200) Service Conductors

200.10) General

200.10.10) For the purpose of this discussion, service conductors are the electrical supply line(s), overhead or underground, which are installed, owned, and maintained by the Company between its distribution system and the Customer's substation. These conductors are installed, owned, and maintained by the Company even though in some cases the Customer may be required to make a financial contribution toward their cost.

200.10.20) The following paragraphs are intended to provide the Customer with general information relative to the Company's requirements for termination of service conductors and to designate a point at which division of ownership occurs. The Company will provide additional supplementary details as required, especially where underground services are involved.

200.20) Overhead Service Conductors

200.20.10) Overhead service conductors are terminated on a deadend structure provided by the Customer. The Company will provide the following data for each overhead service to a substation to assist the Customer in the design of an appropriate deadend structure.

a) Approximate heavy loaded tension for each conductor associated with the service.

b) Required conductor spacing and configuration at point of attachment.

c) Minimum attachment height necessary to provide adequate clearance for service conductors.

200.20.20) Customer shall provide and install a deadend structure of adequate size and structural strength consistent with data furnished by the Company.

200.20.30) Where such deadend structures are constructed of wood, the Customer need not provide additional termination details. The Company will drill the necessary holes and furnish and install all required attachment hardware.

200.20.40) Where steel deadend structures are employed, the Customer shall furnish and install suitable attachment provisions.

200.30) Underground Service Conductors

The Company will generally provide, install and terminate the incoming service lateral cable(s) when the supply to a Customer substation is underground. The following paragraphs outline specific Company requirements for representative installations:

200.30.10) Cubicle–Type Substations Consisting of Metal–Clad or Metal–Enclosed Switchgear Supplied Via Single Conductor Direct Burial Service Lateral Cable or Single Conductor Lead Jacketed Cables

The Customer shall furnish and install the following facilities for entry and termination of underground service lateral(s):

a) Terminal pad with NEMA standard two–hole drilling on which service lateral cables are to be terminated. The Company will connect service lateral cables to Customer's terminal pad with a NEMA standard two–hole cable lug. Such terminal pads shall be located no less than 25" for 26,400 Volts and below and 30" for 34,500 Volts above terminal compartment floor or bottom of cable trench (where present).

b) Where service lateral cables are to be terminated six feet or more above the bottom of the cable trench or cubicle compartment floor, a structural member shall be provided, securely fastened to the terminal compartment walls complete with appropriate drilling to receive service lateral cable clamps. Cable clamp supporting member shall be located three feet minimum and four feet maximum below the center line of cable termination pads. Refer to 200.40.20 to determine required cable clamp drilling.

c) Station ground bus to be extended to the vicinity of cable termination. We Energies will furnish and install the materials necessary for bonding the service lateral concentric strands or lead sheath to the station ground bus.

d) Access to the service lateral termination compartment(s) shall be by hinged door(s) at the front or rear of the switchgear. We Energies will provide the necessary padlock(s).

e) Working space in front of cable termination shall be clear of all obstructions. This working space is for the installation and maintenance of the de–energized termination. Equipment mounted in front of the termination point shall be removable to permit proper installation of service lateral cables.

f) Service lateral conduit. Conduit shall enter switchgear from the bottom. *Top and side entrances are not permitted.*

g) Indoor Substation Application Only

g.1) Cable pulling anchors (see 200.40.30 and 200.40.40), installed at the locations specified by the Company.

g.2) Customer substations located below grade shall be provided with a 12–inch wide by 6–inch (minimum) deep cable trench in the floor as specified by the Company. Depth of

trench required for specific installation shall be such as to meet the requirements of item (a) above. Only the Company's incoming line cables shall be allowed in this trench. Exposed portions of this trench shall be covered with removable "checker plate" consistent with conditions encountered. Size requirements for opening in basement or foundation walls are shown in 200.30.50.

g.3) Customer substations located at grade level shall be provided with service entrance conduit as specified by the Company.

g.4) When indoor customer substations are not located adjacent to an outside wall or not at or below ground level, the Customer shall furnish and install the required service lateral conduit encased in concrete as specified by the Company.

h) (Outdoor Substation Application Only) The Customer shall furnish and install, according to Company specifications, that portion of the service lateral conduit which is beneath the switchgear foundation or pad.

200.30.20) Cubicle–Type Substations Consisting of Metal–Clad or Metal–Enclosed Switchgear Supplied Via Three Conductor Lead Jacketed Cable.
The Customer shall furnish and install the following facilities for entry and termination of underground service lateral(s):

a) Pothead(s) for termination of service lateral cable(s) complete with aerial lugs and connections to cubicle bus. Pothead(s) shall be mounted in incoming line terminal compartment so as to provide a 32–inch minimum clearance between bottom of the pothead wiping bell and the bottom of the cable trench or cubicle compartment floor. Pothead(s) shall be as specified by We Energies.

b) Where the service lateral termination pothead(s) is/are to be mounted six feet or more above the cubicle compartment floor or bottom of cable trench, provisions shall be made for installation of cable support bracket(s). Such provisions shall consist of a structural member securely fastened to cubicle walls drilled to receive a cable support bracket. For three conductor lead covered cable, refer to drawing 200.40.10 for the required cable support drilling. These drillings shall be located at a point 3 feet minimum and 4 feet maximum below the pothead wiping bell. One cable support for each service lateral cable will be provided and installed by We Energies

c) Station ground bus to be extended in the vicinity of pothead mounting. We Energies will furnish and install materials necessary for bonding service lateral cable sheath to ground bus.

d) Access to the service lateral termination compartment(s) shall be by hinged door(s) at the front or rear of the switchgear. We Energies will provide the necessary padlock(s).

e) Working space in front of pothead mounting shall be clear of all obstructions. This working space is for the installation and maintenance of the de–energized pothead termination. Equipment mounted in front of the pothead shall be removable to permit installation of the pothead.

f) Service lateral conduit. Conduit shall enter switchgear from the bottom. Top or side entrances are not permitted.

g) Indoor Substation Application Only

g.1) Cable pulling anchors (see 200.40.30 and 200.40.40), shall be installed at the locations specified by We Energies.

g.2) Customer substations below grade shall be provided with a 12–inch wide by 6–inch (minimum) deep cable trench in the floor as specified by We Energies The trench depth required for the specific installation shall be such as to meet the requirements of item (a) above. Only the We Energies incoming line cables shall be allowed in this trench. Exposed portions of this trench shall be covered with removable "checker" plate consistent with conditions encountered. The floor trench shall extend from beneath the foundation or basement wall entrance to the pothead entrance. Floor trench serving one cubicle shall not be routed through another cubicle. Size requirements for openings in basement or foundation walls are shown in 200.30.50. The location of this opening shall be as specified by We Energies.

g.3) Customer substations at grade level shall be provided with conduit as specified by We Energies

g.4) When indoor customer substations are not located adjacent to an outside wall or not at or below ground level, the Customer shall furnish and install the required service lateral conduit encased in concrete as specified by We Energies.

h) (Outdoor Substation Application Only) The Customer shall furnish and install, according to We Energies specifications, that portion of the service lateral conduit that is beneath the switchgear foundation or pad.

200.30.30) Outdoor Substation Constructed on Open Framework and Supplied Via Lead–Jacketed or Direct Buried Service Lateral Cable.
The Customer shall furnish and install the following facilities for entry and termination of underground service lateral(s):

a) A pothead support consisting of a structural framework complete with appropriate drilling capable of supporting the weight of the pothead and the service lateral cable. The pothead support shall be located at the height above final grade specified by We Energies. Potheads shall be as specified by We Energies based upon the size and type cable to be used.

b) Working space in front of pothead mounting provisions shall be clear of all obstructions for a distance of four feet.

c) Station ground bus shall be extended to the vicinity of pothead mounting. We Energies will furnish and install materials necessary for bonding of service lateral cable sheath to the ground bus.

d) Structural framework complete with appropriate drilling to receive service lateral cable support bracket(s) at a point 4'6" below center line of pothead mounting provisions. Refer to drawings 200.40.10 and 200.40.20 to determine the required cable support drilling. One cable support for each service lateral cable will be provided and installed by We Energies.

e) Connecting leads from pothead aerial lug terminals to substation bus.

f) When slab–type structural foundations are to be used, the Customer shall furnish and install, as specified by We Energies, that portion of the service lateral conduit which is beneath the foundation.

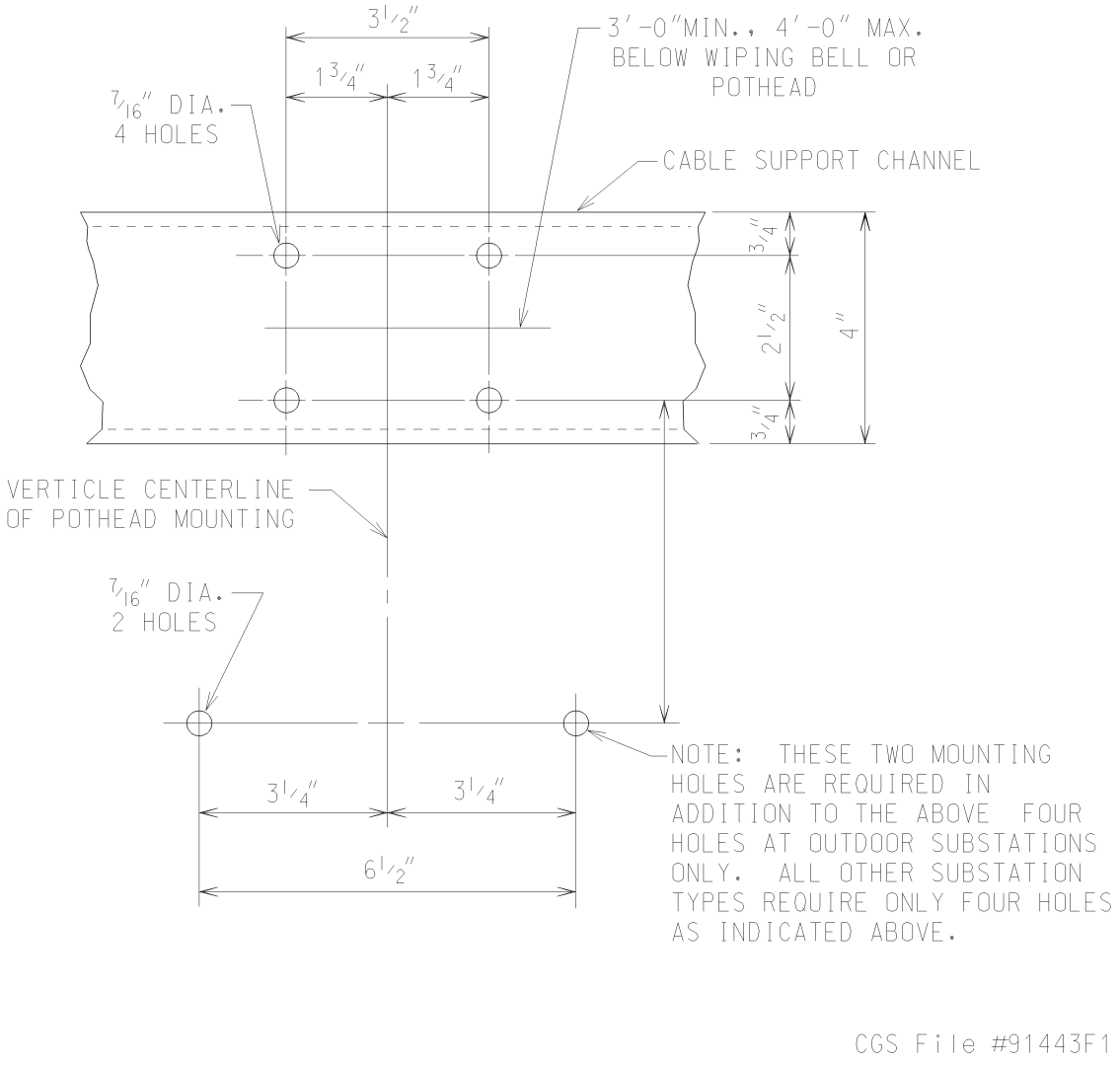
200.30.40) Special Equipment or Construction

The Company shall be consulted to obtain specific requirements for equipment and construction which cannot be classified in any of the above categories.

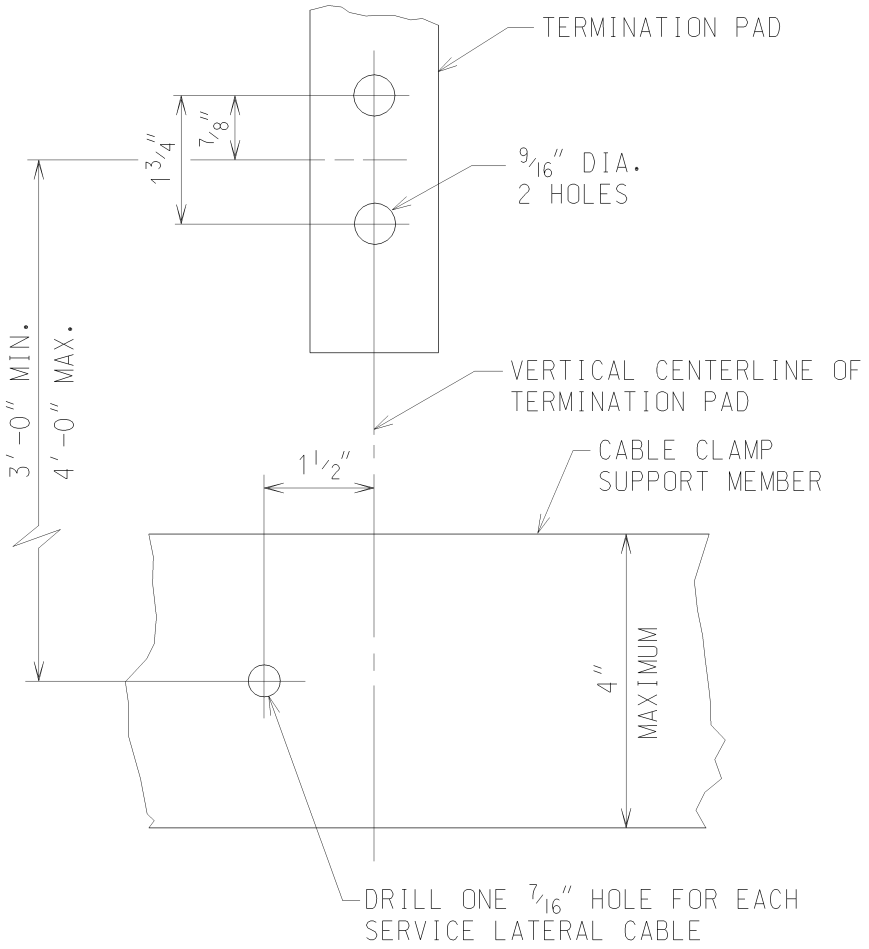
200.30.50) Size requirements for openings in basements or foundation walls.

Number of Ducts	Vertical Size of Wall Opening	Horizontal Size of Wall Opening
1	12"	12"
2	12"	18"
3	18"	18"

200.40.10
Cable Support Drilling Detail for Lead Jacketed Cable

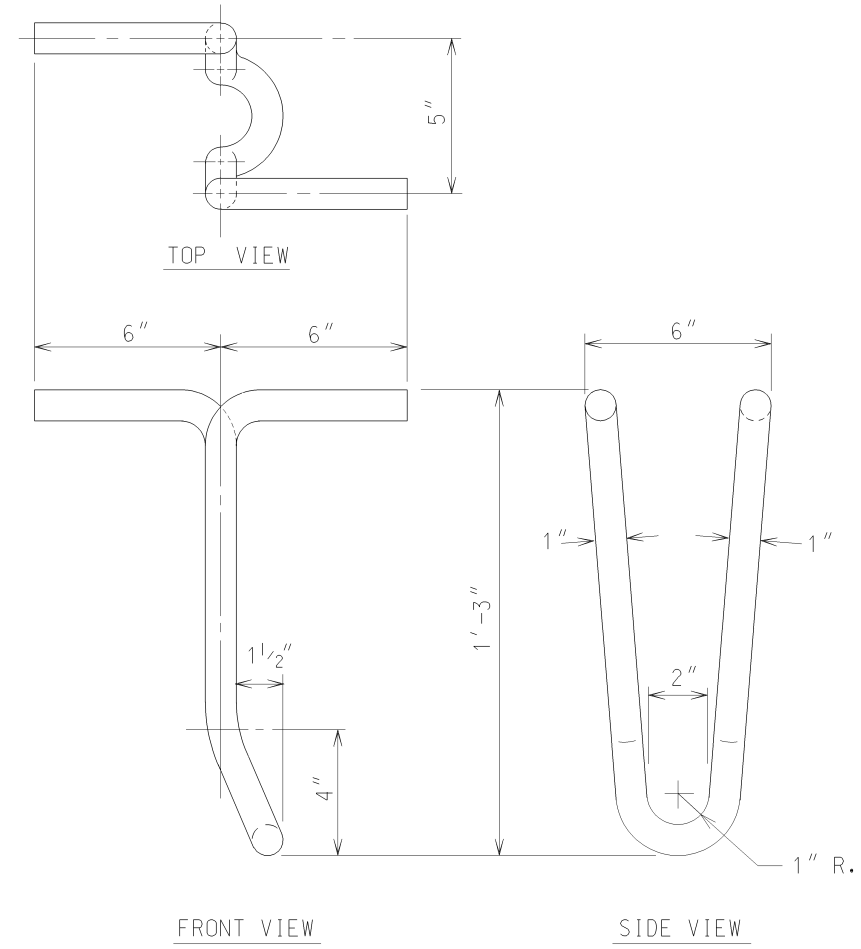


200.40.20
Cable Support Drilling Detail for Direct Buried Cable



CGS File #91443F2

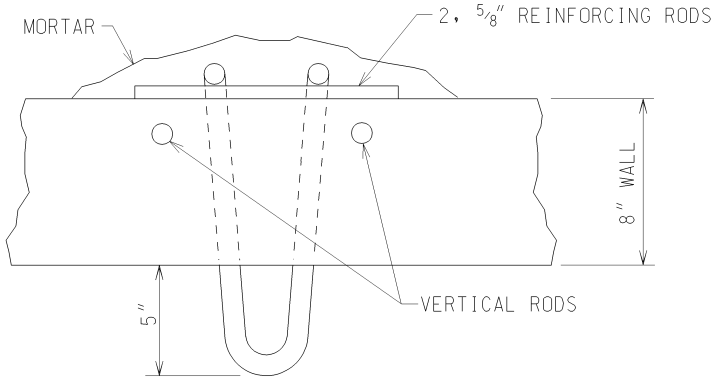
200.40.30
Cable Pulling Anchor Detail

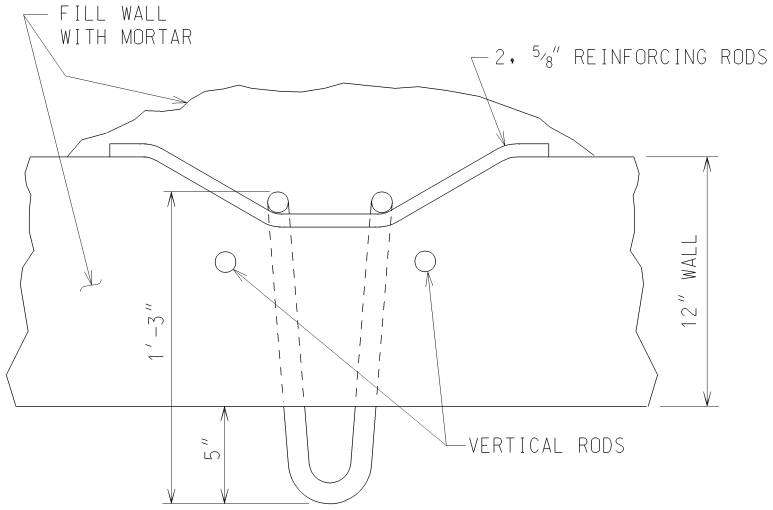


NOTE: MATERIAL, 1″ ROUND STEEL, THOROUGHLY GALVANIZE AFTER BENDING. DEVELOPED LENGTH – 40½″.

CGS File #91443F3

200.40.40
Installation of Cable Pulling Anchor





CGS File #91443F4

210) Routes, Easements and Space Requirements for Service Conductors

210.00.10) When a Customer's substation is remote from We Energies distribution circuits, the service conductors are extended across private property to the Customer's service entrance equipment located either outdoors or within a building.

210.00.20) It is important in planning the route for incoming circuit(s) to avoid conflicts with the Customer's operations and existing or future underground or overhead structures.

210.00.30) We Energies will select the route over which service conductors will traverse between its distribution system and the Customer's substation.

210.00.40) This will generally be the most direct, practical and readily accessible route available consistent with existing conditions.

210.00.50) The Customer shall furnish the necessary easement and tree trimming rights to enable We Energies to construct, operate and maintain the service entrance conductors in accordance with its specifications. (Easement documents and associated exhibits will be prepared by We Energies for the Customer's signature.)

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

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).

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.

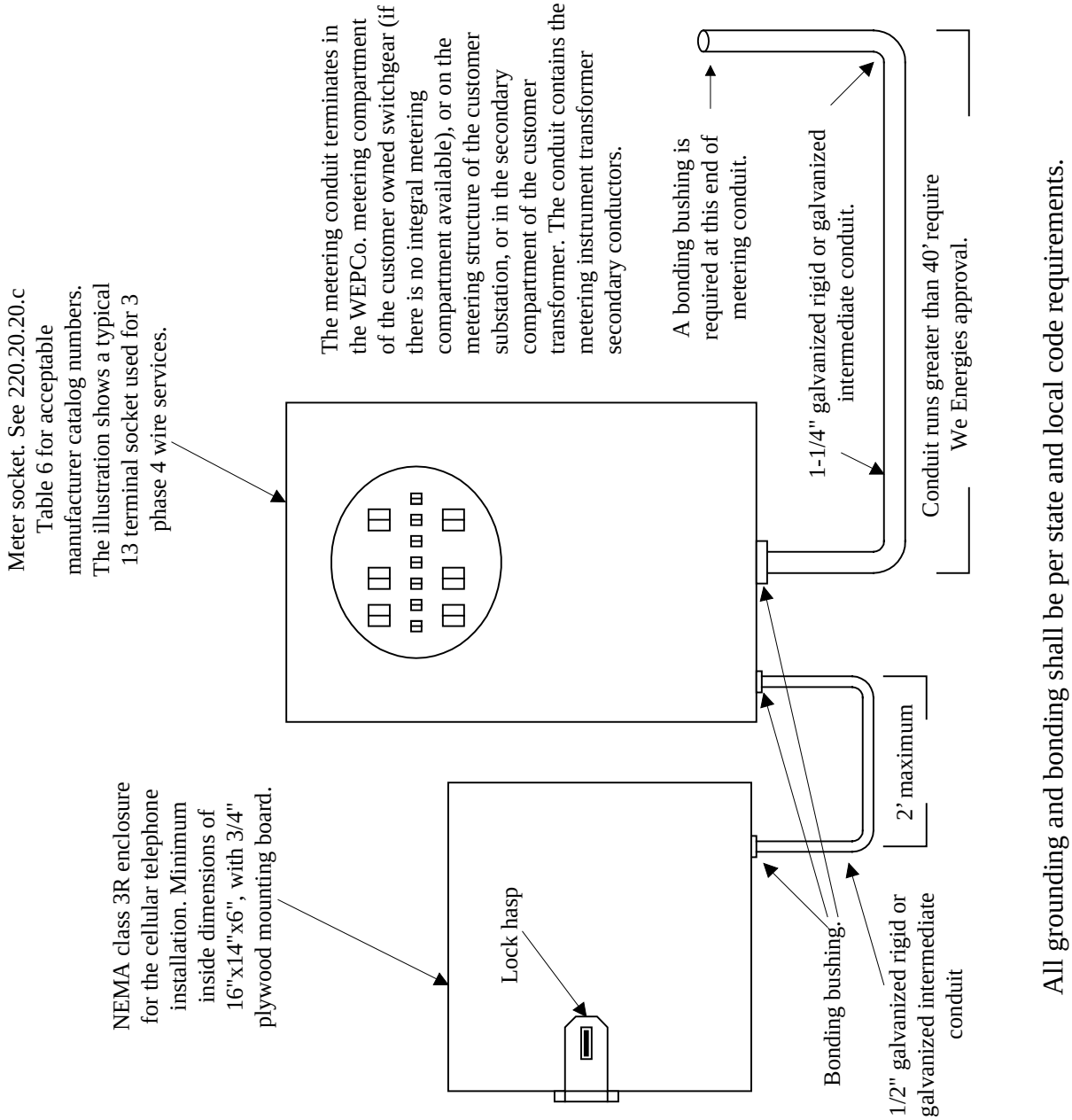
b) Switchgear enclosure surfaces shall not be used as physical support for metering equipment or any other items unless specifically designed for that purpose.

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.

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 1¼" galvanized rigid or galvanized intermediate and shall be terminated in each cubicle and appropriately bonded.

220.20.35
Typical Arrangement of the Transformer Rated Meter Socket and the Cellular Telephone Enclosure



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.

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.

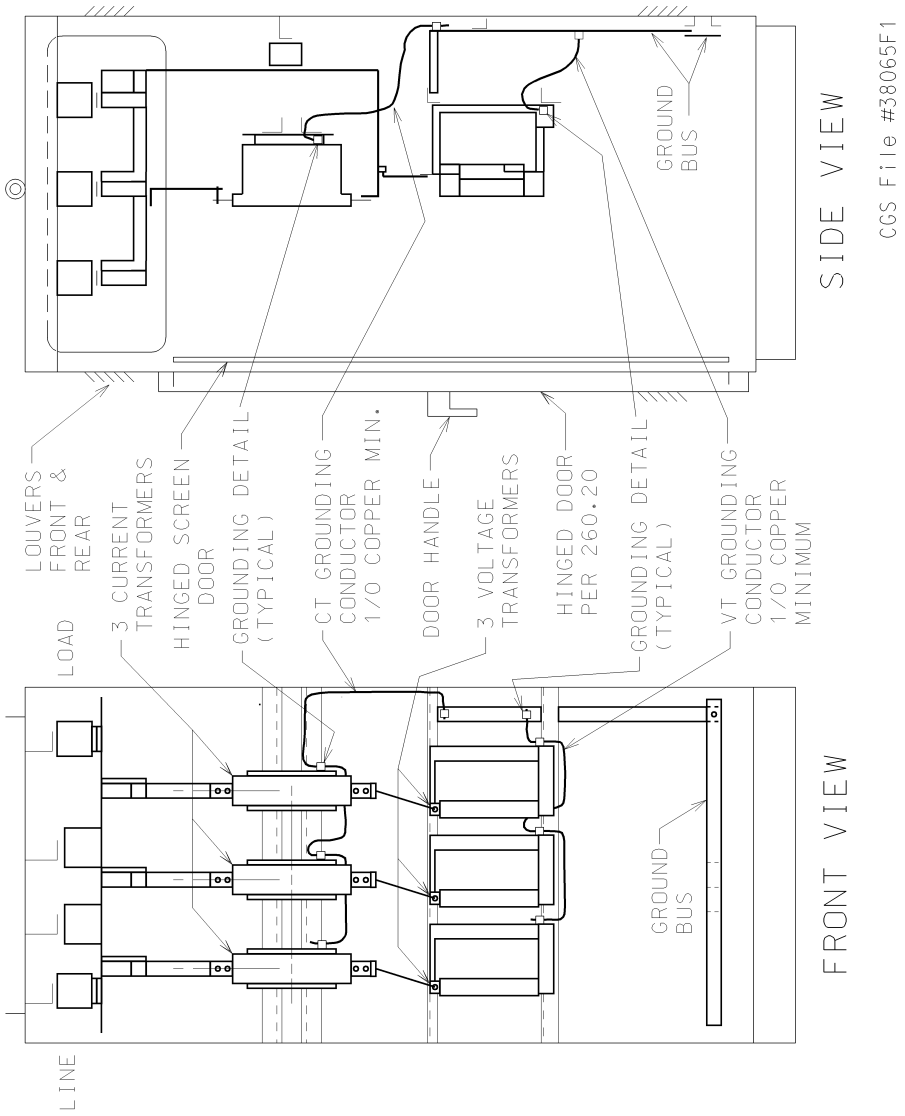
220.40.60) Outdoor metering structure for 3 phase 4 wire distribution system voltages 15kV and below

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.

220.40.10
5kV Metering Switchgear Unit
3–Phase 4–Wire Services — Typical Arrangement

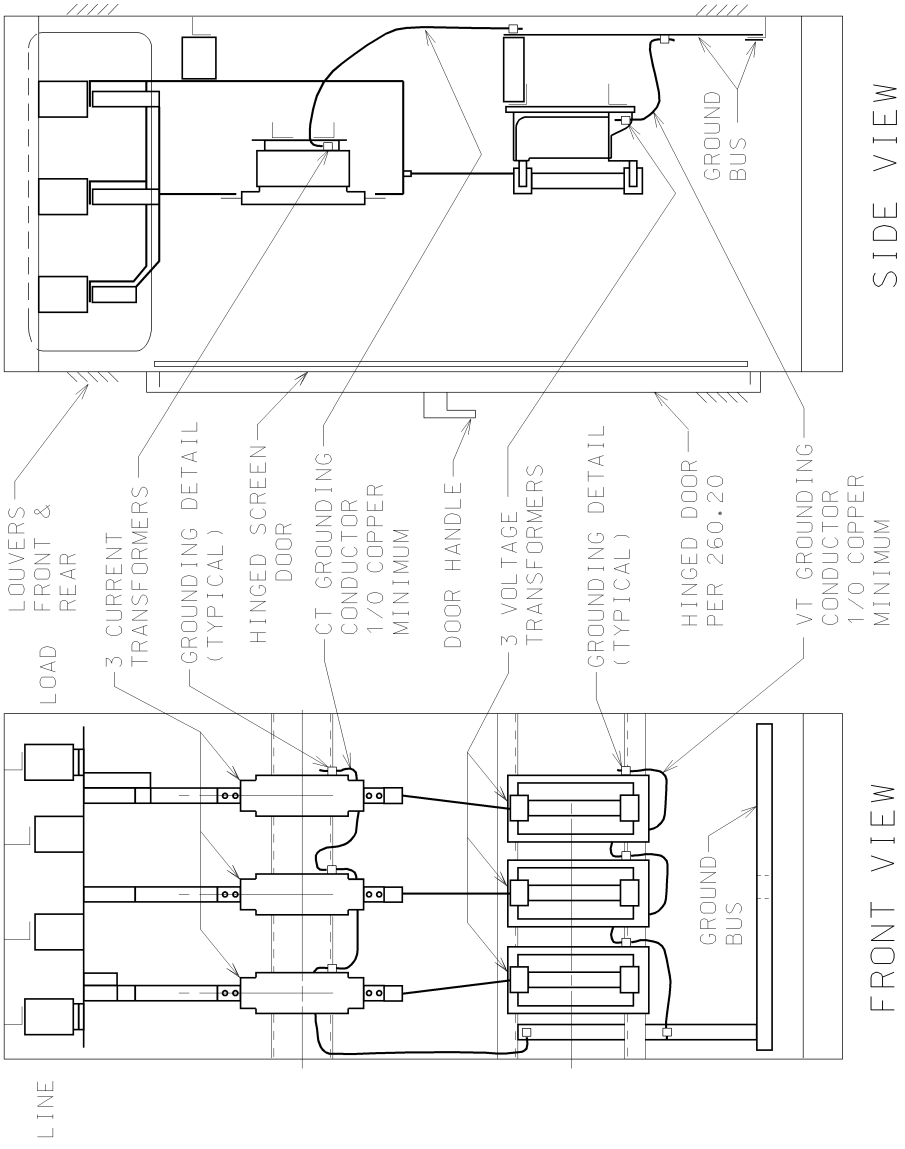
Grounding details on the **current** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.
Grounding details on the **voltage** transformers shall be interconnected and grounded using a minimum conductor size of 1/0 copper.



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

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.

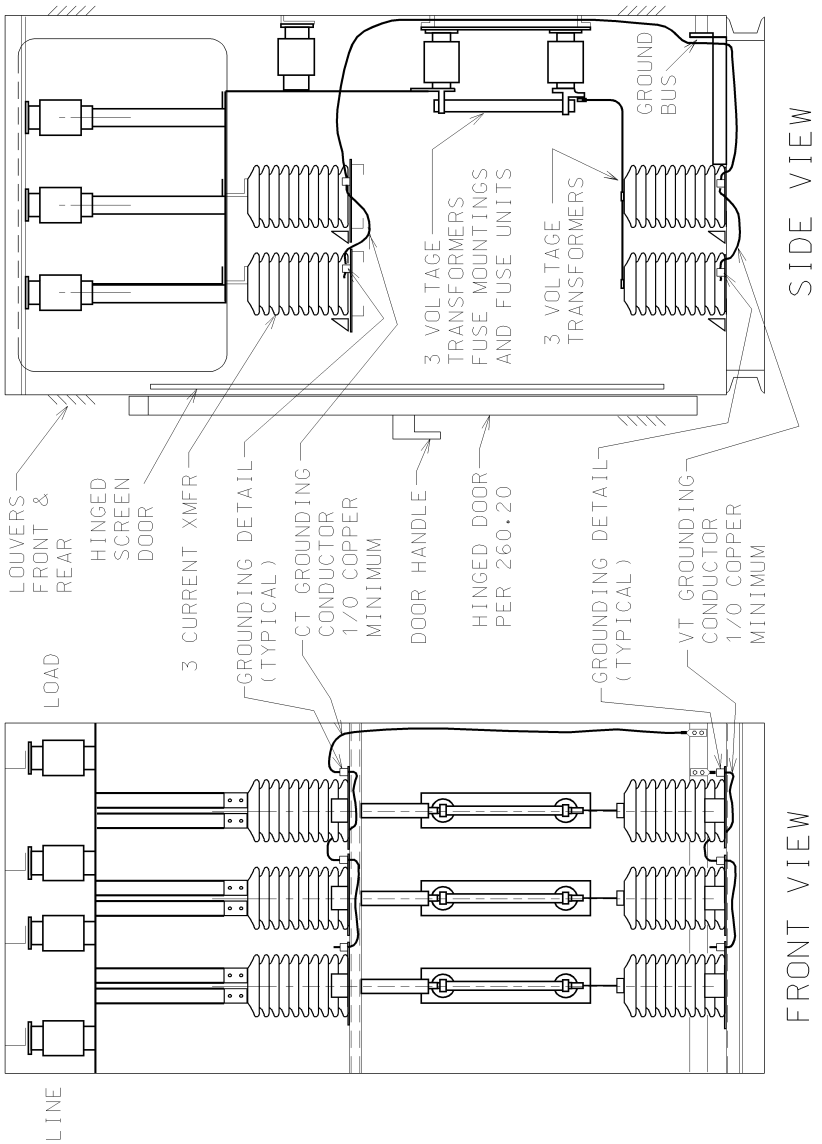


CGS File #38065F3

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

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.

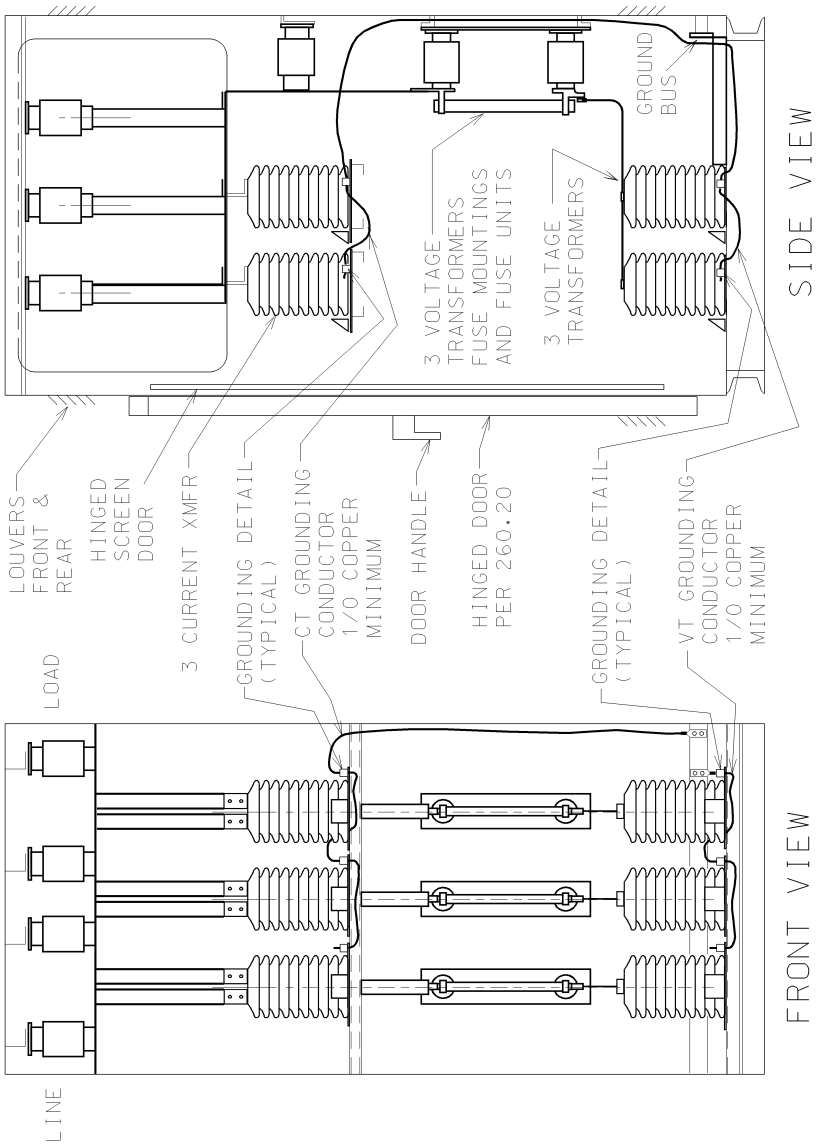


24.9kV Metering Switchgear	
Required Minimum Clearances	125kV BIL
Phase to Phase	10.5 Inches
Phase to Ground	7.5 Inches
Phase to Barrier	2.5 Inches

CGS File #38065F4

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.

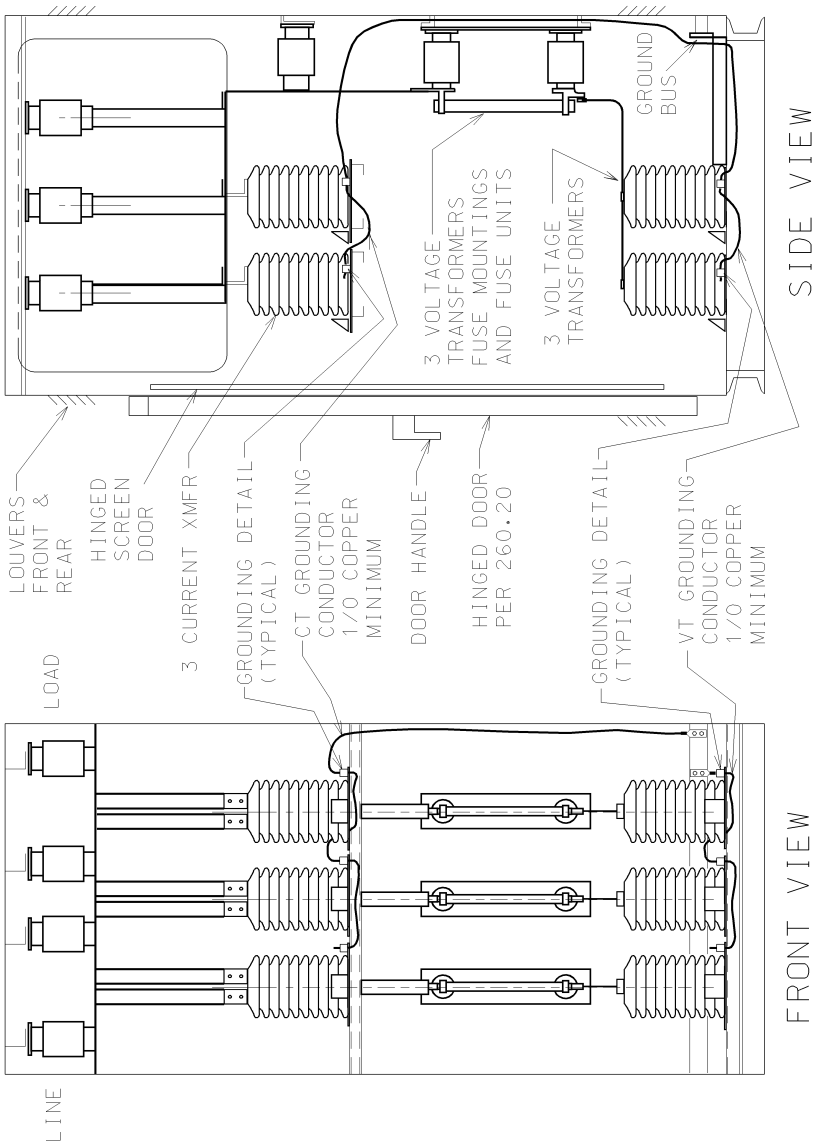


26.4kV Metering Switchgear		
Required Minimum Clearances	125kV BIL	150kV BIL
Phase to Phase	10.5 Inches	12.5 Inches
Phase to Ground	7.5 Inches	9.5 Inches
Phase to Barrier	2.5 Inches	2.5 Inches

CGS File #38065F4

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.

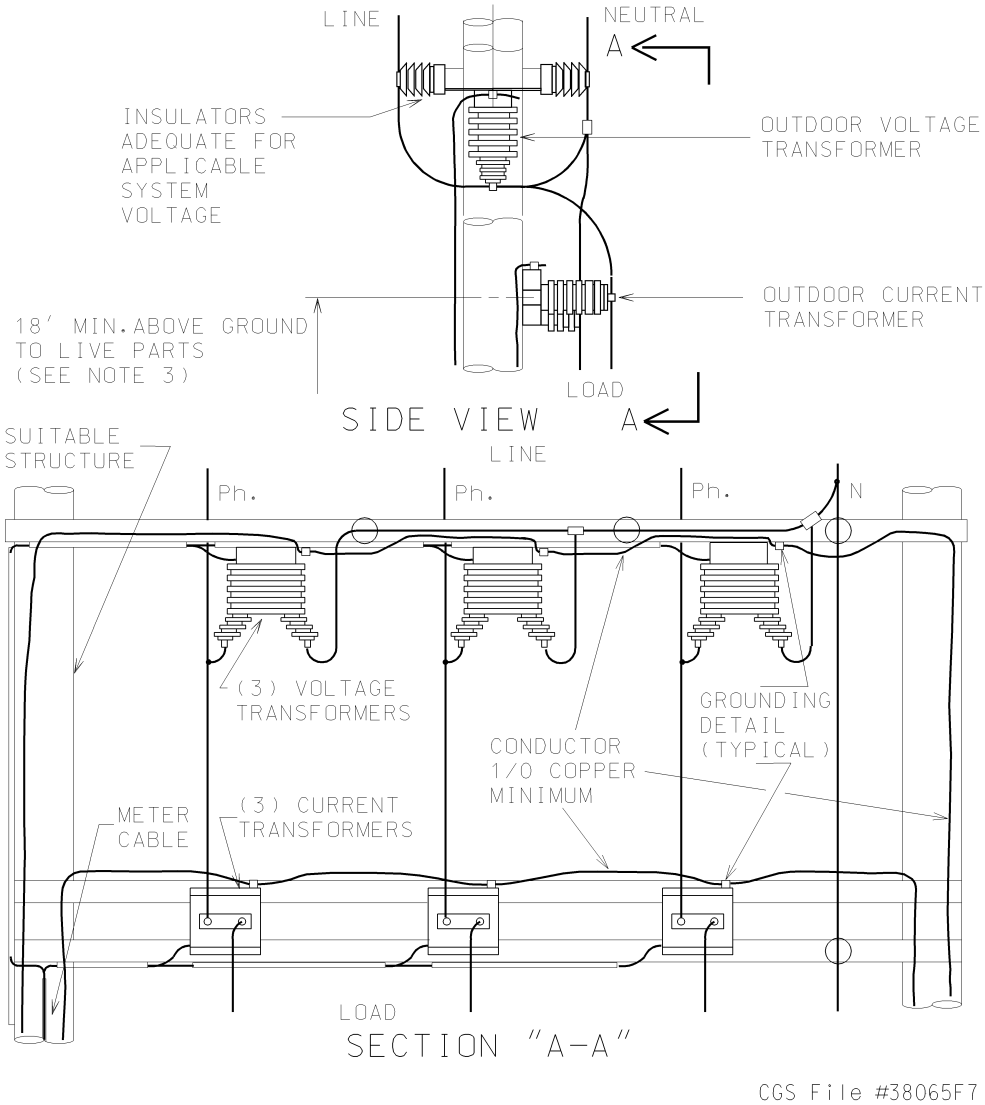


34.5kV Metering Switchgear		
Required Minimum Clearances	150kV BIL	200kV BIL
Phase to Phase	12.5 Inches	18 Inches
Phase to Ground	9.5 Inches	13 Inches
Phase to Barrier	3.0 Inches	3.0 Inches

CGS File #38065F4

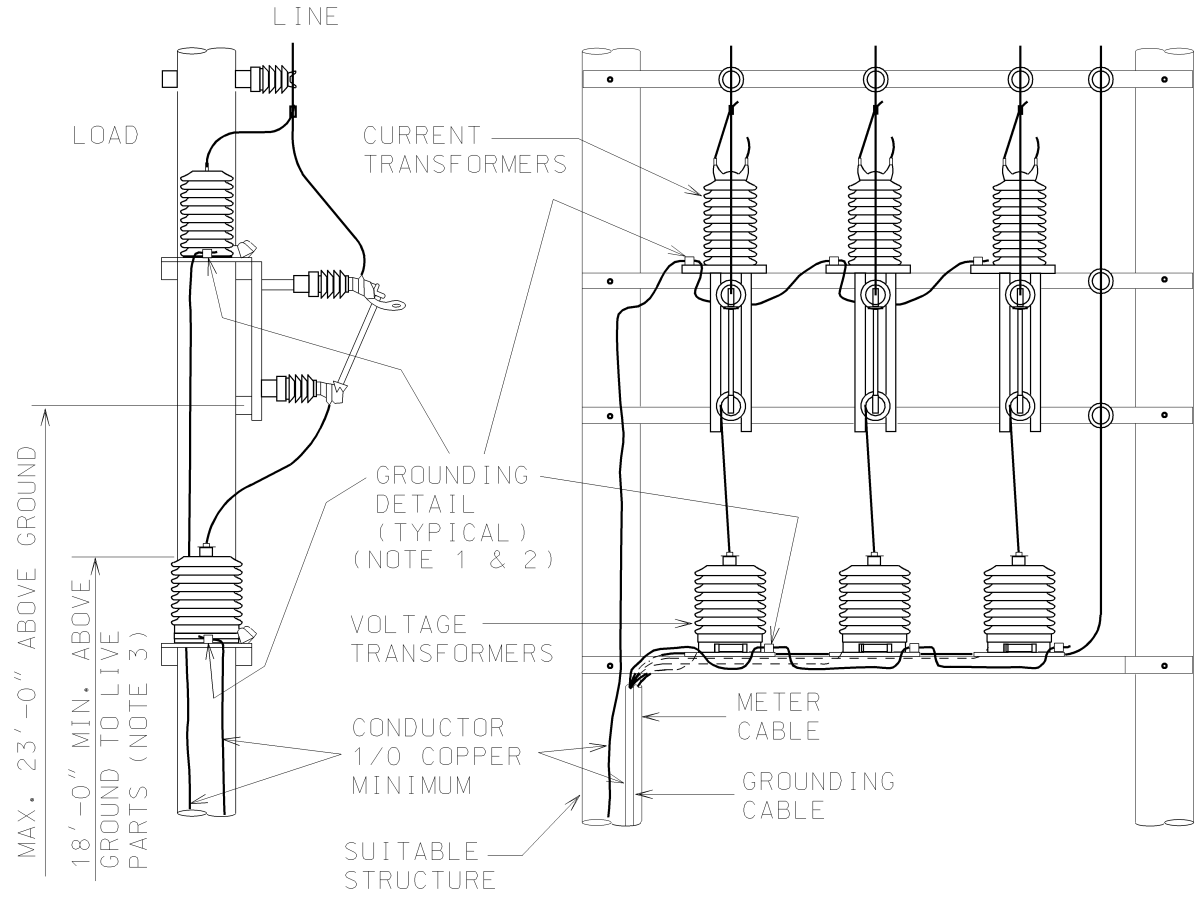
220.40.60
System Voltages 15kV and Below: 3–Phase 3–Wire and 3–Phase 4–Wire Services
Primary Metering Structure for Outdoor Open Style Substations — Typical Arrangement

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.



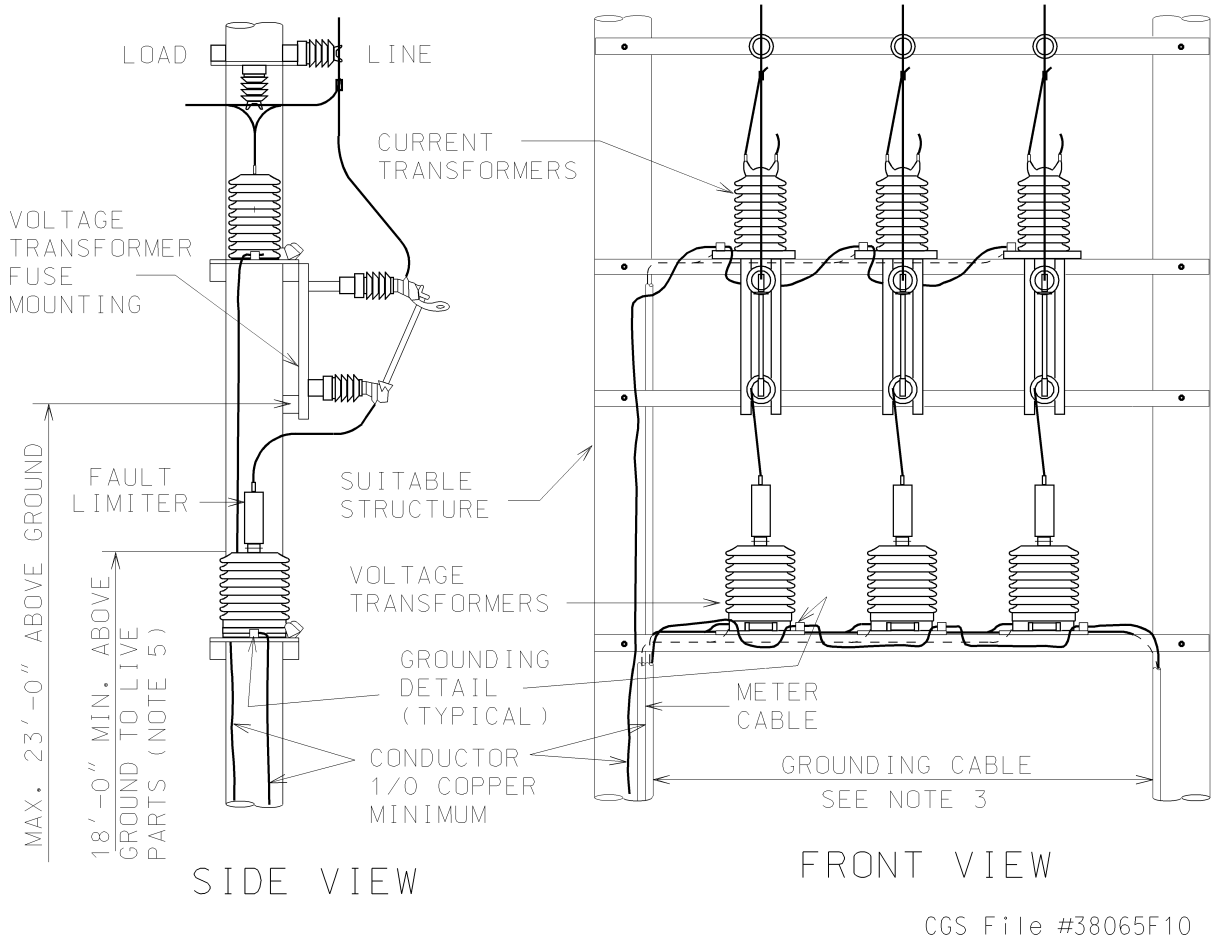
220.40.70
Distribution System Voltages 25kV and Below 3–Phase 4–Wire Services
Primary Metering Structure for Outdoor Open Style Substations — Typical Arrangement

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.



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.



230) Clearance and Spacing

230.10) General

Customer substations shall be constructed in accordance with the requirements of the Wisconsin and/or Michigan State Electrical Codes (all volumes) and applicable local codes or ordinances with respect to live part clearances, spacing of equipment and conductors, and working space. This includes meeting all minimum clearances for live parts as listed in NEC 490–24.

230.20) Operating Space for Open–Type Fuse Installations

For metering voltage transformer fuses, the customer shall provide inside the substation a clear, level area, which extends three feet outside each outboard fuse mounting and a minimum of six feet out from the face of the mounting structure. In addition to the space required to operate the fuses, the substation design shall provide an area adjacent to the fuse structure in which to assemble, raise, and lower the switch stick. The switch stick should be two feet shorter than the distance from grade to the lower support point or lower hinge point of the fuse. The clear area shall be four feet wide and four feet longer than the switch stick, both in ground area and in the path of the stick as it is raised.

240) Signs and Identification

240.10) General

240.10.10) The Customer shall provide a schedule of nameplates and signs for We Energies acceptance prior to construction of substation. Such schedule shall clearly indicate the inscription of each sign or nameplate, and specify the intended location of each.

240.10.20) To cover unusual installations We Energies may require additional signs and markings at the time of installation.

240.20) Location

240.20.10) Signs used to identify equipment are mounted either directly on the equipment or on the station structure close to the equipment identified.

240.20.20) Signs shall not hinder the operation of equipment, reduce electrical clearances or in any way present a hazard.

240.20.30) Danger and Caution signs shall be located so that there is sufficient time to read the warning before encountering the hazard.

240.20.40) Signs giving operating instructions shall be conspicuously located at the operating point either on or near the equipment involved.

240.30) Minimum Sign Requirements for Typical Customer Substations

Before the substation is placed in service, the Customer shall furnish the signs for the style of substation listed in 240.30.10 or 240.30.20.

240.30.10) Signs for Outdoor Open Type Substations:

DESCRIPTION	LOCATION
No Admittance	Outside face of all entrance gates or doors in station fence or enclosure.
Danger High Voltage	Outside face of station fence or enclosure spaced not more than 40 ft. apart.
Phase Identification Letters **A**, **B**, and **C**	Adjacent to deadend attachment or potheads of all incoming lines.
CAUTION: Do Not Open Any Disconnect Switches When Carrying Load or **CAUTION: Do Not Open Any Disconnect Fuses When Carrying Load**	On structure near disconnect switches or disconnecting type fuses in a conspicuous place.
Incoming Line Loadbreak Switch or Incoming Line Circuit Breaker	On or near service loadbreak switch operating handle or service circuit breaker.

240.30.20) Signs for Indoor or Outdoor Substations Consisting of Metal–Enclosed Switchgear With Loadbreak Switches and Fuses, or With Draw–Out Circuit Breakers

DESCRIPTION	LOCATION
NOTICE: Keep This Doorway Free of Obstructions At All Times	Outside face of each gate or door specifically provided as an entrance or exit from station enclosure or vault.
DANGER: High Voltage	On all doors which give access to high voltage components.
Incoming Line Termination	On door which gives access to an incoming line termination, but the associated load break switch.
Incoming Line Loadbreak Switch	Center of front door on all incoming line compartments which contain the designated equipment.
L.B. XXX (A two to five digit number as designated by We Energies)	Above loadbreak switch operating handle on all incoming line compartments which contain operable loadbreak switches in substations served by two or more lines.
Service Fuses	Center of door on compartment which contains the designated equipment.
We Energies Meters	Center of door on compartment which contains the designated equipment.
We Energies Metering Transformers	Center of door on compartment which contains the designated equipment.

250) Enclosures, Fences, and Surfacing – Outdoor Open Type Substations

250.00.10) Customer shall furnish and install a suitable fence or enclosure for outdoor, open–type substations in accordance with the requirements of the Wisconsin and/or Michigan State Electrical Codes (all volumes) and/or applicable local codes and ordinances.

250.00.20) Initial fence construction and final grading shall be done carefully so as to close all voids between the bottom of fence or gate and final grade which may jeopardize the integrity of the enclosure. Also, reasonable maintenance shall be performed, as required, to close such voids which appear after the initial installation due to settling or erosion.

250.00.30) The Customer shall provide and install crushed limestone surfacing outside the substation fence when the fence ground is interconnected with the station ground grid as directed in Section 180.

260) Metal–Enclosed and Metal–Clad Service Entrance Switchgear

260.10) General

Metal–enclosed and metal–clad switchgear assemblies for installation as service equipment shall be constructed in accordance with the latest revisions of applicable ANSI and NEMA Standards and appropriate electrical codes.

260.20) Doors

260.20.10) All compartments containing We Energies cables, terminations and metering equipment shall meet the ANSI C57–12.28 latest revision #14 AWG wire tamper resistance provision.

260.20.20) All compartments shall be equipped with hinged access doors. All doors shall be fitted with concealed hinges and be secured by a sturdy 3–point latching mechanism operated by a single padlockable handle.

260.20.30) Doors handles on compartments in which We Energies supply cable terminate, compartments containing service switch or breaker and compartments containing We Energies metering transformers shall, in addition to the above requirements, accept a standard We Energies. padlock with 21/64 inch shackle and include a single captive recessed penta–head bolt. The door handle and penta–head bolt provision shall be designed so that:

a) The padlock shall block access to the penta–bolt.

b) The door handle cannot be operated until the padlock is removed and the penta–bolt is loosen.

c) The padlock cannot be install until the handle is closed and the penta–bolt tightened.

260.20.40) Doors on compartments in which We Energies supply cable terminate, compartments containing service switch or breaker and compartments containing We Energies metering transformers shall not be secured by key or mechanical interlocks. The service switch or breaker may have a key cylinder interlock that releases keys for downstream devices but does not interfere with the operation of the compartment door.

260.30) Windows

Inspection windows shall be provided in the door of each compartment that contains a switch so that the open and closed positions of all switch blades are readily discernible from the exterior of the enclosure.

260.40) Detachable Panels

260.40.10) Detachable panels on compartments in which We Energies supply cables terminate, compartments containing service switches or breakers, compartments containing We Energies metering transformers, and compartments containing unprotected bus shall be secured so they cannot be removed from the outside of the compartment. The locking provisions shall not be circumvented.

260.40.20) Panels secured by external fasteners using specialty drivers such as hex, torx, star or similar do not meet the intent of this requirement.

260.50) Screen Doors

260.50.10) All compartments that contain We Energies supply cable terminations, service switches, We Energies metering transformers and feeder fuses shall be equipped with hinged screen doors to isolate all high voltage parts.

260.50.20) Service switch compartments equipped with slide–in isolating barriers shall be provided with hinged split screen doors.

a) The upper screen door shall isolate only the portion of the switch above the slide–in barrier.

b) The lower screen door shall extend from just below the upper screen door to the bottom of the compartment.

c) The arrangement and location of the split screen doors and the isolating barriers shall permit the installation of the isolating barriers when only the lower screen door is open.

d) Feeder Switch/fuse compartments shall be equipped with a hinged screen door isolating only the switch. An additional hinged screen isolating the feeder fuses is required unless the compartment door is interlocked to the feeder switch operating handle so that the main door can be opened only with the switch open.

260.60) Slide–In Barriers

260.60.10) The service switch compartment(s) shall be equipped with slide–in barriers whenever the switchgear main bus can be energized from more than one source (i.e. multiple We Energies feeders or a We Energies feeder and customer owned generator feeder).

260.60.20) The slide–in barriers shall insert on insulated rails and slide between the stationary and movable contacts of the disconnect switch.

260.60.30) Slide–in barriers shall be installable using a shotgun type hotstick.

260.60.40) Slide–in barriers shall be fabricated from fiberglass board material.

260.60.50) When installed the barrier shall not contact live parts.

260.60.60) Provisions to store these barriers, when not in use, shall be provided on the outside of the screen door or on the inside of the compartment door.

260.60.70) Storage of slide–in barriers shall not obstruct the viewing window.

260.70) Insulators

260.70.10) Skirted insulators of appropriate ratings shall be used between any connection of a live part and a grounded surface or between live parts of different phases.

260.70.20) The insulators shall be installed so that water will not pool on the skirts.

260.70.30) The insulators may be made of porcelain, cycloaliphatic epoxy resin or silicone rubber.

260.70.40) Requirements for insulators apply to all insulators on unprotected bus which support:

a) Interrupter switches,
b) Fuse mountings on the source side of the fuse,
c) switch push rods,
d) interphase insulators.

260.75) Clearances
The minimum clearance of live parts within metal enclosed switchgear shall be as specified below in 260.75.10. Minimum clearance between live parts and insulated barriers shall be as specified in 260.75.20.

260.75.10) Minimum Clearance of Live Parts (From Table 490–24 of the NEC).

Nominal Voltage Rating (kV)	Impulse Withstand B.I.L. (kV)	Minimum Clearance of Live Parts	
		Phase–to–Phase	Phase–to–Ground
		Indoors	Indoors
	Indoors	Inches	Inches
2.4–4.16	60	4.5	3.0
7.2	75	5.5	4.0
13.8	95	7.5	5.0
14.4	110	9.0	6.5
23	125	10.5	7.5
34.5	150	12.5	9.5
34.5	200	18.0	13.0

260.75.20) Minimum Clearances from Live Parts to Barriers.

System Class (kV)	Impulse Withstand B.I.L. (kV)	Minimum Phase–to–Barrier Clearance (Inches)
5	60	1.5
15	95	1.5
15	110	2.5
25	125	2.5
29 (26.4kV Nominal)	125	2.5
29 (26.4kV Nominal)	150	2.5
35	150	3.0
35	200	3.0

260.80) Momentary Current Rating

The integrated switchgear assembly (interrupter switches, breakers, power fuses, primary bus and enclosure) shall have a momentary current rating equal to or greater than the maximum available short circuit current at the point of application.

260.85) Protective Grounding

All compartments which contain incoming line terminations and/or service fuses shall be equipped with protective grounding facilities as described in Section 180.

260.90) Potheads and Other Cable Terminations

Adequate space shall be provided in the incoming line terminal compartments for the installation of potheads or other terminators (see Section 200.30 for additional detailed termination requirements).

260.95) Accessibility to Outdoor Switchgear

Outdoor switchgear installations equipped with a weatherproof operating and maintenance aisle shall include provisions to secure at least one entrance door with two padlocks. Removal of either padlock shall be sufficient to gain entry. One of the two padlocks will be furnished and installed by We Energies. The second padlock shall be provided by the Customer.

Exception: When Customers provide We Energies keys to their padlock. These keys will be kept in key boxes furnished and installed by We Energies on the Customer's premises near the switchgear.

270) Indoor Substations

270.10) General

270.10.10) Each aisle or work space about substation equipment shall have a suitable means of exit which shall be kept clear of all obstructions. If the plan of the vault and the character and arrangement of equipment are such that an accident would close or make inaccessible a single exit, a second exit shall be provided.

270.10.20) All personnel doors shall swing out and be equipped with full width panic bars that are normally latched but open under simple pressure for quick escape in the event of trouble. A description of the door latch shall be submitted to We Energies for approval. An example of an acceptable door latch is a Von Duprin catalog number 99NL–F

270.10.30) The customer shall furnish and install sufficient lighting fixtures to provide a minimum illumination intensity of 5 foot candles. If the room temperature is to be maintained above 40°F, fluorescent light fixtures may be used. The lighting fixtures shall be so arranged that persons changing lamps or making repairs on the lighting system will not be endangered by live parts or other equipment.

270.10.40) Only metal–enclosed equipment will be allowed in areas accessible to unqualified persons. This equipment must conform to the switchgear requirements listed in section 260. All other equipment must be located in an area where access to which is controlled by a lock.

270.10.50) The customer shall provide We Energies personnel 24–hour per day access to indoor vaults for the purpose of switching and maintenance.

270.20) Secondary Service Transformer Vaults.

270.20.05) Secondary Service Transformer Vaults requirements apply to a room in the customer's facility in which We Energies will build and own an electrical distribution substation. The customer is responsible for the structure and the environment and We Energies is responsible for the electrical distribution equipment.

270.20.10) Indoor vaults shall be located so as to be easily accessible by Company personnel to facilitate moving and operation of utility electrical distribution equipment. The customer must provide floors, doorways, passageways and/or elevators having structural strength and clearances adequate for the transportation, installation and replacement of transformers and associated equipment. These clearances should take into consideration the ultimate transformer size needed for the installation. It is highly desirable that a hatchway or doorway on an outside wall or ceiling of the vault will be provided such that the equipment can be installed directly from the outdoors.

270.20.20) The size and shape of the vault in which We Energies equipment is to be installed must be sufficient to safely operate the installed equipment, perform maintenance on such equipment, and remove and replace such equipment should that become necessary. The vault size and shape will be specified by the We Energies Application Engineer.

270.20.30) The transformer vault shall be constructed according to the requirements of the Wisconsin State Administrative Code, Volume 1 and 2, "Electrical", and meet the requirements of all local inspectors and local ordinances.

270.20.40) Vaults shall be located where they can be ventilated to the outside without using flues or ducts wherever such an arrangement is practicable. When special permission is granted by the administrative authority, flues and ducts may be used if the ducts are of a fire resistive construction.

270.20.50) The vault will be secured with a We Energies installed a high security cylinder lock in each door.

270.20.60) Pipe or duct systems foreign to the electrical installation shall not enter or pass through a transformer vault except by special permission. No system will be approved if it contains appurtenances that require maintenance.

270.20.70) Louvers at the outside of the building shall be covered with 8 mesh per inch copper wire screen and constructed to restrict entrance of snow and rain.

270.20.80) The walls and roofs of vaults shall be constructed of masonry materials which have adequate structural strength for the conditions with a minimum fire resistance of 3 hours. The floors of vaults in contact with earth shall be concrete not less than 4 inches thick, but when the vault is constructed with a vacant space or other rooms below it, the floor shall have adequate structural strength for the ultimate load and a minimum fire resistance of 3 hours.

270.20.90) The customer shall provide fireproof doors suitable for the required size of the doorway. All doors shall swing out of the vault. The We Energies Application Engineer will specify required doorway size and location. The fireproof rating of the door shall meet requirements of 270.20.80. A minimum 3.5" concrete sill or curb shall be provided under each vault doorway to contain within the vault the oil from the largest transformer unless the floor of the transformer vault is at least 4" inches below the adjacent area.

270.20.100) The customer shall provide floor drains to carry off any accumulation of water. The floor shall be pitched to the drains. Sump crocks and pumps associated with transformer vault floor drains shall be located outside of the transformer vault so they can be maintained without entry to the transformer vault. The customer shall consult with local sewerage district

to determine what if any provisions are required to prevent transformer oil entry into the local sewer system in the event of a transformer case leak. The customer is responsible to install any required oil stop provisions.

270.20.110) The customer shall provide ventilation adequate to dispose of transformer full–load losses without creating an excessive ambient temperature (above 40°C).

a) For a vault ventilated by natural circulation, the combined net area of all ventilating openings shall not be less than 3 square inches per kVA of ultimate transformer capacity. Roughly half of the total area of openings required for ventilation shall be in one or more openings near the floor and the remainder in one or more openings in the roof or side walls near the roof Intake and exhaust vents should be located at opposite ends of the vault to promote good air circulation.

b) For a vault ventilated by forced circulation, the forced air system shall provide a minimum ventilation capacity of 2 CF/M/kVA of ultimate transformer capacity. Fan or blower units shall be located outside of the transformer vault so that they can be maintained without entry to the transformer vault. Forced air systems shall be thermostat controlled with a turn–on temperature of 85° F.

270.20.120) When special permission is granted by the administrative authority to ventilate the transformer vault to the indoors, ventilation openings to the indoors shall be fitted with automatic closing fire dampers that operate in response to a vault fire. These dampers shall possess a standard fire rating of not less than 1–1/2 hours. For transformer vaults that are ventilated to the indoors the customer shall hold We Energies harmless for any damage that results from smoke or fire entry into the building associated with a transformer vault fire..

270.20.130) In addition to the lighting circuit, the customer is required to furnish and install one 20 ampere, 120 volt circuit in the transformer vault. This circuit shall be supplied from an emergency service, if present.

270.20.140) The customer shall provide fire suppression system (automatic sprinkler) if required by local inspectors and local ordinances. The fire suppression system shall be a type that is not damaged or activated by freezing temperatures. Heads and associated piping shall not obstruct replacement of transformers or switchgear.

270.20.150) Secondary services shall be metered per the We Energies “Electric Service and Metering Manual Book 1 and 2.

270.20.160) If the customer installs a We Energies approved service termination enclosure We Energies will extend secondary conductors within customer installed conduits from the

transformer vault to the termination enclosure. We Energies will extend conductors no greater than 8 feet outside the transformer vault.

270.20.170) If the customer installs a termination enclosure that is not approved by We Energies, the customer must extend secondary conductors from the termination enclosure to the terminals of the We Energies owned transformers in the transformer vault.

270.20.180) The customer shall be responsible for all maintenance to the:

a) Vault Structure – Walls, floors, ceiling, doors and fire proofing materials.

b) Ventilation System – Louvers, screening, duct work, fans, motors, motor controllers, thermostats, etc.

c) Drainage System – Drains, piping, sumps, pumps, etc.

d) Lighting Systems – Bulbs, fixtures, switches, outlets, conduit and wire.

e) Fire Suppression System – Sprinkler heads, piping, etc.

270.20.190) The Wisconsin State Administrative Code, Volume 2 "Electrical" and We Energies policy does not allow customers access to secondary metered substations. We Energies will inform the customer of any required maintenance, or at the request of the customer will escort the customer through the substation for the purpose of inspection. Any required maintenance will be performed by the customer or his contractor in the presence of a We Energies inspector.

270.30) Vault Agreement.

Prior to energizing any services from the transformer vault the customer shall sign a vault agreement stipulating to all items in section 270 above**.**

280) Interlock Systems

280.10) General

280.10.10) Interlock systems are normally utilized to prevent:

a) The unauthorized paralleling of two or more We Energies supply lines.

b) Improper operation or sequence of operations of various pieces of substation equipment.

c) Access to high voltage current carrying parts until such parts have been de–energized. All applicable codes shall be followed.

280.10.20) Interlock systems may be classified into three main divisions based on the type of interconnection between associated devices. The following is a brief description of each classification:

a) Mechanical interlocks consist of a bar, chain, gear or other mechanical arrangement between associated devices.

b) Electrical interlocks consist chiefly of switches and/or solenoids arranged at the associated devices and connected by electrical conductors. Application is limited to devices adjacent to a satisfactory electrical power source.

c) Key interchange interlocks consist of self–contained individual locking units located at associated devices which permit a desired operation only when conditions are correct for that operation.

280.10.30) After the Customer has completed the initial installation of any We Energies required key–interchange interlock system, all keys (except those held captive in locks) are to be given to We Energies Start–Up Engineer for use in placing the substation equipment in operation. We Energies shall maintain possession and control over all such keys.

280.20) We Energies Required Interlocks for Specific Installations

The following list of We Energies required interlocks are for installations most frequently encountered in customer substations. We Energies may however require interlock systems for installations other than those specifically covered herein as they occur. Specific requirements for these special situations will be provided when necessary by We Energies.

280.20.10) Two line supply with service circuit breakers – Single load fed from either source.
Customer shall provide and install an electrical or key interchange interlock system which will prevent paralleling of supply lines, and permit only one breaker to be closed at any one time by the customer. The system, however, shall permit both breakers to be open at the same time.

280.20.20) Two line supply with interrupter switches – Single load fed from either source.
Customer shall provide and install a key interchange interlock system for manually operated switches or a combination key interchange and electrical interlock system for motor–operated switches which will prevent paralleling of supply lines, by permitting only one interrupter switch to be closed at any one time by the customer. The interlock system shall, however, permit both interrupter switches to be open at the same time. See Part 3, Section II., E., Keyed Permissive Switches, for more information.

280.20.30) Two line supply with service circuit breakers – two loads fed from one source with one normally closed tie breaker or tie switch.
Customer shall provide and install a key interchange interlock system for manually operated devices or an electrical interlock system for electrically operated devices which will prevent paralleling of supply lines by permitting only two of the three devices to be closed at any one time by the customer. The interlock system shall, however, permit all three devices to be open at the same time.

280.20.40) Two line supply with interrupter switches – two loads fed from one source with one normally closed tie switch.
Customer shall provide and install a key interchange interlock system for manually operated switches or a combination electrical and key interchange interlock system for motor operated switches which will prevent paralleling of supply lines by permitting only two of the three interrupter switches to be closed at any one time by the customer. The interlock system shall, however, permit all three interrupter switches to be open at the same time.