

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.

Part 1: Electrical Requirements

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.

Part 1: Electrical Requirements

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.



Part 1: Electrical Requirements

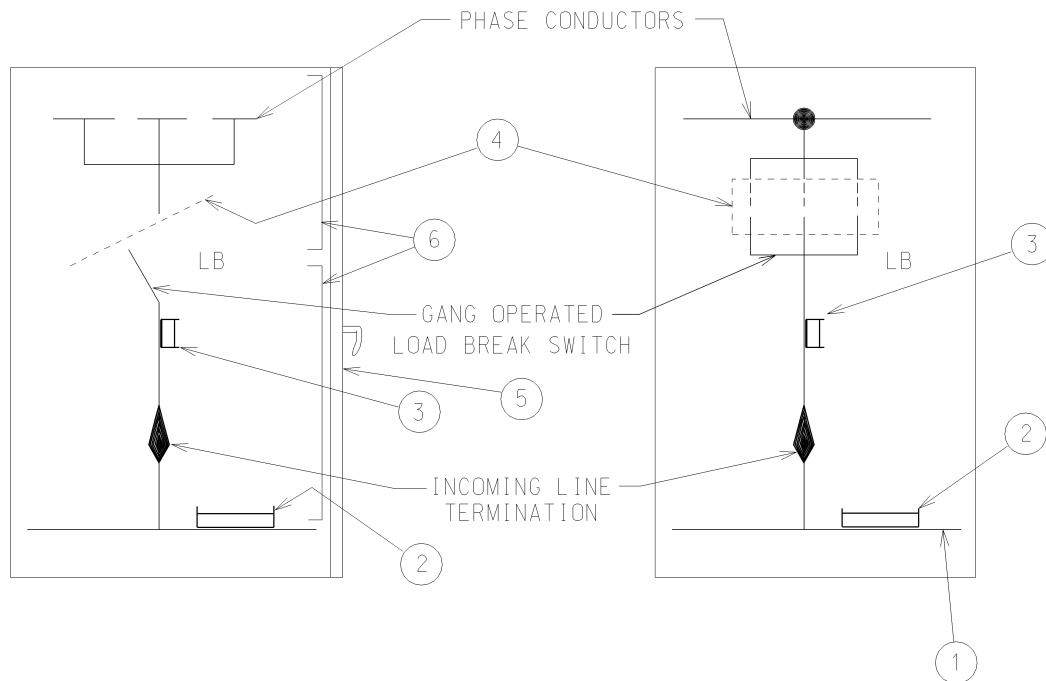
190.30.40) When required to provide ground cable assemblies, the Customer shall also provide suitable storage facilities for such devices. When not in use, ground cable assemblies should be stored appropriately for accessibility and protection from the elements.

Part 1: Electrical Requirements

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

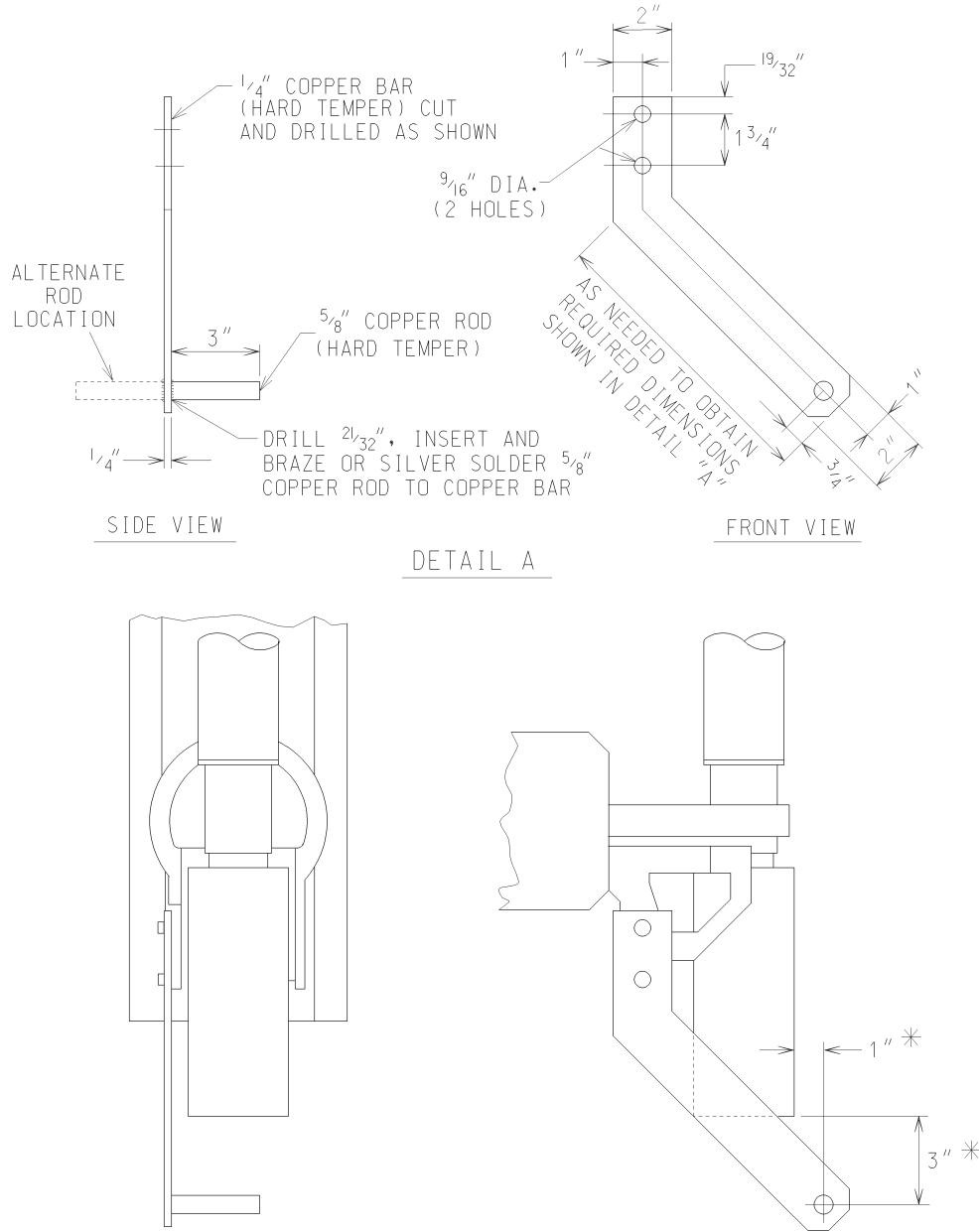


CGS File #91443F5

Part 1: Electrical Requirements

190.920

Power Fuse Ground Attachment Detail



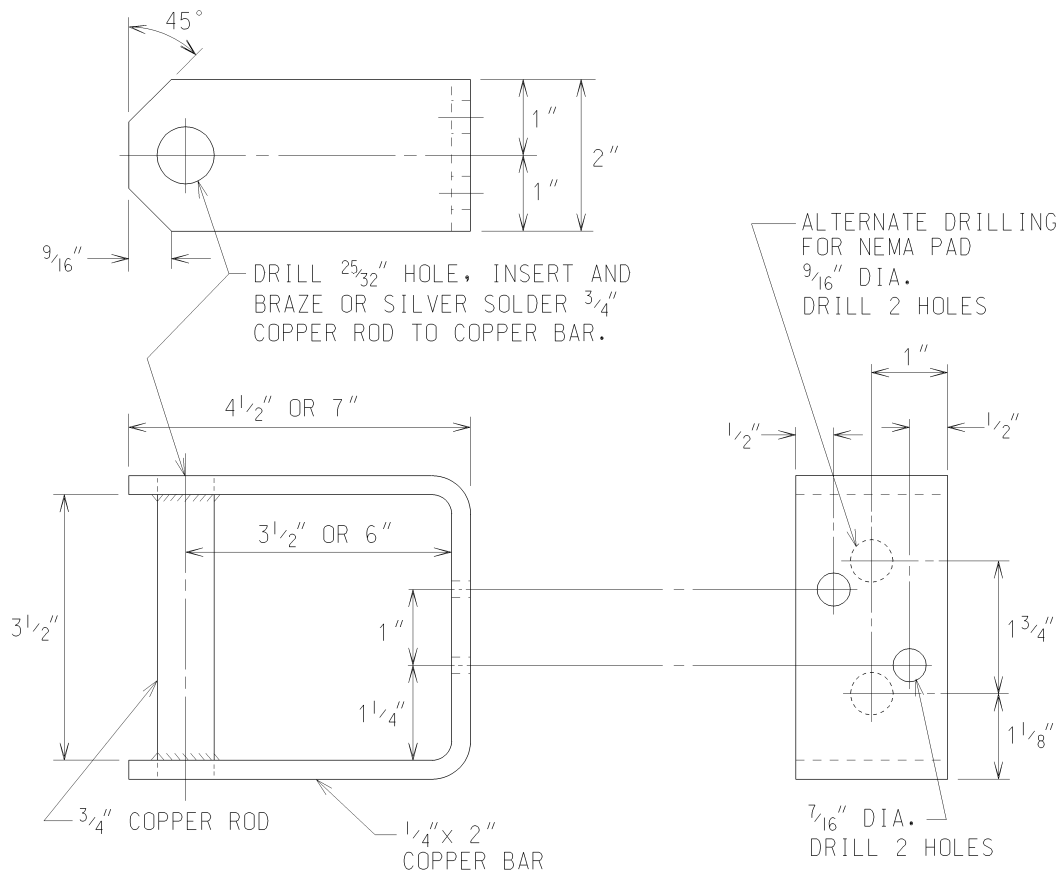
CGS File #91443F6

* REQUIRED MINIMUM DEMENSIONS

Part 1: Electrical Requirements

190.930

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

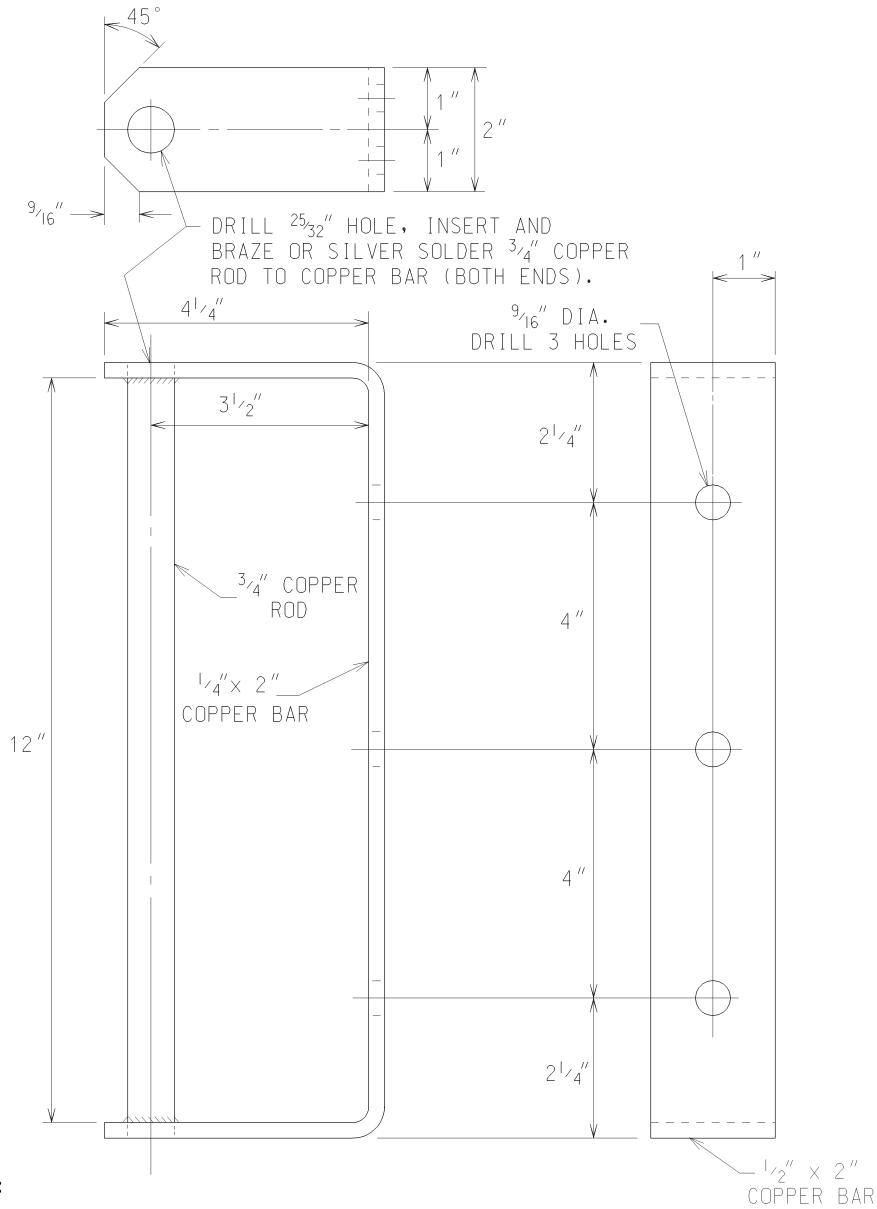


MATERIAL: $1/4$ " x 2" SOLID COPPER BUS BAR (HARD TEMPER) AND $3/4$ " DIAMETER SOLID COPPER ROD (HARD TEMPER).

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