



Part 1: Electrical Requirements

100) Service Voltages

We Energies will specify the service voltage. We Energies may specify the use of dual voltage equipment in some areas of its service territory to accommodate planned conversion to a different service voltage.

Part 1: Electrical Requirements

110) Short Circuit Duty

110.00.10) We Energies will provide the Customer the maximum three phase symmetrical fault current, system X/R ratio and the single phase to ground symmetrical fault current (or the maximum symmetrical and asymmetrical fault currents) for the proposed customer substation using the section 010.20 “New Customer Substation Project Information Sheet” near the front of this manual.

110.00.20) Circuit protective device(s) shall have an interrupting rating sufficient for the system voltage and the current available at the terminals of the device.

110.00.30) Circuit protective devices will be restricted in size and timing to coordinate with existing We Energies source side devices.

110.00.40) Switching and disconnecting devices shall have a fault close rating sufficient for the current available at the terminals of the device.

110.00.50) All devices shall have a momentary withstand rating sufficient for the current available at the terminals of the device.

Part 1: Electrical Requirements**120) Disconnecting Means for Supply Conductors**

120.00.10) The Customer shall provide quantity one (1) disconnect device to isolate each set of We Energies supply circuits from the Customer substation equipment.

120.00.20) The disconnect device(s) shall be located at the nearest point of connection to the We Energies owned supply conductors.

120.00.30) The disconnect device(s) shall be readily accessible. The disconnect device(s) shall be located near a door or gate providing egress from the substation. Other substation equipment shall not be located between the door or gate and the operator of the disconnect device(s).

120.00.40) Disconnect devices which are accepted by We Energies shall consist of one of the following types of equipment in 120.00.40.a through 120.00.40.d:

a) A three phase group-operated load interrupter switch. The device shall conform to the requirements of 120.00.50, 120.00.60 and 120.00.70.

b) For single phase services, a single pole load interrupter switch. The device shall conform to the requirements of 120.00.50, 120.00.60 and 120.00.70.

c) Non draw-out type circuit breakers or circuit reclosers when associated with disconnect switch(es) located on the source side of the circuit breaker or recloser. The disconnect switches shall conform to the requirements of 120.00.50.

d) Draw-out type circuit breakers.

120.00.50) The switch or disconnect shall provide a visible break of all circuit phases. The visible break shall be observable from the source side of the circuit breaker or recloser.

120.00.60) The switch shall be operated by a handle mechanism without exposing the operator to contact with live parts.

120.00.70) The operating handle shall have provisions for locking in the open and closed position. The customer shall lock the switch in the proper position, and provide a mechanism to allow We Energies personnel to operate the switch. This is typically accomplished by providing a key to the customer lock, or by providing a shackle which has an opening at either end (this allows the customer to install a lock at one end, and We Energies to install a lock at the other end).



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120.00.80) An insulator shall be installed in the operating pipe of any switch installed on a wood pole or metal structure. This insulator shall be rated to withstand the phase to ground voltages on the system it will ultimately be served from and shall be located at an elevation of 10' to 12' above the operating handle for the switch.

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130) Unprotected Bus

An unprotected main bus may only be installed when the following conditions are met:

130.00.10) The design of the bus and all materials used in its construction shall be in accordance with We Energies requirements.

130.00.20) All taps from the bus shall be protected by We Energies accepted overcurrent devices.

130.00.30) Insulated cable is not allowed within the unprotected zone.

130.00.40) The circuit length of unprotected strain bus shall not exceed 25 feet without We Energies acceptance.

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140) Service Overcurrent Protection

140.10) Fuses

Fuse requirements are listed below.

140.10.10) Fuse Curves

The Customer shall provide We Energies information, including the manufacturer, type and family of time versus current curves for the proposed fuse type. We Energies will then specify the maximum fuse size that will be allowed at the particular substation location.

140.10.20) Fuse Mountings

All outdoor fuse mountings installed in Customer Substations for service protection shall be of the disconnecting type and shall be removable using a hotstick.

140.20) Circuit Breakers

Circuit breaker requirements are listed below.

140.20.10) Relays

a) We Energies will specify the type and maximum setting of overcurrent relays. The Customer shall provide We Energies certified test reports verifying relay settings and calibration.

b) The current transformers to which the overcurrent relays are connected shall be located on the supply side of the main circuit breaker.

140.20.20) Control Supply Battery

The Customer shall provide, install and maintain a stationary storage battery of sufficient capacity to ensure tripping. Capacitor tripping schemes are not acceptable.

140.30) Circuit Reclosers

Recloser requirements are listed below.

140.30.10) Operating Curves

The Customer shall provide We Energies information including manufacturer, type and operating curves. We Energies will then specify the maximum trip current or control settings.

140.30.20) Recloser Operation

The recloser must be equipped and set for single non-reclosing operation. *Automatic reclosing of Customer service protective devices is not permitted.*

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150) Basic Impulse Insulation Levels and Maximum Continuous Operating Voltages

150.00.10) All high-voltage equipment installed by the Customer on the line side of the service overcurrent protection devices shall have a BIL rating and rated maximum continuous operating voltage not less than that stated in 150.10.

150.00.20) All service overcurrent protection devices shall have BIL ratings and rated maximum continuous operating voltages not less than that stated in 150.10.

150.00.30) For installations without main service overcurrent protective devices, the main bus insulation systems and the overcurrent protective devices connected to the main bus shall have minimum BIL ratings and rated maximum continuous operating voltages not less than that stated in 150.10 (next page).



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150.10) BIL Levels and Maximum Continuous Operating Voltages for Substation Equipment

Nominal System Voltage (kV)	Maximum Continuous Operating Voltage (kV)	Maximum Phase-to-Ground Voltage During Faults (kV)	Equipment Rated Maximum Continuous Operating Voltage	Equipment BIL (kV)	Reduced BIL With Surge Protection (kV)	Notes
3.81Y/2.2	—	—	—	60	—	1
4.16Y/2.4	—	—	—	60	—	1
8.32Y/4.8	—	—	—	75	—	1
12.47Y/7.2	—	—	—	95	—	1
13.2Y/7.62	13.97Y/8.07	9.5	15	95	—	
13.8Y/7.97	14.52Y/8.38	10	15	95	—	
13.2	13.97	14	15	110	95	2
13.8	14.52	14.5	27	125	—	
24.94Y/14.4	26.4Y/15.24	18	27	125	—	
26.4	27.98	22	29	200	125 or 150	2
34.5Y/19.92	36.51Y/21.08	26	38	200	150	2
34.5	36.51	37	38	200	150	2
69	—	—	—	—	—	1
138	—	—	—	—	—	1

Notes:

1. By special permission only. Please contact the local We Energies office before designing for these voltages.
2. We Energies may accept the use of equipment with reduced BIL when the installation includes properly placed and appropriately rated surge arresters. We Energies shall be consulted in all cases where the installation of equipment with reduced BIL ratings is proposed.

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160) Surge Protection

160.00.10) The Customer shall install surge arresters on all circuit phases on the line side of the main service disconnect(s). These surge arresters shall be polymer body MOV arresters and require acceptance by We Energies

160.00.20) If the Customer's distribution system is overhead and operates at the service voltage provided by We Energies (no transformation), the Customer shall install surge arresters on all circuit phases on the load side of the We Energies metering instrument transformers .

160.00.30) The application of the appropriate surge arrester class shall be determined based on the maximum fault duty quoted in section 010.30 "We Energies Electrical System Information: Voltage and Fault Duties" located near the front of this manual. Please request this form for each installation location from the local We Energies representative. This information shall be used in conjunction with sections 160.10 and 160.20 (see the next page) to determine the appropriate arrester for the each site.

160.00.40) Arrester expulsion elements shall not be used inside metal enclosed or metal clad switchgear assemblies.



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160.10) Surge Arresters

NOMINAL CIRCUIT VOLTAGE (V)	SURGE ARRESTER			Notes
	Class	Duty Cycle Voltage Rating (kV)	MCOV Rating (kV)	
3,810Y/2,200	DISTRIBUTION	3	2.55	1
4,160Y/2,400	DISTRIBUTION	3	2.55	1
8,320Y/4,800	DISTRIBUTION	6	5.1	1
12,470/7,200	DISTRIBUTION	10	8.4	1
13,200Y/7,620	DISTRIBUTION	10	8.4	
13,800Y/7,970	DISTRIBUTION	10	8.4	
13,200	INTERMEDIATE	10	8.4	
	STATION	10	8.4	
13,800	INTERMEDIATE	15	12.7	
	STATION	15	12.7	
24,940Y/14,400	DISTRIBUTION	18	15.3	
	INTERMEDIATE	18	15.3	
26,400	INTERMEDIATE	21	17	
	STATION	21	17	
34,500	INTERMEDIATE	36	29	
	STATION	36	29	
34,500Y/19,920	INTERMEDIATE	27	22	
	STATION	27	22	
69,000				1
138,000				1

Note 1: By special permission only. Please contact the local We Energies office before designing for these voltages.

160.20) Surge Arrester Class

CLASS	PHASE TO GROUND SYMMETRICAL FAULT CURRENT (AMPERES)
Distribution	10,000 or less
Intermediate	20,000 or less
Station	>20,000

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170) Transformer Connections and Taps

170.10) Acceptable Transformer Connections for We Energies Systems.

Row	Nominal System Voltage	Acceptable Transformer Connections			
		3 Wire Secondary		4 Wire Secondary	
		Primary	Secondary	Primary	Secondary
1	*3,810/2,200V 4 Wire *4,160/2,400V 4 Wire *8,320/4,800V 4 Wire *12,470/7,200V 4 Wire 13,200/7,620V 4 Wire 13,800/7,970V 4 Wire 13,200V 3 Wire 26,400V 3 Wire 34,500V 3 Wire	Δ	Δ	Δ	GND Y
		Δ	Y		
		Y	Δ		
2	13,800V 3 Wire <i>See 170.10.a.</i>	Δ	Y	Δ	GND Y
3	24,940/14,400V 4 Wire 34,500/19,920V 4 Wire <i>See 170.10.b.</i>	GND Y	Y	GND Y	GND Y
		Triplex Core Only		Triplex Core Only	
4	24,940/14,400V 4 Wire 34,500/19,920V 4 Wire <i>Transformer must be 3000kVA or larger, or be protected as described in 170.10.b.3.</i>	Δ	Δ	Δ	GND Y
		Δ	Y		
		Y	Δ		
5	24,940/14,400V 4 Wire 34,500/19,920V 4 Wire <i>Transformer must be protected as described in 170.10.b.3.</i>	GND Y	Y	GND Y	GND Y
6	*69,000V 3 Wire				
7	*138,000 V 3 Wire				

*By special permission only. Please contact the local We Energies office before designing for these systems.

Table 170.10 is continued on the next page.

Part 1: Electrical Requirements

170.10) (continued)

a) On the 13,800V 3 wire system, it is recommended that the Customer install three single phase transformers connected phase-to-phase. When the We Energies distribution system is converted to 24,940/14,400V 4 wire operation, the transformers may be reconnected in a grounded-wye configuration (taking advantage of the high voltage taps as well).

b) On the 24,940Y/14,400 volt and 34,500Y/19,920 volt systems, transformer installations shall have grounded-wye primary winding connections, and three phase triplex core and coil design with grounded-wye or ungrounded-wye secondary winding connections. These restrictions are designed to avoid ferroresonant conditions and eliminate tank heating phenomena under all abnormal system operating conditions.

b.1) Exception 1: When banking single phase transformers connected in a grounded-wye to grounded-wye configuration or grounded-wye to ungrounded-wye configuration.

b.2) Exception 2: When the transformer rating is 3000kVA or more, transformer connections in Row 4 of 170.10 are acceptable.

b.3) Exception 3: When transformer(s) are protected with devices which sense the loss of source voltage by measuring voltage magnitude and phase angle, and will simultaneously disconnect all phases of the high voltage supply to the transformer(s) in the event of a loss of phase condition. *Contact the local We Energies representative for acceptability before proceeding with this exception.*

b.4) Exception 4: Where a customer presently owns and operates a system and is adding transformation, the transformer connections on the existing equipment are acceptable for the new equipment (providing the connections are listed in Row 4 of 170.10).

170.20) T-Connected Transformers

T-connected transformers shall not be utilized by the Customer at the We Energies supply voltage.

170.30) Transformer Taps

Each transformer shall have five full capacity primary taps with one at nominal system voltage, and two taps at 2 1/2% above, and two taps at 2 1/2% below nominal system voltage. *Customers installing transformers supplied by We Energies 13,800 volt and 26,400 volt distribution system shall contact We Energies for specific tap requirements prior to ordering the equipment.*

Part 1: Electrical Requirements



180) Station Grounding

180.10) General

180.10.10) All substation grounding shall comply with the Wisconsin and Michigan State Electrical Codes and applicable local ordinances. The goal of a substation grounding system design is for the preservation of human life and the protection of equipment through the control of local potential.

180.10.20) This defines the minimum Company requirements for a grounding system; however it is not a design guide. The customer is responsible for the complete design. The following requirements are regarded by We Energies as minimum standards that must be met before We Energies personnel will enter and operate a customer substation, but do not in themselves guarantee that the design is adequate. A Company representative may add to the requirements and recommendations according to site conditions.

180.10.30) The size of the ground conductor shall be appropriate for the magnitude of the available fault current, the operating time of protective devices, and for sufficient mechanical ruggedness. The minimum conductor size for the ground grid and connections to the grid, ground rod and equipment cases shall be #1/0 copper.

180.20) Indoor Substations

180.20.10) Basement Level Substations

a) A 1/4" x 1-1/2" aluminum bar or equivalent copper bar shall be installed along all inside walls of the vault to form a closed loop. In damp areas copper bar shall be utilized.

b) Five-eighths (5/8) inch diameter copperweld ground rods shall be driven at all vault corners and approximately equally spaced along vault walls. Single 8-foot long rods at each rod location are adequate. Install as many ground rods as space permits, maintaining 6-foot typical separation between rods. Do not locate ground rods under doorways or in any other position where they will be hazardous to people walking in the vault. All ground rods are to be connected to the ground bus.

180.20.20) Above Basement Level

a) A 1/4" x 1-1/2" aluminum bar or equivalent copper bar shall be installed along all inside walls to form a closed loop. In damp areas copper bar should be utilized.

b) The ground bar referred to in 180.20.20.a) shall be bonded to building steel in at least four places. The frames of all major equipment shall be bonded to building steel.

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180.30) Outdoor Substations

180.30.10) A grid is required under the entire area substation, consisting of bare–stranded copper cable buried 18 to 24 inches below the soil rough grade . The grid conductors shall be placed 15 feet apart or less depending on soil resistivity. In areas in which We Energies suspects high–resistivity soil, such a quarry, step and touch potential calculations shall be provided with the approval drawings per IEEE 80. A 4–ft by 2 ft grounding mesh is an acceptable supplement to the grid in the absence of these calculations. When required, the supplemental mesh must be installed on top of the rough grade, just under the crushed stone layer. Within the grid, cables connecting ground rods should be laid in parallel lines and uniformly spaced. They should be located, where practical, along rows of structures or equipment to facilitate the making of ground connections. These rows are to be interconnected at various points including the peripheral cable to form a grid. Interconnecting conductor size should not be less than that of the ground bus or grid.

180.30.20) Five–eighths (5/8) inch diameter copperweld ground rods shall be driven to a depth of 8 feet or more at all ground grid corners and approximately equally spaced along the grid perimeter. All ground rods are to be connected to the grid conductors.

180.30.30) A layer of gravel or crushed stone (minimum 6 inches in depth) shall be placed over the entire grid to establish the finished grade.

180.30.40) A buried ground conductor shall encircle all switchgear and transformers within 18 inches of the edge of the equipment enclosure, at a burial depth of at least 18 inches but less than 24 inches.

180.40) Equipment and Structures – Indoor and Outdoor Stations

All noncurrent–carrying metallic parts which might accidentally become energized or statically charged (such as switchgear enclosures, metal structures, building steel, transformer tanks, metal railings, housings, and guards, oil circuit breaker tanks and circuit neutrals) shall be connected to the grid or ground bus in a minimum of two locations by conductors of adequate capacity and mechanical ruggedness. The grid or ground bus should also be connected to any metallic water pipe, metallic drain or sewer pipe located in the station area. Connection shall be made at two points on the pipe at least 20 feet apart and shall consist of a conductor not less than the size of the ground bus.

180.50) Substation Fences

The metal fence surrounding an outdoor open–type substation shall be grounded in accordance with all applicable electrical codes. Of primary concern in the design of a fence grounding system is the reduction of potentials which could prove hazardous to persons within the fence enclosure or approaching from outside.

Part 1: Electrical Requirements

180.50.10) Fence Ground Interconnected With Station Ground Grid

- a) Consideration shall be given to interconnecting the station ground grid with the fence grounds at frequent intervals.
- b) The station ground grid shall be extended 2 feet beyond the substation fence. All corner and gate posts, as well as fence posts shall be connected to the grid.
- c) All metallic fence parts that might accidentally become energized or statically charged must be metallically connected together. At each entrance gate a buried ground conductor loop connected at each end to the perimeter fence ground conductor shall be placed so as to form a rectangle which encompasses an area extending at least 18 inches beyond the gate swing.

180.50.20) Fence Ground Isolated From Station Ground Grid

- a) If the Customer elects to isolate the fence ground system from the station ground grid, a potential difference may be present between the station equipment and the fence during fault conditions.
- b) Under this condition, a minimum separation of 6 feet shall be maintained between the fence and the nearest station ground conductor, grounded equipment, or structure.

180.60) Property Fence

180.60.10) These requirements are in addition to grounding requirements for substation fences (Item F above). Where a metallic property fence is attached to, or passes within 6 feet of a substation fence, it becomes an extension of the substation fence and must be treated accordingly.

180.60.20) Metal property fences installed on the Customer's property shall be grounded to ground rods installed one foot inside the fence at corner posts, gate posts, and at posts on each side of an overhead transmission or distribution line crossing. No connection with the substation ground system is necessary where a minimum separation of 6 feet is maintained between the substation fence and metallic property fence. A buried conductor connecting gateposts is recommended. Fence isolation sections may be utilized to electrically isolate extended sections of property fence from the substation.

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180.70) Outdoor Group–Operated Switches

In outdoor stations utilizing load break switches mounted on wood poles or metal structure, a three–foot by four–foot metallic grating shall be installed on the surface where a person stands when operating the switch. This section of grating shall be connected to the ground grid and the switch operating linkage as close as is practical to the handle. A minimum of #1/0 Cu conductor shall be used for this connection.

Part 1: Electrical Requirements

190) Protective Grounding

190.10) General

The following requirements shall be used as a guide for determining when and where provisions are needed for the attachment of temporary grounds.

190.10.10) Protection of personnel and property is the primary reason for the attachment of temporary grounds. Hazardous potential differences can exist between apparently de-energized electrical conductors or current-carrying parts of equipment and some other point. These potential differences may exist if the conductor is either accidentally energized or becomes charged because of its proximity to other energized conductors. Proper grounding and bonding will effectively eliminate such hazards.

190.10.20) Wisconsin and Michigan's State Electrical Codes and company operating practices dictate that de-energized conductors and other current-carrying equipment parts shall be grounded during the time construction or maintenance work is being done on them. Such grounding is generally accomplished by connecting a temporary ground cable assembly between the conductor and some grounded point. Under certain conditions, special provisions for the attachment to equipment such as grounding switches may be required where the use of individual ground cables would be impractical or hazardous.

190.10.30) The customer shall install "adequate grounding provisions" in each customer substation.

190.10.40) The Company requirements which follow do not cover every situation where grounds might be needed. However, by using the specific requirements included herein as a guide and with an understanding of the hazards involved if grounds are not applied, "adequate provisions" can be made at locations not specifically covered. Each potential source shall be isolated by a visible open from the work area. In addition, safety grounds shall be installed between the visible open and the work area. This document is intended to describe the equipment to meet those criteria.

190.10.50) In some substations grounds can be attached directly to the equipment or conductors. However, because of the limitation in ground clamp range and physical clearances required for safe installation of such clamps, special provisions (ground attachment details) must be made in certain cases for the attachment of ground cable assemblies. Such special provisions (ground attachment details) are also required for bus conductors of special shapes, such as rectangular bar, angle, channel, etc., and at certain locations to make the application of grounds more convenient.

190.10.60) All grounding provisions installed by the customer shall be located so as to render them accessible for safe and convenient application of ground cable assemblies.

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190.10.70) The Customer shall provide and install Company–approved grounding provisions for each incoming line (overhead service conductor or underground service cable). Refer to drawing 190.910.

190.10.80) Unless otherwise specified or permitted, such grounding provisions shall consist of a ground attachment detail permanently attached to each incoming line conductor at a conveniently accessible point on the line side of the Customer's main disconnect and ground bracket(s) located within the incoming line section and permanently connected to the station ground bus.

190.10.90) Refer to drawings 190.920, 190.930, and 190.940 for material specifications on the ground details and brackets.

190.20) Grounding Provisions for Specific Equipment

Applications for which basic requirements for line grounding provisions differ from those indicated above are outlined in the following paragraphs:

190.20.10) "Draw–out" Circuit Breakers

- a) When "draw–out" circuit breakers are used for service switching and overcurrent protection at customer substations, the customer shall provide a three–pole ground/test device.
- b) The ground test device is racked into a compartment in place of the circuit breaker, providing access to the completely insulated switchgear bus conductors for line grounding, bus grounding, low–voltage phase identification, and live–line phasing. Ground cable assemblies and ground brackets are used to complete the connections between the line or bus conductors and the substation ground system. An additional ground/test device may be required in some configurations .

190.20.20) Stationary–Mounted Circuit Breakers

In all customer substations using stationary–mounted circuit breakers for service protection, the Customer shall install ground attachment facilities on both line and load side of the breaker. These facilities can generally be installed on the breaker bushings or isolation disconnect switches. Ground brackets connected to the station ground bus are required for each set of attachment facilities.

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190.20.30) Oil and SF₆ Insulated Switches

190.20.30.a) Oil switches utilized as the customers' service disconnect shall have incoming cable terminations in air-filled compartments. Isolating means shall be provided between the cable terminations and the switch tank bushings. The customer shall provide and install a ground attachment detail at each cable termination. Ground brackets connected to the station ground bus shall be provided for each set of ground attachment facilities.

190.20.30.b) An alternate method may be employed through the use of insulated connectors and bushings. These must have the capability for phase testing, Hi-Potential and fault locate testing, testing for energized/de-energized condition, providing a visible circuit open point, and line grounding.

190.20.40) Power Fuses

The customer equipment shall accommodate grounding on both supply and load side of power fuses which cannot be replaced by means of a switch stick (due to weight, lack of accessibility, or the style of the fuse mount). These accommodations shall consist of ground attachment details installed on the supply side and load side terminals of each fuse mounting. Further, the fuse bay shall contain ground brackets totaling a minimum of 18". The ground brackets shall be connected to the station ground bus. These details are to accommodate safe and expeditious fuse replacement.

Exception: Supply side grounding details are not required if the equipment has slide in isolating barriers for the fuses (or switch – if located in the same compartment).

190.30) Grounding Cable Assemblies

190.30.10) The customer shall provide all necessary grounding cables.

190.30.20) Ground cable assemblies shall be rated for their intended application.

In cases where the Company's standard ground cable assemblies are of inadequate length, special clamping devices are required, the substation is not directly accessible from outside, or other unique circumstances prevail, the Customer shall provide special ground cable assemblies to be used only at the applicable station.

190.30.30) Where additional grounding provisions are installed beyond those specifically required by the Company, and/or where the Company required grounding provisions also include facilities for station bus or equipment grounding, as in the case of ground-test devices (see **190.20.10.**), the Customer shall provide at least one set consisting of three ground cable assemblies. Such cable assemblies shall be of adequate size and sufficient length as required for the specific application.



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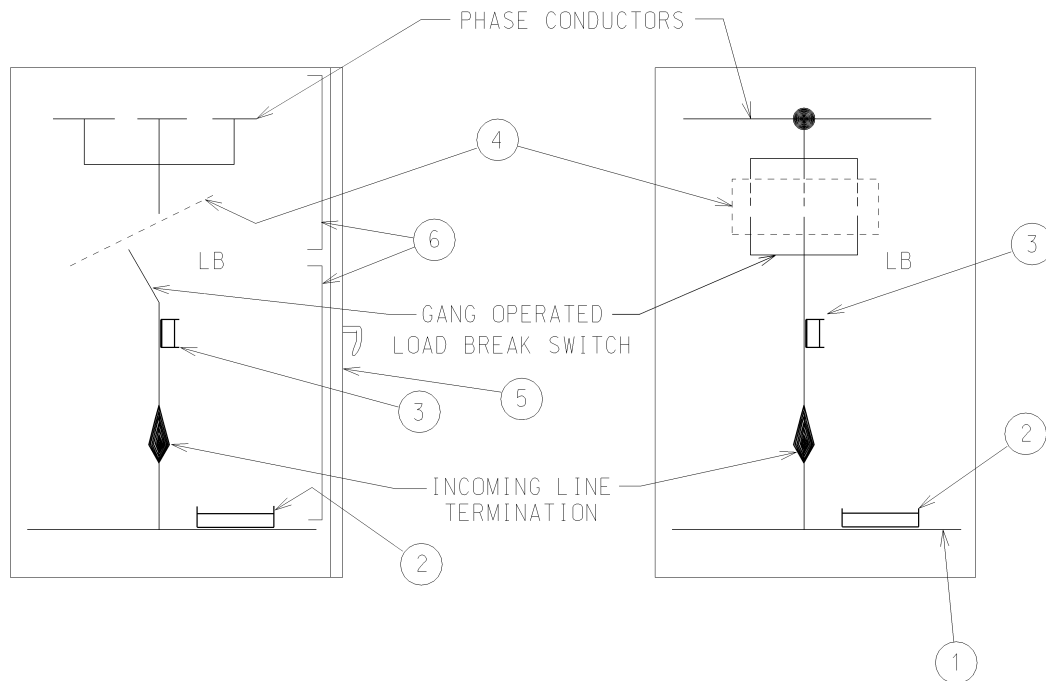
190.30.40) When required to provide ground cable assemblies, the Customer shall also provide suitable storage facilities for such devices. When not in use, ground cable assemblies should be stored appropriately for accessibility and protection from the elements.

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190.910

Grounding Facilities in Metal-Enclosed Switchgear Service Conductor Entrance Bays

ITEM	DESCRIPTION
1.	SWITCHGEAR GROUND BUS
2.	12-INCH GROUND BRACKET (SEE 190.940)
3.	3 1/2" GROUND ATTACHMENT DETAIL (SEE 190.930)
4.	SLIDE-IN ISOLATING BARRIER: REQUIRED FOR SUBSTATIONS SUPPLIED BY TWO OR MORE LINES.
5.	HINGED DOOR PER 260.20
6.	HINGED SCREEN DOOR(S) PER 260.50

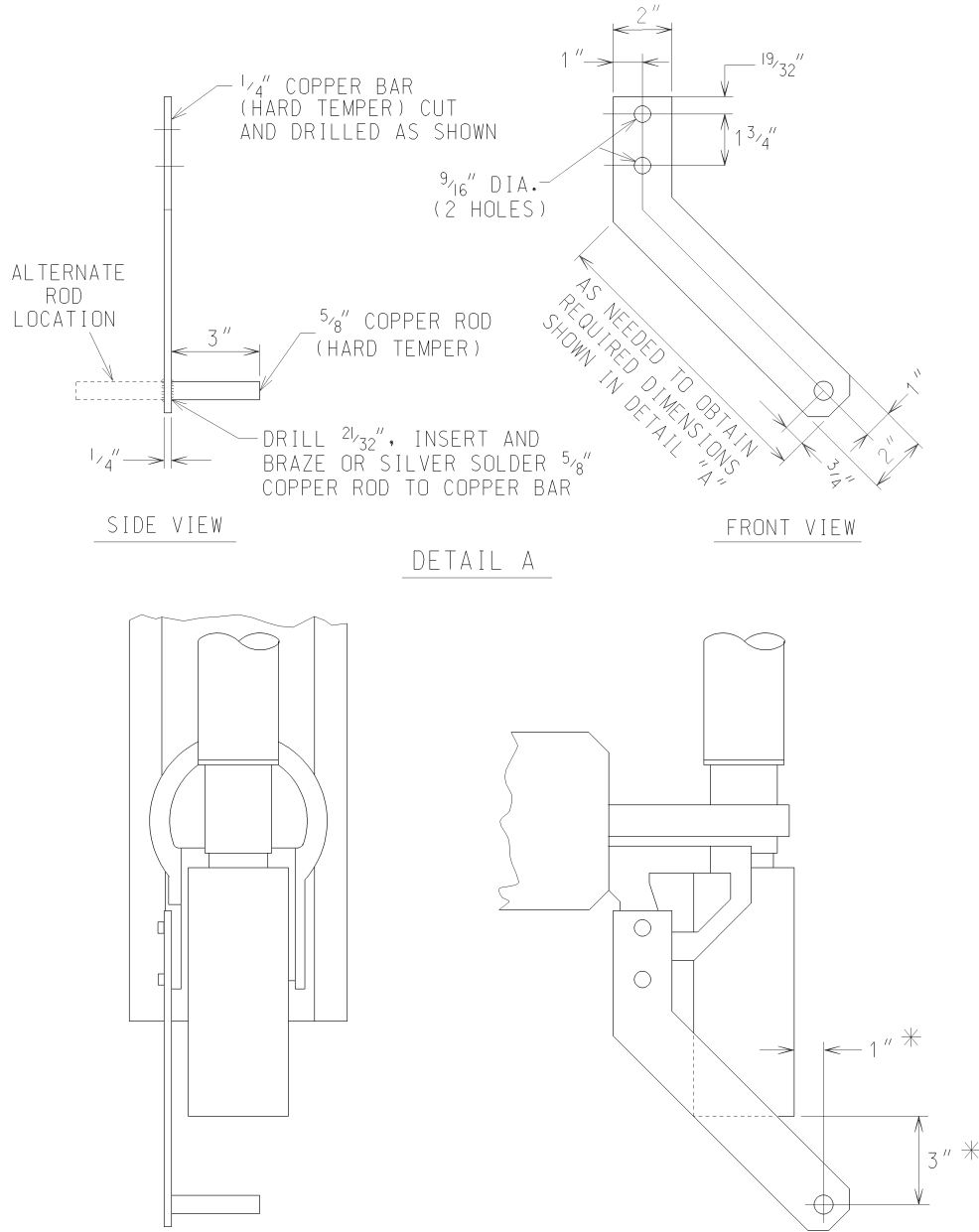


CGS File #91443F5

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190.920

Power Fuse Ground Attachment Detail



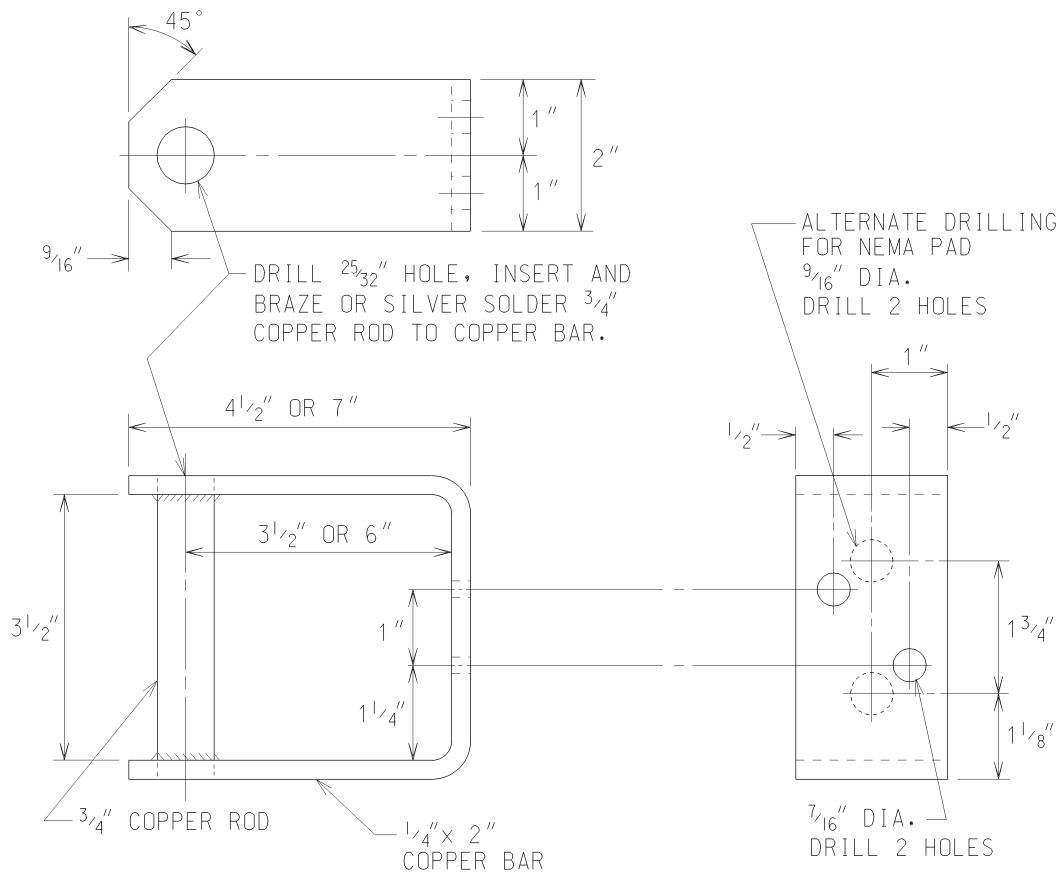
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* REQUIRED MINIMUM DEMENSIONS

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190.930

3-1/2" Ground Attachment Detail, 4-1/2" Depth and 7" Depth

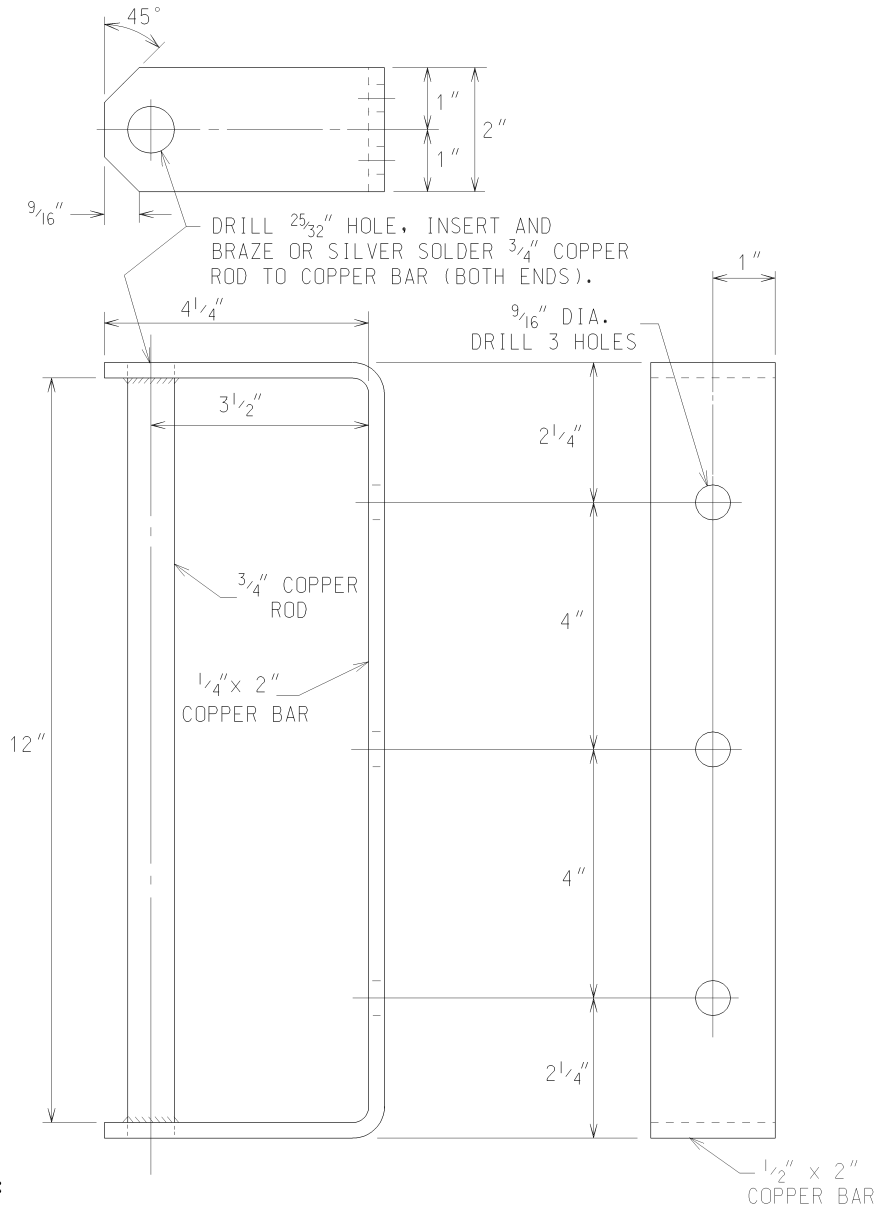


MATERIAL: $1/4'' \times 2''$ SOLID COPPER BUS BAR (HARD TEMPER) AND $3/4''$ DIAMETER SOLID COPPER ROD (HARD TEMPER).

CGS File #91443F7

Part 1: Electrical Requirements

**190.940
12" Ground Bracket**



MATERIAL:
 $\frac{1}{4}$ " x 2" SOLID COPPER BUS BAR (HARD TEMPER) AND
 $\frac{3}{4}$ " DIAMETER SOLID COPPER ROD (HARD TEMPER).

CGS File #91443F8

Part 2: Physical Requirements

195) Capacitors

195.00.10) The installation of shunt capacitors for power factor correction in customer substations can have undesirable effects upon We Energies supply and customers distribution system. Care should be taken when specifying capacitors. During off peak conditions, an excessive voltage rise or a leading power factor can occur. If the capacitors are switched, a voltage dip, light flicker, high frequency ringing, etc. are possible. Switching can also result in over and under voltages which can cause variable speed drives to shut down. In some applications, capacitors may provide a low impedance path for harmonics which may result in operation of protective devices. Harmonics may contribute to a "loss of life" for capacitors. It is suggested that customers have some knowledge of their harmonic levels, or pursue a harmonic analysis prior to specifying capacitors. No general limitations on capacitor size can be made, since the factors which produce these effects vary with the location of the customer's substation, characteristics of the customers load, etc.

195.00.20) The customer shall obtain approval from We Energies for the installation of shunt capacitors. We Energies may place restrictions on the use of these capacitors with respect to voltage regulation, telephone interference or other factors. Capacitors operating at lower voltages which are switched with individual loads are exempt from any restrictions.

195.00.30) Shunt capacitors connected to three-phase, three-wire systems are not grounded to:

- avoid possible interference with telephone equipment,
- obtain better compensation for unbalanced voltages.

It may be necessary, however, to ground shunt capacitors installed at certain locations on the three-phase, three-wire systems to obtain proper coordination of protective devices.

195.00.40) Shunt capacitors installed on 13,200 volt, 13,800 volt, 26,400 volt, 34,500 volt, 69,000 volt, and 138,000 volt three-phase, three-wire systems shall be wye-connected for ungrounded operation.



Part 2: Physical Requirements

197) Parallel Generation

The Customer shall contact We Energies for specific requirements concerning power quality, relaying, liability and safety.