



## **Revenue Metering Guide**

### **ENMAX Power Corporation**

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## Glossary

Electrical terms used in this manual are based on accepted electrical industry practice and the company's "Terms & Conditions".

**AMR** - Automatic Metering Reading.

**AECUC** - Alberta Electrical and Communications Utility Code.

**CEC** - Canadian Electrical Code, Part 1 and Amendments.

**CSA** - Canadian Standards Association.

**Cold Sequence Metering** - Overcurrent protection and disconnect is connected between the utility supply and the meter / metering installation.

**Demand** - The average value of power over a specified interval of time. The most common quantities are kilowatt (kW) and kilovolt Amperes (kVA) demand.

**Energy** - The integral of active power with respect to time. E.g. kilowatt-hours (kWh)

**Harmonics** - Distortions to the voltage and current waveforms from their normal sinusoidal shape.

**Hot Sequence Metering** - Utility supply is connected directly to meter / metering installation.

**Instrument transformer enclosure** - The enclosure supplied and installed by the customer for the housing of instrument transformers.

**Instrument Transformer Metering** - Using a transformer in a metering circuit to step down the current and/or the voltage to a level that can be accommodated safely by the meter.

**Interval metering** - Energy values are recorded for a specific time period on a continual basis typically 1min, 5 min, 15 min, or 1 hr.

**Meter enclosure** - The enclosure supplied and installed by the customer for the housing of a meter.

**Meter socket** - A meter mounting device for the purpose of installing a self-contained meter.

**Multiple Service** - A service to a building such as an apartment building or shopping center that has two or more units and a common service entrance in which each unit is served and metered separately.

**Network** - Three-wire service obtained from two-phase wires and a neutral of a three-phase four-wire wye system. (120/208volts)

**Polarity mark** - Marked indicators on a transformer to show the instantaneous direction of current flow through the windings. Current flow into the primary marker causes current flow out of the secondary marker.

**Self-contained Meter** - A meter designed to accommodate the full line current and voltage of the circuit.

**Single phase** - A service comprised of a 120/240 volt three wire circuit.

**Time of use metering** - Energy and demand registrations are segregated into time blocks during each day. Each time block is assigned a rate period. These rate periods are scheduled by time, day of the week, holidays, and/or season.

**Three phase** - A service with three phase conductors and a neutral.

**SCA** - Alberta Safety Codes Act.

# **1.00 General Requirements**

## **1.01 Access to Metering Equipment**

Enmax employees or agents must have reasonable and unhindered access to all Enmax metering equipment for the purpose of reading, testing and changing that equipment. Where ready access to the metering equipment is not given due to locked doors, Enmax may request a key for its use. Enmax may install a lock-box for the purpose of keeping the key on site.

## **1.02 General**

Enmax reserves the right to refuse to energize any service or metering installation within its service territory, if, in its opinion, the installation is considered unsafe, a hazardous condition exists, or until the service entrance equipment, its location and application, complies with this Revenue Metering Guide.

Enmax meters must be located on the load side of the customers' breaker / fused-disconnect (Cold Sequenced Metering). The only Hot Sequence installations allowed by Enmax are single phase, Residential meters that are self-contained.

Customer transformers are not permitted to be installed on the line side of an Enmax meter.

## **1.03 Safety Requirements**

There shall be provided at each meter and distribution center a clear space in width not less than the width of the distribution center extending from the floor to a point not less than 15 cm above the highest unit of the distribution center and being a depth no less than 75 cm from the outmost protruding surface of the grouped equipment.

A minimum working space of 1 m wide by 2.2 m high is required in front of all electrical equipment and to the sides and back where access is required.

A minimum passageway of 1 m wide by 2.2 m high must be maintained as an entrance or exit from all electrical areas. If 1200 amps or more, or rated over 750V (CEC Part I 2-310 (2) ) there shall be two points of exit or a minimum of 1.5 meters of unobstructed working space.

Metering equipment cannot be located in areas that are hazardous to anyone working on that equipment or to the metering equipment itself. Hazardous locations are defined as any area involving moving machinery, dust, vibration, fumes, water and/or moisture.

No meter shall be located in an environment that is considered dangerous due to H<sub>2</sub>S or where H<sub>2</sub>S may be present and may be hazardous.

No meter shall be located in a biologically hazardous location, for example livestock and poultry facilities. This requirement is in place protect Enmax staff from the danger of contracting or spreading any disease or virus.

It is not permissible to mount water, sewer, gas or other pipes or equipment foreign to the electrical metering installation directly above electrical metering equipment or to encroach on minimum working space around electrical metering equipment.

The areas where electrical metering equipment is installed must have adequate illumination and ventilation to carry out all work safely.

Enmax will not install meters in alleyways or areas where the meter is unprotected from moving equipment, or in the path of water from eaves or rainspouts, or where the meter may be subject to steam, or corrosive hazardous vapors. Enmax will not install meters in areas that are difficult to access; such areas include open pits, near moving machinery, hatchways, closets or stairways or where there are noticeable vibrations.

#### **1.04 Care of Metering Equipment**

The customer is required to exercise reasonable care for the protection of the Enmax metering equipment installed on the customer's premises. Should any damage occur or the metering equipment be lost or stolen after installation, the said customer shall be liable for the cost of repair or replacement.

#### **1.05 Temporary Meter Removal**

Enmax Revenue Metering Section shall be contacted prior to removal of a meter from an energized, metered service. Meters connected to instrument transformers (CT's and PT's) shall only be disconnected by Enmax Revenue Metering employees or agents. Enmax must be notified before meter is re-installed. Enmax personnel must be present at the time of re-installation.

#### **1.06 Non-Standard Services**

##### **1.06.01 Acceptance Procedures**

Whenever the requirements of this guide cannot be met, drawings must be submitted to Enmax Revenue Metering for approval. The required drawings should be submitted as early as possible, before the ordering and installation of service entrance equipment or other associated equipment. Please note that any approval is only for the service in question and is not a general approval for future services.

##### **1.06.02 Drawings and Specifications**

Two copies of equipment drawings, specifications and site plans are required by Enmax for non-standard services. In some cases a hand drawn sketch that clearly shows the layout and dimensions are all that is needed. Drawings submitted must clearly show all equipment related to the revenue metering, including service entrance equipment and revenue metering enclosures. These drawings should show elevations and enclosures sizes. Drawings are to be sent to Metering Standards at Enmax Revenue Metering located at 8820 52 St SE. One copy will be returned when approved.

In case of a dispute, verbal conversations will not be honored by Enmax staff. You must have prints approved by Metering Standards for non-standard services.

## **1.07 Construction Requirements**

### **1.07.01 Electrical Modifications to Existing Services**

Customers planning any modification or addition to their electrical system including increased load, back-up power supplies and transfer switches shall contact Enmax Revenue Metering at (403)514-3744 to obtain a written approval before modifying an existing service. The earliest contact with Enmax Revenue Metering will help ensure that any additions or changes are installed correctly and safely and they are satisfactory to both the inspection authority and Enmax. The customer may be charged for costs associated with any change required to Enmax equipment due to the service modification.

### **1.07.02 Temporary Services**

All temporary construction (Saw) services where the service disconnect rating does not exceed 200 amps will be located on the load side of the customers' **fused-disconnect** (Cold Sequence Metering).

## **1.08 Metered & Unmetered Conductors**

All service entrances must be designed and constructed such that metered and unmetered conductors are not run in the same conduit or raceway.

### **1.09 Meter Service Area Definition**

A meter used for revenue purposes shall not cover more than one clearly defined area. Conversely, *more than one* revenue meter may not service one clearly defined area. A clearly defined area is defined as an individual building, unit, bay, or apartment. Only one meter per area shall be permitted with the following exceptions.

Changes may be made to an area which creates a need for an additional meter to be installed in an existing area. Changes to the existing service shall not be made without the express consent of Enmax Revenue Metering (refer to section 1.06 Non-Standard Services for further instructions).

The purpose of this regulation is, to ensure that Enmax Revenue Metering meters accurately measure the customers' consumption.

## **2.00 Types of Metering**

### **2.01 Self-Contained Metering:**

#### **2.01.01 Load Limits**

The maximum load for a self-contained meter is 200 Amp per phase.

#### **2.01.02 Voltage Limits**

The maximum voltage limit for a self-contained meter is 600-volt phase to phase.

**Table 1**

Self-Contained Meters (up to 200 amps)					
Voltage	Phase	Wire	Connection	Socket	Figure
120/240	1	3		4Jaw	5
120/208	3	3	Network	5 Jaw	6
120/208	3	4	Star (Y)	7 Jaw	7
277/480	3	4	Star (Y)	7 Jaw	7
347/600	3	4	Star (Y)	7 Jaw	7

Meter sockets are to be mounted:

- As close as possible to the service box.
- In a clean, readily accessible area that is satisfactory to Enmax.
- Free from severe or continual vibration.
- Level on the horizontal and vertical planes (buildings with sloping sides require special provisions).
- If mounted outside, mounted with the centerline of the meter at a height of 1.5 m to 1.8 m above finished grade (the preferred height is 1.5 m).
- If mounted inside, mounted with the centerline of the meter socket at a height of 1.5m to 1.8m above the finished grade.
- The main service disconnect, splitter box, and sub-service disconnects must have provision for Enmax padlocks.

Meter sockets may be recessed providing that 25-mm (1”) clear space around the circumference of the socket is provided for every 50-mm (2”) or fraction thereof that the rear face of the socket extends into the recess. When the building finish is meant to come flush around the circumference of meter sockets, the back of the ring shoulder of the socket shall protrude at least 6 mm (1/4”) from the building finish. Meter socket must be mounted such that the jaws are plumb through all vertical planes and the socket cleaned of all foreign matter before connection will be made.

### **2.01.03 Supply of Self-contained Metering Equipment**

#### **The customer shall:**

Supply and install an approved meter socket complete with a screw type sealing ring for Enmax use that conforms to recognized industry standards ( i.e. CSA, ULC etc...) (see Table 2)

Make all connections within the meter socket.

#### **Enmax shall:**

Supply the meter and install the meter in the socket.

**Note:** Ringless meter sockets and sockets with current bypass switches (automatic circuit closures) will not be accepted for the metering at any installation serviced by Enmax.

## **2.02 Instrument Transformer Metering:**

### **2.02.01 General**

Instrument transformer type metering is required on all services exceeding 200 amps per phase. If it is required to enter an instrument transformer enclosure you must contact Enmax Revenue Metering.

### **2.02.02 Instrument Transformer Metering Equipment Location**

For Enmax owned distribution transformer installations, meter and metering equipment installation shall be connected on the load side of the distribution transformer.

For customer owned distribution transformer installations, meter and metering equipment shall be connected on the line side of the distribution transformer.

Customer equipment is not allowed within the Instrument Transformer enclosure. The instrument transformer cabinet shall not be used as a splitter box. The instrument transformer enclosure is reserved for Enmax Revenue Metering equipment only.

### **2.02.03 Supply of Instrument Transformer Metering Equipment**

#### **The customer shall:**

- Supply and install a manufacturer pre-wired meter enclosure according to specifications shown in **Table 2**.
- Supply and install a current transformer enclosure according to specifications shown in **Table 3**.
- Supply and install a 31.75 mm (1 1/4") conduit between the current transformer and the meter enclosure. ( 25.4 mm (1") conduit for single phase installations)
- Supply and install all hardware, buswork, termination and/or cable required for primary connections to the current transformers.
- Supply and install a 19mm (3/4") plywood sheet behind all enclosures.

#### **Enmax shall:**

- Supply instrument transformers.
- Supply and install the secondary wiring.
- Supply and install the meter.

The instrument transformers are available to the customer for installation upon request from Enmax Revenue Metering located in its South Service Centre. Customer shall provide site ID and Electrical Permit number to ENMAX when requesting for instrument transformers.

#### **2.02.04 Mounting of Instrument Metering Equipment**

The customer is required to mount:

- A meter enclosure.
- A current transformer enclosure.
- All current transformers.
- A conduit between current transformer enclosure and meter enclosure.

The customer shall assume the cost of installing the above metering equipment.

The current transformers are to be mounted in the following manner:

- Screwed to the back panel of the current enclosure and must be removable from the front. All mounting holes on the current transformer must be utilized.
- Ensure that the current transformer nameplates are clearly visible when the enclosure is open.
- Ensure that the current transformers are positioned **with the primary polarity mark toward the source of supply** and in an arrangement that will not obstruct access to the secondary terminals. (**Figure 4**)
- For single phase 3 wire CT's, the supply, (line1/line2) shall be connected to the same side of the CT. (**Figure 2**)

#### **2.02.05 Connection of Instrument Metering Equipment**

The customer is responsible to make all the connections to the instrument transformer primary. These connections should be properly secured and conductors shall be shaped or formed and supported so that no tension is applied to the current transformers.

Damaged current transformers are required to be replaced before energization.

Enmax Revenue Metering will make all the connections to current transformer secondary, testing switch, and the meter.

#### **2.02.06 Meter Enclosure**

A separate meter enclosure is required for each instrument transformer service. This enclosure is a manufacturer pre-wired meter enclosure including a 13-jaw meter socket (for 3-phase services) or 4-jaw meter socket (for single phase services), a test switch and wiring from the test switch to the socket. Meter enclosure specifications are shown in following table.

**Table 2**

No. of Jaws	Manufacturer Model No.	Specifications	Dimensions H x W x D (cm)	Manufacturer
13-jaw	CT113-SWL	13 Jaw c/w Test switch 120/208, 277/480, 347/600 Volts 3 Phase, 4 Wire, Wye	48 x 30 x 14	Thomas & Betts, Microelectric Canada
13-jaw	602C3040C13-603	13 Jaw c/w Test switch 120/208, 277/480, 347/600 Volts 3 Phase, 4 Wire, Wye	51 x 31 x 12	Meter Devices
4-jaw	CT104-SWL	4 Jaw c/w Test Switch 120/240 Volt 1 Phase, 3 Wire	48 x 30 x 14	Thomas & Betts, Microelectric Canada
4-jaw	602C3040C4610	4 Jaw c/w Test Switch 120/240 Volt 1 Phase, 3 Wire	51 x 31 x 12	Meter Devices

**Note:** Meter enclosures are available through local distributors.

**2.02.06.1 Location**

Meter enclosure shall be located:

- Indoor in a clean readily accessible area that is satisfactory to Enmax.
- In the same room as the current transformer enclosure.
- Within a maximum of 7 m (23') conduit run from the current transformer enclosure.
- Each meter position shall be "Cold Sequence Metering" equipped with a circuit breaker / fused disconnect on the line side of the socket meter for each individual unit it supplies.
- The circuit breaker / fused disconnect must have provision for an ENMAX padlock.

**2.02.06.2 Mounting**

Meter enclosures shall be mounted:

- With the center line of the enclosure 1.5 m to 1.8 m above the floor.
- On ¾" sheet of plywood.
- Level on both the horizontal and vertical planes.
- Free of severe or continual vibration.

**2.02.07 Grounding**

Each meter enclosure must be bonded.

### 2.02.08 Current Transformer Enclosures

A separate current transformer enclosure is required for each instrument transformer service according to the specifications shown in **Table 3**.

### 2.02.09 Sub-services

Where a transformer rated service is a sub-service, the meter must be installed on the load side of a sub-service disconnect. The sub-service disconnect must have provision for an ENMAX padlock. (Figure 3B)

### 2.02.10 3 Phase / 3 Wire / Delta Customer Loads

For all services feeding a delta load configuration, the incoming service must still be metered as a 3 Phase 4 Wire Wye service. Therefore, a non-current carrying neutral conductor must be pulled into main disconnect from an Enmax Transformer and brought to the CT cabinet for metering purposes, and terminated by means of an Isolated Neutral Bar. This neutral conductor must be a minimum size of #6 AWG and must be identified (white).

**Table 3**

CURRENT TRANSFORMERS (CT's) AND ENCLOSURES							
Service			Service Size in Amps	Current Transformer Enclosure			No. of CT's Required
				Size cm (in)			
Voltage	Phase	Wire		H	W	D	
120/240	1	3	200-400	61 (24)	61 (24)	25 (10)	1 3-wire
120/240	1	3	401-600	76 (30)	76 (30)	25 (10)	1 3-wire
120/208 Y	3	4	200-600	76 (30)	76 (30)	25 (10)	3 2-wire
120/208 Y	3	4	601-1200	91 (36)	91 (36)	30 (12)	3 2-wire
120/208 Y	3	4	1201-1500	122 (48)	122 (48)	30 (12)	3 2-wire
277/480 Y	3	4	200-1200	91 (36)	91 (36)	30 (12)	3 2-wire
277/480 Y	3	4	1201-3000	122 (48)	122 (48)	30 (12)	3 2-wire
347/600 Y	3	4	200-1200	91 (36)	91 (36)	30 (12)	3 2-wire
347/600 Y	3	4	1201-3000	122 (48)	122 (48)	30 (12)	3 2-wire

**Note:** All dimensions are minimums.

### 2.02.11 Current Transformer Enclosures

Current transformer enclosures shall:

- Be located indoors in a clean, readily accessible area that is satisfactory to Enmax.
- Be located in the same room as the meter enclosure.
- Be located within a maximum of 7 m (23') conduit run from the meter enclosure.
- Be mounted so the bottom of the enclosure is **no less** than 7.6 cm (3") above the finished grade.
- Be mounted so the bottom of the enclosure is **no more** than 1.5 meters (60") above the finished grade.
- Conform to all other Enmax Revenue Metering Guide requirements.

The current transformer enclosure shall be equipped with vertically hinged doors, which are non-removable in the closed position. These doors shall be equipped with a latch and have provisions for securing the door with an Enmax padlock. Cover plates are not acceptable on current transformer enclosures.

### 2.02.12 Latches and Locking Mechanisms

Provisions for securing the padlock shall be metal. Plastic latches or locking mechanisms are not acceptable.

### 2.02.13 Conduit Requirements

A metal conduit, of 31.75 mm (1 1/4") minimum diameter and a maximum length of 7 m (23') , is required between the current transformer enclosure and meter enclosure. This conduit shall be terminated with lock nuts and bushings except where threaded hubs are supplied.

The conduit is for the exclusive use of Enmax. When it is necessary to route revenue metering secondary wires through compartments other than those reserved for Enmax use, a metal conduit shall be installed through each compartment for the exclusive use of Enmax. The run should be continuous and uninterrupted.

The number of bends shall be kept to a minimum, but in no case shall there be more than three 90 degree bends (or the equivalent of three 90 degree bends).

The metering conduit run within the switchgear and between the switchgear and the meter cabinet **shall not have fittings with removable covers**. If 'LB's or similar conduit fittings must be used, they must be sealable and clearly visible. Permission must be granted by Enmax Revenue Metering for the use of LB's or similar fittings.

### 2.02.14 Splitter Trough Applications

A lockable, suitably rated splitter trough for the application, located immediately after, and on the load side of the main disconnect for the building shall be provided. Each service coming out of the splitter trough must go directly into a lockable disconnect before proceeding to the individual socket type meter base. **(Figure 1)**

## **3.00 Residential Services**

### **3.01 Single Phase Residential Services - Single Meter Installations**

These services are generally single-phase 120/240 volt (**Figure 5**) or network 120/208 volt (Figure 6), 200 amp or less, self-contained services supplying residential houses in urban and rural areas.

#### **3.01.01 Installation**

Such meter installation shall be:

- On the outside wall of the house.
- Connected on the line side of service disconnect.
- Mounted with the centerline of the meter at a height of 1.5 meters to 1.8 meters above the finished grade.

If the finished grade is to be completed at a future date, the customer must supply a platform to meet the height requirements. A minimum height of 1.5 meters above finished grade must be maintained when a permanent structure such as a deck is built in the clear access area of the meter.

A meter whose height above any finished grade becomes greater or less than the specified limits, or meter that is otherwise rendered inaccessible due to alterations to the building or finished grade level, must be moved and be brought into the limits specified above within 30 days after receipt of notification to move said meter.

#### **The customer shall:**

- Supply and install a CSA approved low voltage, socket type meter base.
- Supply and install conduit, wire and all service entrance equipment.

#### **Enmax Shall:**

- Supply and install the meter.

### **3.02 Single Phase Residential Instrument Transformer Metering**

These services are required where the load will exceed 200 amps.

#### **3.02.01 Installation**

Such meter installations shall have:

- The meter mounted on the outside of the house.
- The meter mounted with the centerline of the meter at a height of 1.5 to 1.8 m above the finished grade.

- Instrument transformer mounted indoors, within an enclosure specified in **Table 3. (Figure 2)**
- The instrument enclosure and meter shall be connected by a 25.4 mm (1”) conduit.
- The meter connected on the load side of service disconnect.

**The customer shall:**

- Supply and install a 4-jaw meter socket as listed in **Table 2.**
- Supply and install an instrument transformer enclosure as listed in **Table 3.**

**Enmax shall:**

- Supply the required current transformer.
- Supply and install the secondary wiring.
- Supply and install the meter.

**3.03 Single phase / Network/ Multiple Residential Services/ Multiple Meter Installations (Duplexes/Townhouses)**

These services are generally single-phase 120/240 (Figure 5)volt or 120/208 volt (Figure 6) self-contained services supplying a building that has several meters supplied from a single service entrance.

**3.03.01 Installation**

Such meter installation shall be:

- Grouped together in an approved area.
- Identified by address or unit number with a permanent legible label on all meter sockets and disconnects.
- If mounted outside, mounted with the centerline of the meter at a height of 1.5 meters to 1.8 meters above finished grade (the preferred height is 1.5 meters).
- If mounted inside, mounted at a height of 1.5 meters to 1.8 meters above finished grade.
- The main service disconnect, splitter box, and sub-service disconnects must have provision for Enmax padlocks.
- The number of consumer’s services of the same voltage and characteristic, terminating at any one supply service, run to, on, or in any building, shall not exceed six.
- Connected on the load side of the sub service disconnect.

**The customer shall:**

- Supply and install the meter sockets.
- Supply and install all the service entrance equipment.
- For a 120/208 service a neutral conductor must be pulled into and terminated at the 9 o’clock terminal of the meter socket (**Figure 6**).

**Enmax shall:**

- Supply the meters.
- Perform connectivity test.
- Install the meters in the sockets.

**3.04 Single phase /Network/ Multiple Residential Services/ Multiple Meter Installations (Apartments)**

These services are generally single-phase 120/240 volt or 120/208 volt self-contained services supplying a building that has several meters supplied from a single service entrance.

**3.04.01 Installation (Figure 1)**

Such meter installation shall be:

- Located indoors.
- Grouped together in an approved area.
- Connected on the load side of the sub service disconnect.
- Identified by address or unit number with a permanent legible label on all meter sockets and disconnects.
- Mounted with the centerline of the meter at a height of 1.5 m to 1.8 m above the floor level.

The main service disconnect, splitter box, and sub-service disconnects must have provision for Enmax padlocks.

**The customer shall:**

- Supply and install the meter sockets.
- Supply and install all the service entrance equipment.
- Identified by address or unit number with a permanent legible label on all meter sockets and disconnects.
- For a 120/208 service a neutral conductor must be pulled into and terminated at the 9 o'clock terminal of the meter socket (**Figure 6**).

**Enmax shall:**

- Supply the meters.
- Perform connectivity test.
- Install the meters in the sockets.

## **4.00 Farm services**

### **Single phase farm services/ Self-contained Metering**

These services are single-phase 120/240-volt (**Figure 5**) services supplying farm operations, where the main breaker does not exceed a rating of 200 amps. The centerline of the meter shall be mounted at a height of 1.65m above finished grade. The meter shall be mounted on a customer owned pole.

#### **The customer shall:**

- Supply and install an approved meter socket.
- Supply and install all the service entrance equipment.

#### **Enmax shall:**

- Supply the meter.
- Install the meter.

## **5.00 Commercial Services**

### **5.01 General**

For commercial services in which the service entrance / metering is not located on the main floor, an approved stairway, elevator, and/or escalator must be installed to facilitate the transfer of equipment to and from the electrical room. Ladders do not provide appropriate access and are therefore not acceptable.

### **5.02 Single-phase Commercial Services/ Self-contained Metering (Single Meter)**

These are commercial services where the service disconnect rating does not exceed 200 amps and metering shall be on the load side of the disconnect.

The meter shall be mounted:

- On the outside wall of the building.
- At a height of 1.5 meters to 1.8 meters above finished grade.

The main service disconnect, splitter box, and sub-service disconnects must have provision for Enmax padlocks.

#### **The customer shall:**

- Supply and install an approved meter socket.
- Supply and install all the service entrance equipment.

#### **Enmax shall:**

- Supply the meter.

- Install the meter.

### **5.03 Single-phase/ Network/ Commercial Services/ Self-contained Metering (Multiple meter)**

These are commercial services where the service disconnect rating does not exceed 200 amps and shall be metered on the load side of the service disconnect.

The meters shall be mounted:

- Grouped together in an approved area.
- Identified by address or unit number with a permanent legible label on all meter sockets and disconnects.
- Mounted with the centerline of the meter at a height of 1.5 m to 1.8 m above the finished grade.

The main service disconnect, splitter box, and sub-service disconnects must have provision for Enmax padlocks.

**The customer shall:**

- Supply and install approved meter sockets.
- Supply and install all the service entrance equipment.
- Identified by address or unit number with a permanent legible label on all meter sockets and disconnects.
- For a 120/208 service a neutral conductor must be pulled into and terminated at the 9 o'clock terminal of the meter socket (**Figure 6**).

**Enmax shall:**

- Supply the meter.
- Perform connectivity test.
- Install the meter.

### **5.04 Single-phase/ Commercial Services/ Instrument Transformer Metering**

These are commercial services where the service disconnect exceeds a rating of 200 amps. The meter shall be mounted in an approved area. The instrument transformer enclosure shall be located indoors. Meter shall be mounted on the load side of the disconnect.

The main service disconnect, splitter box, and sub-service disconnects must have provision for Enmax padlocks.

**The customer shall:**

- Supply and install a four-jaw meter socket as specified in **Table 2**.
- Supply and install an instrument transformer enclosure as specified in **Table 3**.
- Supply and install all the service entrance equipment.

- Identified by address or unit number with a permanent legible label on all meter sockets and disconnects.
- Mounted with the centerline of the meter at a height of 1.5 m to 1.8 m above the finished grade.

**Enmax shall:**

- Supply and install secondary wiring.
- Supply the meter.
- Install the meter.

**5.05 Three-phase/ Commercial Services/ Self-contained Metering**

These are commercial services where the service disconnect rating does not exceed 200 amps. Meter shall be on the load side of service disconnect and mounted at a height of 1.5 m - 1.8 m above the finished grade.

The main service disconnect, splitter box, and sub-service disconnects must have provision for Enmax padlocks.

**The customer shall:**

- Supply and install an approved meter socket.
- Supply and install all service entrance equipment.
- Identified by address or unit number with a permanent legible label on all meter sockets and disconnects.
- Mounted with the centerline of the meter at a height of 1.5 m to 1.8 m above the finished grade.
- A neutral conductor must be pulled into and terminated at the 3<sup>rd</sup> bottom jaw of the meter socket (Figure 7).meter socket.

**Enmax shall:**

- Supply the meter.
- Install the meter.

**5.06 Three-phase/ Commercial Services/ Instrument Transformer Metering**

These are services where the service disconnect rating exceeds 200 amps. Metering shall be on the load side of the customer's breaker. Meters and instrument transformer enclosure shall be located in the same room inside the building. **(Figure 3A & 3B)**

The main service disconnect, splitter box, and sub-service disconnects must have provision for Enmax padlocks.

**The customer shall:**

- Supply and install a 13-jaw meter socket as specified in **Table 2**.

- Supply and install an instrument transformer enclosure as specified in **Table 3**.
- Be responsible to make the primary connections to the instrument transformers.
- Identified by address or unit number with a permanent legible label on all meter sockets and disconnects.
- Mounted with the centerline of the meter at a height of 1.5 m to 1.8 m above the finished grade.

**Note: Where the customer's installed capacity is above 200KVA, refer to section 7.02 for additional requirements.**

**Enmax shall:**

- Install the secondary wiring.
- Make all the secondary connections.
- Supply the meter.
- Install the meter.

**5.06.01 Resistive Grounded Services**

The customer must obtain approval from ENMAX before installing a resistive grounded system. ENMAX must be contacted for service requirements.

## **6.00 Commercial or Industrial Primary Metered Service**

### **6.01 Service Application and Acceptance**

For Primary Metered Services a kick-off meeting must be arranged prior to project initiation. High voltage main service switchgear shop drawings and a single line diagram with metering point clearly marked must be submitted for acceptance as soon as completed in order that Enmax Revenue Metering Section can order any necessary equipment to complete metering arrangements without delay.

Manufacturing of equipment should not start until all final drawings have been reviewed and accepted by ENMAX. This will avoid costly alterations to completed equipment.

### **6.02 Primary Switchgear Specifications (Figure 8)**

- A separate metering transformer cell for each service must be provided. The size of the metering transformer cell must meet CSA standards. The metering transformer cell must have a hinged door, be padlockable, and is reserved for utility use only.
- The metering transformer cell door must not be electrically or mechanically interlocked with any other cells.
- A protection / isolation cell (ie. Fused disconnect / breaker) must be provided upstream of the metering transformer cell and an isolation means (ie. Visible isolation switch or

breaker) must be provided immediately downstream of the metering transformer cell, and ahead of any customer equipment.

- High voltage main service switchgear incorporating metering equipment must be constructed so that all instrument transformers required for the metering are readily accessible.
- Barriers are required between all sections of the equipment, including metered and unmetered conductors and between sections reserved for the customer and Enmax.
- There shall be no customer energy consuming equipment (eg. Space heater) connected before the metering transformers.
- Enmax Revenue Metering will supply eight ground ball studs to be installed by the customer. There will be two ground balls per phase, one ground ball is located on the bus at the entrance to the metering transformer cell and the other is on the same bus exiting the cell. The Current and Potential Transformer for each phase are to be installed between these two ground balls.
- Two ground ball studs shall be mounted on the ground bus. The ground ball studs shall be arranged in a way that all grounding connections are accessible and can be safely installed from the metering transformer cell entrance.
- The ground bus shall be located as close as possible to the metering transformer cell door opening and near the bottom of the cell.
- Working space of 3 m (10') clearance is required in front of the metering transformer cell in order for Enmax Metering personnel to safely install the grounds.

### **6.03 Supply of Primary Metering Equipment**

The customer is required to supply:

- A meter enclosure according to specifications shown in **Table 2**.
- A section of high voltage main service switchgear for installation of instrument transformers that is acceptable to ENMAX. (See 6.02)
- A conduit between the instrument transformer compartment and the meter enclosure.(See 6.08)
- All hardware, buswork, termination and/or cable required for primary connections to the Current and Potential Transformers.
- A plywood sheet behind the meter enclosure. (See 6.06)
- Meter communication requirements. (See 6.09)
- For more details and specifications please call the Enmax Revenue Metering at 403-514-3744.

In addition, at sites with Preferred/Alternate feeders the customer is required to supply:  
**(Figure 11)**

- A 61 x 61 x 25 cm (24"x 24"x 10") auxiliary cabinet. This cabinet shall be equipped with a vertically hinged lockable door and be made of a minimum 14-gauge metal. Located adjacent to and between the meter enclosures.
- A conduit run from this cabinet to the outside of the building. This 19mm (3/4") EMT conduit shall terminate at a 6" x 6"x 4" (minimum size) weatherproof, padlockable box for the external antenna. The box shall be mounted on the outside wall at a height between 1.5 m and 1.8 m above finished grade.

- A 25.4 mm (1”) conduit run from this cabinet to both meter enclosures.
- A duplex receptacle (120V, 15A) supplied by a dedicated circuit to be mounted in the panel.
- For more details and specifications please call the Enmax Revenue Metering at 403-514-3744.

Enmax will supply:

- Revenue meters.
- Instrument transformers (current and potential).
- Secondary wiring.

The instrument transformers are available to the customer for installation at Enmax Revenue Metering located in its South Services Center.

#### **6.04 Mounting of Primary Metering Equipment**

The customer is required to mount:

- A meter enclosure.
- All instrument transformers in the instrument transformer compartment. (**Figure 8**)
- A conduit between instrument transformer and meter enclosure.
- A conduit between the meter and the antenna box mounted on the building external wall, if it is a **single meter installation (Figure 9)**
- If it is a **preferred/alternate site**, an auxiliary cabinet with conduit running to both meters and a conduit run to the antenna box mounted on the building external wall. (**Figure 11**)
- The ground balls on each phase and the ground bus as described in Section 6.02. (**Figure 8**)

The customer shall assume the cost of installing the above metering equipment. (For information regarding pulse outputs, see section 8.00 Use of Metering Signals for Customer Load Management System)

The instrument transformers, both current and potential, are to be mounted in the following manner:

- Securely mounted in the instrument transformer compartment. All mounting holes on the instrument transformers must be utilized.
- The Instrument transformer nameplates are clearly visible when the compartment door is open.
- Current transformers shall be positioned with the primary polarity mark toward the source of supply, between two ground ball studs, and in an arrangement that will not obstruct access to the secondary terminals.
- Potential transformers shall be connected to the buswork on the line side of the Current transformers, between two ground ball studs, and shall be of a non-draw out style.

## 6.05 Connection of Instrument Transformers

The customer is responsible to make all the connections to the instrument transformer primaries. These connections should be properly secured and conductors shall be shaped or formed and supported so that no tension is applied to the current transformers.

Enmax Revenue Metering will make all the connections to current and potential transformer secondary, testing switch, and the meters.

## 6.06 Meter Enclosure Requirements

A separate meter enclosure is required for each instrument transformer service. This enclosure is a manufacturer pre-wired meter enclosure including a 13-jaw meter socket, a test switch and wiring from the test switch to the socket. Meter enclosure specifications are shown in **Table 2**.

**Location** - Meter enclosures should be located:

- In a clean readily accessible area that is satisfactory to Enmax.
- In the high voltage room within a maximum of 7 m (23') of conduit from the instrument transformer compartment. (**Figure 9**)
- To conform to all other requirements.
- In such an area as to maintain a 1 m clear zone around the Meter enclosure to facilitate the mounting of any other auxiliary panels that might be required for auxiliary metering equipment or load management equipment.

If the arrangement specified above is impractical, the following less desirable alternatives may be considered:

- In an electrical room adjacent to the high voltage room within a maximum of 7 m (23') of conduit from instrument transformer compartment; or
- In the high voltage room and located on a wall adjacent (within 3 m or 10') to the entrance door.

**Mounting** - Meter enclosures shall be mounted:

- With the center line of the enclosure 1.5 meter to 1.8 meters above the floor.
- Level on both the horizontal and vertical planes.
- Mounted on 19 mm (3/4") sheet of plywood.
- Free of severe or continual vibration.

**Grounding** - Each meter enclosure must be grounded to the system ground.

## 6.07 Outdoor Primary Metering Requirements

A separate non-interlocked compartment of high voltage main service switchgear is required for each instrument transformer service. The size of such switchgear shall meet CSA standards. The switchgear requires hinged doors over all live electrical equipment. The door of the instrument

transformer compartment shall be equipped with a latch and have provisions for securing the door with Enmax padlock.

For outdoor high voltage main service switchgear installation, the instrument transformer compartment and meter enclosure must be weather proof. **(Figure 10)**

The Meter enclosure shall not be mounted on any part of the outdoor switchgear.

## **6.08 Conduit Requirements**

A metal conduit, of 31.75 mm (1 ¼") minimum diameter and a maximum length of 7 m (23'), is required between the instrument transformer enclosure and meter enclosure. This conduit shall be terminated with lock nuts and bushings except where threaded hubs are supplied. The conduit must be a continuous run.

The metering conduit run within the primary switchgear and between the primary switchgear and the meter enclosure shall not have fittings with removable covers. The conduit is for the exclusive use of Enmax. When it is necessary to route revenue metering secondary wires through compartments other than those reserved for Enmax use, a metal conduit or suitable metal raceway shall be installed through each compartment for the exclusive use of Enmax.

## **6.09 Meter Communication Requirements (Figure 9 & 11)**

To allow for remote meter communication, a conduit shall be installed from the meter enclosure to the outside of the building. This 19mm (3/4") EMT conduit shall terminate at a 6"x 6"x 4" (minimum size), weatherproof, padlockable box. The box shall be mounted on the outside wall at a height between 1.5 m and 1.8 m above finished grade.

**This box shall be in a location approved by Enmax.**

## **7.00 Interval Metering Requirements**

### **7.01 Existing Site**

Where a customer's peak load is above 150 KVA twice in the previous 365 days, or upon a customer's request, an interval meter that is capable of remote interrogation will be installed. At an existing site, where modifications are made to the infrastructure requiring a Demand greater than 150 kVA, an interval meter will be installed.

Enmax will cover the cost of interval metering equipment if the customer's peak load is above 150 KVA twice in the previous 365 days . Otherwise, the customer shall assume the cost of interval metering upgrade, communication line and raceway installation. Please call Enmax Revenue Metering Section for details.

The customer is not required to make telephone line terminations.

## 7.02 New Site

An interval meter will be installed at all new sites with a planned installed capacity of 200 kVA or greater. See Table 4 below for details. To allow for automatic meter reading, a conduit shall be installed from the meter enclosure to outside the building. The 19 mm (3/4") EMT conduit shall terminate at a 6" x 6" x 4", weatherproof, lockable, hinged box. The box shall be mounted on the outside wall at a height between 1.5 m and 1.8 m above finished grade.

**Table 4**

<b>Interval Meter Table</b>			
<b>Service Volts</b>		<b>Service Disconnect Size</b>	
120/208	Volts	800	Amps
277/480	Volts	400	Amps
347/600	Volts	300	Amps

## 8.00 Use of Metering Signals for Customer Load Management System

Enmax may provide metering signals to customers, commonly within the commercial and industrial rate classes, for their load management system upon receipt of a written request. In those circumstances where the metering signal is not an integral part of the customer's existing metering installation, Enmax Revenue Metering Section may make necessary installation change and/or upgrade to provide metering signals to the customer. The customer may be required to provide a 120-volt AC power supply with a duplex receptacle. *(Note-If the customer requires pulse outputs and there is no auxiliary panel he shall provide the panel complete with a dedicated duplex receptacle.)*

Any required auxiliary metering equipment necessary shall be electrically isolated from Enmax revenue metering facilities. Enmax Revenue Metering Section will maintain its metering installation during normal working hours. However, it accepts no liability for the operation of customer's auxiliary metering equipment and continuity of such signals.

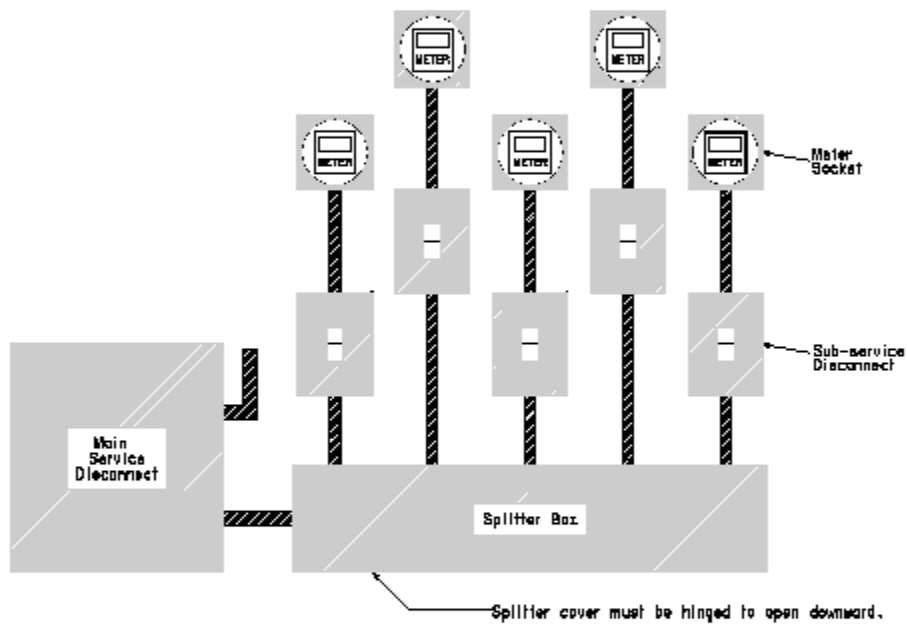
Enmax will not supply a time interval pulse under any circumstances.

The standard metering signals that may be available from Enmax metering installations are watt-hour (Wh), and volt-amperes reactive hour (VARh).

The customer shall assume all incremental costs incurred by Enmax in order for the provision of metering signals and maintenance of such equipment, including auxiliary metering equipment.

## APPENDIX

Figure #1 - Multiple Meter Installation



**Note:**

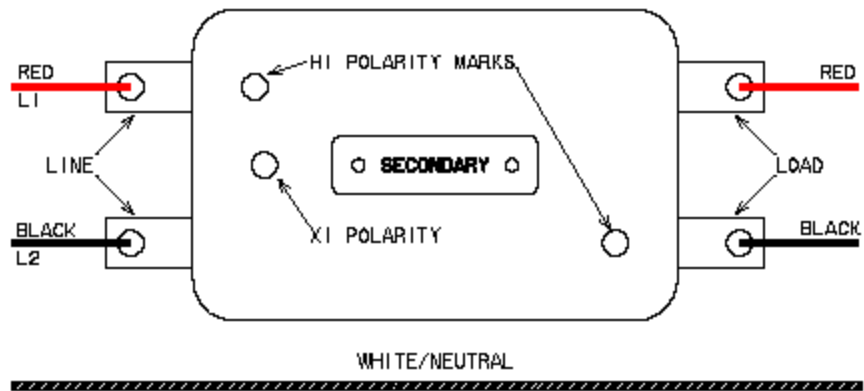
All meter sockets and sub-service disconnects must be identified by an address and/or unit number with a permanent legible label.

Meter sockets must be mounted between 1.5 metres to 1.8 metres from the floor.

Main service disconnect, splitter box and sub-service disconnects must have provision for Enmax padlocks.

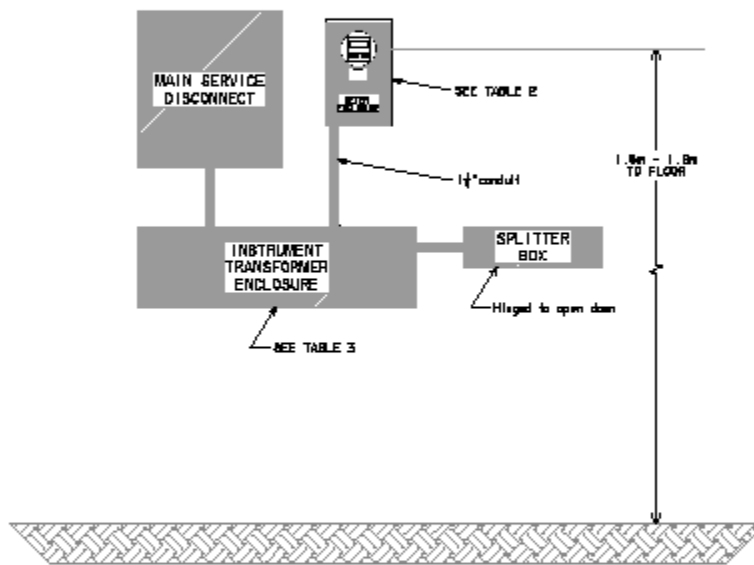
All enclosures to be mounted on  $\frac{3}{4}$ " plywood

Figure #2 - Single phase transformer rated CT connection



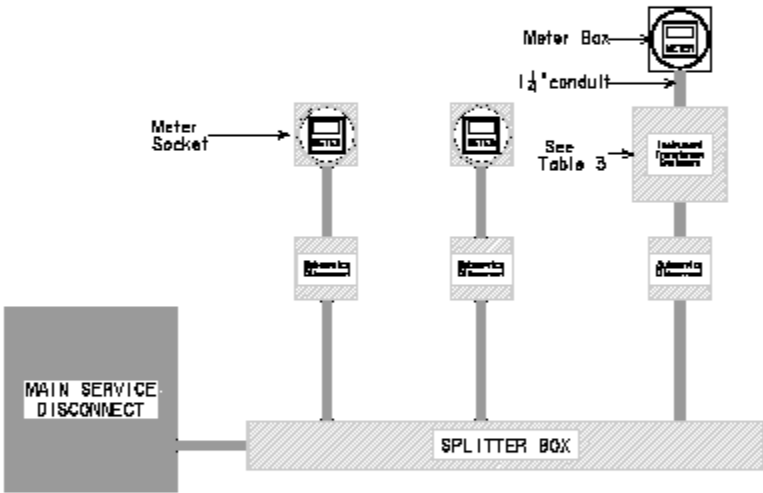
NOTE: Connect the incoming supply to the line side terminals

Figure #3A – Single meter, instrument transformer metering layout – Commercial three phase service



Note: All enclosures to be mounted on  $\frac{3}{4}$ " plywood.

Figure #3B - Multiple meter, with instrument transformer layout - Three phase service



Note: TR subservices must have a Subservice disconnect  
All enclosures to be mounted on 3/4" plywood.

Figure #4 - Three Phase CR Layout

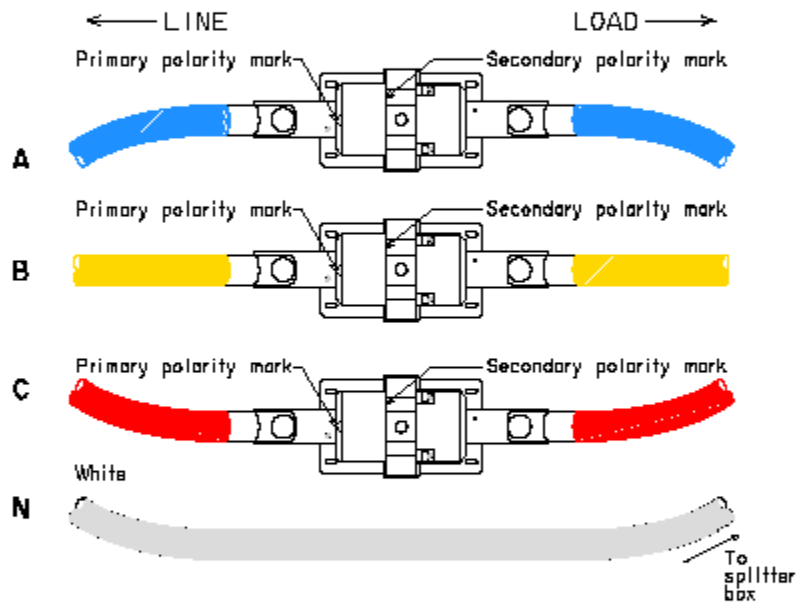
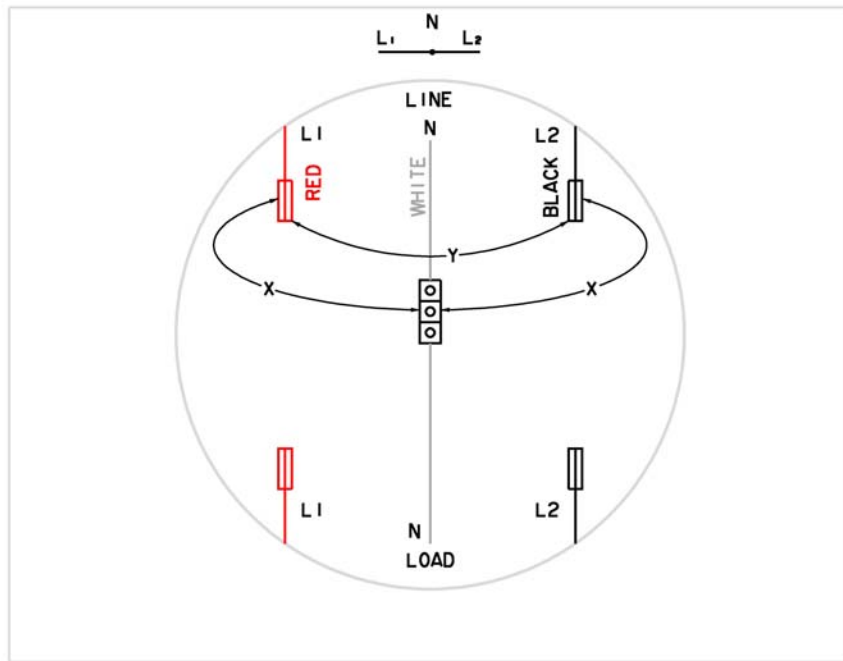
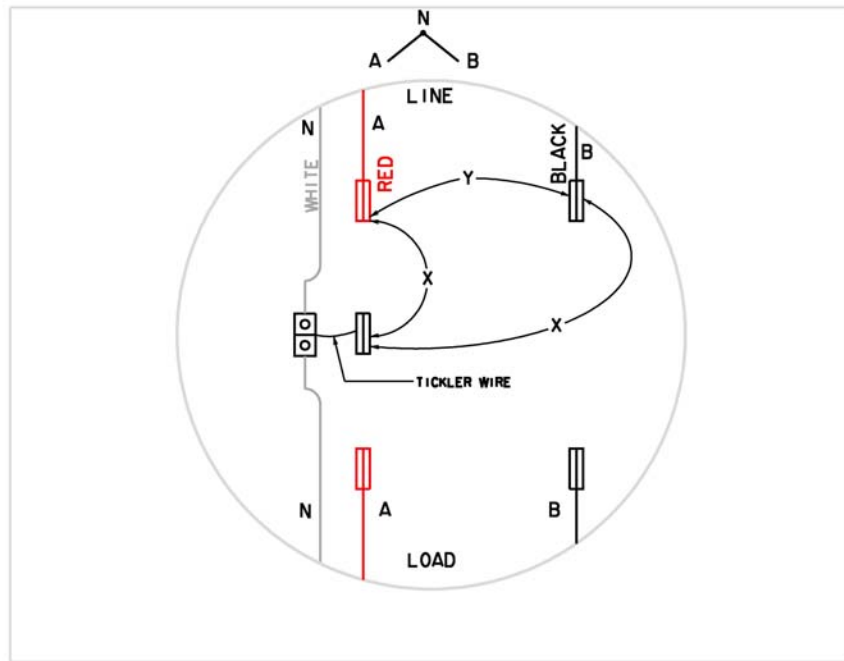


Figure 5 – Single-Phase, Three Wire Circuit, 120/240 Volts



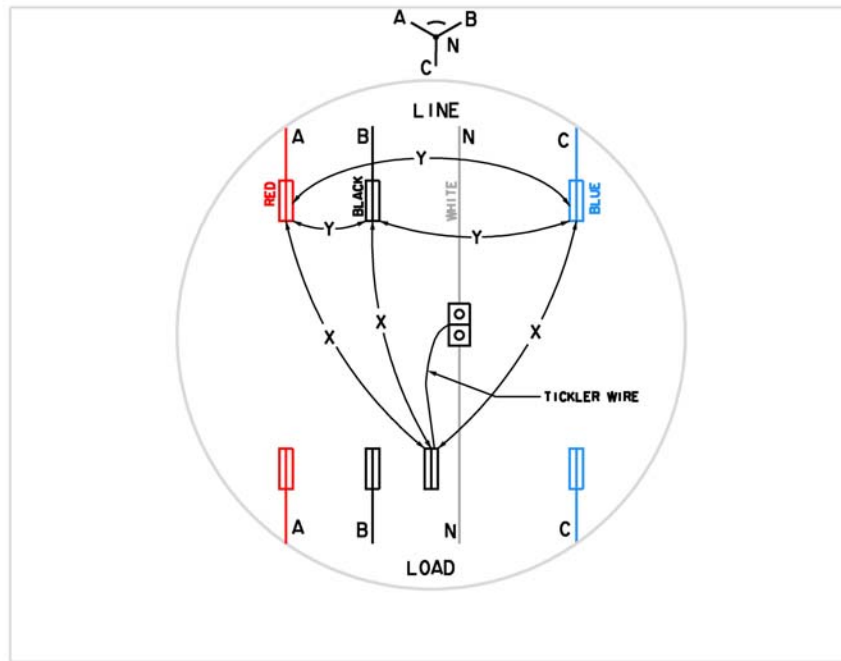
LINE VOLTAGE	MEASURED VOLTAGE	
	x	y
120 / 240	120	240

Figure 6 – Three Wire Circuit, Network Circuit, 120/208 Volts



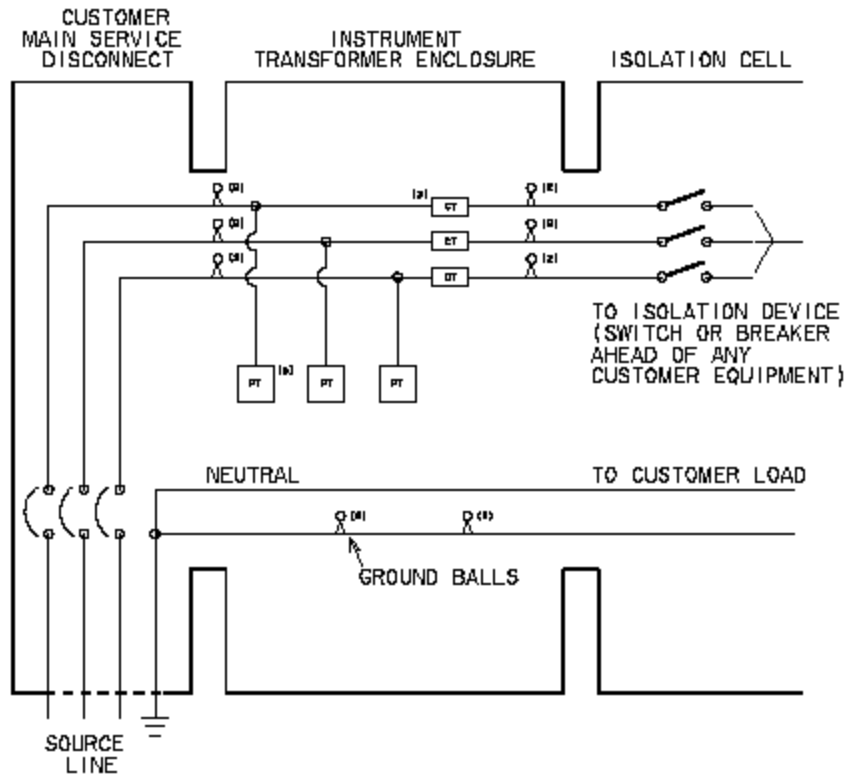
LINE VOLTAGE	MEASURED VOLTAGE	
	x	y
120 / 208	120	208

Figure 7 – Three-Phase, Four Wire Wye Circuit, 120/208, 277/480 or 347/600 Volts



LINE VOLTAGE	MEASURED VOLTAGE	
	x	y
120 / 208	120	208
277 / 480	277	480
347 / 600	347	600

Figure #8 - Primary Metering Wiring Diagram



Note:

- (1) All ground balls are to be accessible from the same cell opening, with the ground bus immediately inside that opening.
- (2) Ground ball locations (x8 supplied by Enmax) installed by customer.
- (3) Instrument Transformers supplied by Enmax, pick up and installed by customer.

Figure #9 - Primary Metering Arrangement (One Meter)

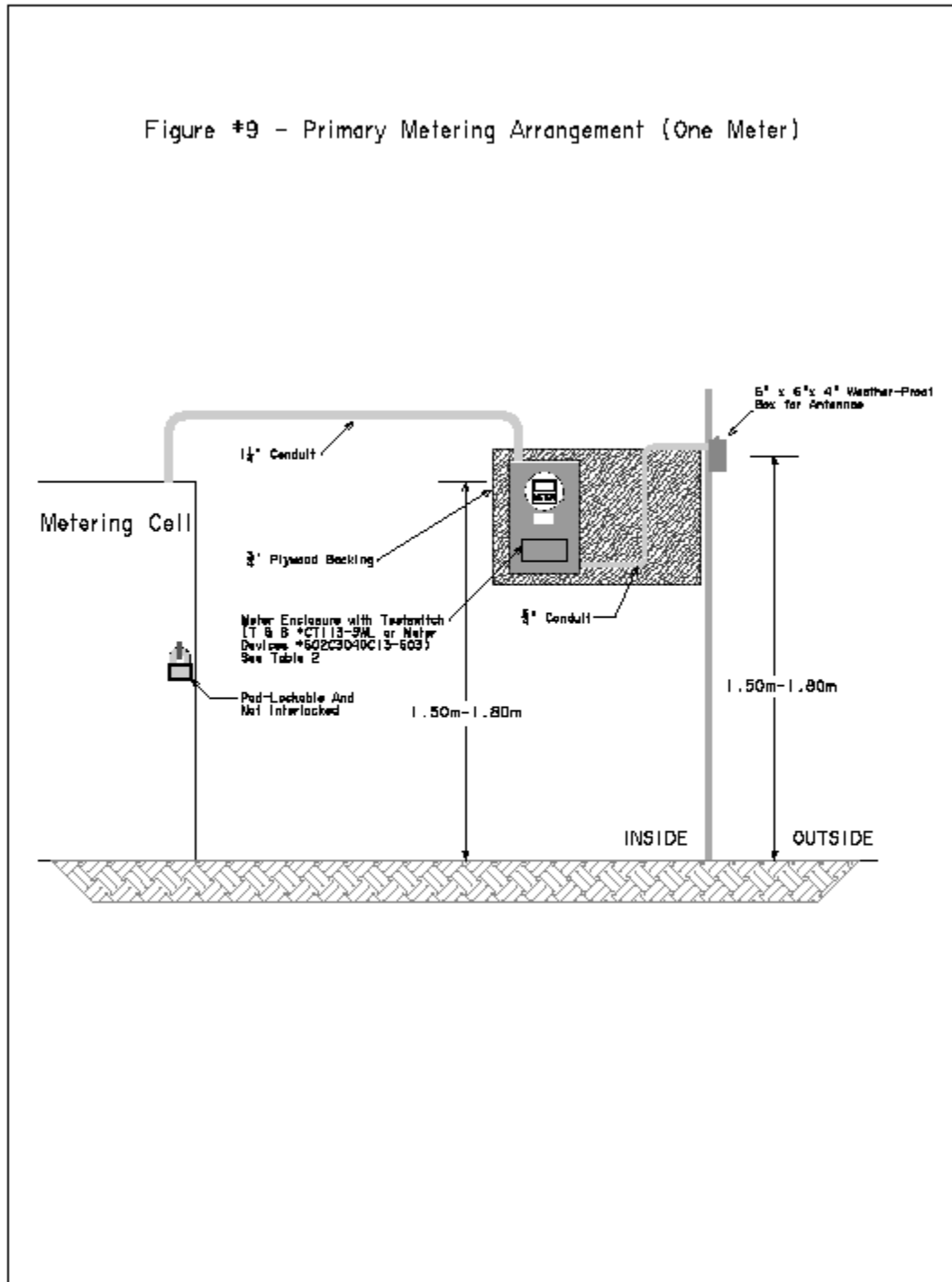


Figure #10 - Outdoor Mounted Metering Enclosure

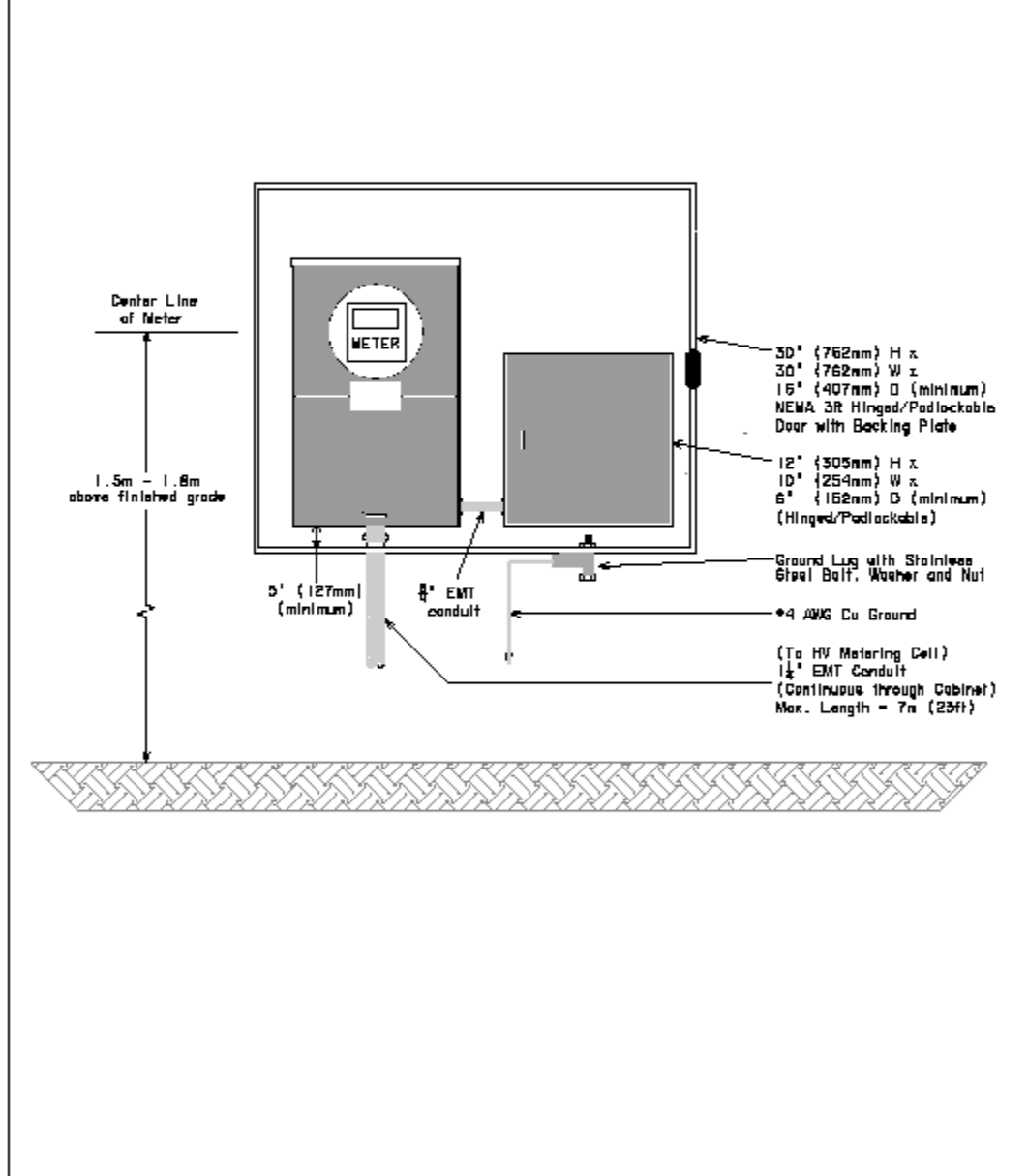


Figure +11 - Preferred and Alternate Meter Assembly Layout

