering installation meets the requirements indicated in [Metering Installation Accessibility](#).
6. Customer to ensure that the metering pad-mount shall meet the following minimum clearances:
 - 3m for the operating side
 - 3m for the live front
 - 1m for all other sides
7. If installed in a location with moving vehicles or machinery, mechanical protection is required. Refer to [Protective Bollards for Metering Equipment](#) for additional information.

Hydro One shall:

1. Supply an approved pad-mount metering unit designed for medium voltage with a dead front design, outdoor rated and tamper proof, for above grade installation on a concrete vault.
2. Supply and terminate the elbow connections on the primary cables.
3. Supply and install bushing inserts, and caps to match the system voltage, cable size and load.
4. Supply a [T/R Meter-Mounting Enclosure](#) installed on the side of the pad-mounted metering unit.

Energy Storage Facilities shall notify Hydro One regarding the presence of such equipment and shall enter a DCA with Hydro One.

4.3.4 Emergency Back-Up Generation

Please refer to Emergency Back-Up Generation in the [Hydro One Conditions of Service](#).

CSA approved Meter-Mounting Device models with manual or Automatic Transfer Switches can be found in [CSA Approved Meter-Mounting Devices](#).

Customers intending to use a back-up generator and Transfer Switch attached to a MMD shall contact Hydro One for more information.

Hydro One is not responsible for any damage to such equipment during the installation, inspection, reading, maintenance, repair, alteration, removal, or replacement of all or any part of a Meter Installation. If the Transfer Switch is obstructing the metering installation during servicing, Hydro One will not be able to service the equipment.

5. Appendix

5.1 Units of Measurements

Recognized symbols for SI units have been used in the Canadian Electrical Code, Part I. For the convenience of the user, these symbols, and the units they represent have been listed below:

Unit Abbreviation	Unit Detail
A	ampere(s)
dBm	decibel
Hz	hertz
kcmil	1000 of Circular Mils
kW	kilowatt
kWh	kilowatt-hour
m	metre
mm	millimetre
V	Volt

5.2 Definitions & Abbreviations

Capitalized terms used in this Guide that are not defined below will have the meanings set out in Section 2 of the Ontario Electrical Safety Code or the Conditions of Service. Otherwise, capitalized terms used in this Guide will have the corresponding meanings as defined below in this Section 3.

400A T/R Meter-Mounting Device

A 400A rated, single-phase, transformer type, 5-Jaw Meter Mounting Device assembly with integrated CTs and 4 pole test-switch.

Acceptable

A product or service that meets Hydro One requirements.

AMI

Advanced Metering Infrastructure.

American National Standards Institute or ANSI

Is the primary organization for fostering the development of technology standards in the United States.

American Wire Gauge or AWG

The American (or Brown and Sharpe) Wire Gauge as applied to non-ferrous conductors and non-ferrous sheet metal.

Maximum Demand

The highest demand measured over a selected period, such as one month, and referred to as peak demand.

MCM

Is an abbreviation for thousands for circular mils, an old measurement for wire gauge.

Measurement Canada or MC

The Federal Government authority responsible for revenue metering regulations in Canada, formerly known as Industry Canada and Customer and Corporate Affairs Canada (CCAC) - more information can be found at <http://www.ic.gc.ca/eic/site/mc-mc.nsf/eng/Home> or 1-877-325-3996

Meter Centre

A modular metering solution accommodating compact, group metering applications, typically used in commercial or high density residential areas.

T/R Meter-Mounting Enclosure

Outdoor rated metal enclosure to house a transformer type meter, test switch, fusing, wiring and associated equipment.

Meter Installation

The meter and, if so equipped, the instrument transformer(s), enclosure or compartment housing the instrument transformers (IT), wiring, test links, fuses, lamps, loss of potential alarms, meters, data recorders, telecommunication equipment and spin-off data facilities installed to measure power, provide remote access to the metered data and monitor the condition of the installed equipment, whether or not such equipment is located in the immediate vicinity of the meter and includes, where applicable, AMI Network Equipment, and including all other equipment required for the Meter Installation.

Meter Multiplier

The actual amount of energy consumed is too large to be registered and the meter shows a fraction of the actual use. A multiplier is then applied to the difference between your present and previous readings to determine your actual energy use. The meter multiplier is determined by the meter manufacturer and is indicated on the meter nameplate. If the meter multiplier is X1, it may or may not appear on the meter nameplate. All meter multipliers other than X1 will appear on the meter nameplate.

Meter Socket

Device for mounting a self-contained S-Base meter. In addition, there are transformer type meter sockets that come with test switch compartments in various jaw configurations required to install Hydro One supplied test switches and meters for Transformer Type Metering. Both types of Meter Sockets are referred to as a meter mounting device **MMD** in the OESC.

Multiplier

A term used in metering circuits to express the ratio of instrument transformers or the rating on meters.

Potential Transformer

See Voltage Transformer.

Primary Metering Unit or PMU

A specific type of equipment, either single or three-phase, consisting of instrument transformers connected to the primary distribution system. It consists of an assembly of individual VTs, CTs, and a bracket. May also be referred to as modular metering unit.

Pulse

An electrical signal which departs from an initial level for a limited duration of time and returns to the original level. For example, a sudden change in either the voltage or current in a digital circuit produced by the opening or closing of a contact and used to activate a counting device. In an electronic meter, each pulse represents a specific amount of energy that varies by meter model/type.

Retail System

Hydro One Networks Inc.'s electrical distribution system (less than 44kV) used to supply retail Customers.

Retail Customer

An end-use Customer served directly by Hydro One Networks Inc. and not a wholesale market participant (i.e., registered with the Independent Electricity System Operator).

'S'-Base

A type of meter with a standard arrangement of blades at the back of the meter, which fit into an ANSI standard socket base.

Self-Contained Meter, S/C

A meter designed to be connected directly in the Customers supply circuit, typically 100A or 200A. No instrument transformers are required. Also referred to as S/C within this document.

Service Type

The number of phases and wires and the interconnection between them. The three main Hydro One metering service types are defined below:

Single-phase:

- **Two-wire (2W) service:** typically has one conductor grounded (neutral) and a phase conductor, with a nominal voltage of 120V between them.
- **Three-wire (3W) service:** typically has one conductor (neutral) which is grounded and two-phase conductors with a voltage of 240V between them and 120V between each phase conductor and neutral.

Network: A network service is a three-wire service supplied from a three-phase, four-wire, wye distribution system, with one of the conductors being the neutral conductor, and the other two being phase conductors.

Polyphase:

- **Three-phase, three-wire (3W) service:** has no neutral conductor and may be supplied by either an open delta or closed delta transformer bank.

- **Three-phase, four-wire (4W) service:** has three-phase conductors and a neutral conductor where the phase-to-phase voltage is equal to the square root of 3 times the phase to neutral voltage.

Three-phase, four-wire, delta service: has one transformer winding which is centre tapped and grounded. The voltage between the two adjacent phases and the centre tap is 120V, and the voltage of the third phase to the two adjacent phases is 240V. The voltage between the third phase and the centre tap is 208V.

Service Upgrade

Changing an existing Meter Installation to comply with the latest metering standard.

Single Stage of Transformation

Voltage supplied to the Customer following a single step down after an initial step down at a Distribution Station.

Single Line Diagram or SLD

A simplified notation for representing a three-phase power system.

SMMD

Single-Meter-Mounting Device. A Meter-Mounting Device with a single meter position.

Single-phase

Refer to Service Type.

Smart Meter

A smart meter records how much electricity used based on when it was used (typically hourly) and communicates this information automatically via wireless and other technologies. In contrast, conventional electricity meters are read manually and measure only how much electricity is used between readings.

Surge Suppressor/ Arrestor

A device that is used to protect metering and telecommunications circuits from excessive or damaging voltage surges.

Test Switch

A device containing current and/or voltage isolating mechanisms, which are used to isolate meters from their current and voltage input sources.

Transformer (XFMR) Type Meter

A meter designed to be used with instrument transformers such as current and voltage transformers.

T/R

See Transformer-Rated Meter Installation.

Transformer-Rated Meter-Mounting Enclosure

A device for mounting a meter that works in conjunction with a current transformer and/or potential transformer. The load side is energized whether the meter is in place or not.

Transformer-Rated Meter Installation

Comprised of the meter, meter enclosure, the instrument transformers, instrument transformer enclosure, wiring, test switch, fusing and all associated equipment required for the Meter Installation. Also referred to as “T/R”.

Underwriters Laboratories of Canada or ULC

Underwriters Laboratories of Canada (ULC) is an independent product safety testing, certification, and inspection organization.

Utility Metering Compartment (UMC)

Enclosure or compartment that is used to house instrument transformers within a Customer owned switchgear or switchboard.

Voltage

- **Low Voltage** – Any voltage exceeding 30V but not exceeding 750V.
- **Medium Voltage** – Any voltage exceeding 750V but not exceeding 44kV.

Volt-amperes or VA

The mathematical product of voltage and ampere carried thereby.

Voltage Transformer or VT

An instrument transformer designed to reduce the measured voltage to a lower secondary value suitable for application of metering.

VT Ratio

The VT ratio is the primary voltage of the VT divided by the secondary voltage of the VT (e.g., For a VT rated at 4800V primary and 120V secondary, the ratio would be 40).

Wooden Post

A 6x6 wood post used mainly to mount a Meter Mounting Device for pad-mount central metering installation.