TORONTO HYDRO

METERING REQUIREMENTS

for

13.8 kV & 27.6 kV CUSTOMER-OWNED SUBSTATIONS

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CERTIFICATE OF APPROVAL THIS TECHNICAL SPECIFICATION MEETS THE SAFETY REQUIREMENTS OF SECTION 4 OF ONTARIO REGULATION 22/04	
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CONDITIONS OF SERVICE, SECTION 6 - REFERENCE #7

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1.0 SCOPE

1.1 Toronto Hydro Requirements

This publication covers the metering requirements for Toronto Hydro customers. They apply to both permanent and temporary services. These requirements are in addition to those of the "Supply Authority" stated in the Ontario Electrical Safety Code for service entrance, connection, and metering of electrical energy.

1.2 Ontario Electrical Safety Code

Nothing contained in these requirements shall prejudice or supersede any requirements of the Ontario Electrical Safety Code or affect regulations of existing building codes, unless specifically stated herein.

Some requirements identified by the latest edition of the Ontario Electrical Safety Code have been included for convenience and reference purposes, even though they may be under the Electrical Safety Authority (ESA) jurisdiction.

2.0 PURPOSE

This document is intended to provide guidance to Toronto Hydro customers and their agents in the design, preparation of plans, and construction of the proposed service installation with respect to revenue metering. These requirements apply to all new, rearranged or upgraded services, both permanent and temporary, and are intended to provide an efficient and safe supply of electrical energy with respect to revenue metering.

It shall be the responsibility of the customer to conform to the latest edition of these requirements, the Toronto Hydro Conditions of Service, and the Ontario Electrical Safety Code.

3.0 DEFINITIONS AND THE INTERNATIONAL SYSTEM OF UNITS

3.1 Definitions

In addition to the definitions stated in Section "O" of the Electrical Safety Code, the following meanings have been ascribed to the terms defined below.

Acceptable	Meets Toronto Hydro requirements.
Accessible	The equipment is not guarded by locked doors, elevation or other effective means.
Approval	Approval of drawings and customers' equipment is limited to the approval of Toronto Hydro's metering requirements and does not

	construe acceptance of liability arising from substandard design or workmanship.
Compartment	A subdivision of a unit.
Customer	Means a person that has contracted for or intends to contract for connection of a building or an embedded generation facility. This includes developers of residential or commercial sub-divisions.
Customer-owned Substation	A customer-owned civil structure accommodating customer-owned electrical equipment connected to Toronto Hydro 13.8 kV or 27.6 kV system.
Exit	A path of travel, which leads from a floor area to a separate building, an open public thoroughfare or an exterior open space, which is protected from fire exposure from the building and has access to an open public thoroughfare.
High Voltage	In this document, high voltage means 13.8 kV or 27.6 kV.
MSG	Manufacturer's Standard Gauge for uncoated steel.
Readily Accessible	Capable of being reached quickly for operation, removal or inspection, without requiring climbing over or removing of obstacles or resorting to the use of portable ladders, chairs, etc.
Unit (Switchgear)	A full height and full depth module of a switchgear assembly. It is sometimes referred to as "cell", "cubicle" "section" or "enclosure".

3.2 The International System of Units

Measurements and weights used in this publication are expressed in SI units. The metric units have been rounded as close as possible to the previously used units. Equipment or materials not available in metric units shall be equal to or larger than the units specified in this publication. Equivalent measurements will be accepted if equipment or materials are not manufactured in metric units.

4.0 METERING CHARGES

Metering charges will apply to all 13.8 kV and 27.6 kV primary metering. Costs will be determined by Toronto Hydro.

5.0 PROCEDURE FOR OBTAINING TORONTO HYDRO APPROVAL

Following acceptance of a customer's application for a primary metered service or a proposal to modify an existing primary metered service, the following procedure shall apply.

5.1 Drawings

The customer shall submit drawings for Toronto Hydro approval in accordance with Section 6.

5.2 Additional Drawings

If the drawings or information do not meet the Toronto Hydro requirements or are not sufficiently clear, then revised or additional drawings and information must be submitted when requested by Toronto Hydro.

5.3 Manufacture of Equipment – Drawing Approval

Manufacture of equipment should not start until all drawings and information have been approved. This will avoid costly changes to completed equipment. Final revision of all drawings must be delivered to Toronto Hydro as least four weeks prior to the delivery of the switchgear to the service site.

5.4 Inspection of Equipment Prior to Shipment

Toronto Hydro reserves the right to inspect the completed equipment at the manufacturer's plant, prior to shipment.

5.5 Compliance with Requirements

When the installation of the equipment has been completed, Toronto Hydro will inspect the equipment to ensure it complies with these requirements.

5.6 Metering Equipment Delivery

Metering equipment delivery may take up to 16 weeks after the switchgear drawings have been approved.

6.0 ENGINEERING DRAWINGS AND SPECIFICATIONS

6.1 Drawings Required for Acceptance

Fully dimensioned and scaled drawings submitted for Toronto Hydro's review and acceptance shall include but not be limited to those listed below. The minimum number of drawings required is indicated in brackets. The published requirements may change without notice. Additional drawings may be requested.

(a) Electrical substation layout drawing showing the location of the electrical switchgear and all revenue metering (meter cabinets). (2)

(b) Single line distribution diagram. (2)

(c) Manufacturer's or shop drawings of the proposed switchgear with a utility compartment detail drawing. (2).

6.2 DRAWING REVISIONS

If any drawings require revision, Toronto Hydro will determine the number of copies of each drawing to be re-submitted for further review and acceptance.

7.0 SUBSTATION REQUIREMENTS

7.1 Exits and Doors

7.1.1 Miscellaneous Requirements

Two exits, one at each opposite end of the substation, are required. The exit doors shall open in the direction of exit travel and shall be equipped with panic type hardware. The doors shall be fitted with a keyed cylinder lock and handle on the opposite side of the door from the bar, all to be acceptable to Toronto Hydro.

8. 0 SAFE WORKING SPACE

Safe working space in vicinity of service entrance equipment including metering shall be in accordance with the Electrical Safety Code Rule 2-308 (Working Space About Electrical Equipment) and shall include the requirements in sections 8.1 – 8.7 below.

8.1 Minimum Space Requirement

A minimum of 1.5 metres shall be provided in front of all doors giving access to switchgear components and where Toronto Hydro is required to work.

8.2 Side or Rear Access Panels

Side or rear access panels are not acceptable for metering transformer installations.

8.3 Aisle Space

A clear passageway at least 0.9 metres wide and 2.2 metres high shall be maintained as an exit route from all service entrance equipment. This headroom must also be maintained in the working space in the vicinity of the service entrance equipment.

8.4 Blocking of Exit Route

Where the compartment hinged doors or draw-out components would block the exit route, a clear minimum space of 0.6 metres must be maintained from the edge of the access door or components in their fully open position.

8.5 Illumination of Equipment

Adequate illumination shall be provided in accordance with Electrical Safety Code Rule 2-314 (Illumination of Equipment) to allow for proper operation and maintenance of electrical equipment. The lighting shall be controlled by wall switches located at the entrances to these areas.

8.6 Accessibility for Maintenance

Passageways and working space around electrical equipment shall not be used for storage and shall be kept clear of obstructions and so arranged as to give authorized persons ready access to all parts requiring attention in accordance with Electrical Safety Code Rule 2-312 (Accessibility for Maintenance).

8.7 Access to Substation by Toronto Hydro

Immediate access to the substation must be provided on a 24-hour basis for Toronto Hydro personnel. A door, equipped with a Toronto Hydro lock, giving direct access to the substation from the outside shall be provided where practicable. Alternatively, the doors along the route leading to the substation must be equipped with Toronto Hydro locks.

If Toronto Hydro locks are not practical, the customer shall provide Toronto Hydro the appropriate access keys or magnetic cards to enable entry from street to the substation.

9.0 EQUIPMENT REQUIREMENTS

9.1 Enclosures

9.1.1 Sheet Steel Enclosures

All enclosures including barriers between compartments containing high voltage components shall be of sheet steel not less than #11 MSG and all other covers, barriers, panels and doors shall not be less than #14 MSG.

9.1.2 Enclosure Interiors

Interiors of enclosures shall be finished in white enamel.

9.1.3 Mimic Bus

A mimic bus on the front door of the switchgear compartment with no rear access shall indicate the internal electrical arrangement of equipment in each compartment. The mimic bus shall be securely fastened to the panel. For switchgear with rear access doors, all components, both front and rear, shall be marked and labeled similarly.

9.1.4 Name Plates

Switchgear data nameplates shall be engraved or stamped type and mounted in accessible location. Photographic imprinting is not acceptable. Where weatherproof switchgear is installed the nameplates shall bear the CSA designation "C22.2 No. 94" and type of enclosures.

9.2 Metering Compartments – 13.8 kV Switchgear

The following switchgear components shall be installed within separate compartments formed by sheet steel barriers:

(a) Each set of metering current transformers and each set of metering voltage transformer fuses.

(b) Each set of voltage transformers.

9.3 Metering Compartment – 27.6 kV Switchgear

The current transformers and voltage transformers can be installed in the same compartment. Barriers and fuses for the voltage transformers are not required.

9.4 Compartments and Openings

There shall be no openings whatsoever in compartment walls, which will permit the flow of ionized gases or flames into adjacent compartments.

9.5 Primary Connections between Compartments

Where the primary connections pass from one compartment to another compartment, the through-bushings installed in metallic barriers shall be rated fully at the same insulation level as the switchgear. Insulating material between compartments is not permitted.

9.6 Access Doors – 13.8 kV Switchgear

Individual hinged access doors are required to provide access to the following compartments:

(a) Each set of metering current transformers and each set of voltage transformer fuses.

(b) Each set of voltage transformers.

9.7 Access Doors – 27.6 kV Switchgear

A single hinged access door is required to give access to the current transformers and voltage transformers.

9.8 Hinged Access Doors

All hinged outer access doors shall open at least 135° and all hinged inner doors shall open at least 90°.

9.8.1 Stops on Access Doors

Access doors shall have stops to hold the door in their fully open position.

9.9 Padlock Hasps

Access doors shall be equipped with padlock hasps measuring at least 30 mm wide by 5 mm thick capable of accepting a standard Toronto Hydro padlock with an 8 mm shackle.

9.10 Securing Access Doors

Access doors shall be adequately secured with either 25 mm knurled head captive bolts, which require no tools to unscrew, or handles with at least three latching points.

9.11 Barriers – 13.8 kV Switchgear

9.11.1 Requirement for Barriers

Phase to phase and phase to ground barriers shall be installed on each set of fixed metering voltage transformer fuses.

Such barriers shall extend from the base of the insulator supports to a point 50 mm beyond the fuse ferrules.

9.11.2 Type of Barriers

The barriers must be white, flame retardant insulating material meeting the National Electrical Manufacturers Association (N.E.M.A.) requirements for grade GPO-3 and be minimum 5 mm thick.

Barriers are not required on 27.6 kV switchgear.

9.12 Electrical Clearances

9.12.1 Bare Conductors

The phase to phase and phase to ground clearances of bare conductors and other current carrying parts shall be in accordance with the requirements of CSA Standard C22.2 No. 31.

9.12.2 Connection Clearances

Where 13.8 kV connections are made to any components supplied or installed by Toronto Hydro (e.g. current and voltage transformers and/or fuses), such connections shall be assumed to be bare and full CSA through air clearances shall be maintained.

10.0 TORONTO HYDRO METERING REQUIREMENTS

10.1 General Information

10.1.1 Supply of Metering Equipment For Switchgear Assemblies

Toronto Hydro will supply to the switchgear manufacturer current transformers, voltage transformers and/or primary fuse supports, of a type determined by Toronto Hydro, for installation and connection by the manufacturer during the construction of the switchgear. The switchgear manufacturers shall at no time disassemble and/or change in any manner the Toronto Hydro equipment sent to them. Meters, fuses, test blocks, secondary wiring and associated equipment required for Toronto Hydro revenue metering will be supplied and installed by Toronto Hydro after installation of the switchgear at the service site.

The switchgear manufacturer and or electrical contractor is to make all primary connections in the revenue metering compartment of the switchgear including the appropriate ground connections (#2/0) to the metering transformers whenever a ground lug is provided on the base of the metering transformers.

10.1.2 Connections

The voltage transformers shall be connected on the line side of the current transformers. Customers' instrumentation shall be connected on the load side of the Toronto Hydro metering, unless special approval is obtained.

10.1.3 Equipment Mounting

Metering transformers and/or primary fuse supports shall be mounted in an arrangement acceptable to Toronto Hydro. They must be capable of being easily installed or removed without access to other compartments and be readily accessible with readily accessible secondary terminals.

(Refer to sections 9.2 and 9.3 for compartment requirements. Also, see diagram #2 for 13.8 kV switchgear and diagram #3 for 27.6 kV switchgear in section 11.0 below)

10.1.4 Internal Conduit and Fittings – 13.8 kV Swtichgear

A 25 mm rigid conduit with bushings shall be installed in the switchgear between the current transformers and the voltage transformers for the secondary wiring - see diagram #2 in section 11.0 below for the location. Flexible conduit is not acceptable.

10.1.5 Internal Conduit and Fittings – 27.6 kV Switchgear

A 25 mm rigid conduit with bushings shall be installed between the current transformer and voltage transformer secondary terminal boxes and a 260 mm x 260 mm junction box (complete with cover). The junction box shall be located on the side-wall of the metering cell near the front by the access door. See diagram #3 in section 11.0 below. Flexible conduit is not acceptable.

10.2 Current Transformers

10.2.1 Number of Current Transformers

Provisions shall be made for three current transformers, although in some cases only two will be installed in each metering current transformer compartment.

10.2.2 Clearance and Spacing

The electrical clearance around the current transformers with respect to 13.8 kV and 27.6 kV bus sections or conductors shall meet the requirements of the latest CSA standard C22.2 No. 31.

10.2.3 Polarity and Mounting Arrangement

Metering current transformers shall be installed with their polarity marks towards the incoming Toronto Hydro lines. The metering current transformers are to be mounted across the front of the cells. Front to back mounting is not acceptable.

10.3 Voltage Transformers, Fuse Supports and Fuses

10.3.1 Fuse Supports and Fuses

Metering installations for 13.8 kV switchgear shall have three primary fuse supports and fuses for each set of voltage transformers. Fuses will be supplied and installed by Toronto Hydro at the time of meter installation. Fuse supports are not required for 27.6 kV switchgear.

10.3.2 Voltage Transformer Connections – 13.8 kV Switchgear

(a) The minimum acceptable copper cable (or equivalent bar) size for primary connections shall be #4/0 AWG or 11 mm diameter copper rod between the main bus and the fuse supports and #6 AWG between the current limiting fuses and the voltage transformers.

(b) Where the primary connections pass from one compartment to another compartment through a metal barrier, through bushings shall be provided. Insulating material between compartments is not permitted.

10.3.3 Voltage Transformer Connections – 27.6 kV Switchgear

The minimum acceptable copper cable (or equipment bar) size for primary connections shall be #2 AWG or 6mm diameter copper rod between the main bus and the voltage transformers.

10.3.4 Mounting Arrangements – 13.8 kV Switchgear

The voltage transformers and fuses must be installed in a fixed position. Draw-out or swing-out arrangements are not acceptable for revenue metering installations. See diagram #2 in section 11.0 below for the preferred arrangement.

Revenue metering voltage transformers shall comply with the following:

(a) Revenue metering voltage transformers must be mounted on the base plate in the metering cell. The voltage transformer fuse supports shall be mounted in the compartment directly above (see section 9.2(a)).

(b) The access opening for the voltage transformer compartment shall have a clear height of 0.66 metres minimum.

(c) Primary fuse supports shall be mounted so that the center line of each fuse is approximately 1.2 metres above the floor but in no case less than 0.9 metres or more than 1.5 metres.

(d) The voltage transformers are to be mounted with their secondary terminal blocks located at the front of the switchgear near the access doors.

10.3.5 Mounting Arrangements - 27.6 kV Switchgear

The voltage transformers must be installed in a fixed position. Draw-out or swing-out arrangements are not acceptable for revenue metering. See diagram #3 in section 11.0 below for the preferred arrangement.

The voltage transformers are to be mounted with their secondary terminal blocks located at the front of the switchgear, near the access doors.

10.4 Meter Cabinet and Conduit Installation

10.4.1 Meter Cabinet

A CSA approved meter cabinet shall be supplied and installed by the customer in a protected and accessible location approved by Toronto Hydro.

(a) For indoor installations the meter cabinet shall be installed indoors, inside the electrical room. If the meter cabinet is located in an area equipped with a sprinkler system, the meter cabinet provided should be weatherproof.

(b) For outdoor substations the meter cabinet shall be mounted in an adjacent building; if this is not practicable the cabinet must be weatherproof, equipped with door stops and located outdoors. The location and mounting are to be approved by Toronto Hydro.

(c) The top of the cabinet shall not exceed 1.8 metres above floor level or finished grade. The bottom of the cabinet shall not normally be less than 0.6 metres above floor level or finished grade.

(d) A clear working space of 0.9 metres is to be provided in front of the meter cabinet. In order to maintain this clearance, the customer at the request of Toronto Hydro may be required to install bollards in front of the meter cabinet area.

(e) Revenue meters shall not be installed in or on the switchgear.

(f) A #2/0 bare copper ground wire is to be installed from the system ground in the electrical room to the exterior of the meter cabinet.

10.4.2 Cabinet Size and Construction

(a) The meter cabinet size shall normally be 915 mm wide x 915 mm high x 305 mm deep. For specialized meter installations involving totalizing pulse-metering equipment, Toronto Hydro shall be consulted regarding cabinet requirements since circumstances may require a cabinet of different dimensions.

(b) The cabinets shall be constructed of sheet steel of a minimum of #14, MSG. They shall be equipped with a removable interior mounting panel of sheet steel of minimum of #12 MSG. This panel shall be 80mm narrower than the width and 80 mm shorter than the height of the cabinet and be mounted to permit a clearance of 13 mm behind it.

(c) Cabinets shall be equipped with hinged double doors opening at the middle. Doors shall be provided with a non-locking type latch and handle or latch-handle combinations and shall not have more than three latching points.

10.4.3 Metering Conduit

(a) A conduit, for the exclusive use for the Toronto Hydro meter wiring, shall be provided by the customer and installed between the cubicle in the switchgear containing the metering transformers and the meter cabinet. The maximum length of conduit shall be no longer than 30 metres. The customer shall supply and install a conduit of a nominal diameter of not less than 51 mm. The conduit is to terminate at the cubicle as shown on diagrams #2 and #3 in section 11.0 below.

(b) The number of bends shall be kept to a minimum but in no case no more than three (3) 90° bends should be installed. Pull boxes and/or fittings with removable covers are not permitted.

(c) The Electrical Contractor shall install a strong nylon, polyrope or equivalent pull line in the conduit between each metering transformer compartment and the meter cabinet leaving 1.5 metres excess at each end.

10.5 Remote Metering (RIMS) – Services 50 kW and Greater

The customer is to provide and install the following:

(a) A 120 Volt duplex receptacle is to be located at the bottom right corner inside the meter cabinet. The receptacle is to be connected to an uninterruptible power supply (UPS) if available. Should the meter cabinet be located in an outdoor environment, then the 120 Volt duplex shall be equipped with ground fault interrupter protection.

(b) The name and phone number of an onsite contact person.

(c) In locations selected for cellular communications, a 32 mm (1 ¼") EMT or PVC conduit from the meter cabinet to an outdoor location for the installation of an antenna to be mounted 1.8 m (6 ') above ground. The conduit installation shall not be more than 30.5 m (100') in length.

(d) In locations where cellular communication cannot be installed, a 13 mm (½") metallic conduit with bushings at both ends between the revenue metering cabinet and the telephone room. The 13 mm (½") EMT is to terminate at the top right corner of the meter cabinet.

A 2 pair (4 conductor) telephone cable is to be installed in the 13 mm (½") conduit. A RJ11 (4 pin) telephone jack is also to be provided and installed on the telephone cable in the meter cabinet. The telephone jack is to be left at the

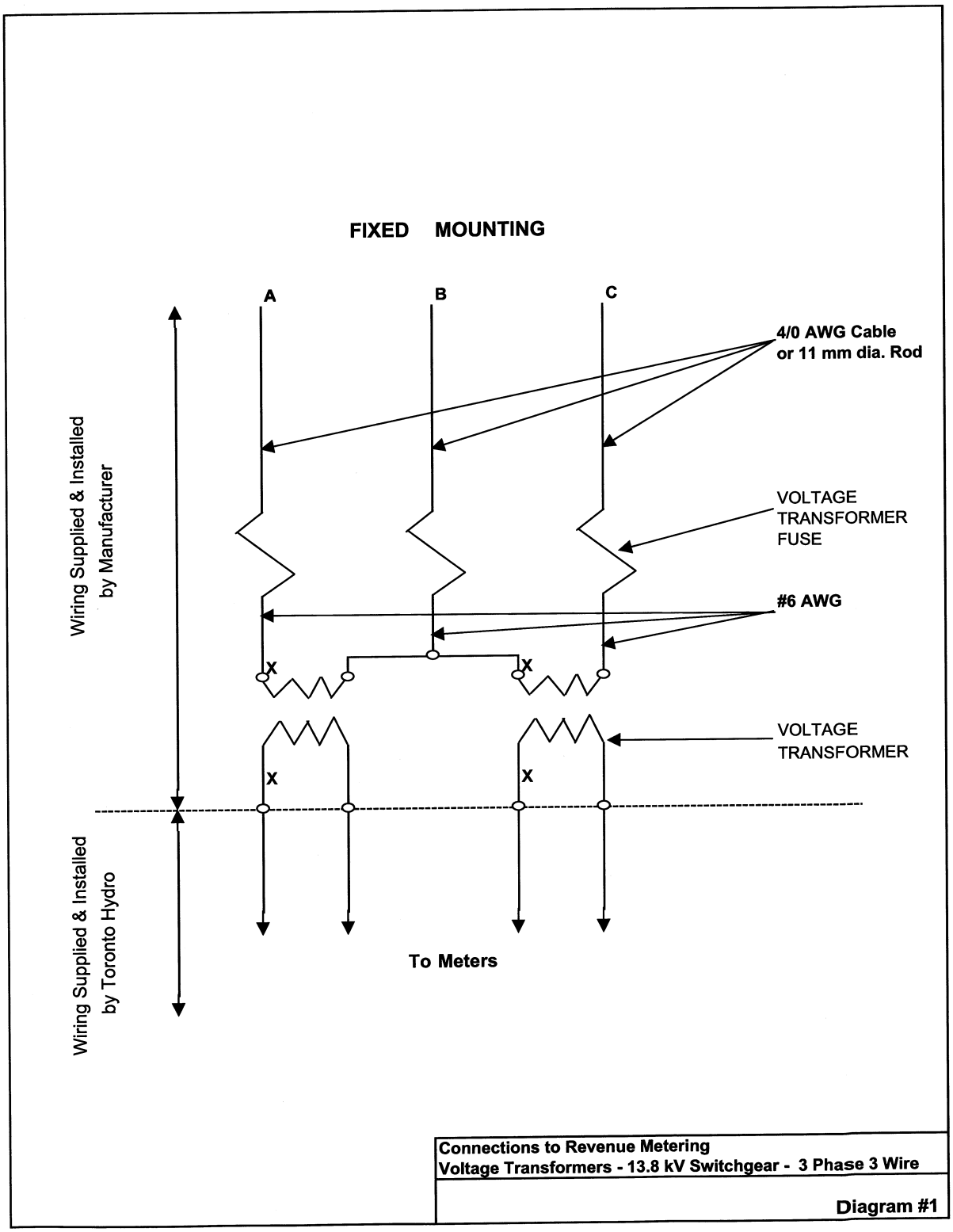
bottom of the meter cabinet with enough telephone cable to allow mounting the jack anywhere in the cabinet. The telephone cable terminating in the telephone room is to be clearly labeled "TORONTO HYDRO METERING".

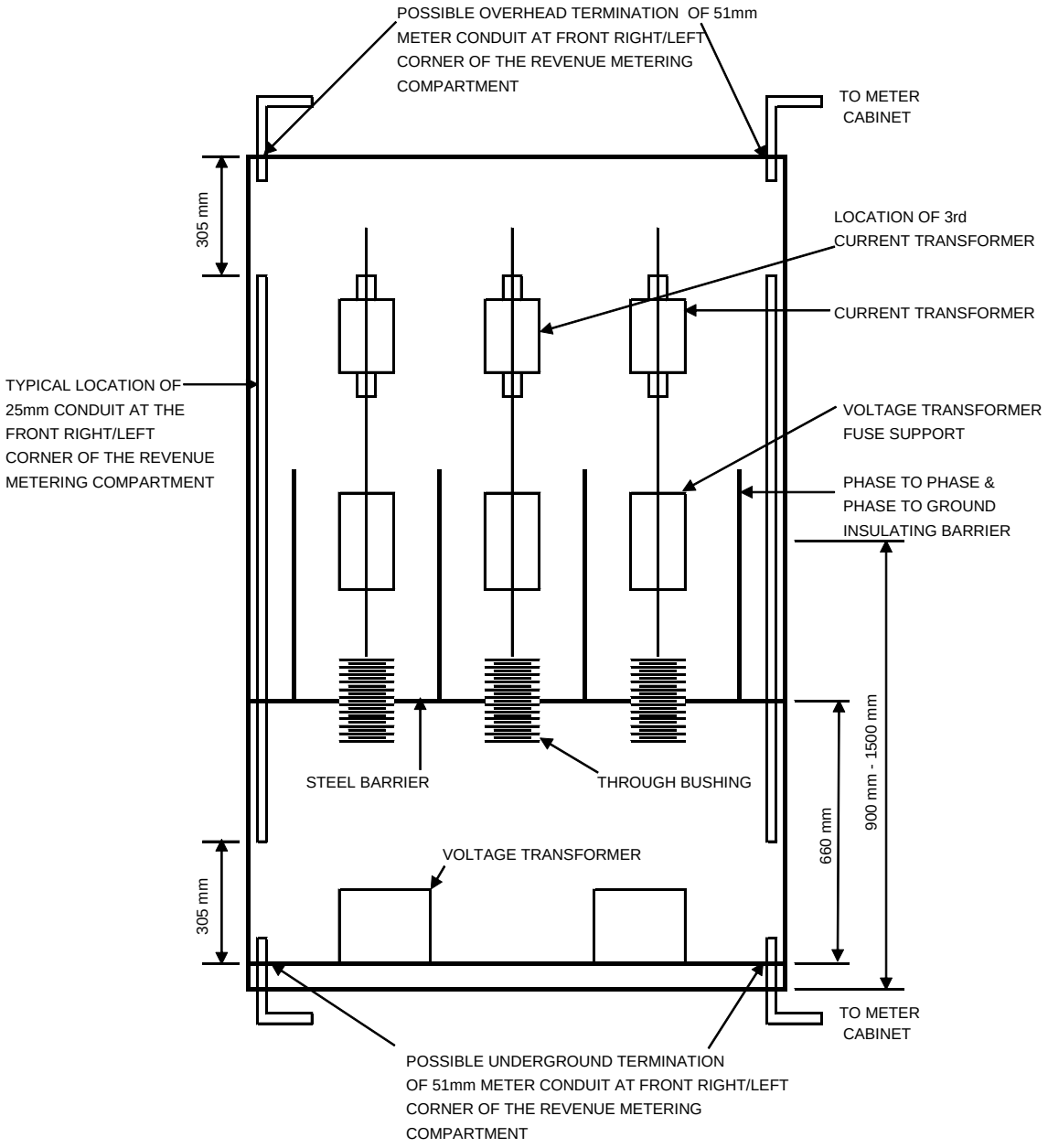
Toronto Hydro will arrange to have the telephone line activated. Customer owned telephone lines or customer shared telephone lines are not acceptable.

10.6 Pole/Structure Mounted 27.6 kV Outdoor Substations

The customer shall provide facilities for mounting revenue metering transformers and or meters on the pole or structure. This type of arrangement will be approved on an individual basis as a special installation.

11.0 DIAGRAMS


FIXED MOUNTING
A
B
C
4/0 AWG Cable
or 11 mm dia. Rod
VOLTAGE
TRANSFORMER
FUSE
#6 AWG
X
X
VOLTAGE
TRANSFORMER
X
X
Wiring Supplied & Installed
by Manufacturer
Wiring Supplied & Installed
by Toronto Hydro
To Meters
Connections to Revenue Metering
Voltage Transformers - 13.8 kV Switchgear - 3 Phase 3 Wire
Diagram #1



NOTE:

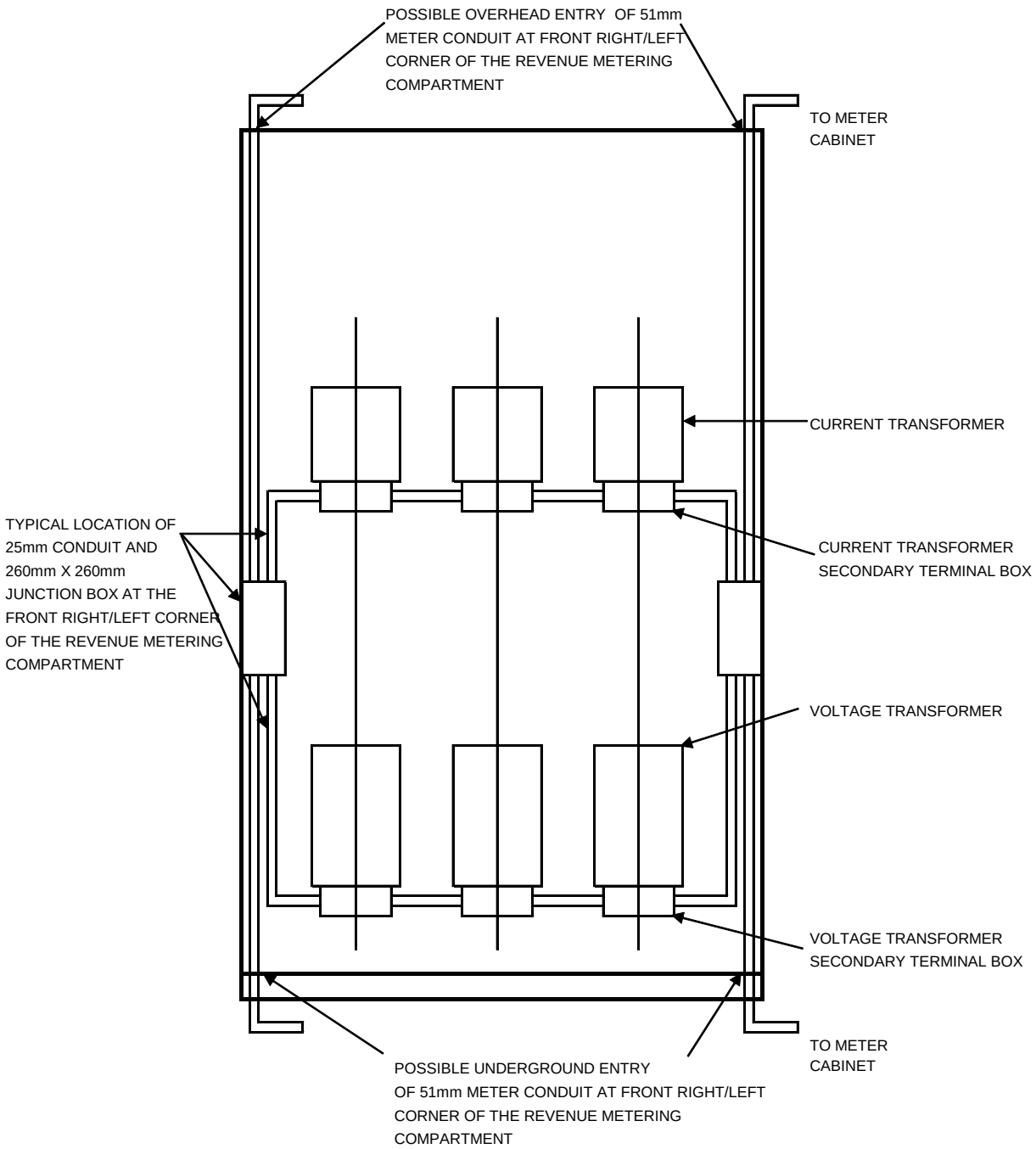
1. Current transformers and the voltage transfomer fuse supports are to be on the same vertical plane.

2. Refer to Section 10 for detailed specifications.

3. Drawing is not to scale.

Metering Compartment Front View Showing Relative Position of Metering Transformers and Fuse Supports - 13.8 kV Switchgear - 3 Phase 3 Wire

Diagram #2



NOTES:

1. Current transformers and the voltage transformers are to be on the same vertical plane.

2. Refer to Section 10 for detailed specifications.

3. Drawing is not to scale.

Metering Compartment Front View Showing Relative Position of Metering Transformers - 27.6 kV Switchgear - 3 Phase 4 Wire

Diagram #3