

Part 2: Physical Requirements

220 Metering

220.10) General

Metering of the incoming service will normally be accomplished by the installation of a loss compensating system on the low voltage side of the customer transformer(s). For certain applications, installation of metering instrument transformers at the service voltage may be advantageous to both We Energies and to the Customer. These instrument transformers are typically connected directly after the main service disconnect switch. The appropriate method and location of metering facilities will be determined by We Energies on an individual basis. This determination will be based on overall installation cost, reliability, and the Customer's future plans for revision and expansion. Please contact the local We Energies Service Center to determine whether high voltage (primary) or low voltage (secondary) side metering will be used.

220.20) Metering at Service Voltages Above 600V

220.20.10) Metering Instrument Transformers

- a) Instrument transformers supplied by We Energies shall be mounted by the Customer. In addition, the Customer shall make all necessary primary connections to such devices. If subsequent replacement of these devices should become necessary because of equipment failure, We Energies will perform the mounting and connection operations. The instrument transformers shall be oriented such that the polarity markers are connected to the line side of the customer bus work, and so that the secondary connection compartments face the front of the switchgear compartment.
- b) Where indicated in the illustrations, the grounding terminals of voltage and current transformers shall be grounded. For voltage transformers, the neutral (N2) conductor shall not serve as a ground. A separate conductor, #1/0 copper minimum, is required.
- c) The metering current and voltage transformers shall be connected on the load side of the Customer's main service disconnect.
- d) The voltage transformers shall be connected on the line side of the metering current transformers.
- e) Outdoor metering installations involving the use of instrument transformers at 24,900, 26,400 or 34,500 Volts require primary voltage transformer fuses. Additionally, current limiting fuses are required for outdoor use of instrument transformers at 26,400 or 34,500 Volts.
- f) When separate primary fuses or current limiting fuses are required for metering voltage transformers, they shall be installed and connected by the Customer. We Energies will

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provide these fuses and their mountings, and will furnish specific guidelines for the proper placement of these fuses.

g) The instrument transformers shall not be used to support the bus bars or as a bus insulator.

h) The Customer shall obtain the required metering instrument transformers from the local We Energies office. Arrangements for the Customer to pickup this equipment shall be made through the local We Energies service center.

i) Exception: If the Customer desires factory installation of metering instrument transformers when such units are to be placed in metal-clad or metal-enclosed switchgear, We Energies will, when instructed to do so, forward them to the manufacturer. Customer instructions for such an arrangement shall be directed to the local We Energies service center as early as possible. This allows We Energies to reserve specific transformers for the job, thereby allowing the manufacturer to design the metering cubicle accordingly. Instructions shall include the following:

- Name of the switchgear manufacturer
- Specific address of plant to which units are to be shipped
- Name and title of the individual to whom the units are to be directed
- Customer's purchase order number (for reference)
- Approximate date by which units will be required at factory

We Energies will exercise every effort to assure prompt and safe delivery of instrument transformers to the manufacturer, but will not assume responsibility for delays caused by loss or damage of such equipment in transit.

220.20.20) Associated Metering Equipment

a) The Customer shall provide and install suitable meter mounting devices as specified below. The meter mounting devices and conduit shall be bonded and grounded in accordance with the Wisconsin or Michigan State Electrical Codes and applicable local ordinances. All conduit shall be galvanized rigid or galvanized intermediate. Meter mounting devices shall be located and mounted in accordance with the We Energies "General Information" section of the *Electric Service and Metering Manual*, and conform to the "General Requirements of Meter Mounting Devices" in Section D (except only the transformer rated meter sockets listed in 220.20.20.c are permitted for primary rate accounts. The sockets in 220.20.20.c have sufficient room to accommodate the cellular telephone connections).

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b) Meter mounting devices shall consist of a Transformer Rated Meter Socket from 220.20.20.c and a waterproof, sealable, enclosure with minimum inside dimensions of 16" x 14" x 6" containing a 3/4" wood mounting board. The connection between the meter socket and the enclosure is to be made with 1/2" galvanized rigid or galvanized intermediate conduit. See 220.20.35

Exception: When the switchgear is equipped with integral meter mounting provisions as described in 220.20.30.d.

c) Acceptable transformer rated meter sockets for customer substations.

Supplier	Socket Catalog Numbers	
	3-Phase, 3-Wire	3-Phase, 4-Wire
Erickson	W-330	W-340-SS
Meter Devices	601U3128A8-302	601U3128A13-303
RJB	MS2033-8	MS2034-13

d) The Customer shall install 1¼" galvanized rigid or galvanized intermediate conduit between the meter socket and the instrument transformer location. The conduit run shall be exposed where practical and may be up to 40 feet in length without approval from We Energies.

e) All required revenue meters, metering conductors or cables, test switches, relays and other equipment not previously mentioned will be furnished and installed by We Energies.

220.20.30) Metering Cubicle Unit for Metal-Clad or Metal-Enclosed Switchgear Applications

a) The Customer shall furnish and install a We Energies approved metering cubicle unit where We Energies metering instrument transformers are to be mounted. This unit shall be specifically designed for metering equipment only, and no devices other than those required for support and connection of metering instrument transformers will be permitted.

b) Switchgear enclosure surfaces shall not be used as physical support for metering equipment or any other items unless specifically designed for that purpose.

c) For cubical-type installations with remote meter enclosures, the required meter conduit shall be terminated inside the cubicle containing instrument transformers with an appropriate conduit bonding bushing. The We Energies preferred location for this conduit is the front third of the metering cubicle compartment in an unobstructed area. Contact the switchgear manufacturer for a more precise location for this conduit.

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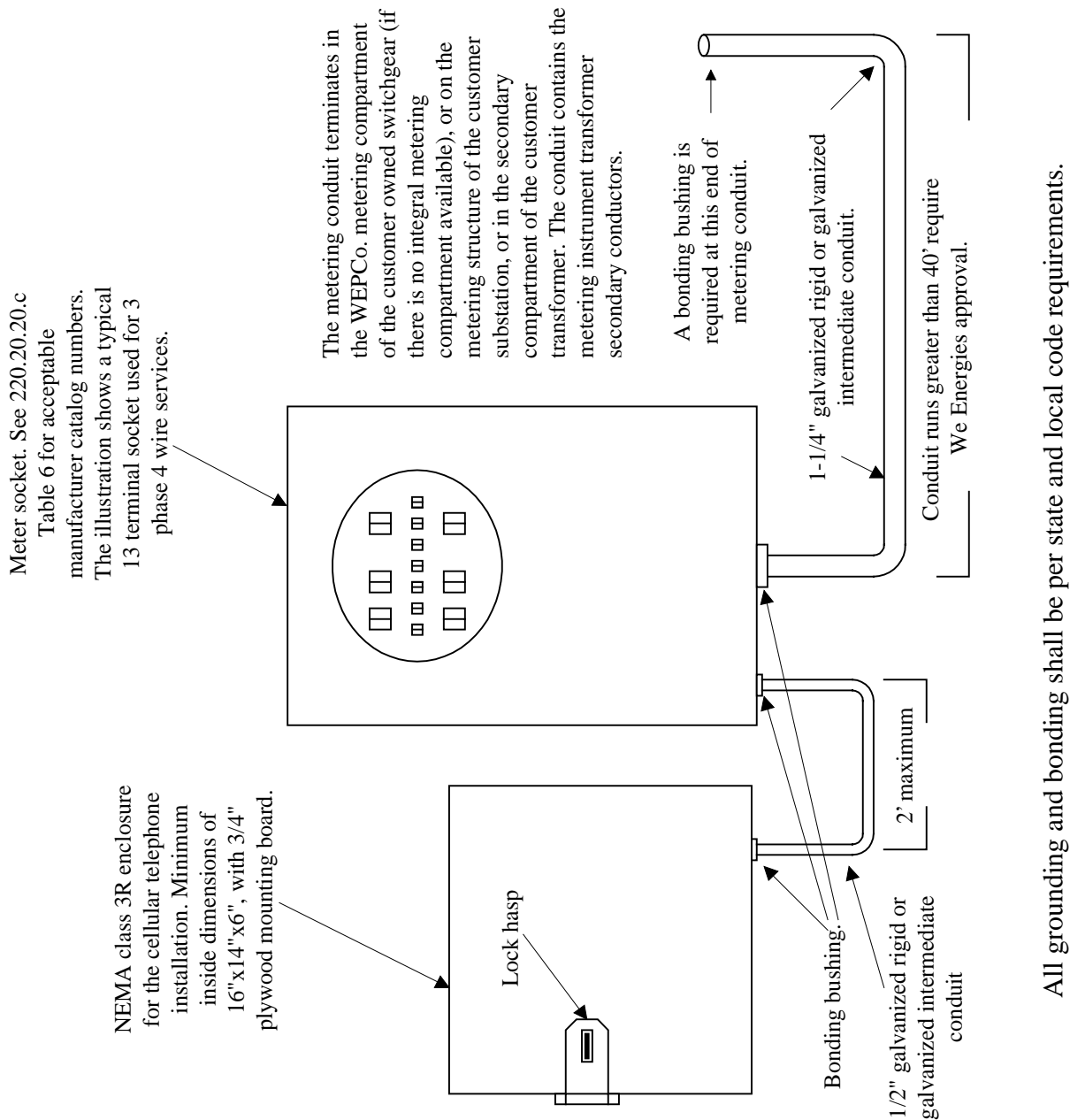
d) The Customer may choose to provide meter mounting space (within the metering cubicle). This compartment shall have minimum dimensions of 44" high x 30" wide x 14" deep. This space shall be completely separated from all high voltage equipment by sheet metal barriers.

e) Where two metering cubicles are provided as part of one switchgear lineup, and space is provided for mounting meters in those cubicles, conduit shall be run between the metering cubicles. This conduit shall be 1/4" galvanized rigid or galvanized intermediate and shall be terminated in each cubicle and appropriately bonded.

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Typical Arrangement of the Transformer Rated Meter Socket and the Cellular Telephone Enclosure



All grounding and bonding shall be per state and local code requirements.

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220.20.40) Metering Instrument Transformer Arrangement for Outdoor, Open-Type Substations 34,500 Volts and Below

- a) Where the substation design utilizes a wood structure, the required 1¼" meter conduit shall be terminated on a vertical column (pole) of the structure on which metering instrument transformers are located. The termination shall be made at a point 8 feet above finished grade. We Energies will provide and install the necessary support and termination materials for extension of the metering cable beyond this point.
- b) Where the substation design utilizes a steel structure, 1" minimum conduit shall interconnect the secondary terminal boxes of all metering instrument transformers. 1¼" minimum size metering conduit shall be used between the meter enclosure and the first conduit body junction point.
- c) See 220.40 for additional requirements.

220.20.50) Street Light Transclosures

Meter enclosures used for housing metering associated with street light transclosures shall have a minimum depth of 10½" to accommodate time of use meters.

220.30) Loss Compensated Metering

220.30.10) At installations where secondary side metering is chosen by We Energies, the revenue meter will be programmed to electronically compensate for the Customer's transformer and line losses. For these applications, the Customer shall be required to provide We Energies with a certified test report of the power transformer to ensure accurate compensation.

220.30.20) Approved meter mounting devices for installations metered at 600 volts or below are identical to the devices specified for metering above 600 volts and are listed in 220.20.20.c. All other requirements for installations metered at 600 volts or below are detailed in the *Electric Service and Metering Manual*.

220.40) Illustrations

220.40.00) The following illustrations show examples of typical metering instrument transformer installations in Customer owned metal enclosed or metal clad substations and in Customer-owned outdoor open-type substations for all We Energies system voltages.

220.40.10) Metering switchgear units for application on 3 phase 4 wire system voltages of 4,160 Volts and below.

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220.40.20) Metering switchgear units for application on 3 phase 3 wire and 3 phase 4 wire system voltages above 4160 Volts up to and including 13,800 Volts.

220.40.30) Metering switchgear units for application on 3 phase 4 wire distribution system voltages above 13,800 Volts, up to and including 24,900 Volts.

220.40.40) Metering switchgear units for application on 3 phase 3 wire and 3 phase 4 wire system voltages above 13,800 Volts up to and including 26,400 Volts.

220.40.50) Metering switchgear units for application on 3 phase 3 wire and 3 phase 4 wire 34.5 kV systems where available.

220.40.60) Outdoor metering structure for 3 phase 4 wire distribution system voltages 15kV and below

220.40.70) Outdoor metering structure for the 24.9kV 3 phase 4 wire distribution system.

220.40.80) Outdoor metering structure for the 26.4kV and 34.5kV 3 phase 3 wire and 3 phase 4 wire systems.

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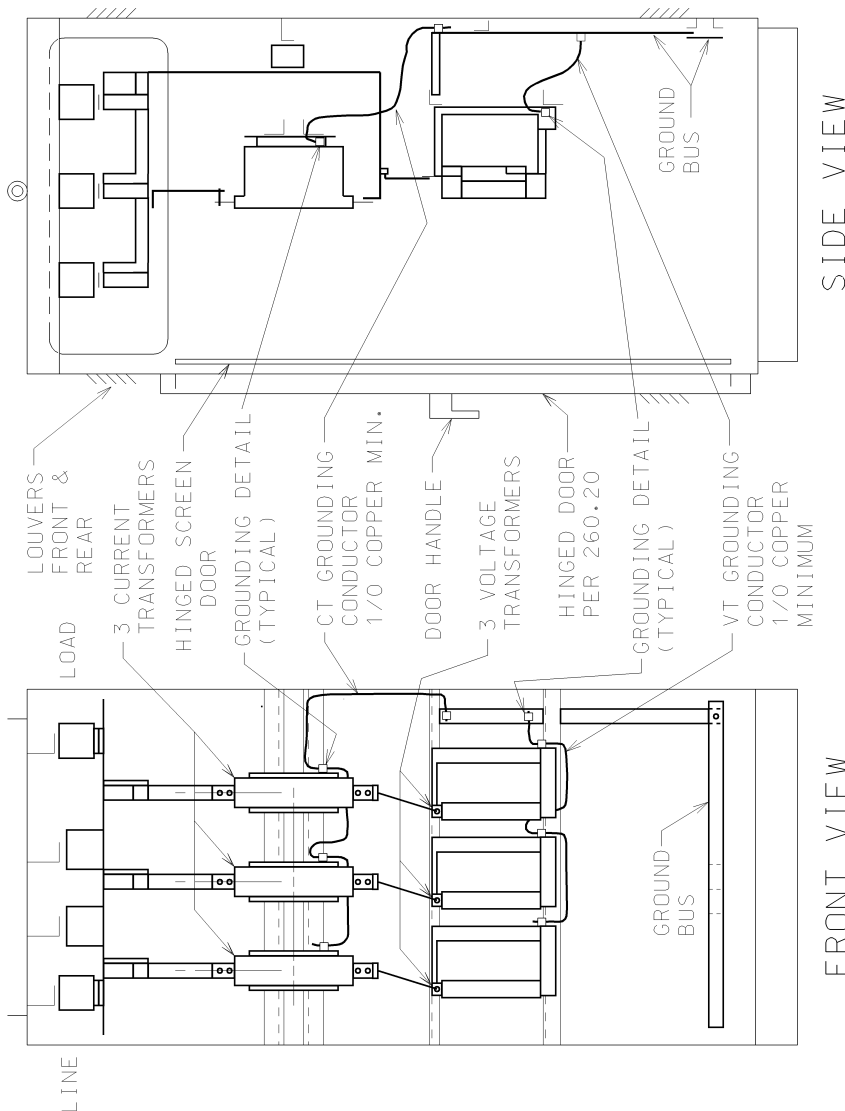
220.40.10

5kV Metering Switchgear Unit

3-Phase 4-Wire Services — Typical Arrangement

Grounding details on the **current** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.

Grounding details on the **voltage** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.



CGS File #38065F1

5kV Metering Switchgear	
Required Minimum Clearances	60kV BIL
Phase to Phase	4.5 Inches
Phase to Ground	3.0 Inches
Phase to Barrier	2.0 Inches

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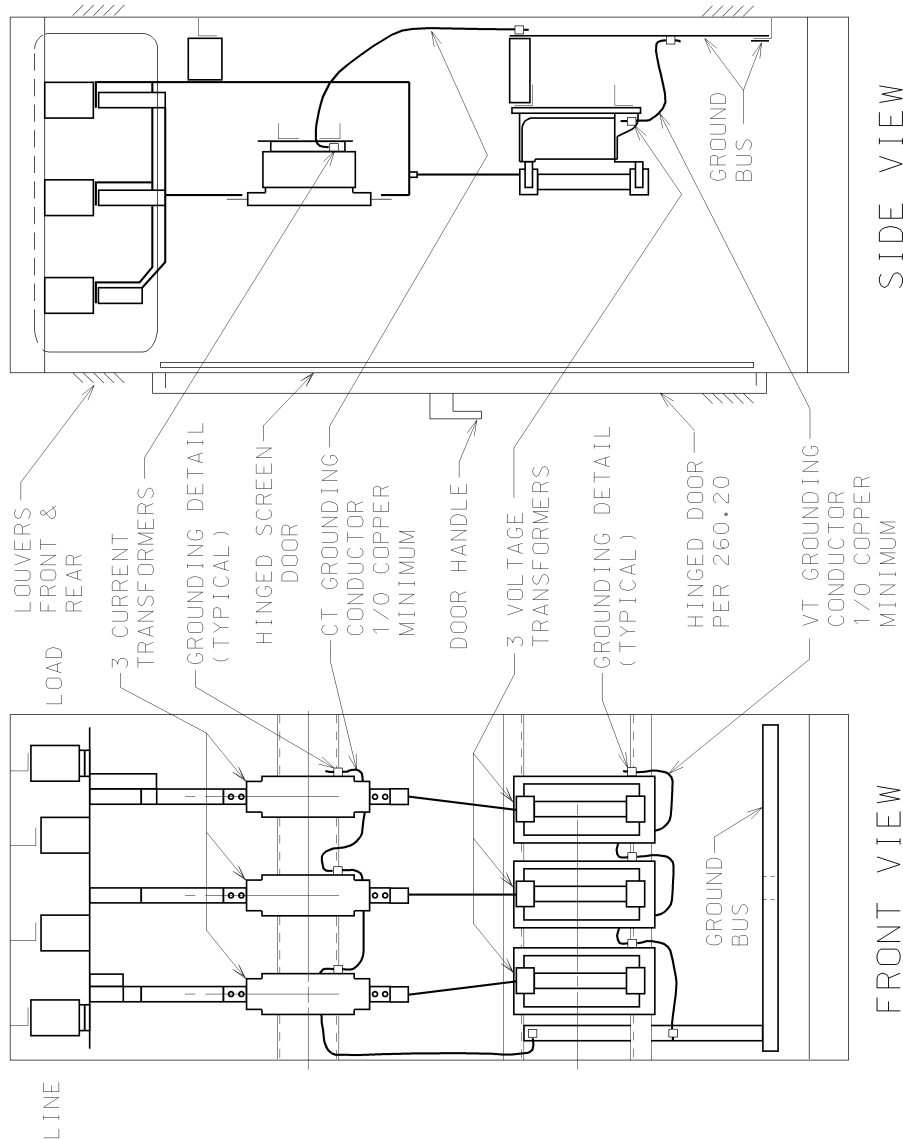
220.40.20

15 kV Metering Switchgear Unit

3-Phase 3-Wire and 3-Phase 4-Wire Services — Typical Arrangement

Grounding details on the **current** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.

Grounding details on the **voltage** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.



CGS File #38065F3

15kV Metering Switchgear		
Required Minimum Clearances	95kV BIL	110kV BIL
Phase to Phase	7.5 Inches	9.0 Inches
Phase to Ground	5.0 Inches	6.5 Inches
Phase to Barrier	2.0 Inches	2.0 Inches

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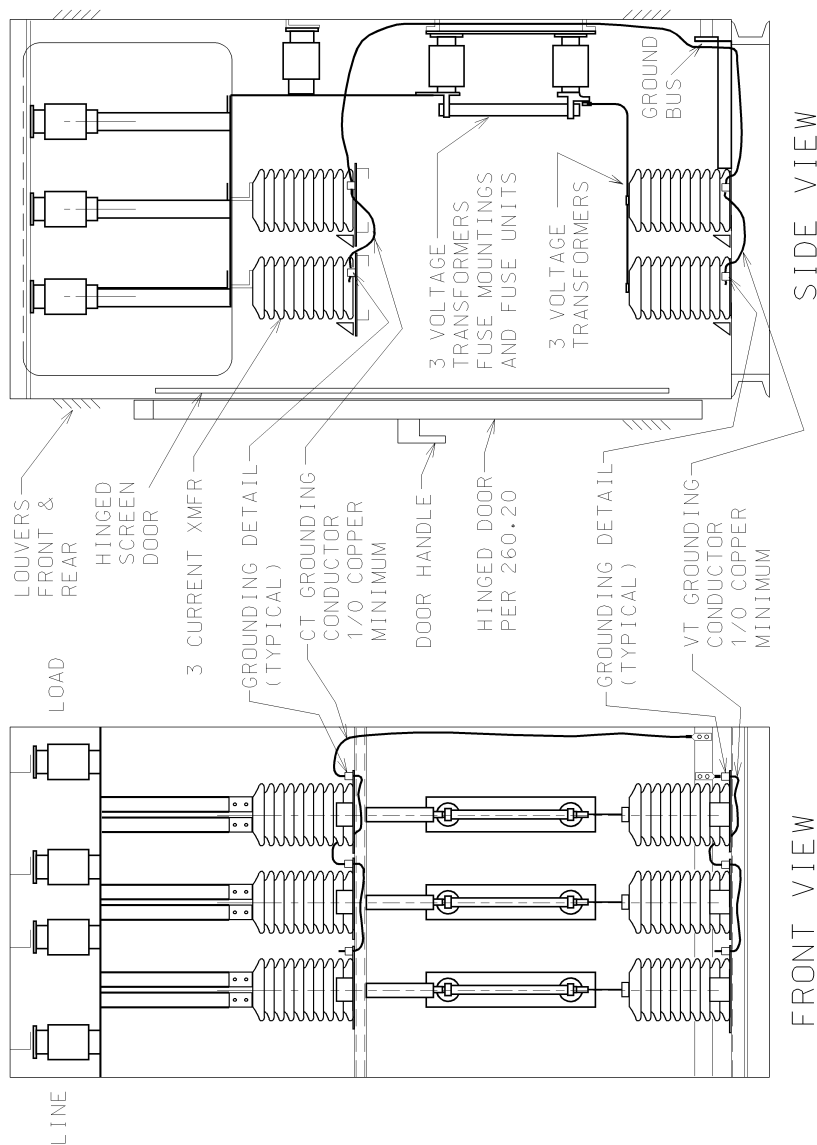
220.40.30

25 kV Metering Switchgear Unit

3-Phase 4-Wire Services — Typical Arrangement

Grounding details on the **current** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.

Grounding details on the **voltage** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.



CGS File #38065F4

24.9kV Metering Switchgear	
Required Minimum Clearances	125kV BIL
Phase to Phase	10.5 Inches
Phase to Ground	7.5 Inches
Phase to Barrier	2.5 Inches

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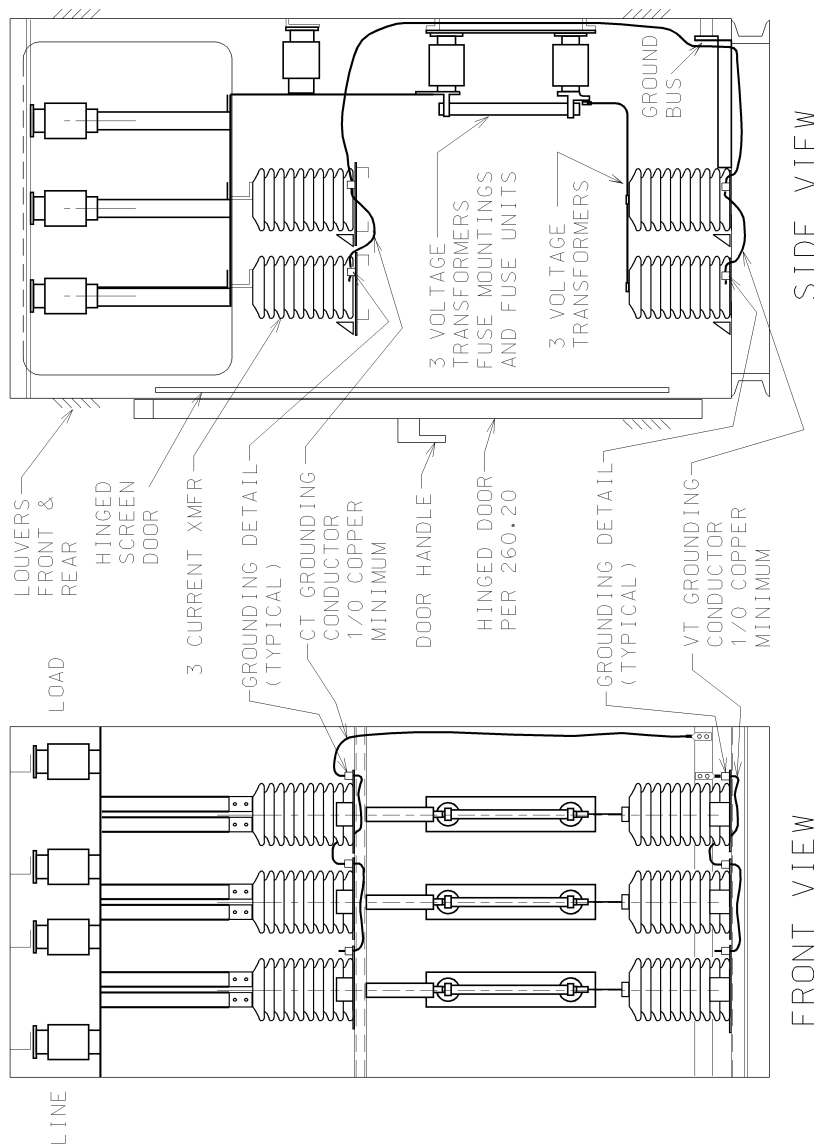
220.40.40

26.4 kV Metering Switchgear Unit

3-Phase 3-Wire and 3-Phase 4-Wire Services — Typical Arrangement

Grounding details on the **current** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.

Grounding details on the **voltage** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.



CCS File #38065F4

26.4kV Metering Switchgear		
Required Minimum Clearances	125kV BIL	150kV BIL
Phase to Phase	10.5 Inches	12.5 Inches
Phase to Ground	7.5 Inches	9.5 Inches
Phase to Barrier	2.5 Inches	2.5 Inches

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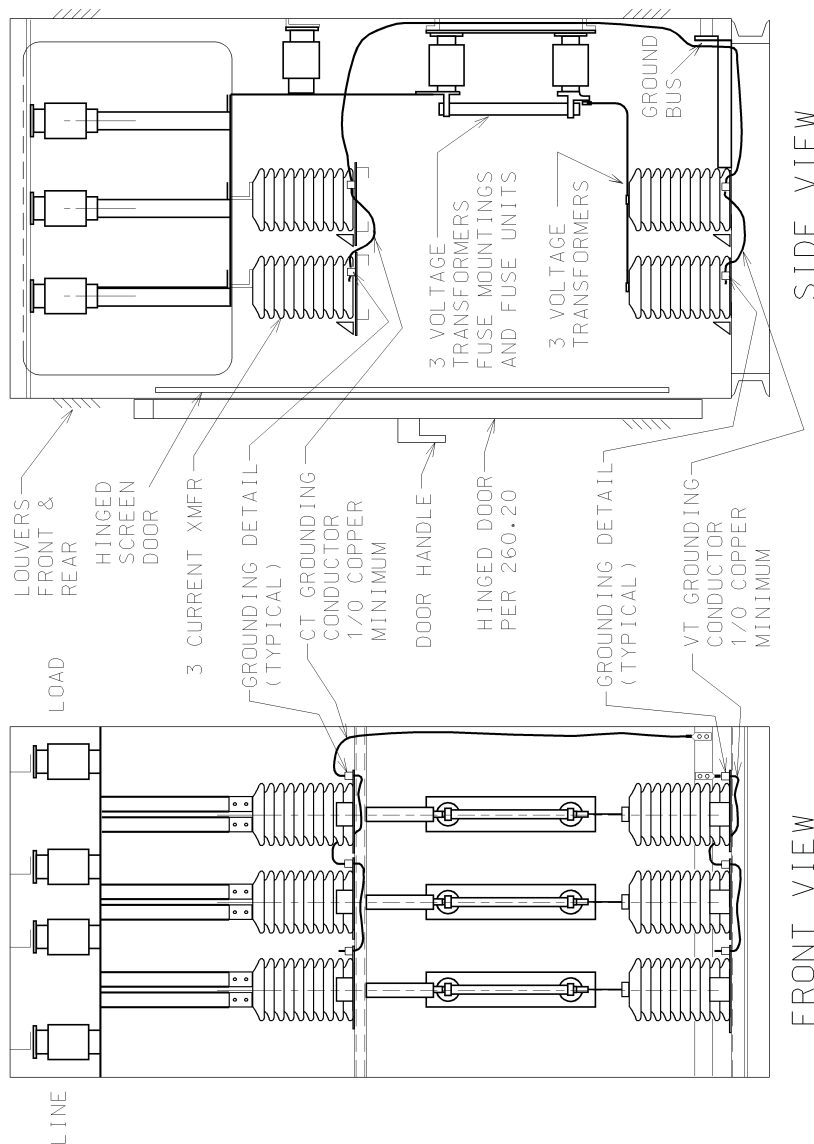
220.40.50

34.5 kV Metering Switchgear Unit

3-Phase 3-Wire and 3-Phase 4-Wire Services — Typical Arrangement

Grounding details on the **current** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.

Grounding details on the **voltage** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.



CCS File #38065F4

34.5kV Metering Switchgear		
Required Minimum Clearances	150kV BIL	200kV BIL
Phase to Phase	12.5 Inches	18 Inches
Phase to Ground	9.5 Inches	13 Inches
Phase to Barrier	3.0 Inches	3.0 Inches

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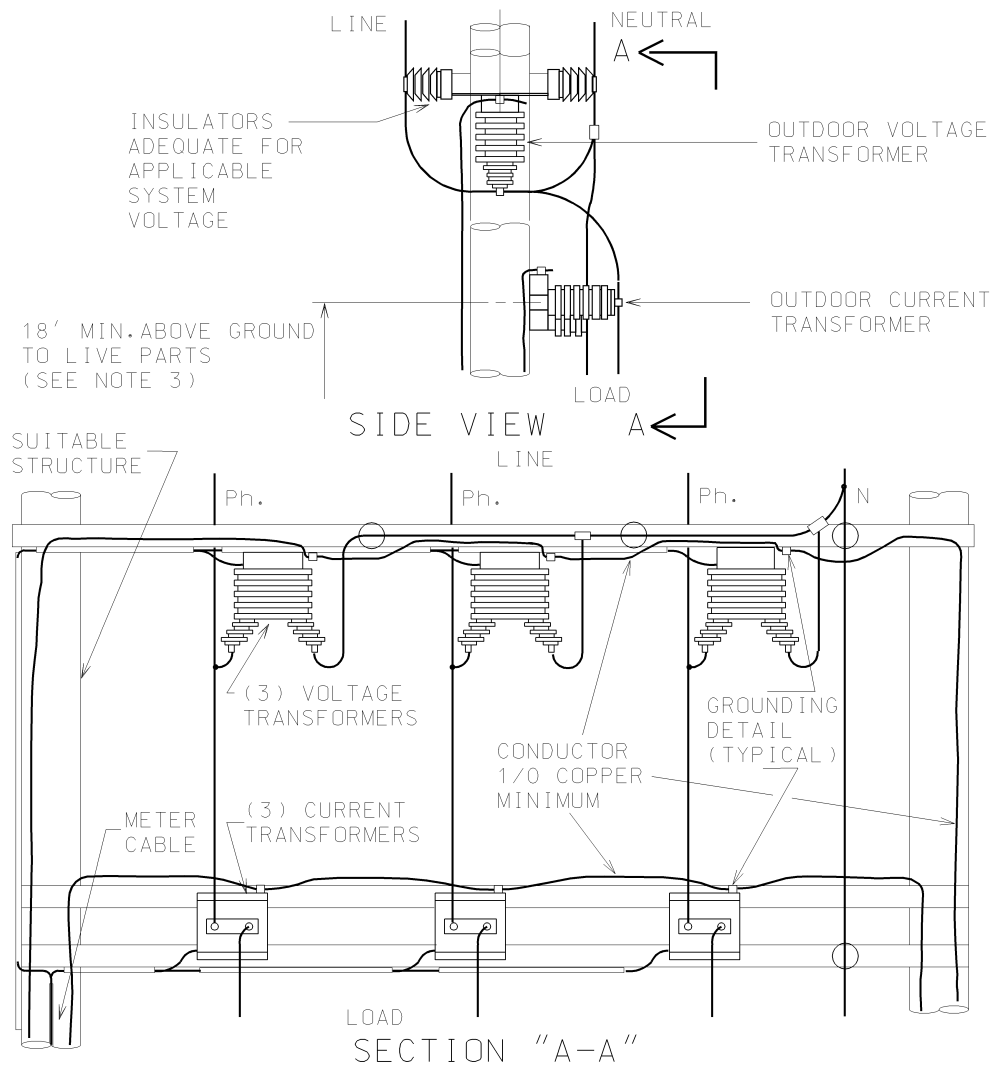
220.40.60

**System Voltages 15kV and Below: 3-Phase 3-Wire and 3-Phase 4-Wire Services
Primary Metering Structure for Outdoor Open Style Substations — Typical Arrangement**

Note 1: Grounding details on the **current** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.

Note 2: Grounding details on the **voltage** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.

Note 3: This clearance may be reduced to 9'0" if the installation is within a substation enclosure as described in Section 250.



CGS File #38065F7

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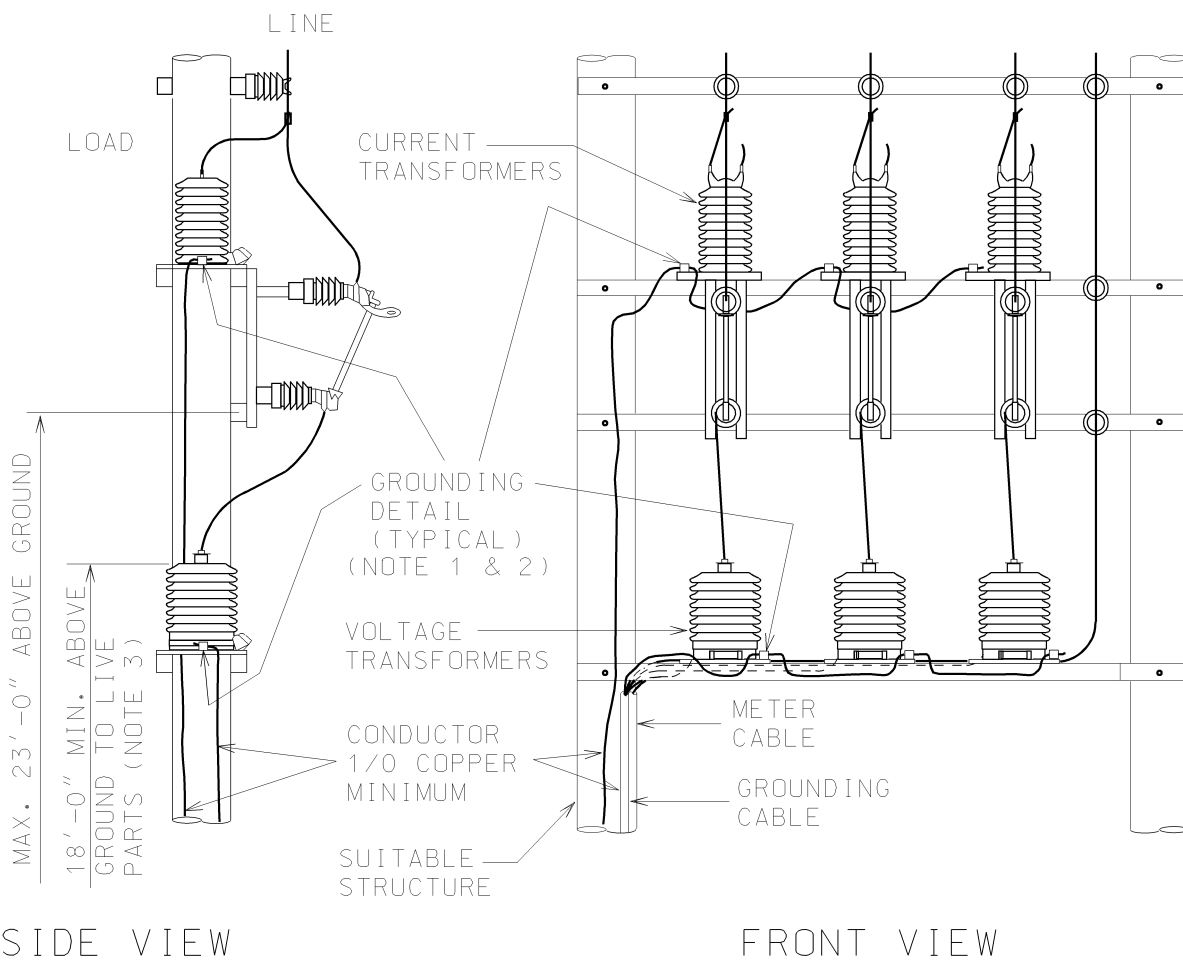
220.40.70

**Distribution System Voltages 25kV and Below 3-Phase 4-Wire Services
Primary Metering Structure for Outdoor Open Style Substations — Typical Arrangement**

Note 1: Grounding details on the **current** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.

Note 2: Grounding details on the **voltage** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.

Note 3: This clearance may be reduced to 9'6" if the installation is within a substation enclosure as described in Section 250.



CGS File #38065F8

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220.40.80

**System Voltages 26.4kV and 34.5kV, 3-Phase 3-Wire and 3-Phase 4-Wire Services
Primary Metering Structure for Outdoor Open Style Substations — Typical Arrangement**

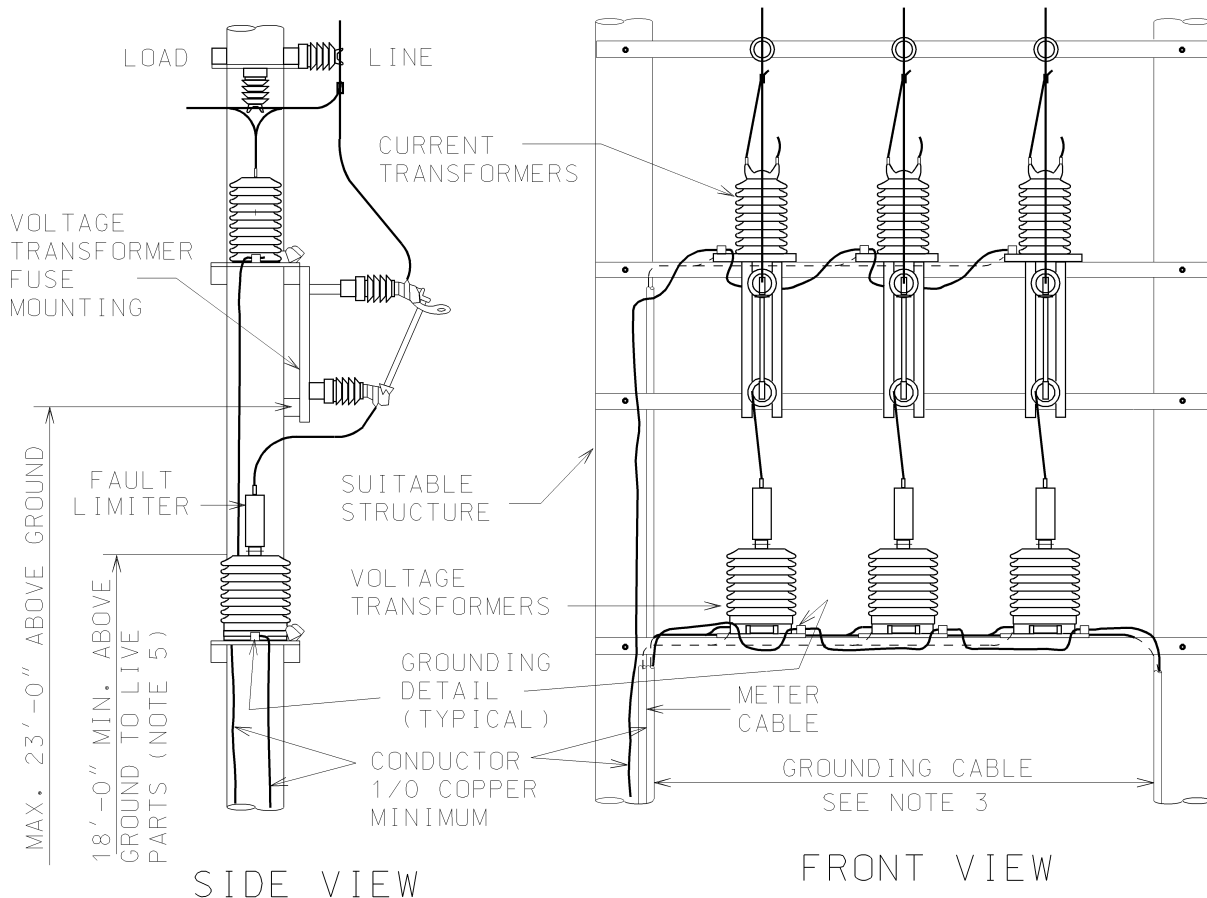
Note 1: Grounding details on the **current** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.

Note 2: Grounding details on the **voltage** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.

Note 3: When using wood pole and crossarm construction, the ground lead for the voltage transformers shall form a loop which ties the driven ground rods together or connects to the ground system inside the substation.

Note 4: The fault current limiting fuse terminal shall not rest on the voltage transformer insulation.

Note 5: This clearance may be reduced to 9'6" (26.4kV systems) or 9'10" (34.5kV systems) if the installation is within a substation enclosure as described in Section 250.



CGS File #38065F10