

	TITLE: Technical Specification	
RECOMMENDED: P. Lemay	NO: GCS0032	REV: 1
APPROVED: M. Wyndham		
REV. DATE: 2020-11-23		

Primary Revenue Metering Specification

REVISION SHEET

Revision	Description of Change	Date	Initial
0	Original Document	2017-07-27	kem/ed
1	Remove HOL's scope of work and revise references, general update	2020-11-23	pl/mw

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1. Introduction

Primary metering may be available for commercial or industrial customers whose supply voltage meets the requirements of HOL's ECS0012 - Conditions of Service. This specification provides the minimum technical requirements for the design and installation of new primary revenue metering installations as well as upgrades to existing installations.

Customers or their agents should contact HOL with any inquiries concerning primary services and shall be responsible to ensure they have the current revision of this specification prior to commencing work as amendments may be made from time to time. The latest Metering Specifications are available through the HOL website – refer to HOL's Conditions of Service under 'Contact Information' for more information.

2. References

This document refers to the following HOL documents and specifications:

Hydro Ottawa	– ECG0005	– Commercial Primary Service Ownership Demarcation, Customer Owned Transformer
Hydro Ottawa	– ECG0008	– Distribution System Voltage and Power Quality
Hydro Ottawa	– ECS0012	– Conditions of Service
Hydro Ottawa	– ECS0036	– Customer Owned Medium Voltage Service Equipment Directly Connected to HOL's Distribution System without Upstream Protection
Hydro Ottawa	– ECS0043	– Underground Primary Service Typical Customer Owned Primary Switchgear Layout
Hydro Ottawa	– EGS0001	– Grounding Stud
Hydro Ottawa	– GCS0002	– Primary Voltage Services
Hydro Ottawa	– GCS0008	– Secondary Voltage Revenue Metering Specification
Hydro Ottawa	– MCS0025	– Indoor Interval Metering with Switchboard and Switchgear
Hydro Ottawa	– MCS0026	– Indoor Interval Metering with Double Ended Switchboard and Switchgear
Hydro Ottawa	– MCS0066	– Typical Interval Metering with Modem Enclosure Using Telephone Line
Hydro Ottawa	– MCS0105	– Agr/Com/ERF/Res Minimum Clearance In Front Of Revenue Metering Equipment
Hydro Ottawa	– MCS0116	– Primary Services Interval Metering Outdoor Type Installation – Construction Detail
Hydro Ottawa	– MCS0117	– Overhead Three Phase Primary Metering Installation – Customer Service
Hydro Ottawa	– MCS0129	– Typical Interval Metering with Wireless Modem Enclosure
Ontario	–	Current edition of the Ontario Building Code
Ontario	–	Current edition of the Ontario Electrical Safety Code (OESC)
Society of Automotive Engineers (SAE)	–	SAE J429 – Mechanical and Material requirements for Externally Threaded Fasteners

3. Scope

This document outlines HOL's practices regarding primary revenue metering installations. It describes the prerequisites and technical requirements for new primary revenue metering installations as well as existing primary service installations undergoing upgrade.

The type of primary revenue metering equipment will be determined by the application, voltage, and ampacity of the service to be metered. For details on primary service offerings and requirements, please refer to HOL document GCS0002 – Primary Voltage Services and HOL's Conditions of Service.

4. Definitions

'Cold Metering' – see definition of "Cold Metering" in HOL's Conditions of Service.

'Compartment' means a subdivision of a switchgear/switchboard unit.

'CT' means "Current Transformer". A CT is a type of Instrument Transformer and used as part of a metering circuit to detect the flow of current on a service being metered.

'Customer' – see definition of "Customer" in HOL's Conditions of Service.

'Demarcation Point' – see definitions of both "Operational Demarcation Point" and "Ownership Demarcation Point" in HOL's Conditions of Service.

'EMT' means "Electrical Metallic Tubing".

'ERF' means "Energy Resource Facility", a term that encompasses any type of generation present on HOL's grid.

'GFCI' – see definition of "Ground Fault Circuit Interrupter" in the OESC.

'HOL' means "Hydro Ottawa Limited".

'ITs` means "Instrument Transformers". ITs refers to a class of devices, often part of a metering circuit, which is used to step down currents or voltages of an electrical system for measuring purpose. Instrument transformers are two types: Current Transformer or Potential Transformer.

'Interval Meter' – see definition of "Interval Meter" in HOL Conditions of Service.

'Lamacoid' means a generic term commonly used for specifying 2-ply or 3-ply, laminated engraving stocks and/or the nameplates, tags, or legend plates produced from [plastic] stock.¹

'Line Side' of a device refers to the point at which utility supplied energy enters the device. Also may be referred to as the "High Side", "Grid Side", or "Utility Side" of a device.

'Load Side' of a device refers to the point at which utility supplied energy exits the device. Also referred to as the "Customer Side", "Downstream" side, or "Low Side" of a device.

'Low-Voltage' – see definition of "Low-Voltage" in the OESC.

'Maintenance' means any activity intended to keep equipment in satisfactory working condition, including tests, measurements, replacements, adjustments, and repairs.

'Meter Socket' means the mounting device consisting of meter jaws, connectors, and enclosure for receiving a socket-type revenue meter.

'Mimic Bus' – A primary single line diagram affixed on the outside face of a switchboard or switchgear showing the principle connections and electrical components contained inside each compartment.

'NEMA' means the "National Electrical Manufacturers Association".

'OHSA' means the "Ontario Occupational Health and Safety Act" and regulations.

'Permanent' means a period of time greater than one (1) calendar year.

¹ – Adapted from <http://www.cuttingedgeinc.com/ref/glm2.htm> as of 2015/03/30.

'PMU' means Primary Metering Unit. Typically refers to a group of six Instrument Transformers (three PTs and three CTs), mounted in a single location, used to provide revenue metering for a 3 Phase Primary Metered Service. Note that 2-element revenue metering is used for delta-connected Services.

'Primary Metered Service' means a primary service equipped with utility metering equipment.

'Primary Service' means any electrical service supplied with a nominal voltage greater than 750V but less than 50,000V. Primary services are two type installations: indoor and outdoor type installation.

'Primary Voltage' means any voltage between 750V and 50,000V.

'PT' means "Potential Transformer". A PT is a type of Instrument Transformer and used as part of a metering circuit to detect voltage on a service being metered.

'Raceway' – see definition of "Raceway" in the OESC. The use of raceway includes rigid, flexible, metallic or non-metallic conduit.

'Seal' means a locking device to secure a meter or other service equipment against tampering by non-HOL personnel.

'Standard HOL Padlock' is a padlock that uses a 9.5 mm [3/8"] shackle; its manufacturer, model, and style are determined by HOL.

'Supply Point' – see definition of "Supply Point" in HOL's Conditions of Service.

'Test Switch' means a device used to isolate voltage and current connections between a meter and external Instrument Transformers.

'Upgrade' – see definition of "Upgrade" in HOL's Conditions of Service.

5. Primary Metering Fundamental Requirements

- 5.0.1 The requirements described in this section apply to all types of primary services. Metering requirements specific to a type of service may be found in the respective section of the document.
- 5.0.2 All installations referenced in this document shall comply with the requirements of the latest edition of HOL's Conditions of Service, the current editions of the Ontario Electrical Safety Code and Canadian Electrical Code, Measurement Canada specifications, and all other applicable federal, provincial, and municipal laws, by-laws, specifications, and codes.
- 5.0.3 It is the Customer's responsibility to ensure that all Customer supplied and installed equipment meet the requirements of this document and comply with all applicable laws and codes.
- 5.0.4 All proposed electrical equipment shall be approved by at least one of: ESA, CSA, or ULC and shall carry the markings of the approving organization.
- 5.0.5 Unless noted otherwise, all mechanical fasteners including bolts, nuts, washers, spacers, etc., used to fulfill the requirements of this document shall meet, or exceed, SAE Grade 5 specifications as per SAE J429-1999.
- 5.0.6 All Customer constructed structures (used in conjunction with HOL revenue metering or ancillary equipment) that do not adhere to accepted construction or industry standards, statutes, or codes shall be reviewed and approved by a Professional Engineer, prior to energization, at the Customer's cost. The intent is to verify the structure has adequate strength and to ensure the structure can endure typical conditions for the duration of its useful life.

- 5.0.7 HOL requires safe and unobstructed access to the revenue metering and ancillary equipment at all times as per HOL's Conditions of Service. No HOL revenue metering equipment shall be installed in a location that would present a hazard to HOL personnel or the public either while the equipment is in service or undergoing maintenance.
- 5.0.8 The Customer shall supply and install protective arrangements, to HOL's satisfaction, to protect workers and metering equipment, from moving machinery, dust, fumes, moisture, excessive noise, or vibration for both indoor and outdoor type installations..
- 5.0.9 Customer owned electrical installations shall meet HOL's requirements and be approved by ESA prior to energization. The ESA Connection Authorization Certificate shall be provided to HOL and include the service address (as it appears in HOL's records), voltage, ampacity of the service, and any de-rated protective equipment.
- 5.0.10 Any work performed on a primary service requiring an ESA permit, or where a primary service was disconnected for over six (6) months, shall require a review by HOL to ensure that the primary service installation and revenue metering equipment are compliant to current HOL standards. This includes, but is not limited to, the replacement of non-standard and/or obsolete services and equipment as per Appendix G of HOL's Conditions of Service.

The Customer shall be exempt from meeting current HOL standards if the work performed meets all requirements below:

- a) Work performed does not alter or affect the metering circuit, the ampacity of the service entrance and/or the Customer's service entrance equipment. This shall not include like-for-like replacement of damaged equipment.
 - b) Work performed is limited to maintenance activities including torqueing and cleaning of equipment.
 - c) Measurement Canada deems the existing revenue metering equipment acceptable.
- 5.0.11 Primary metering shall use cold metering. HOL metering equipment shall be installed immediately next to, and within easy and obvious sight of, the main service entrance disconnect it takes supply from.
- 5.0.12 A visible disconnecting device shall be installed immediately after HOL metering equipment for the purposes of isolating the metering circuitry except if deemed unnecessary by Hydro Ottawa. Refer to ECS0043 for "Typical Customer Owned Primary Switchgear Layout".
- 5.0.13 The disconnects of Sections 5.0.11 & 5.0.12 shall meet the following requirements:
- a) each disconnect shall have factory installed provisions enabling it to be locked in the "open" position using a standard HOL padlock and
 - b) each disconnect shall have a visible and obvious means of verifying its state.

The owner of the disconnects shall permit HOL personnel to operate, or provide staff to operate upon request, these primary disconnects to perform work on the metering equipment as necessary.

- 5.0.14 The location of the revenue metering equipment shall be determined in consultation with, and is subject to approval by HOL. Refer to HOL's Conditions of Service for more information.
- 5.0.15 All primary metering equipment shall be mounted plumb and level and shall not be recessed in the wall it is mounted on where applicable.
- 5.0.16 A minimum of 1500 mm [5'] of horizontal and vertical clearance shall be provided in front of all service entrance apparatus, disconnect means, and revenue metering equipment. The area shall be free of any obstructions, permitting easy and obvious access to the equipment. Refer to HOL specification MCS0105 for more information.

- 5.0.17 The finished grade, or floor, immediately in front of all service entrance apparatus, disconnect means, and revenue metering equipment shall be level for the entire width of the equipment and the entire extent of the clearance specified in this document. The intent is to create a safe surface from which to perform work and operate electrical equipment.
- 5.0.18 No Customer owned equipment shall be connected to any internal part of HOL owned revenue metering circuitry.
- 5.0.19 No Customer owned equipment shall be installed on the line side of HOL revenue metering equipment other than the main service entrance disconnect and protective devices.
- 5.0.20 The Customer shall not install or operate equipment that interferes with the safety, operation, or accuracy of HOL owned revenue metering and ancillary equipment.
- 5.0.21 Only HOL and/or their contractor may conduct work on HOL revenue metering equipment. No Customer shall remove, connect, alter, repair, or tamper with HOL's revenue metering equipment or seals.
- a) Customer conducting maintenance on their electrical system and require HOL seal(s) to be cut shall contact HOL Metering Services to make arrangements for the existing seal(s) to be removed and install new seal(s) as required.
 - b) In the event of an accidentally damaged seal, the Customer shall notify HOL Metering Services by the next business day with the Customer's name, service address, and the date the seal was noticed to be missing or damaged. HOL shall dispatch a Meter Technician to inspect the service and, if found satisfactory, install new seals as needed.
- 5.0.22 All electrical outlets installed in an outdoor location or that may be exposed to outdoor elements shall have factory installed GFCI capability as per the OESC.

5.1 Service Entrance Eligibility

- 5.1.1 Primary metering is subject to availability for commercial or industrial customers with typical supply voltages being 13.2kV or 27.6kV. Other primary voltages may be available subject to approval by both HOL's Distribution Design and Metering departments.
- 5.1.2 Primary metered services may be provided for conditions that differ from the above criteria at HOL's determination. Examples may include services with large or unique loading requirements and/or in difficult to access locations.
- 5.1.3 Prior to finalizing the design and/or buying equipment, the Customer shall contact HOL's Distribution Design Department to determine if their project and/or site are eligible for a primary metered service.

5.2 Submission Requirements and Lead-Times

- 5.2.1 Any new primary metering installation or modification to an existing installation requires consultation with HOL a minimum of 8 months prior to the expected energization date. The customer and/or their consultant shall provide the following information prior to any equipment being ordered:
- a) Preliminary single-line diagram indicating the proposed location for the metering equipment; Refer to ECS0043 for "Typical Customer Owned Primary Switchgear Layout".
 - b) Completed Load Summary Form, as per Appendix A of HOL's Conditions of Service.
 - c) Project construction schedule and timelines, including the switchgear manufacturing and delivery schedule, if applicable.

- 5.2.2 Primary metering instrument transformers are not stocked by HOL for new construction projects and typically require a 4 to 6 month lead-time for procurement.
- 5.2.3 Detailed manufacturer's shop drawings for primary switchgear shall be submitted to HOL for review prior to manufacturing if applicable. The drawings shall provide the plan, elevation and cross sectional views of the switchgear including electrical dimensions and working clearances. All components must be clearly identified and properly cross-referenced to a bill of materials. HOL Distribution Design and Metering Departments will review drawings and provide comments as required.
- 5.2.4 In situations where HOL will ship the instrument transformers for factory installation into switchgear, a pre-paid Bill of Lading shall be provided by the Customer which includes the address and project reference number of the switchgear manufacturer.
- 5.2.5 HOL reserves the right to inspect completed equipment at the manufacturing plant prior to shipment.

5.3 Electrical Room Requirements

- 5.3.1 Prior to construction, renovation or modification of their electrical room, the Customer shall submit to HOL a detailed proposed layout for their electrical room including dimensioning and clearance allowances.
- 5.3.2 The electrical room itself:
- a) Shall be located indoors, inside a permanent structure that meets the requirements of the Ontario Building Code and HOL specification GCS0002.
 - b) Shall not be a confined space as defined by OHSA.
 - c) Shall be kept locked at all times, preventing access by unauthorized personnel.
 - d) Shall be maintained by the Customer and reserved for the sole purpose of the electrical equipment that it contains. The electrical room shall provide a clear, unobstructed, safe and adequate working space as determined by HOL and equipment manufacturer.
 - e) Shall be equipped with adequate lighting that provides illumination at the working level, in accordance with Illuminating Engineering Society standards. The lighting shall have mechanical protection and be controlled via a wall switch located adjacent to the electrical room's outer door.
 - f) Shall be heated to keep excess humidity and moisture from damaging the metering equipment. The ambient temperature shall be maintained between 10-30°C at all times.
 - g) If not located on the ground floor, the Customer shall provide a stairway to the electrical room's entrance. The permanent stairway shall meet the Ontario Building Code requirements. The use of a ladder shall not be acceptable.
 - h) Shall have a minimum ceiling height of not less than 2130 mm [7'] above the finished grade or floor and be large enough to accommodate the full height and width of the metering installation including a minimum of 1500 mm [5'] of horizontal clearance in front of all revenue metering equipment.
 - i) Outside doors providing access to electrical rooms must have at least 150 mm [6"] clearance between final grade and the bottom of the door.
 - j) Shall be equipped with 120VAC, 15A and grounded convenience wall outlets to meet the Ontario Building Code and Ontario Electrical Safety Code requirements.

5.4 Permanent Labels and Tags Requirements

- 5.4.1 Unless noted otherwise, the Customer is responsible for the following labelling:
- a) Labelling fonts shall be at least 19 mm [3/4"] in height.

- b) Product labelling shall be resistant to moisture, mechanical wear (i.e. cannot be accidentally removed or rubbed off), and resistant to fading due to age and UV light.
- c) Meter socket base(s) shall be identified/labelled with its civic address.
- d) Switchgear compartment(s) containing HOL metering equipment shall be identified "For Supply Authority Use Only" to the outside of the compartment's front and rear access door(s)/panel(s).
- e) Cabinet(s) and/or enclosure(s) containing HOL metering equipment shall be identified "For Supply Authority Use Only" to its outside front access door(s).
- f) All nomenclature and/or labelling shall be verified and validated by the Customer's electrical contractor prior to the request for energization.

5.4.2 Mimic diagram shall be affixed to the outside of the primary switchgear compartment's front and rear access doors/panels. The mimic diagram shall:

- a) clearly identify incoming utility supply, disconnect and isolation means, interlocks, bus and bus tie-in, utility metering equipment, outgoing or incoming feeder, all sources of voltage under normal and emergency conditions etc.
- b) be mechanically fastened to the switchgear and be resistant to moisture and mechanical wear (i.e. cannot be accidentally removed or rubbed off), and resistant to fading due to age and UV light.

5.5 Metering Cabinets and/or Enclosures Requirements

5.5.1 A 120Vac heater shall be included within each metering cabinet and /or enclosure located outdoors or subject to temperature < 10°C. The heater(s) shall be capable of maintaining at 10°C the temperature inside the metering cabinet and/or metering enclosure with a -20°C ambient temperature.

5.5.2 Metering cabinets and/or enclosures shall meet the following requirements:

- a) Shall be painted with grey baked enamel.
- b) Shall come with factory-installed hardware allowing the cabinet to be locked with a Standard HOL Padlock.
- c) Shall meet, or exceed, the requirements of NEMA Type 4 or NEMA Type 4X specifications if mounted in an outdoor location or in a location that is subject to the outdoor elements. The NEMA Type shall be determined in consultation with, and is subject to approval by HOL. Modified and/or damaged metering cabinet or enclosure may be affecting its original specifications.
- d) Shall meet, or exceed, the requirements of Nema Type 3 or Nema Type 3R specifications if mounted in an indoor location or in a location that is not subject to the outdoor elements. The NEMA Type shall be determined in consultation with, and is subject to approval by HOL. Modified and/or damaged metering cabinet or enclosure may be affecting its original specifications.
- e) Shall be factory installed with welded hinge doors capable of opening outward at least 90 degrees with respect to the enclosure. All hinged doors shall swing from left to right or right to left.
- f) Shall be provided with removable inner panel c/w mounting hardware.
- g) Shall be provided with factory-installed bonding stud/post on the inner panel and doors c/w necessary bonding straps/wires (minimum #10 AWG stranded copper conductor) to suit.
- h) Shall be provided with factory-installed ground stud.
- i) Shall be provided with pole mounting kit if install/attach to service pole

5.6 Installation Requirements

5.6.1 Refer to MCS0025 and MCS0026 for indoor type switchgear installation or MCS0116 for outdoor type switchgear installation.

- 5.6.2 Refer to MCS0117 for outdoor type overhead installation.
- 5.6.3 Revenue metering conductors shall be housed in dedicated raceway(s) which raceway(s) shall be visually traceable except if factory installed within the switchgear.
- 5.6.4 All metal raceway shall be bonded to ground as per ESA and OESC requirements.
- 5.6.5 All raceway that enter, or exit, a NEMA, CSA, or ULC rated enclosure shall do so in a manner that does not de-rate the enclosures' rating.
- 5.6.6 All outdoor revenue metering raceway shall be PVC or liquid-tight, CSA approved, and continuous in length (i.e. it shall not use any splice fittings along its run).
- 5.6.7 When PVC or liquid-tight revenue raceway enters a permanent structure, it shall transition from PVC to EMT at a point closest to the indoor side of the exterior wall as practicable.
- 5.6.8 For revenue meters mounted indoors, only EMT conduit shall be used to house conductors entering or exiting an enclosure used to house metering equipment.
- 5.6.9 All liquid-tight flexible conduits shall have a UV rated sheath and steel core.
- 5.6.10 All EMT and PVC conduit shall terminate at an enclosure with NEMA rated fittings and bushings.
- 5.6.11 All liquid-tight flexible conduits shall terminate at an enclosure with liquid-tight fittings.
- 5.6.12 All newly installed empty metering conduits shall have an industrial-grade polypropylene rope, 6 mm [1/4"] in diameter or more, fished through it in conduit runs longer than 6000 mm [236"].
- 5.6.13 All conduit entering, or exiting, a meter socket base shall do so using the factory knock-outs located on the bottom-half of the meter socket base.

6. Instrument Transformers

- 6.0.1 For switchgear mounted primary metering equipment, HOL shall supply and ship the instrument transformers, at the customers expense, to the manufacturer for installation in the switchgear. A pre-paid Bill of Lading shall be provided by the Customer which includes the address and project reference number of the switchgear manufacturer. The manufacturer shall not disassemble, tamper with, modify and/or substitute any HOL supplied equipment
- 6.0.2 The instrument transformers shall be sized in accordance with the Load Summary form provided by the Customer.
- 6.0.3 For pole-mounted primary metering equipment, HOL shall supply and install the metering instrument transformers, secondary wiring and associated hardware.
- 6.0.4 Where there is potential for lightning, the instrument transformers shall be within a lightning arrestor's zone of protection.
- 6.0.5 Unless specified otherwise, all HOL instrument transformers to be mounted within a primary switchgear shall be of the 'bar' type.
- 6.0.6 Refer to Schedule 1 Table S1-1 for "Primary Service Meter Socket Types and Required Number of Metering Instrument Transformers".

6.1 Instrument Transformer Installation Requirements

- 6.1.1 The instrument transformers shall be installed so that the primary and secondary terminals are readily accessible and the nameplates visible. The installation shall allow for easy replacement of a defective instrument transformer.
- 6.1.2 The Customer is responsible for the instrument transformer primary connections within switchgear applications. The connections shall be properly secured and conductors/buses shall be shaped, formed and supported so that no tension is applied to the instrument transformers.
- 6.1.3 Proper polarity association of the instrument transformers is important for the correct operation of the revenue metering equipment, with the polarity marks pointing towards the utility supply.
- 6.1.4 The instrument transformers shall not be installed in an area where they block ventilation openings and/or in area of breaker arc venting.
- 6.1.5 Secure instrument transformers and route conductors so that they do not directly contact live terminal or bus.
- 6.1.6 The instrument transformers shall be bonded to ground with a minimum 2/0 AWG copper conductor.

6.2 Potential Transformer (PT) Requirements

- 6.2.1 PTs shall be of a fixed type and permanently connected in a manner allowing for ease of replacement in the event of failure. Draw-out, swing-out, or self-disconnecting primary connection methods are not acceptable.
- 6.2.2 PTs shall be electrically connected on the Line Side of the CTs and connected in accordance to their reference polarity markings (i.e. H1 or • or +) which shall always be oriented to the line side.
- 6.2.3 For 13.2kV PTs mounted in switchgear the PT H1 connection shall be a minimum #2 AWG insulated copper conductor.
- 6.2.4 For 27.6kV PTs mounted in switchgear the PT H1 Connection shall be via rigid bus due to the need to support the fuse holder. Refer to Section 6.4 for details.
- 6.2.5 For 3-element metered services, the PT H2 to neutral connection shall be a white insulated conductor with a minimum #8 AWG wire size. Each PT shall have an individual H2 to neutral connection.

6.3 Current Transformer (CT) Requirements

- 6.3.1 CTs shall be permanently connected to the buses in a manner allowing for ease of replacement in the event of failure.
- 6.3.2 CTs shall be connected in accordance to their reference polarity markings (i.e.H1 or Arrow or White Dot) which shall always be oriented to the line side.

6.4 Potential Transformer (PT) Fusing

- 6.4.1 All PTs intended for installation within an enclosure or switchgear shall be equipped with integrated protective fusing.

- 6.4.2 The PTs shall be equipped with 1 or 2 fusing positions, depending on the metering configuration. HOL shall install Type E current limiting fuses.
- a) For 13.2kV services the PTs shall be fused with 15.5kV 1A, 1E or equivalent fuses with an interrupting rating of 35kA. The PTs will come complete with integrated fuse holder(s) if supplied by HOL.
 - b) For 27.6kV services the PTs shall be fused with 25.8kV, 1A, 1E or equivalent fuses with an interrupting rating of 32kA.
 - i. The fuse holder may be installed separate from each respective PT. In this case the fuse holder shall be installed immediately before the PT.
 - ii. Alternatively, a horizontal fuse holder may be used where one end is secured to the PT and the other cantilevered to the respective phase bus. The customer shall supply a bus connection bracket meant for securing the free end of the fuse holder. The bus bracket shall be sized appropriately to support the fuse holder. A minimum bracket size of 30mm wide x 6.4mm [1-1/4" x 1/4"] is recommended.

7. Interval Metering

- 7.0.1 HOL will install an interval meter and associated equipment for all new or upgraded primary services. The interval meter shall be interrogated remotely, using a dedicated analog telephone line or wireless modem. If required, the phone line shall be provided and maintained by the Customer.
- 7.0.2 The Customer shall supply and install an approved transformer-rated meter base appropriate for the requested Service. Refer to section 5.6 for installation requirements.

7.1 Meter Types

- 7.1.1 Primary metering installations with loads less than 5MW shall require a standard HOL interval meter. Refer to Schedule 1 Table S1-1 to 3 for "HOL Approved Commercial Transformer Rated Meter Socket Bases".
- 7.1.2 Dependant on the type of service and at HOLs discretion, customers may be required to upgrade to a meter with advanced Power Quality functionality such as an ION series meter. Services that will be required to upgrade to an advanced PQ meter include:
- a) Services with loads equal to or greater than 5MW.
 - b) Services with ERFs capable of generating over 2MW.
 - c) Services with large inductive, capacitive or non-linear loads that may affect the user's ability to meet HOLs Power Quality requirements outlined in ECG0008.
 - d) Services with unique loading requirements
 - e) IESO registered market participants
- 7.1.3 Customers may elect to upgrade to an advanced Power Quality meter, should they wish to take advantage of the additional features. In such cases, the customer would be responsible for additional ongoing maintenance costs of the upgraded meter.

7.2 Interval Metering with Modem Enclosure using Telephone Line

- 7.2.1 When required by HOL, the Customer shall provide a dedicated, direct dial analog telephone line for each individual meter point. The line(s) shall be for the sole use of HOL Metering. The service will not be energized until the communication modem and phone line(s) are proven functional.

- 7.2.2 For switchgear metering applications within an electrical room, the Customer shall install an enclosure to house the communications equipment. The enclosure shall meet the requirements identified in Section 5.5. Refer to MCS0066 for indoor type installation with interval metering and modem enclosure using telephone line.
- 7.2.3 A tag, or label, bearing the phone number for the telephone circuit shall be attached to the RJ-11 jack at the modem enclosure.
- 7.2.4 The telephone cable terminating in the telephone room shall be clearly labelled "HYDRO OTTAWA METERING".
- 7.2.5 Prior to the interval meter installation by HOL, the dedicated telephone line shall be thoroughly tested by the premise-wiring contractor to verify the following:
- a) Dial tone is available.
 - b) Both inbound and outbound calls can be made.
 - c) The assigned phone number and extension (if applicable) is correct.
- 7.2.6 HOL shall schedule a Meter Technician to perform the metering installation once notified that the metering requirements are met and the dedicated phone line is functioning.

7.3 Interval Metering with Wireless Modem Enclosure

- 7.3.1 For switchgear metering applications within an electrical room, the Customer shall install an enclosure to house the communications equipment. The enclosure shall meet the requirements identified in Section 5.5. Refer to MCS0129 for indoor type installation with interval metering and wireless modem enclosure.
- 7.3.2 For outdoor type installation, the Customer shall install a metering cabinet to house the meter base and the communication equipment. The cabinet shall meet the requirements identified in Section 5.5. Refer to MCS0116 for outdoor type switchgear installation with interval metering and wireless modem enclosure or MCS0117 for `Overhead Three Phase Primary Metering Installation`.
- 7.3.3 HOL shall schedule a Meter Technician to perform the metering installation once HOL has been notified that the Customer requirements have been met.

7.4 Manual Collection of Interval Data

- 7.4.1 If HOL is unable to retrieve the interval meter data then HOL shall visit the meter location and collect the data using a manual data retrieval system.
- 7.4.2 If the inability to retrieve meter data is due to a failure of the telephone line and/or the 120VAC plug powering the communications equipment, HOL shall notify the Customer of the failure and the Customer shall be responsible for repairs within five business days. Thereafter, if the issue has not been remedied to HOL's satisfaction, HOL shall continue to collect the data manually and charge the Customer a monthly manual meter reading charge as per the OEB approved rate.

7.5 Interval Metering Output Request for Load Analysis

- 7.5.1 Primary metered Customers may request access to the metering data directly from the metering equipment via an external communications port, or may request from HOL reports containing interval metering data at their expense.

8. Primary Switchgear

8.1 Switchgear Instrument Transformer Compartments

- 8.1.1 Metal Clad switchgear used for service entrance shall include one (1) utility instrument transformer compartment per metering point installed within the switchgear. The IT compartment(s) shall be dedicated to HOL metering equipment and be provided with a lockable vertically hinged access door. Refer to ECS0043 for "Typical Customer Owned Primary Switchgear Layout".
- 8.1.2 IT compartment(s) shall not be used as a pass through for non-metering conductors.
- 8.1.3 IT compartment(s) shall be on the load side and immediately adjacent to the switchgear main service entrance disconnect(s) which disconnect(s) shall be provided with visual mean to confirm the device closed or open status when applicable.
- 8.1.4 IT compartment(s) shall be permanently identified "For Supply Authority Use Only".
- 8.1.5 IT compartment(s) shall have barriers between it and other compartments and include a viewing window, or approved alternative, permitting direct view of the metering equipment.
- 8.1.6 IT compartment(s) shall provide sufficient space for up to three (3) current transformers and three (3) potential transformers c/w protective fuses. The switchgear manufacturer shall include three (3) CT removable bus links to be secured within the instrument transformer compartment to suit..
- 8.1.7 Grounding studs, meeting the requirements of HOL Construction Detail EGS0001, shall be installed in each IT compartment as per the following:
 - a) One set of grounding studs shall be installed on the bus bars inside the metering compartment at the line side of each metering CT.
 - b) One set of grounding studs shall be installed on the bus bars inside the metering compartment at the load side of each metering CT.
 - c) A ground stud shall be installed on the ground bus and located immediately behind the instrument transformer compartment door.
 - d) All ground studs shall be installed in a manner facilitating easy installation of a ground clamp using a hot stick.
- 8.1.8 Mounting bolts or nuts for support of the base of the instrument ransformers shall be installed in a manner permitting complete installation and removal of the metering equipment from within the compartment in which they are installed. Fixed mounting studs using nuts or bolts shall be required for this purpose.
- 8.1.9 Outdoor style metal enclosed switchgear shall have heater(s) to maintain a minimum ambient temperature inside the uiltity compartment(s). The heater(s) shall be powered from the Customer public service and capable of maintaining at 10°C the temperature inside the IT compartment(s) with a -20°C ambient temperature.
- 8.1.10 Outdoor style metal enclosed switchgear shall be ventilated in a manner such that the maximum ambient temperature within the IT compartment does not exceed 30°C.

8.2 Switchgear Meter Compartments

- 8.2.1 The meter compartment(s) shall be dedicated to HOL metering equipment and be provided with a lockable vertically hinged access door.
- 8.2.2 The meter compartment(s) shall not be used as a pass through for non-metering conductors.

- 8.2.3 The meter compartment(s) shall be on the load side and immediately adjacent to the switchgear main service entrance disconnect(s).
- 8.2.4 The meter compartment(s) shall be permanently identified "For Supply Authority Use Only".
- 8.2.5 The meter compartment(s) shall have barriers between it and other compartments and include a viewing window, or approved alternative, permitting direct view of the metering equipment.
- 8.2.6 The meter compartment(s) shall provide sufficient space for the interval meter and ancillaries; Refer to MCS0116 for power requirements and compartment dimensions.
- 8.2.7 HOL will supply and install, at the customer's cost, a meter socket adapter and test switch. The customer will not be required to supply a transformer rated meter base.
- 8.2.8 Outdoor style metal enclosed switchgear shall have heater(s) to maintain a minimum ambient temperature inside the meter compartment. The heater shall be powered from the Customer public service and capable of maintaining at 10°C the temperature inside the utility compartment with a -20°C ambient temperature.

8.3 Switchgear isolation Disconnect

- 8.3.1 Each IT compartment(s) shall be provided with isolation disconnect on the load side of the compartment to prevent ac power backfeed except if deemed unnecessary by HOL.
- 8.3.2 The isolation disconnect shall be provided with a visual mean to confirm disconnect closed or open status when applicable.

9. Overhead Primary Metering Units (PMUs)

- 9.0.1 Subject to approval, HOL may permit the use of an Overhead Primary Metering Unit if the metering application is a:
 - a) large quarry and/or open pit,
 - b) campus type development,
 - c) large industrial, commercial or institutional type development,
 - d) location that is difficult to access, or
 - e) privately owned distribution network supplied by a HOL overhead line.
- 9.0.2 HOL's Conditions of Service outline eligibility and conditional requirements for overhead primary services.
- 9.0.3 The PMU shall be installed on a customer owned pole in a location determined during the design review process with HOL's Design Department.
- 9.0.4 The customer owned primary service entrance switch should be visible from the metering point within a pole span.
- 9.0.5 There shall be direct vehicle access to the overhead metering point and the main site service entrance disconnect.
- 9.0.6 Overhead installations shall be built as per HOL drawing MCS0117 unless otherwise directed by HOL.

9.1 Instrument Transformer Requirements

- 9.1.1 For pole-mounted primary metering installations, HOL shall supply and install the required PMU to include all liquid-tight cables and terminations at the customer owned metering cabinet.

9.2 Metering Enclosure and Meter Adapter Base Requirements

- 9.2.1 Refer to MCS0117 for “Overhead Three Phase Primary Metering Installation – Customer Service”. The metering cabinet shall be supplied and installed by the Customer on the same pole as the PMU.
- 9.2.2 HOL will supply and install, at the customer’s cost, a meter socket adapter and test switch. The customer will not be required to supply a transformer rated meter base.

Schedule 1 - Technical Data Tables

Table S1-1: Primary Service Meter Socket Types and Required Number of Metering Instrument Transformers

Voltage	No. of Phases	No. of Wires	Configuration	Meter Socket Type	Meter	No. of Metering Inst. Transformers (Provisions For)	
						CTs	PTs
13.2kV	3 Phase	3-Wire	Delta	8-Jaw Meter Socket Base	3 Phase, 2-Element, 10A, 120V, 3-Wire	2	2
		4-Wire	Grounded-WYE	13-Jaw Meter Socket Base	3 Phase, 3-Element, 10A, 120V, 4-Wire	3	3
27.6kV	3 Phase	3-Wire	Delta	8-Jaw Meter Socket Base	3 Phase, 2-Element, 10A, 120V, 3-Wire	2	2
		4-Wire	Grounded-WYE	13-Jaw Meter Socket Base	3 Phase, 3-Element, 10A, 120V, 4-Wire	3	3

Table S1-2: HOL Approved Commercial 13-Jaw Transformer Rated Meter Socket Bases For 3 Phase, 4-Wire Primary Services

Service Type	Manufacturer	Catalog Number	Meter Socket Base Requirements
3 Phase,4 Wire, Wye Primary Service	EATON (CUTLER-HAMMER)	TSU13	13-Jaw Meter Socket base is required for a 3 Phase, 4-Wire, 3-Element, Primary Service.
	DURHAM	RSTL13-2K	CSA approved weatherproof NEMA Type 3R, 20A, 600V Meter Socket base complete with: <ul style="list-style-type: none"> • CSA approved for copper only • Conductor range for #14 AWG to #8 AWG • Metal screw type lock sealing ring • Provisions for 10-pole metering Test Switch • Bottom cover is lockable and sealable
	HYDEL	CTS130PW	
	ABB (MICROELECTRIC)	CT113	

Table S1-3: HOL Approved Commercial 8-Jaw Transformer Rated Meter Socket Base for 3 Phase, 3-Wire Primary Service

Service Type	Manufacturer	Catalog Number	Meter Socket Base Requirements
3 Phase, 3 Wire, Delta Primary Service	EATON (CUTLER-HAMMER)	TSU8	A 8-Jaw Meter Socket base is required for a 3 Phase, 3-Wire, 2-Element, Primary Service
	DURHAM	RSTL8-2K	CSA approved weatherproof type NEMA Type 3R, 20A, 600V Meter Socket base complete with: <ul style="list-style-type: none"> • CSA approved for copper only • Conductor range for #14 AWG to #8 AWG • Metal screw type lock sealing ring • Provisions for 10-pole metering Test Switch • Bottom cover is lockable and sealable
	HYDEL	CTS800PW	
	ABB (MICROELECTRIC)	CT108	