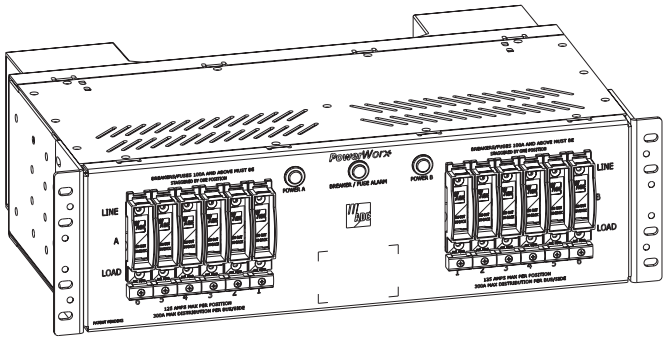
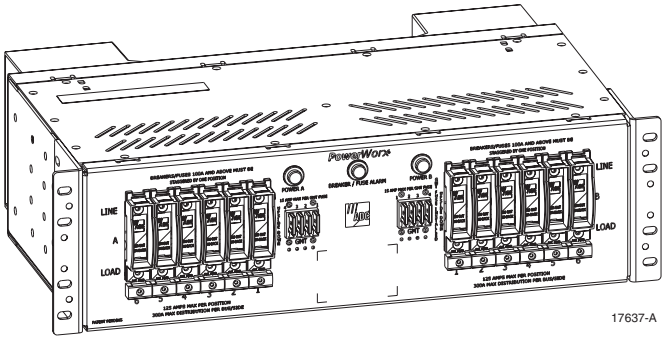
PowerWorx Advantage Series

# Circuit Breaker/Fuse Power Distribution Panel User Manual

Part # PWX-061-J0
*Effective: 12/2016*

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# PowerWorx Advantage Series
# Fuse Panels

**NOTE:**

**Photographs contained in this manual are for illustrative purposes only. These photographs may not match your installation.**

**NOTE:**

**Operator is cautioned to review the drawings and illustrations contained in this manual before proceeding. If there are questions regarding the safe operation of this powering system, contact Alpha Technologies or your nearest Alpha representative.**

**NOTE:**

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## Copyright

| ISSUE | DATE | REASON FOR CHANGE |
|---|---|---|
| 1 | 02/2003 | Original release |
| 2 | 07/2003 | Revised to provide information about center-trip circuit breakers |
| 3 | 10/2007 | Removed references to specific wire sizes for input power wiring (specifics replaced with “appropriate” in several places; revised grounding statement in two places. |
| 4 | 09/2010 | Added TLS/TPS fusing to product description, accessories, specifications, and procedures. |
| 5 | 10/2016 | Updated to Alpha brand. |

# Table of Contents

# List of Figures

# 1. Safety

SAVE THESE INSTRUCTIONS: This manual contains important safety instructions that must be followed during the installation, servicing, and maintenance of the product. Keep it in a safe place. Review the drawings and illustrations contained in this manual before proceeding. If there are any questions regarding the safe installation or operation of this product, contact Alpha Technologies or the nearest Alpha representative. Save this document for future reference.

**About This Manual**

This manual describes the PowerWorx Advantage Series 3RU (three rack unit) High Current Circuit Breaker/Fuse Power Distribution Panel and provides installation, test, operation, and maintenance procedures. The Advantage Series Power Distribution Panel is used to supply fused dc power to the –48 Vdc powered equipment that is installed in a typical bay line-up.

**Standards Certification**

The Advantage Series Power Distribution Panel complies with the applicable sections of the following standards: UL, NEC 2002, NEBS Level 3, and CSA.

## 1.1 Safety Symbols

To reduce the risk of injury or death, and to ensure the continued safe operation of this product, the following symbols have been placed throughout this manual. Where these symbols appear, use extra care and attention.

The use of ATTENTION indicates specific regulatory/code requirements that may affect the placement of equipment and /or installation procedures.

**NOTE:**

**A NOTE provides additional information to help complete a specific task or procedure. Notes are designated with a checkmark, the word NOTE, and a rule beneath which the information appears.**

**CAUTION!**

**CAUTION indicates safety information intended to PREVENT DAMAGE to material or equipment. Cautions are designated with a yellow warning triangle, the word CAUTION, and a rule beneath which the information appears.**

**WARNING!**

**WARNING presents safety information to PREVENT INJURY OR DEATH to personnel. Warnings are indicated by a shock hazard icon, the word WARNING, and a rule beneath which the information appears.**

## 1.2 General Safety

**CAUTION!**

**The power distribution panel uses electrical voltage and current levels that may be considered an electrical hazard per GR-1089. Only qualified personnel should be allowed to install, operate, maintain, or otherwise come into contact with this equipment when energized. Only insulated tools should be used on energized elements of the panel.**

**WARNING!**

**Disconnect or turn off the power before connecting the fuse panel input or output wires. This may require turning off the system office battery input at the office distribution panel or removing the appropriate output circuit fuse at the fuse panel.**

**CAUTION!**

**Using the wrong fuse or circuit breaker may cause damage to the protected equipment or the power distribution panel. When replacing a blown fuse, make sure the fuse-type and current rating of the replacement fuse complies with any recommendations provided by the manufacturer of the protected equipment and does not exceed the maximum for the panel.**

**WARNING!**

**Wet conditions increase the potential for receiving an electrical shock when installing or using electrically-powered equipment. To prevent electrical shock, never install or use electrical equipment in a wet location or during a lightning storm.**

**WARNING!**

**Rings, watches, and bracelets can accidentally come into contact with electrically energized terminals and wires. Always remove all personal jewelry before working on electrical equipment.**

**CAUTION!**

**This unit has two power inputs. For total isolation from electrical shock and energy hazard, disconnect both power inputs. Care must be taken to correctly connect each power supply to separate power sources.**

# 2. Product Overview

This section describes the functions and features provided by the PowerWorx Advantage Series 3RU High Current Circuit Breaker/Fuse Power Distribution Panel and provides a table of product specifications.

Choice of dual 10/10 or dual 20/20 configuration. The dual 10/10 panel (ten fuses per bus) uses individual GMT fuse holders. The dual 20/20 panel (20 fuses per bus) uses 4-position GMT fuse holders.

Maximum fuse size of up to 20 Amps for dual 10/10 panels (with individual fuse holders) and of up to 10 or 15 Amps (depending on the panel type) for dual 20/20 panels. The maximum fuse size is printed on the panel. Fuse sizes on all panels include all GMT standard fuse sizes up to the maximum printed on the panel.

## 2.1 Product Function and Features

The Advantage Series breaker/fuse panel, shown on the cover page of this manual, is used to supply protected dc power for applications that require high current circuit breakers and/or fuses (up to 100 Amps per circuit breaker, and up to 125 Amps per fuse). The Advantage series panel may be used to provide primary power distribution to secondary power distribution panels, such as the Traditional GMT fuse panel or the Select Series circuit breaker/fuse panel, which is typically used in applications requiring under 50 Amps.

The Advantage series panel may also be used to provide high-current secondary power distribution to network elements that draw over 50 Amps of current. The Advantage series panel is typically installed in a central office, multimedia headend, remote site, CEV, or other restricted access location requiring breaker/fuse protected dc power.

The Advantage Series breaker/fuse panel provides the following basic functions and features:

- Dual –48 Vdc input power bus feeds with a maximum rating of 300 Amps per bus.
- Six high current circuit breaker/fuse mounting positions for each of the two power buses. Can be used with either TPC or TLS/TPS fuses and/or circuit breakers. Maximum circuit breaker size available is 100 Amps. Maximum fuse size available is 125 Amps (TPC or TLS). Maximum TPS fuse size is 70 Amps.
- One 4-position GMT fuse holder (option) for each of the two power buses. The maximum fuse size is 15 Amps.
- One high-brilliance breaker/fuse alarm indicator (field-replaceable red LED).
- Two high-brilliance power indicators (one field-replaceable green LED for each bus).
- Universal mounting brackets permit installation in a 19- or 23-inch, WECO or EIA, equipment rack.
- Mounts within 3 rack spaces (5.25 inches).
- –48 Vdc input and output voltage.
- Two-hole compression-lug style terminals for input and high current output power connections.
- Four grounding studs to ensure reliable chassis ground connectivity.
- Screw-down terminals or wire-wrap pins for alarm relay contact connections (Normally Open, Normally Closed, and Common).
- Form C relay contacts are provided to indicate when there is a blown fuse or tripped circuit breaker or when there is a loss of power from an input power bus.
- Easy to remove/replace plastic protective covers mount over the input and output terminal connections to enhance safety.

## 2.2 Breaker/Fuse Panel Components

The basic Advantage Series breaker/fuse panel is shown in Figure 1 and the same panel with the GMT fuse option is shown in Figure 2. The breaker/fuse panel components are either mounted on or housed within a powder-painted sheet metal (cold rolled steel) enclosure. The circuit breaker/fuse mounting positions, the power LED indicators, and the fuse alarm LED indicator are located on the front side of the enclosure.

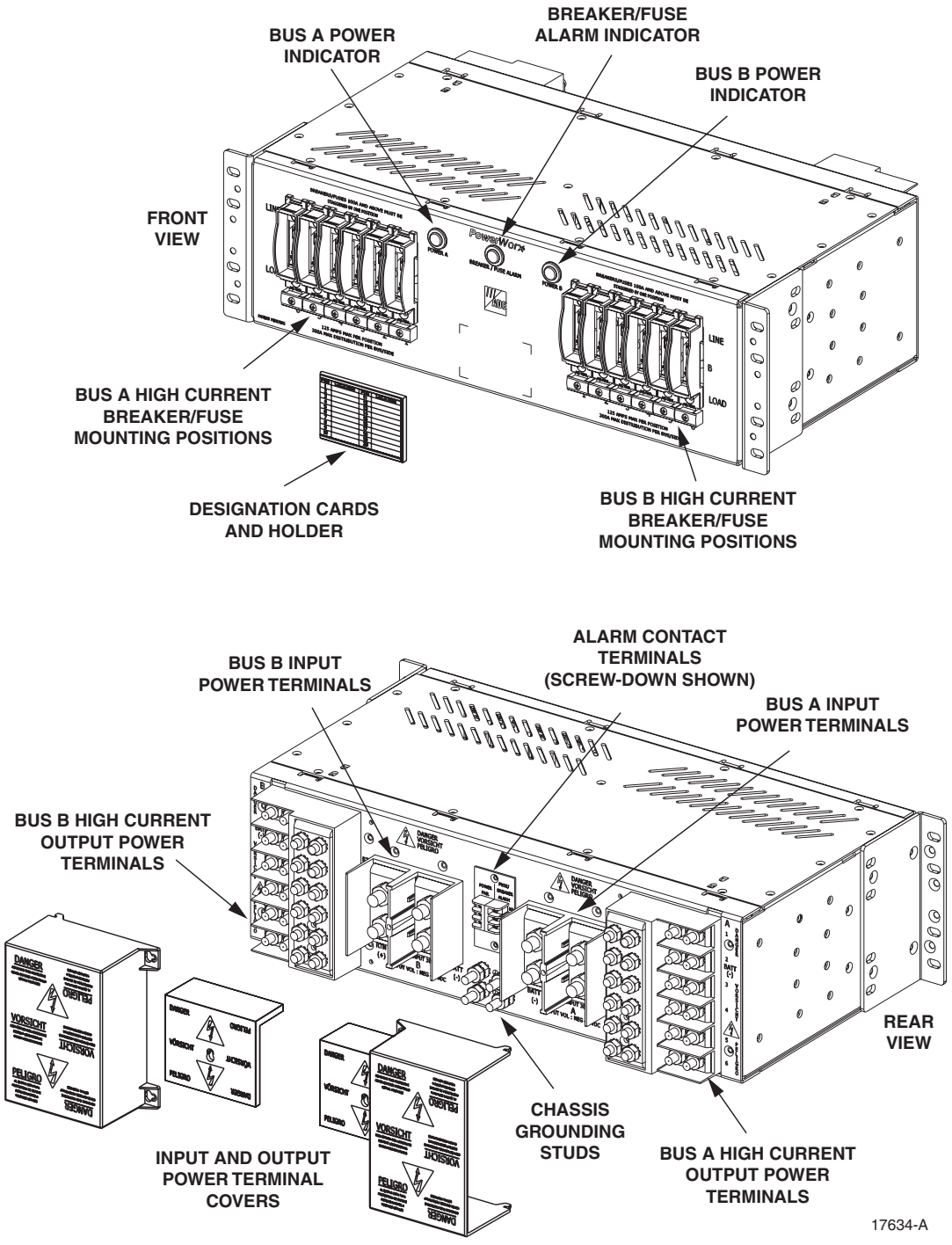



Figure 1 — Advantage Series Circuit Breaker/Fuse Panel Without GMT Fuse Option

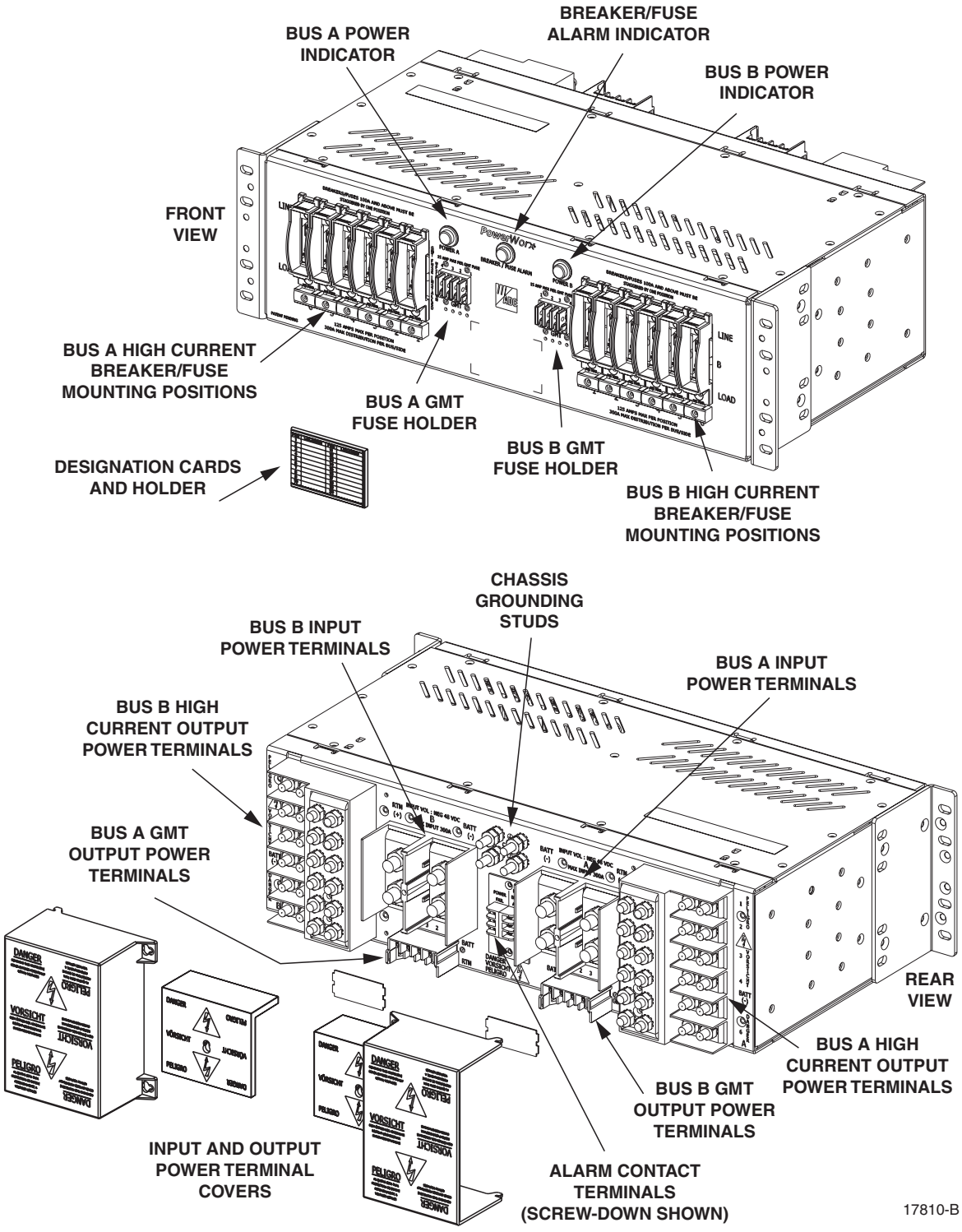



Figure 2 — Advantage Series Circuit Breaker/Fuse Panel With GMT Fuse Option

The input power terminals, output power terminals, fuse alarm terminals, and grounding studs are located on the rear side of the breaker/fuse panel enclosure. The plastic protective covers install over the input and output power terminals. The covers prevent accidental contact with the terminals when power is applied to the breaker/fuse panel. The internal bus wiring and alarm relay circuit boards are mounted within the enclosure and are not user accessible. Fuses, circuit breakers, lug terminals, and other items are available separately as accessory items.

## 2.3 Packaged Hardware

The Advantage Series breaker/fuse panel includes various hardware components that are packaged separately and shipped in the carton with the basic breaker/fuse panel. The packaged hardware components are shown in Figure 3 and include the following items:

- 3/8-inch long, combination drive, 12-24 pan-head screws (4) and #12 flat washers (4) - Used to secure the breaker/fuse panel mounting brackets to the equipment rack.
- Designation cards (2), card holder, and clear cover - Used to record information about the fused equipment. The card holder includes a pressure sensitive adhesive backing for quick attachment to flat vertical surfaces. The card and clear cover insert into the card holder. Also available as an accessory item.
- Fuse holder adapters - Used for mounting TPC and TLS/TPS fuse holders
- 6-32 flathead screws (24) - Used for securing circuit breakers to circuit breaker holders or fuses holder adapters to fuse holders.
- Designation windows (12) and cards (4) - Used for labeling each individual circuit breaker/fuse position.
- Rear protective covers (6) - Used to prevent accidental contact with the power input and output terminals.

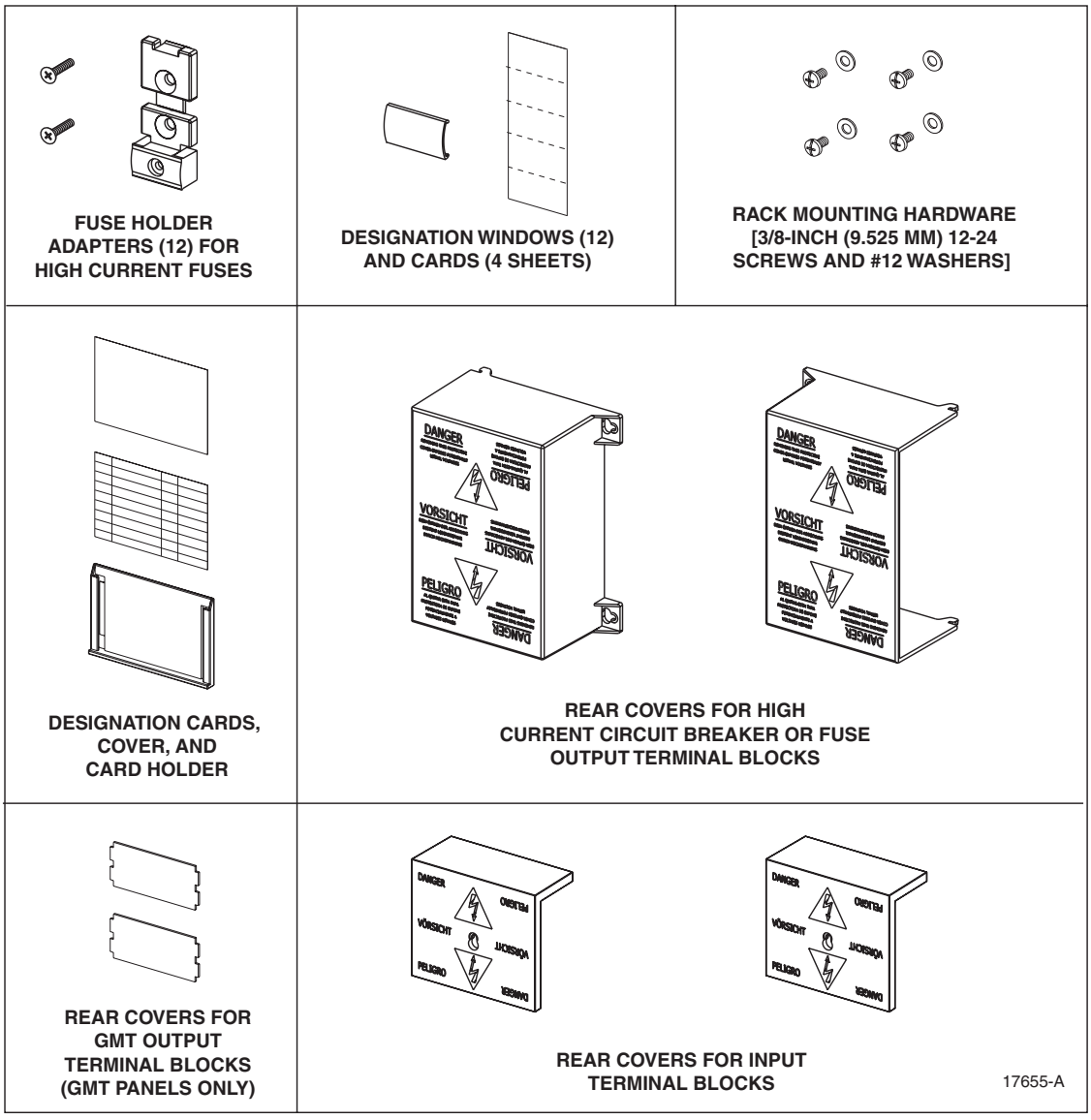



Figure 3 — Packaged Hardware Components

## 2.4 Options

The basic Advantage Series circuit breaker/fuse panel provides six high current circuit breaker/ fuse mounting positions for each power bus. On an optional basis, the basic circuit breaker/fuse panel may be ordered with two 4-position GMT fuse holders. Each GMT fuse holder will accept a maximum fuse size of 15 Amps. Two sets of terminal blocks (one for each bus) with screw- down terminals are provided for the GMT output power connections. The GMT output power terminals have a bottom feed orientation. Also available on a optional basis, the alarm terminal block may be ordered with either screw-down terminals or wire-wrap pin terminals.

## 2.5 Accessories

The following accessories are available from ADC for the Advantage Series circuit breaker/fuse panel documented in this manual:

- TPC fuses (Bussmann) - Available in the following sizes: 5, 20, 25, 30, 40, 50, 60, 75, 90, 100, and 125 Amps.
- TPC fuse holders with bullet type terminals (Bussmann) - Required for installing TPC fuses.
- LS Littelfuses - Available in the following sizes: 20, 25, 30, 35, 40, 50, 60, 70, 80, 90, 100, and 125 Amps.
- LTFD101 (Telecom fuse disconnect) fuse holders with bullet type Littelfuse terminals - Required for installing TLS fuses.
- 18/100 Amp GMT fuse - Required in each fuse holder. It is used as an alarm indicator when the main TLS fuse blows.
- GMT fuses - Available in the following sizes: 18/100, 2/10, 1/4, 3/8, 1/2, 3/4, 1, 1-1/3, 1-1/ 2, 2, 2-1/2, 3, 3-1/2, 4, 5, 7-1/2, 10, 12, and 15 Amps.
- GMT fuse puller - Used to grip GMT fuse for easy removal from panel.
- Circuit breakers (Carling C-Series with bullet style terminals) - Available in the following sizes: 5, 7.5, 10, 15, 20, 25, 30, 35, 40, 50, 60, 70, 80, 90, and 100 Amps.
- 2-hole compression lugs - Used to attach cables to the power input and output terminals and chassis ground studs.
- Designation cards (2), card holder, and clear cover - Used to record information about the fused equipment. The card holder includes a pressure sensitive adhesive backing for quick attachment to flat vertical surfaces. The card and clear cover insert into the card holder.

## 2.6 Mounting

The Advantage Series breaker/fuse panel can be mounted in either a 19- or 23-inch (482.6 or

584.2 mm) equipment rack. A universal set of mounting brackets is provided with the panel. The breaker/fuse panel can be flush mounted or recessed 2, 4, or 5.52 (center of gravity) inches (50.8, 101.6, or 140.2 mm). The mounting brackets are equipped with multiple holes to allow the fuse panel to be mounted in racks with WECO 1.0-inch (25.4 mm) or EIA 1.25-inch (31.8 mm) hole spacing. The breaker/fuse panel requires 5.25 inches (133.4 mm) of rack space for mounting plus one open rack space above and below the chassis for air circulation (UL installation requirement).

## 2.7 Power Buses

The Advantage Series breaker/fuse panel has two isolated power bus (power feed) circuits which are designated as the A and B power buses. Each power bus circuit distributes the input power to the corresponding A and B output power circuits. In each bus circuit, current flows from the input power terminals, through the circuit breaker or fuse, to the output power terminals. The maximum current capacity of each power bus circuit is 300 Amps which is marked on the front side of the breaker/fuse panel. The power dissipation of the breaker/fuse panel is 60 watts maximum at 300 Amps per bus.

## 2.8 High Current Fuses

The Advantage Series breaker/fuse panel accepts TPC or TPS/TLS type fuses. Fuses install in individual fuse holders (with bullet type terminals) that insert into the breaker/fuse mounting positions on the panel front side. Up to six fuses can be installed per power bus. The maximum fuse size available for a TPC or TPS fuse is 125 Amps. The maximum fuse size available for a TLS (Littelfuse) fuse is 70 Amps. An empty mounting position must be left on either side of any fuse that is rated at 100 or more Amps. Fuses and fuse holders are available from ADC as accessory items.

Fuse functionality is as follows for the different types:

- When a TPC fuse opens, the input power bus is disconnected from the corresponding output circuit. This causes the breaker/fuse alarm LED to light and opens/closes a set of alarm relay contacts. A red LED on the front of the TPC fuse lights to indicate which fuse has opened. Bussmann TPC fuses and fuse holders are available separately as accessory items.
- When a TPS or TLS opens, the corresponding GMT indicator fuse blows, disconnecting the output circuit from the power bus. This causes the breaker/fuse alarm LED to light and opens/closes a set of alarm relay contacts. The blown GMT fuse indicates the exact circuit that has been blown.

## 2.9 GMT Fuses

The Advantage Series breaker/fuse panel with the GMT fuse option uses standard GMT fuses which can range in size from 18/100 to 15 Amps. The GMT fuses install in two fuse holders located on the front side of the panel.

The fuse holders have a maximum capacity of four GMT fuse positions on each side. The maximum fuse size is 15 Amps. When a fuse opens, the input power is disconnected from the corresponding output circuit. This causes the Breaker/Fuse Alarm LED to light and opens/ closes a set of alarm relay contacts. GMT fuses are available separately as accessory items.

## 2.10 Circuit Breakers

The Advantage Series breaker/fuse panel uses single-pole magnetic circuit breakers (equipped with bullet type terminals) that can range in size from 5 to 100 Amps. The circuit breakers insert into the breaker/fuse mounting positions on the front side of the breaker/fuse panel. Circuit breaker holders with integral finger guards are provided with the breaker/fuse panel to prevent accidental operation of the breaker handle. Up to six circuit breakers can be installed for each power bus. The maximum size circuit breaker is 100 Amps. An empty mounting position must be left on either side of a 100 Amp circuit breaker.

When a circuit breaker trips, the input power bus is disconnected from the corresponding output circuit. This causes the breaker/fuse alarm LED to light and opens/closes a set of alarm relay contacts. Carling C-series circuit breakers are available separately as accessory items. Airpax LELK1 series circuit breakers and Eaton AM1R series circuit breakers can also be used.

## 2.11 Input/Output Voltage

The Advantage Series breaker/fuse panel accepts an input voltage of –48 Vdc (nominal) within a range of –42 to –56 Vdc. The output voltage is the same value as the applied input voltage.

## 2.12 Input Power Connections

Input power is supplied to the fuse panel through the A and B input power terminal blocks. Each input terminal block includes two pairs of 3/8-inch studs that are used for connecting the BATT (battery –) and RTN (return +) input power cables. Each pair of studs is mounted on 1.0 inch centers and accepts 2-hole compression lugs with a maximum width of 1.3 inches (33 mm). Compression lugs for various wire sizes are available as accessory items. Nuts with captive washers are included to secure the compression lugs to the studs. The input terminal blocks are located on the rear side of the fuse panel and are oriented vertically for top-down or bottom-up cable entry.

## 2.13 High Current Output Power Connections

High current output power is supplied to the protected equipment through the A and B high current output power terminal blocks. Each high current output terminal block includes twelve pairs of 1/4- inch studs that are used for connecting the BATT (battery –) and RTN (return +) output power cables. Each pair of studs is mounted on 0.625 inch centers and accepts 2-hole compression lugs with a maximum width of 0.72 inches (18.1 mm).

Compression lugs for various wire sizes are available as accessory items. Nuts with captive washers are included to secure the compression lugs to the studs. The high current output terminal blocks are located on the rear side of the fuse panel and are oriented horizontally for left-side (B bus) and right-side (A bus) cable entry. For operation at 125 Amps, the minimum recommended wire size for the output power wiring is #2 AWG wire.

## 2.14 GMT Output Power Connections

When the breaker/fuse panel is equipped with GMT fuses on each side, output power is supplied to the protected equipment through the A and B GMT output power terminal blocks. Each terminal block consists of four pairs of screw down terminals equipped with M3.5 screws. The terminal pairs are used for connecting the power feed and power return output power wiring to the fused equipment. Each terminal will accept a compression-type lug terminal with a maximum width of 0.312 inches. Copper wire in sizes ranging from #14 to #22 AWG may be used for the output power wiring. The output power terminal blocks are located on the rear side of the panel and are oriented for bottom cable entry.

## 2.15 Ground Connections

Two pairs of 1/4-inch studs are provided on the rear side of the breaker/fuse panel for grounding the chassis. Each pair of studs is mounted on 0.625 inch centers and accepts 2-hole compression lugs. Compression lugs for various wire sizes are available as accessory items. Nuts with captive washers are included to secure the compression lugs to the studs. Two #1 AWG (stranded) or two #2 AWG (flex) copper wires are recommended for the grounding cables.

## 2.16 Alarm Operation and Connections

The Advantage Series breaker/fuse panel contains circuitry that opens and closes a set of Form C relay alarm contacts when a breaker/fuse opens or when power to either power bus is lost. These contacts may be used to open or close a loop connected to an external alarm system.

During normal operation (power applied), the normally open (NO) contacts remain open and the normally closed (NC) contacts remain closed. When a breaker trips, a fuse opens, or when power to a power bus is lost, the NO contacts close creating a connection between NO and common (C) terminals; and the NC contacts open creating an open circuit between NC and C terminals. The rating for the alarm relay contacts is 110 Vac/125 Vdc maximum voltage, 1.0 Amp maximum switching current.

Panels may be ordered with screw-down terminals or wire-wrap pins for the alarm terminal connections. One set of terminals is provided for power failure alarms and the another set of terminals is provided for circuit breaker/fuse alarms. The two sets of terminals are labeled POWER FAIL and FUSE/BREAKER ALARM. Alarm terminals may be jumpered if required to provide one alarm connection to report both power fail and fuse/breaker alarms. The screw-down terminals will accept #16 to #30 AWG copper wire and a spade-type compression lug with a maximum width of 0.20 inches (5 mm). The wire-wrap pins will accept #22 to #26 AWG wire. All alarm connections are located on the rear side of the breaker/alarm panel.

## 2.17 LED Indicators

Two green LED power indicators (POWER A and POWER B) are provided on the front side of the breaker/fuse panel. A separate power indicator is provided for each of the two power input buses (A and B). The power indicators stay on as long as power is supplied to the corresponding power bus. The power indicators turn off if power is turned off to the corresponding power bus. Each power indicator LED can be field-replaced if it fails.

One red LED breaker/fuse alarm indicator (BREAKER/FUSE ALARM) is provided on the front side of the breaker/fuse panel. The breaker/fuse alarm indicator turns on if a breaker trips or a fuse opens on either of the two power buses. The breaker/fuse alarm indicator turns off when the tripped breaker is reset or when the open fuse is removed or replaced with a functional fuse. The breaker/fuse alarm indicator LED can be field-replaced if it fails.

## 2.18 Cooling

The Advantage Series breaker/fuse panel relies on convection air flow for cooling. Holes are provided on the top and bottom of the panel to allow heated air to escape from the panel and cool air to enter. At least one rack unit of space must be provided above and below the fuse panel to allow for air circulation

**CAUTION!**

**Blocking the vent holes could allow excessive heat to build up within the breaker/fuse panel which could shorten the life of certain internal components. Always provide the specified clearance above and below the panel.**

## 2.19 Dimensions and Specifications

Figure 4 shows dimensions for the Advantage Series panel. Table A lists specifications.

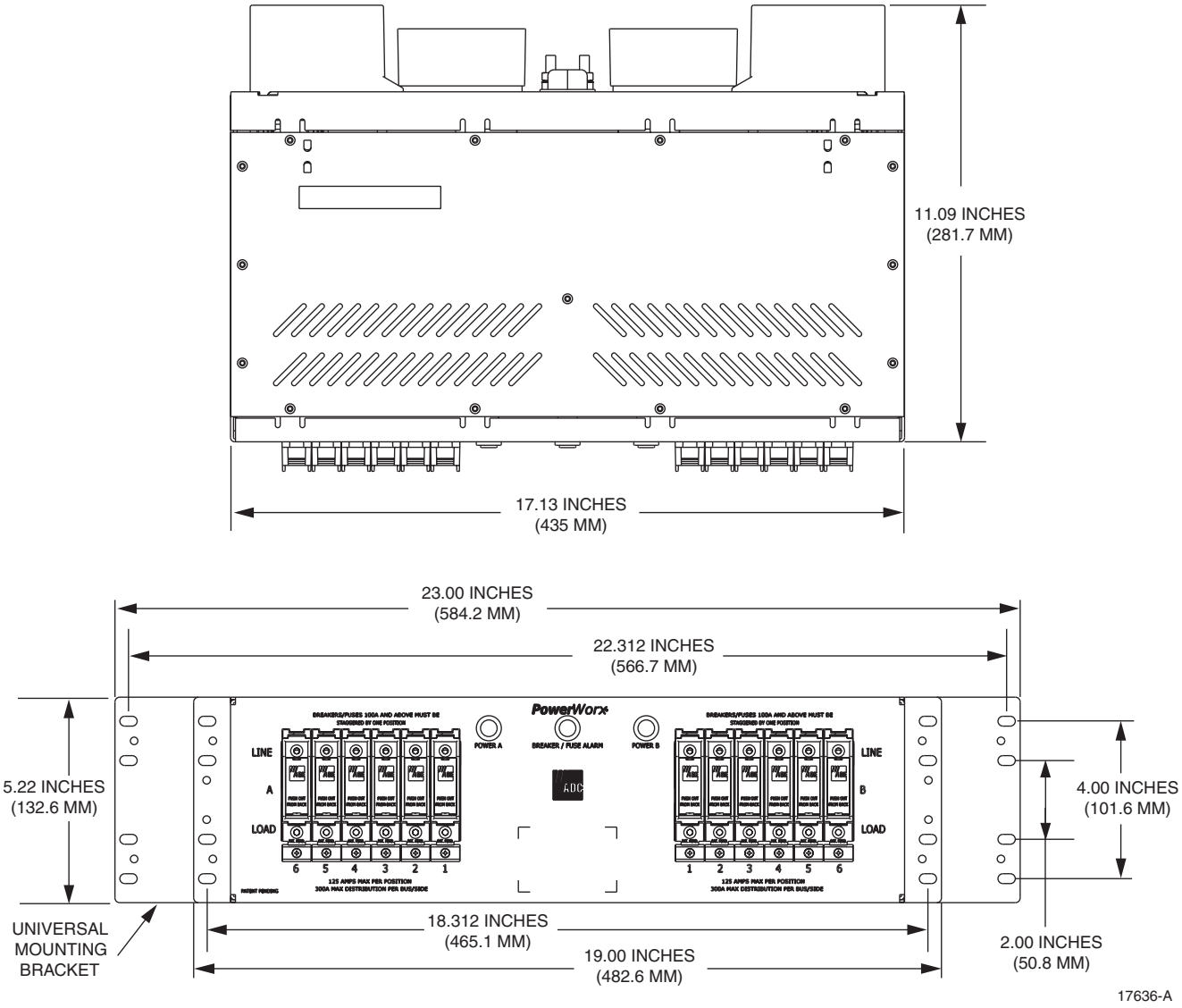



Figure 4 — Dimensions of Advantage Series Breaker/Fuse Panel

The following table provides specifications for the Advantage Series panel.

**Table A — Fuse Panel Specifications**

| Parameter | Specification | Remarks |
|---|---|---|
| **Physical** | | |
| Weight | 25 lbs. (11.34 kg) | |
| Dimensions (HxWxD) | 5.22 x 17.13 x 11.09 inches (132.6 x 435 x 281.7 mm) | See Figure 4 |
| Color | Putty white | |
| Rack mounting | 19- or 23-inch | EIA or WECO hole spacing |
| **Electrical** | | |
| Operating voltage | –48 Vdc | –42 to –56 Vdc tolerance |
| Input current | 300 Amps per bus maximum | |
| Fuse types<br>TPC (Bussmann) GMT<br>TPS<br>TLS (Littelfuse) | <br>125 Amps maximum<br>15 Amps maximum<br>125 Amps maximum<br>70 Amps maximum | TPC, TLS, and TPS fuses require bullet type fuse holders. TLS and TPS fuse holders (LTFD101) have a GMT fuse indicator (18/100) |
| Circuit Breaker type<br>Magnetic, single pole | <br>100 Amps maximum | <br>Bullet type terminals |
| Breaker/high current fuse posi- tions | 6 per bus, 12 total | |
| GMT fuse positions | 4 per bus, 8 total | |
| Input terminal type | 2-hole compression lug (1.0 inch hole spacing | Maximum lug width 1.3 inch (33 mm) |
| High current output terminal type | 2-hole compression lug (0.625 inch hole spacing) | Maximum lug width 0.72 inch (18.1 mm) |
| GMT output terminal type | Screw down terminals with M3.5 screws | Maximum lug width 0.318 inch (8 mm) |
| Alarm terminal type | Screw down terminals (with 3- 48 screws) or wire-wrap pin | Max lug width 0.20 inches (5 mm) |
| Alarm contact voltage | 110 Vac, 125 Vdc maximum | |
| Alarm contact current | 1 Amp maximum | |
| Grounding connections | 2-hole compression lug (0.625 inch hole spacing | |
| **Environmental** | | |
| Operating temperature | –5º C to +55º C (23º F to +131º F) | |
| Storage temperature | –45º C to +85º C (–49º F to +185º F) | |
| Humidity range | 0% to 95% humidity | No condensation |
| Altitude range | Up to 13,000 ft. (3.96 km) | |
| Fire rating | All components UL94-V1 or better | |
| Acoustic noise | 0 dBA above ambient | |
| Heat dissipation (fully loaded) | 60 watts maximum | 300 Amps per bus |
| Heat dissipation (no load) | 3 watts | |
| **Torque** | | |
| Mounting bracket chassis screws | 25 pound force-inches | 2.8 Newton meters |
| Mounting bracket rack screws | 27 pound force-inches | 3.1 Newton meters |
| Input power terminal nuts | 50 pound force-inches | 5.6 Newton meters |
| High current output power terminal nuts | 32 pound force-inches | 3.6 Newton meters |
| GMT output power terminal screws | 15 pound force-inches | 1.7 Newton meters |
| Alarm terminal screws | 8 pound force-inches | 0.9 Newton meters |
| Grounding stud nuts | 32 pound force-inches | 3.6 Newton meters |

# 3. Before Starting Installation

This section provides general installation recommendations, unpacking and inspection procedures, and lists the tools and materials required for breaker/fuse panel installation.

## 3.1 General Installation Recommendations

The Advantage Series breaker/fuse panel must be installed in a central office, equipment room, CEV or other restricted access location. Mount the breaker/fuse panel in the uppermost area of the rack to reduce the exposure of the power wiring.

Route the ground, alarm, and power cables to the breaker/fuse panel according to local practice and procedures. After routing the cables, secure them to the equipment rack or to any cable management devices that are in use. Follow the instructions provided in this manual for connecting the cables to the breaker/fuse panel. The wiring procedures are sequenced so that the grounding, alarm, and output power wiring will be installed before the input power wiring is connected. After all wiring is completed, install a lockout devise at the breaker/fuse panel input power source (power bay) to prevent power from being accidentally applied to the panel. Do not apply power to the breaker/fuse panel until instructed to do so for installation testing (see Section 4, Testing). After all the wiring has been installed and all installation tests have been completed, install the protective covers on the rear side of the breaker/fuse panel.

**WARNING!**

**The breaker/fuse panel uses electrical voltage and current levels that may be considered an electrical hazard per GR-1089. Only qualified personnel should be allowed to install, operate, maintain, or otherwise come into contact with this equipment when energized. Only insulated tools should be used on energized elements of the panel.**

**WARNING!**

**Wet conditions increase the potential for receiving an electrical shock when installing or using electrically-powered equipment. To prevent electrical shock, never install or use electrical equipment in a wet location or during a lightning storm.**

## 3.2 Unpacking and Inspection

Before starting the installation, always open the shipping boxes and verify that all parts have been received and that no shipping damage has occurred. Use the following procedure to unpack and inspect the fuse panel:

1. Open the shipping carton and carefully unpack the fuse panel from the protective packing material.
2. Check the fuse panel for broken or missing parts. If there is any damage, contact Alpha Technologies before proceeding.

**In Canada and the USA, call toll free 1-888-462-7487**

**Customers outside Canada and the USA, call +1-604-436-5547.**

## 3.3 Installation Tools Required

- The following tools are required to install the breaker/fuse panel:
- Phillips screwdrivers (#1 and #2)
- Flat-blade screwdrivers (medium and large
- Torque screwdriver calibrated in pound-force inches or Newton meters
- Torque wrench calibrated in pound-force inches or Newton meters
- 9/16-inch and 7/16-inch sockets (for torque wrench)
- Wire cutter
- Wire stripper
- Wire-wrap tool (wire-wrap pin alarm terminals are available as an option)
- Compression lug crimpers for multiple lug sizes
- Multimeter
- Heat gun

## 3.4 Materials Required

The following materials are required to install the breaker/fuse panel:

- Insulated copper wire of appropriate size for input power connections
- #1 AWG (stranded) or #2 AWG (flex) copper wire for ground connections
- #2 AWG insulated copper wire (or whatever size is appropriate for the load) for the high current output power connections
- #14 to #22 AWG insulated copper wire for GMT output power connections
- #16 to #30 AWG insulated copper wire for screw-down terminal alarm connections or #22 to #26 AWG insulated solid copper wire for wire-wrap terminal alarm connections
- Compression lugs for the input, output, and grounding cable connections
- UL94V0 rated heat-shrink tubing
- Circuit breakers
- TPC fuses and TPC fuse holders
- GMT fuses (option)

# 4. Installation

This section provides the installation procedures for the Advantage Series breaker/fuse panel.

## 4.1 Test Continuity

Each Advantage Series fuse panel is thoroughly tested before being shipped. However, before the breaker/fuse panel is installed, a continuity test should be performed to verify that no internal damage has occurred during shipping and handling. Using a multimeter that is set to perform a continuity check, perform the following tests.

### Test 1: Input Battery to Input Return

Connect one test probe to the bus A input power BATT (–) terminal and the other test probe to the bus A input power RTN (+) terminal (see Figure 5). Verify that no continuity exists between the input power BATT and RTN terminals. Repeat test procedure for the bus B input power terminals.

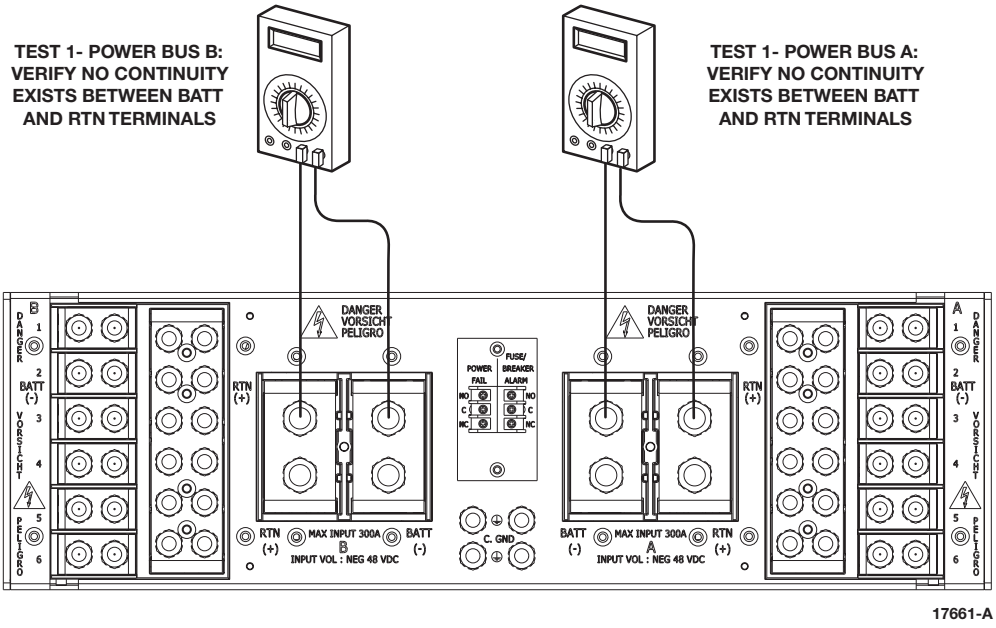



Figure 5 — Test 1: Input Battery to Input Return

### Test 2: Input Return to High Current Output Return

Connect one test probe to the bus A input power RTN (+) terminal and the other test probe to the bus A high current output power RTN (+) terminal (see Figure 6). Verify that continuity exists between the specified terminals. Repeat the same test procedure for the bus B input power RTN (+) terminal and the bus B high current output power RTN (+) terminal.

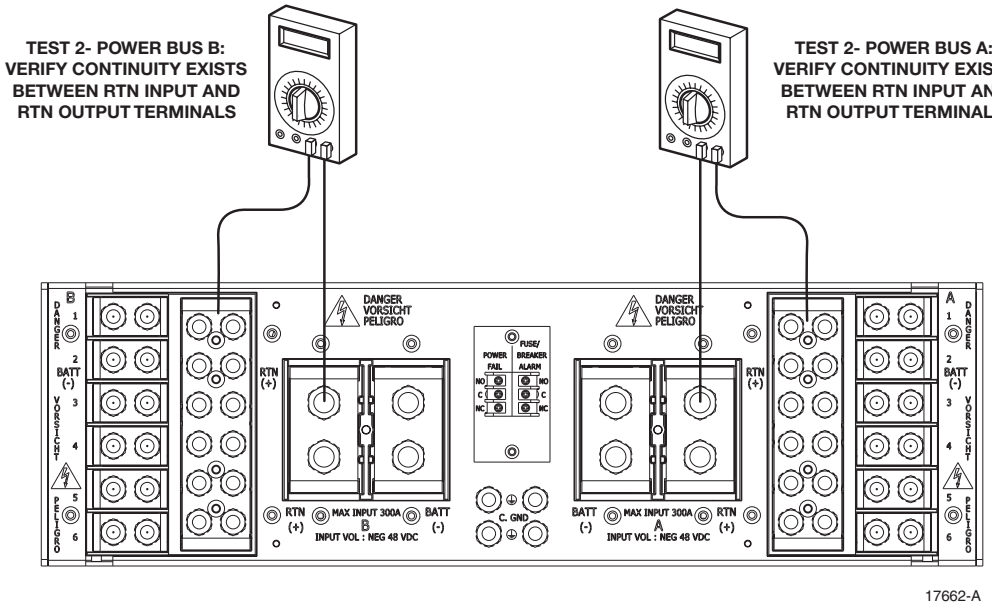



Figure 6 — Test 2: Input Return to High Current Output Return

### Test 3: Input Return to GMT Output Return

Connect one test probe to the bus A input power RTN (+) terminal and the other test probe to the #1 RTN (+) terminal on the bus A GMT output power terminal block (see Figure 7). Verify that continuity exists between the specified terminals. Verify that continuity exists for each of the remaining (#2 through #4) bus A GMT output power RTN (+) terminals. Repeat the same test procedure for the bus B GMT output power terminal block RTN (+) circuits.

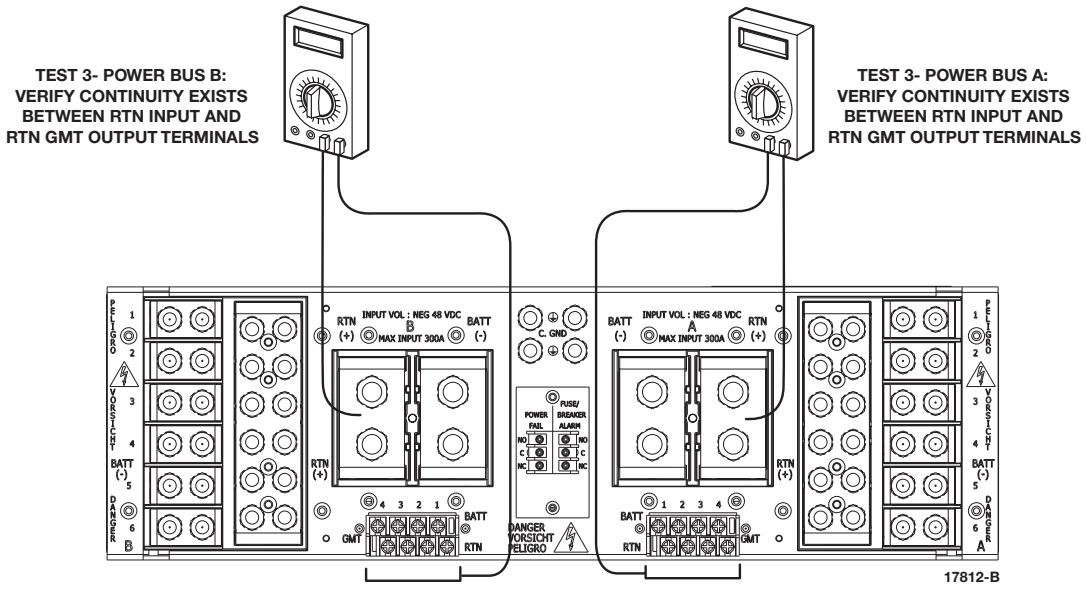



Figure 7 — Test 3: Input Return to GMT Output Return

**Test 4: Input Battery to GMT Output Battery**

Remove the dummy fuse from position #1 on the bus A GMT fuse holder and install a working GMT fuse (see Section 5.4, GMT Fuse Installation and Replacement Procedure). Connect one test probe to the bus A input power BATT (–) terminal and the other test probe to the #1 output power terminal on the bus A GMT output terminal block (see Figure 8). Verify that continuity exists between the specified terminals. Repeat the test procedure for each of the remaining (#2 through #4) bus A GMT output power BATT (–) terminals. Repeat the same test procedure for the bus B GMT output power terminal block BATT (–) circuits. Remove all GMT fuses from the fuse panel following completion of this test and re-install the dummy fuses.

**Test 5: Alarm Terminals**

Connect the test probes alternately between the C and NC terminals and the C and NO terminals on each set of alarm terminals. Verify that no continuity exists between the C and NC terminals and that continuity does exist between the C and NO terminals.

If the breaker/fuse panel fails any of the specified tests, it is defective and must not be installed. Contact ADC (see Section 7, Customer Information and Assistance) for an RMA (Return Material Authorization) and to reorder if replacement is required.

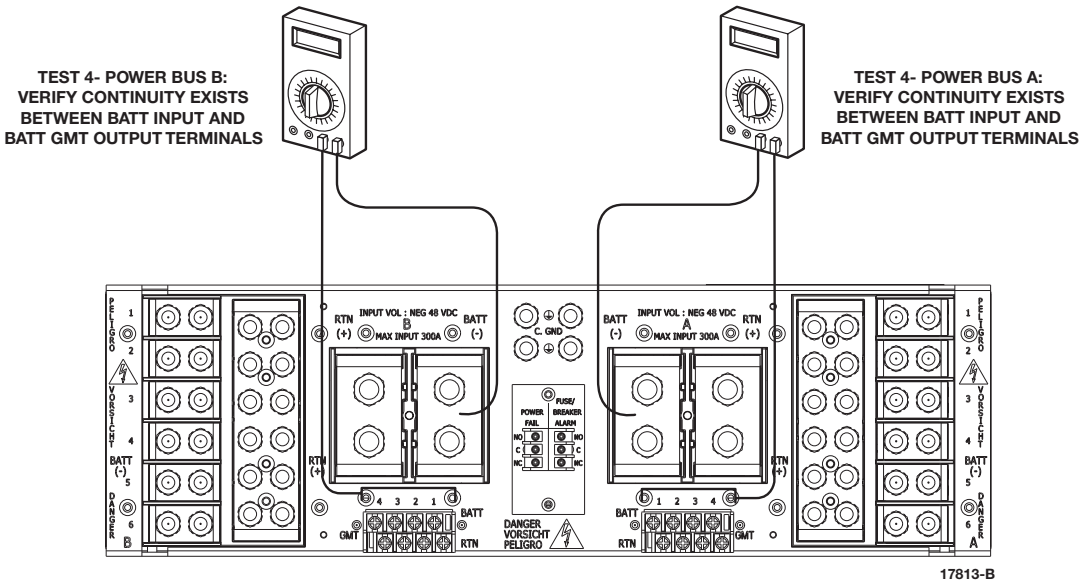



Figure 8 — Test 4: Input Battery to GMT Output Battery

## 4.2 Mounting Procedure

The Advantage Series breaker/fuse panel can be mounted in either a 19- or 23-inch wide rack. Four 3/8-inch (9.53 mm) long, Phillips-drive, 12-24 pan-head screws and four #12 flat washers are provided for attaching the mounting brackets to the equipment rack. Use the following procedure to install the breaker/fuse panel in the equipment rack:

The breaker/fuse panel is shipped with the mounting brackets installed for flush mount installation in a 19-inch rack. If the breaker/fuse panel will be recess mounted or installed

1. in a 23-inch rack, proceed to step 2. If the breaker/fuse panel will be flush mounted in a 19-inch rack, proceed to step 5.
2. Remove both mounting brackets from the breaker/fuse panel and save the screws for reuse.
3. Reinstall both mounting brackets in the required recessed position or re-orient the mounting brackets as shown in Figure 9 if mounting the breaker/fuse panel in a 23-inch rack.
4. Attach the brackets to the sides of the breaker/fuse panel chassis using the eight 3/8-inch (9.53 mm) 10-32 flathead thread-forming screws removed in step 2. Tighten screws to 25 pound force-inches (2.8 Newton meters) of torque to insure grounding.

**CAUTION!**

**When attaching the mounting brackets to the breaker/fuse panel, use only the 3/8-inch (9.53 mm) long, thread-forming, flathead screws provided. Use of other hardware could cause contact with internal components. If parts are lost, contact Alpha to order replacement parts.**

5. Place the breaker/fuse panel in the specified mounting space within the rack as shown in Figure 10. Provide one rack unit of space above and below the chassis for air circulation.

**CAUTION!**

**Blocking the vent holes could allow excessive heat to build up within the breaker/fuse panel which could shorten the life of certain internal components. Always provide the specified clearance above and below the panel.**

6. Secure the panel to the rack using the four 3/8-inch (9.525 mm) long 12-24 pan-head screws and #12 flat washers provided (use star washers when required by local practice). Tighten the screws to 27 pound-force inches (3.1 Newton meters) of torque.

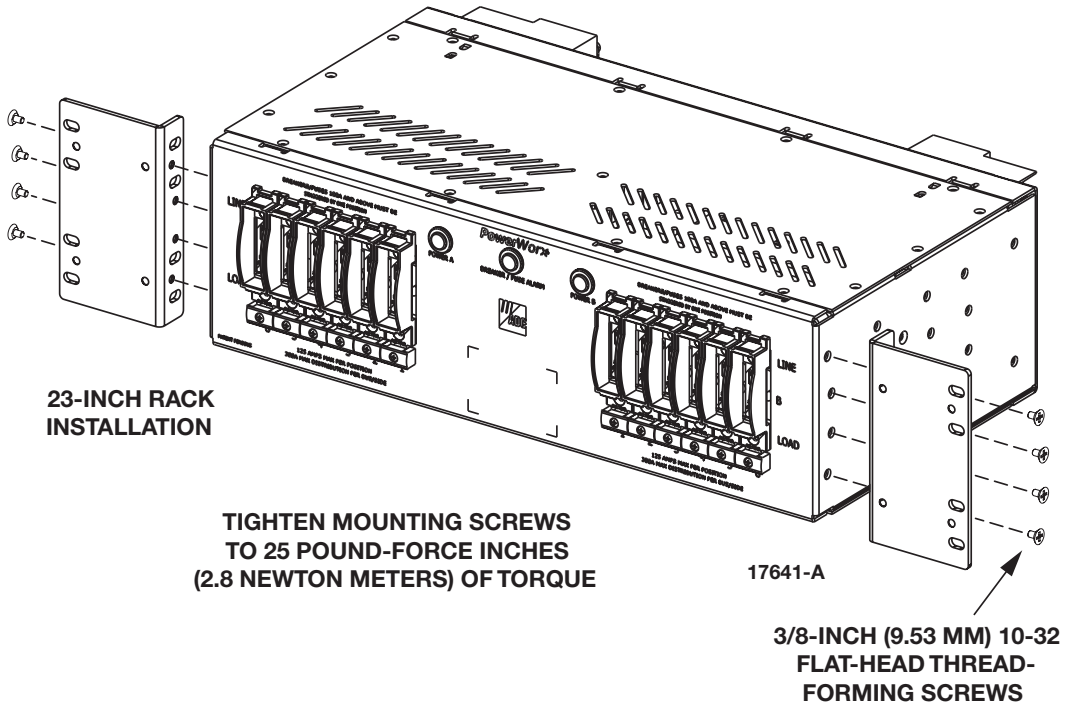



Figure 9 — Mounting Bracket Orientation for Installation in a 23-Inch Rack

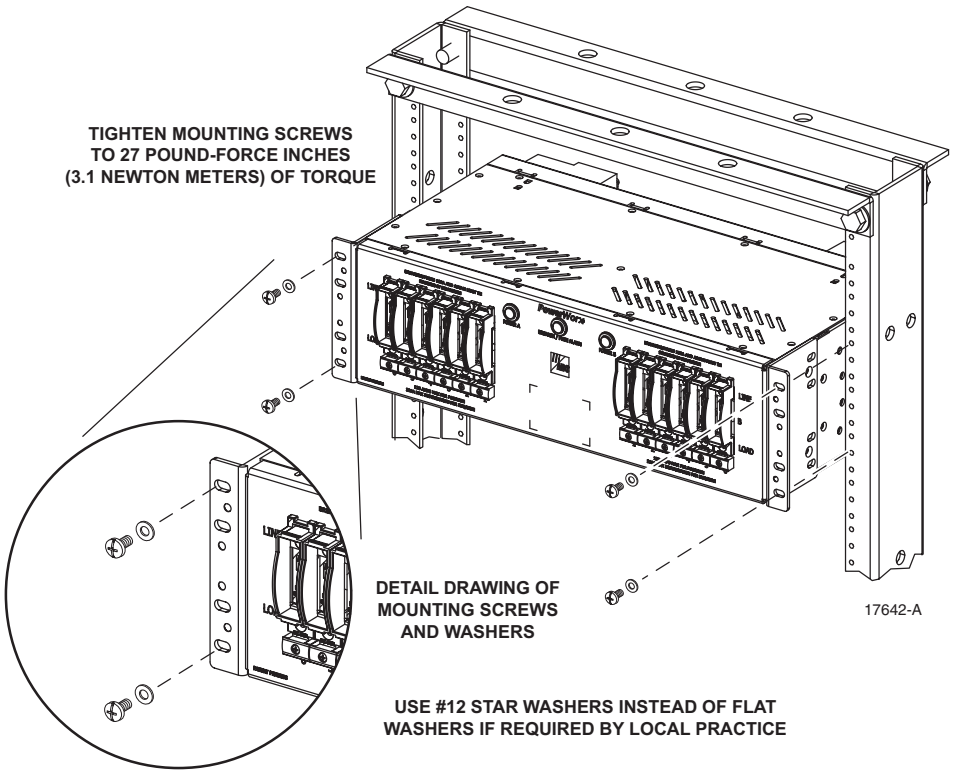



Figure 10 — Typical Fuse Panel Installation in Equipment Rack

## 4.3 Chassis Ground Connections

Two pairs of 1/4-inch studs are provided on the rear side of the breaker/fuse panel for connecting grounding cables. Each set of studs is mounted on 0.625 inch centers and accepts a 2-hole compression lug (accessory item). Nuts with captive locking washers are provided to secure the compression lugs to the studs.

Use the following procedure to connect the fuse panel to an approved office ground source:

1. Obtain two lengths of #1 AWG (stranded) or #2 AWG (flex) wire for use as the chassis grounding wires.
2. Strip back the insulation (per the lug manufacturer's recommendation) from one end of each wire as shown in Figure 11.

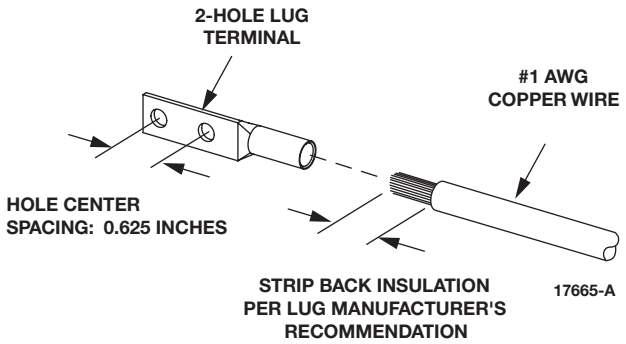



Figure 11 — Grounding Wire 2-Hole Lug Installation

3. Terminate one end of each wire with a #1 AWG 2-hole lug terminal (requires crimper).
4. Use the nuts (with captive locking washers) provided to secure the grounding wires to the C GND (chassis ground) studs at the rear of the fuse panel as shown in Figure 12.
5. Use a torque wrench (with a 7/16-inch socket) to tighten the grounding stud nuts to 32 pound-force inches (3.6 Newton meters) of torque.
6. Route the free end of each chassis grounding wire to an approved office ground source.
7. Cut each chassis grounding wire to length and connect it to the office ground source as required by local code or practice.

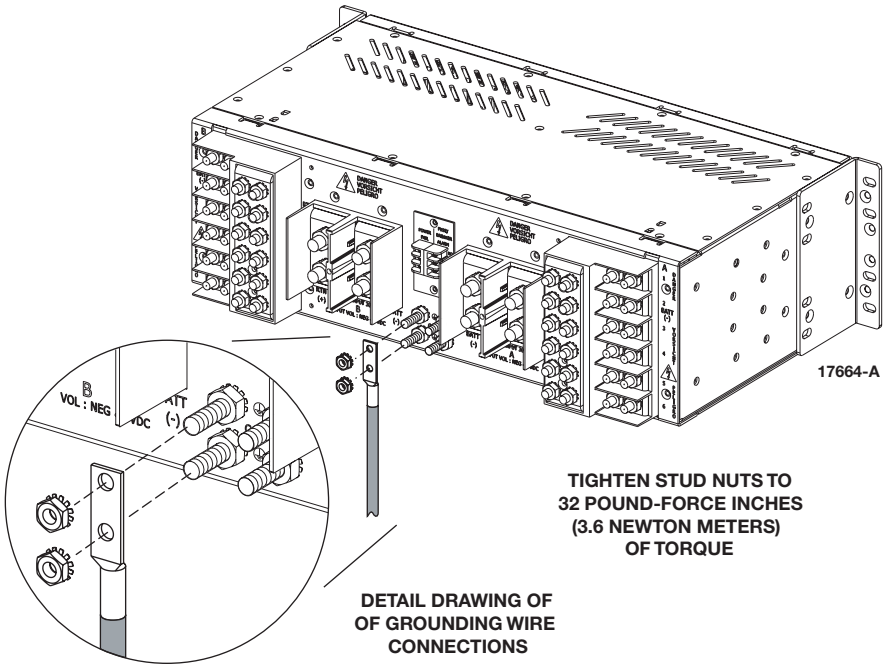



Figure 12 — Chassis Ground Connections

## 4.4 External Alarm System Connections

Normally open (NO) and normally closed (NC) alarm contacts are provided for connecting the Advantage Series breaker/fuse panel to an external alarm system. Alarm connections are through either screw-down terminals or wire-wrap pins located on the rear side of the breaker/ fuse panel. Two sets of terminals, labeled FUSE/BREAKER ALARM and POWER FAIL, are provided for reporting separate power fail and fuse/breaker alarms. The terminals may be jumpered if required to provide one alarm connection to report both power fail and fuse/breaker alarms.

The screw-down type terminal strip can accept #16 to #32 AWG copper wire. Screw-down terminal alarm wires may be terminated with spade-type compression lugs (maximum width

0.20 inches) or the wire insulation may be stripped back from the wire end and the bare wire looped under the screw head. Use a torque screw driver to tighten the terminal screws to 8 pound-force inches (0.9 Newton meters).

The wire-wrap terminal strip can accept #22 to #26 AWG solid copper wire. Strip back the insulation approximately 1.5 inches (38.1 mm) before inserting the wire into the wire-wrap tool.

When separate alarm connections are required for reporting the FUSE/BREAKER and POWER FAIL alarms, connect the alarm system wires to the alarm terminals as shown in Figure 13. When one alarm connection is required for reporting both types of alarms, install jumper wires as shown in Figure 14 and then connect the alarm system wires to the specified terminals.

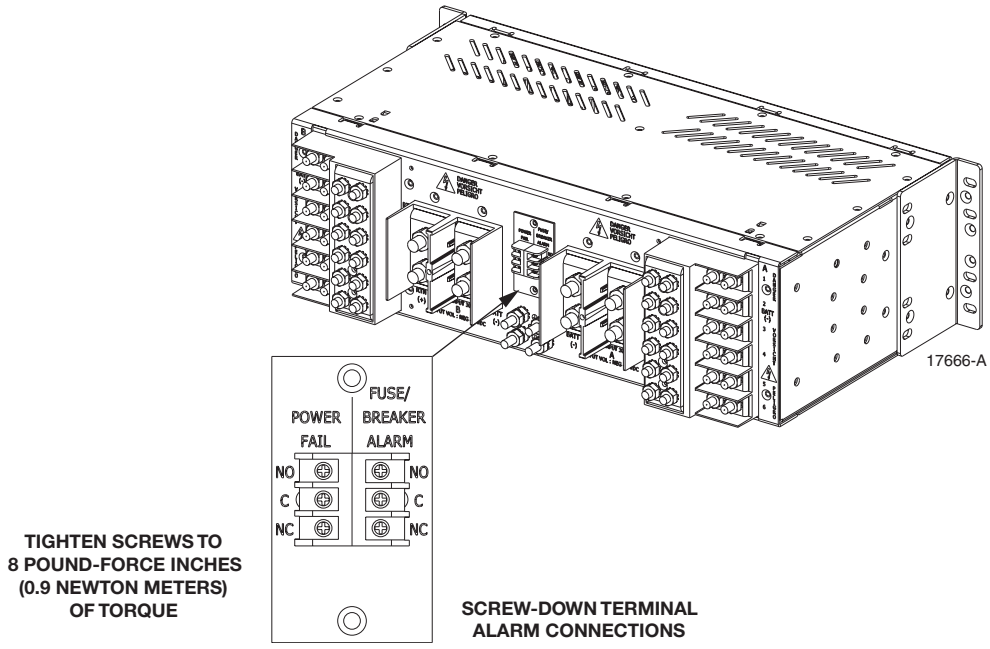



Figure 13 — Alarm Terminal Block Wiring Connections for Individual Alarm Reporting

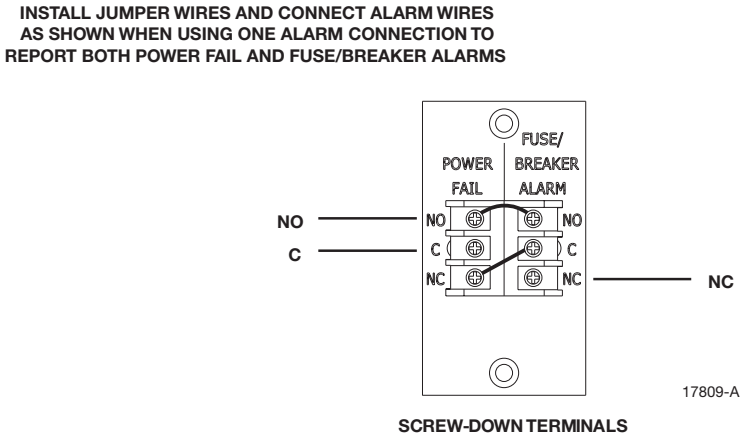



Figure 14 — Alarm Terminal Block Jumper and Wiring Connections for Combined Alarm Reporting

## 4.5 High Current Output Power Connections

High current output power is supplied to the protected equipment through the A and B high current output terminal blocks. Each high current output terminal block consists of twelve pairs of 1/4-inch studs that are used for connecting the BATT (battery –) and RTN (return +) output power wires. Each pair of studs is mounted on 0.625 inch centers and accepts a 2-hole compression lug (accessory item) with a maximum lug width of 0.72 inches (18.1 mm). Nuts with captive locking washers are provided to secure the compression lugs to the studs. The output terminals are numbered to correspond with the breaker/fuse positions.

Use the following procedure to connect each pair of high current output wires to the A or B high current output terminal blocks:

1. Obtain two lengths of #2 AWG insulated copper wire (or whatever size is appropriate for the load) for use as the output power wires.
2. Strip back the insulation (per the lug manufacturer's recommendation) from one end of each wire as shown in Figure 15.
3. Slide a 2-inch length of UL94V0 rated heat shrink insulation over the end of each wire.

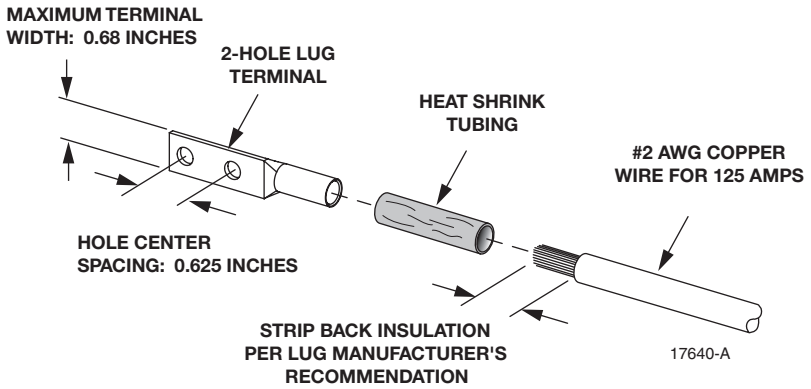



Figure 15 — High Current Output Wire 2-Hole Lug Installation

4. Terminate one end of each wire with the appropriate sized 2-hole lug terminal (requires crimper).
5. Slide the heat shrink insulation down to the lug terminal so the barrel end of the terminal is covered.
6. Use a heat gun to apply heat to the heat shrink insulation until it tightens around the wire and barrel end of the terminal.
7. Tag each cable end with the polarity (+ or –), circuit designation, and termination destination.
8. Use the nuts (with captive locking washers) provided to secure the output power wires to the specified terminals and as shown in Figure 16:
   - Negative (–): Connect to BATT (–) terminals on the A or B output power terminal blocks.
   - Positive (+): Connect to RTN (+) terminals on the A or B output power terminal blocks.

**NOTE:**

**If an output power circuit will carry 100 Amps or more, do not use the adjacent output power terminals for connecting other circuits. This is necessary because an empty breaker/fuse mounting position must be provided on either side of each breaker or fuse that has a rating of 100 Amps or greater.**

9. Use a torque wrench (with a 7/16-inch socket) to tighten the output power terminal block nuts to 32 pound-force inches (3.6 Newton meters) of torque.

**WARNING!**

**A loose or improperly tightened power terminal connection can become hot enough to cause a fire. Tighten all power terminal lug nuts to the specified torque.**

10. Route the free end of each output power cable to the protected equipment and connect it per the equipment manufacturer's recommendations.

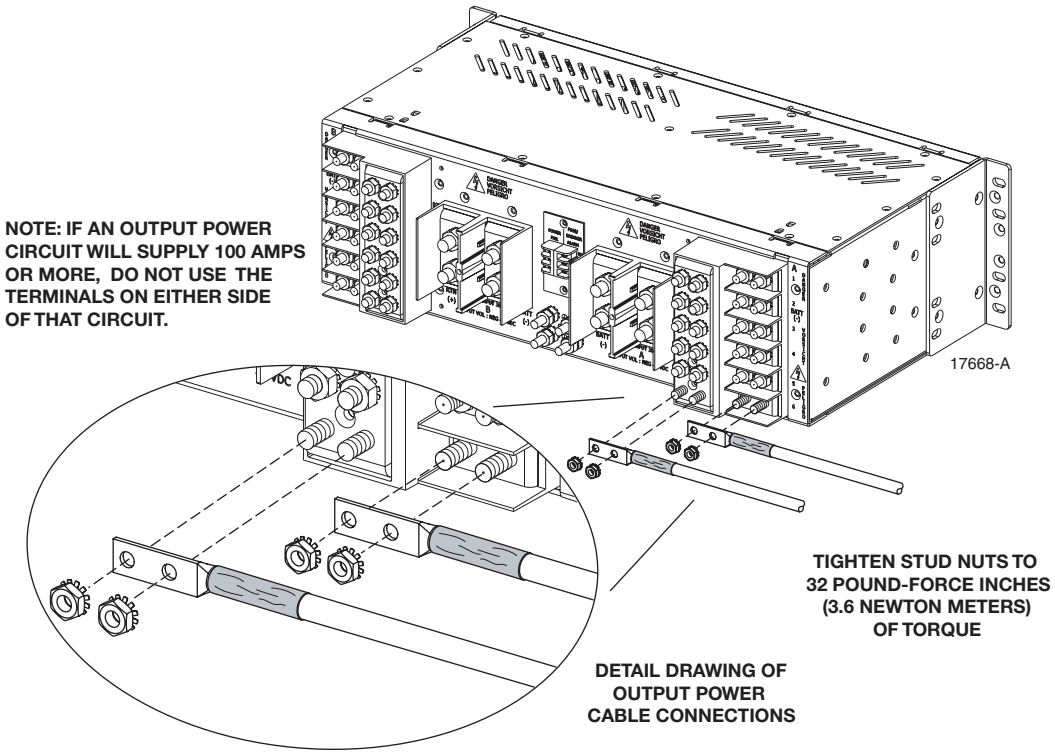



Figure 16 — High Current Output Wire Connections

## 4.6 GMT Output Power Connections (Option)

On Advantage Series breaker/fuse panels that are equipped with the GMT fuse option, GMT fused output power is supplied to the protected equipment through the A and B GMT output terminal blocks. Each GMT output terminal block consists of four pairs of screw-down terminals equipped with M3.5 screws. The terminal pairs are used for connecting the power feed and power return output power wiring to the fused equipment. The terminal pairs are numbered to correspond with the GMT fuse positions.

Copper wire in sizes ranging from #14 to #22 AWG may be used for the GMT output power wiring. The GMT output power wires may be terminated with spade-type compression lugs (maximum width 0.312 inches) or the insulation may be stripped back from the wire end and the bare wire looped under the screw head.

Connect each pair of GMT output wires to the breaker/fuse panel as shown in Figure 17. Use a torque screw driver to tighten the terminal screws to 15 pound-force inches (1.7 Newton meters) of torque. Route the GMT output wires to the panel from the bottom.

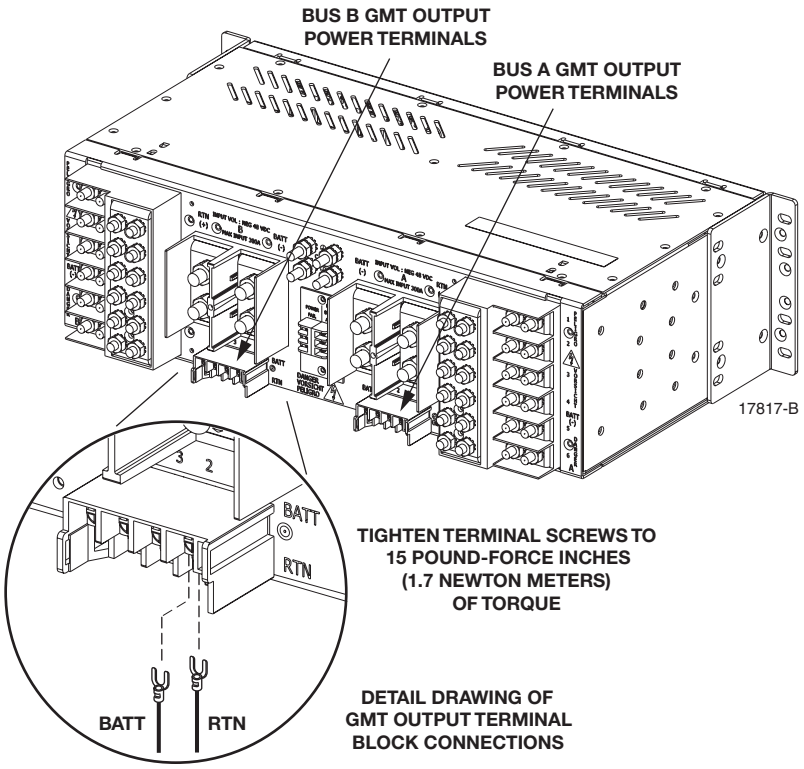



Figure 17 — GMT Output Power Wire Connections

## 4.7 Input Power Connections

Input power is supplied to the fuse panel through the A and B input terminal blocks. Each input terminal block consists of two pairs of 3/8-inch studs that are used for connecting the BATT (battery –) and RTN (return +) input power cables. Each pair of studs is mounted on 1-inch centers and accepts a 2-hole compression lug (accessory item) with a maximum width of 1.3 inches. Nuts with captive lock washers are provided to secure the compression lugs to the studs.

**CAUTION!**

**Connect only the input voltage wire [the wire labeled BATTERY or BATT, or labeled with the negative (–) voltage polarity and/or the voltage value] to the connector on the breaker/ fuse panel labeled BATT. Connect only the input return wire [the wire labeled RTN, RETURN, or BATTERY GROUND, or labeled with the positive (+) voltage polarity] to the connector on the breaker/fuse panel labeled RTN.**

**CAUTION!**

**Caution should be taken to not reverse the input wires to the breaker/fuse panel. Within the breaker/fuse panel, the internal return wiring is not protected by circuit breakers or fuses. If the wires are reversed, current will flow through the unprotected return wiring in the breaker/fuse panel to the equipment. This condition can cause damage to equipment in the frame in which the breaker/fuse panel is installed and to equipment in adjacent frames.**

**CAUTION!**

**This unit has two power inputs. For total isolation from electrical shock and energy hazard, disconnect both power inputs. Care must be taken to correctly connect each power supply to separate power sources.**

Use the following procedure to connect the input power cables to the A and B input terminal blocks:

1. Obtain four lengths of appropriately sized insulated copper wire for use as the input power cables. To select wire size, refer to NEC and local procedures and codes.
2. Strip back the insulation (per the lug manufacturer's recommendation) from one end of each wire as shown in Figure 18.

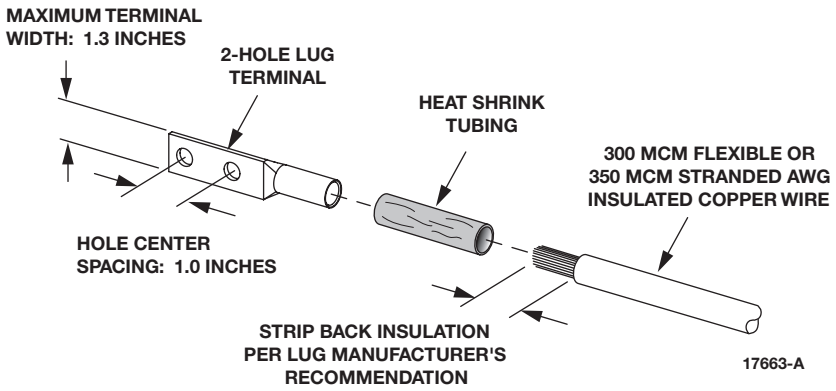



Figure 18 — Input Cable 2-Hole Lug Installation

3. Slide a 2-inch length of UL94V0 rated heat shrink insulation over the end of each wire.
4. Terminate one end of each wire with the appropriate sized 2-hole lug terminal (requires crimper).
5. Slide the heat shrink insulation down to the lug terminal so the barrel end of the terminal is covered.
6. Use a heat gun to apply heat to the heat shrink insulation until it tightens around the wire and barrel end of the terminal.
7. Tag each cable end with the polarity (+ or –), power source (A or B), and termination destination
8. Use the nuts (with captive locking washers) provided to secure the input power wires to the specified terminals as shown in Figure 19.
   - Negative (–): Connect to BATT (–) terminals on the A or B input power terminal blocks.
   - Positive (+): Connect to RTN (+) terminals on the A or B input power terminal blocks.

**NOTE:**

**If the breaker/fuse panel is not equipped with GMT output power terminal blocks, the input power wires may routed to the panel from either the top or the bottom. If the breaker/fuse panel is equipped with GMT output power terminal blocks, route the input power wires to the panel from the top.**

9. Use a torque wrench (with a 9/16-inch socket) to tighten the input power terminal block nuts to 50 pound-force inches (5.6 Newton meters) of torque.

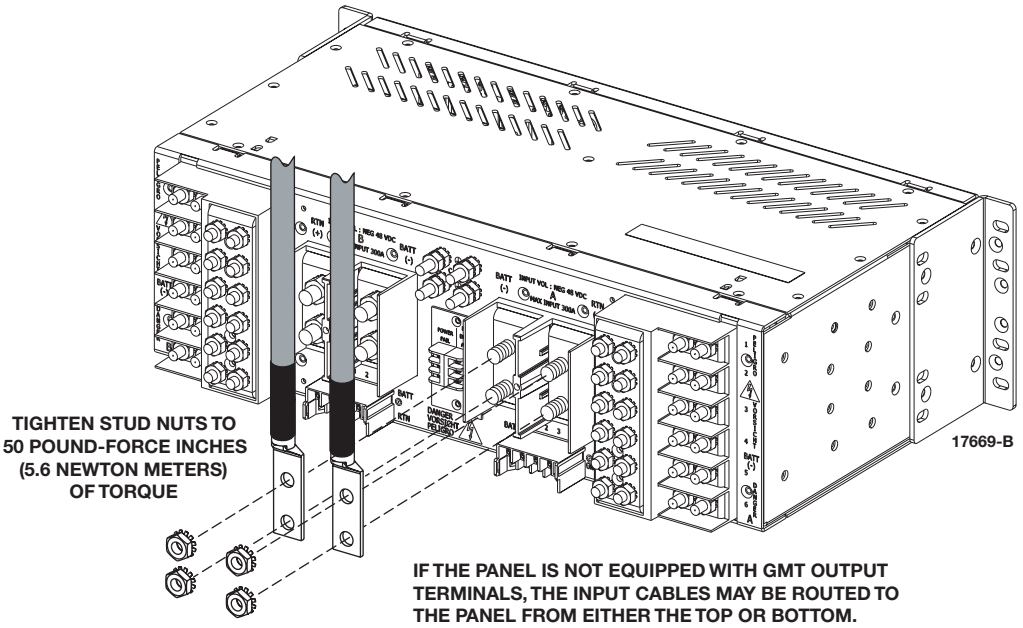



Figure 19 — F Input Power Connections

**WARNING!**

**A loose or improperly tightened power terminal connection can become hot enough to cause a fire. Tighten all power terminal lug nuts to the specified torque.**

10. Route the free end of each input power cable to the office battery source.
11. Connect the input power cables to the office battery power source in accordance with applicable local electrical codes and/or National Electrical Codes. Do not apply power to the breaker/fuse panel until instructed to do so for testing (see Section 4, Testing).

## 4.8 Breaker/Fuse Designation Card Holder Installation

The breaker/fuse designation card holder may be attached to the breaker/fuse panel, as shown in Figure 20, or to any convenient location that is close to the breaker/fuse panel. Remove the paper from the back of the adhesive strip and press the card holder against the mounting surface. Fill out one of the designation cards with the required circuit information and insert it in the card holder.

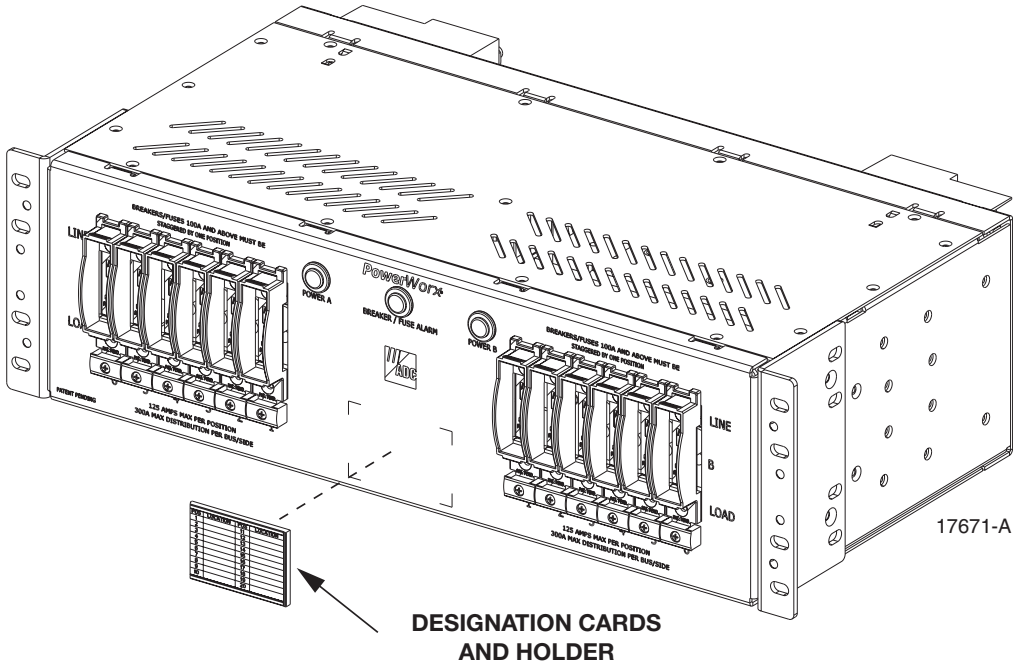



Figure 20 — Breaker/Fuse Designation Card Holder Installation

# 5. Testing

Following installation, perform the following tests to verify that the Advantage Series breaker/ fuse panel is correctly wired and that the alarm system is functioning properly.

**WARNING!**

**The breaker/fuse panel uses electrical voltage and current levels that may be considered an electrical hazard per GR-1089. Only qualified personnel should be allowed to install, operate, maintain, or otherwise come into contact with this equipment when energized. Only insulated tools should be used on energized elements of the panel.**

## 5.1 Power Indication Test

Verify that all the installation procedures in Section 3, Installation have been completed and that all connections are properly tightened. Turn on the power (both sources) to the breaker/ fuse panel. With both power sources turned on and no circuit breakers or fuses installed, the POWER-A and POWER-B indicators should light and the BREAKER/ FUSE ALARM indicator should stay off.

Verify that the alarm contacts are functioning properly. With power applied, the alarm relay contacts should provide an open circuit between the common (C) terminals and the normally open (NO) terminals and a closed circuit between the common (C) and normally closed (NC) terminals. Using a multimeter that is set to test for continuity, connect the probes alternately between the C and NC terminals and the C and NO terminals for both sets of alarm terminals. Verify that continuity exists between the C and NC terminals and that no continuity exists between the C and NO terminals.

## 5.2 Connection Polarity Test

Verify that the input power cables are connected to the correct terminals. Using a multimeter that is set to measure DC voltage, measure the voltage between the A and B input power RTN terminals and chassis ground. The voltage level should be less than 2.0 Vdc. If the voltage is more than 2.0 Vdc, disconnect the power from the breaker/fuse panel and reverse the input power wires. Reconnect the power and again measure the voltage between the input RTN terminal and the chassis ground. Verify that the voltage level is less than 2.0 Vdc.

## 5.3 Breaker/Fuse Alarm Test

**NOTE:**

**The breaker/fuse alarm system can be tested using either a tripped circuit breaker or, if the panel supports the GMT fuse option, a failed GMT fuse. Due to the design of TPC fuses, testing the breaker/fuse alarm system using a failed TPC fuse is not practical.**

Install a tripped circuit breaker (place handle in OFF position) or a GMT fuse that has failed into one of the breaker/ fuse positions for power bus A or power bus B (refer to Section 5.1 or Section 5.4 for the installation procedures). The BREAKER/FUSE ALARM indicator will change from off to red and the breaker/fuse failure alarm relay will operate.

Using a multimeter that is set to test for continuity, connect the probes alternately between the C and NC terminals and the C and NO terminals on the breaker/fuse alarm terminals. Verify that no continuity exists between the C and NC terminals and that continuity exists between the C and NO terminals. If using a failed GMT fuse for testing, remove fuse when testing is complete.

## 5.4 Power Failure Alarm Test

At the input power source (power bay) for the breaker/fuse panel, disconnect either the A or B input power source from the breaker/fuse panel by removing the appropriate fuse or turning off the appropriate circuit breaker at the battery distribution fuse bay. The POWER-A or POWER-B indicator will change from green to off and the power fail

alarm relay will operate. Using a multimeter that is set to test for continuity, connect the probes alternately between the C and NC terminals and the C and NO terminals on the power fail alarm terminals. Verify that no continuity exists between the C and NC terminals and that continuity exists between the C and NO terminals. Reconnect the A or B input power source to the breaker/fuse panel. The POWER-A or POWER-B indicator will go on (green) and the power fail alarm relay contacts will return to their normal state.

## 5.5 Protective Cover Installation/Removal

Install the rear protective covers, shown in Figure 21, when all the wiring and tests are completed. Turn off the power (both sources) to the breaker/fuse panel. To install the input power and high current output power terminal block covers, locate the six threaded holes on the rear side of the panel. Thread a 4-40 panhead screw (provided) into each of the six holes and tighten two or three turns. Hold each cover so the opening for the cable is oriented properly and then place the cover over the screw heads. Slide the cover back and forth or up and down until properly seated and then tighten the screws. To install the GMT output power terminal block covers, snap each cover into place over the corresponding terminal block. When all covers are in place, turn on the power (both sources) to the breaker/fuse panel. If the protective covers are lost or damaged, contact Alpha Technologies for replacement.

**Protective Cover Installation/Removal**

**WARNING!**

**The input terminals and any in-use output terminals are electrically energized and may cause burns or an electrical shock if touched. Use care to avoid touching energized terminals when the protective covers are removed.**

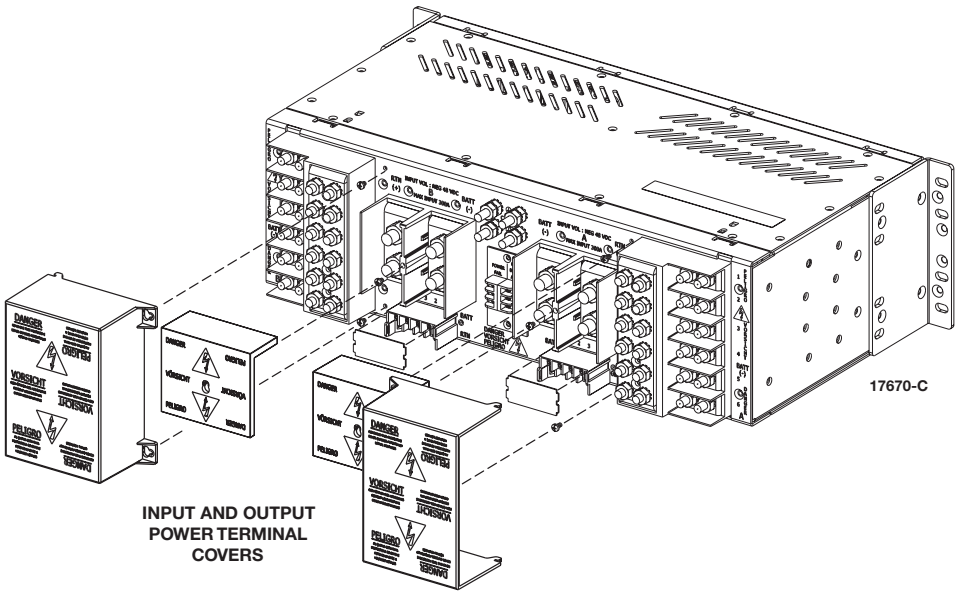



Figure 21 — Protective Cover Installation/Removal

# 6. Operation

Operation of the Advantage Series breaker/fuse panel consists of installing circuit breakers, resetting tripped circuit breakers, installing fuses, replacing opened fuses, and connecting new equipment to the output power circuits. If a circuit breaker trips or a fuse opens, the breaker/fuse alarm LED indicator lights and the breaker/fuse alarm relay contacts switch to the alarm state.

**WARNING!**

**The breaker/fuse panel uses electrical voltage and current levels that may be considered an electrical hazard per GR-1089. Only qualified personnel should be allowed to install, operate, maintain, or otherwise come into contact with this equipment when energized. Only insulated tools should be used on energized elements of the panel.**

## 6.1 Circuit Breaker Installation and Reset Procedure

### 6.1.1 Initial Circuit Breaker Installation

Install a circuit breaker of the recommended size and type (as specified by the equipment manufacturer) in each breaker/fuse position as needed. The current rating of the circuit breaker (in Amperes) is indicated on the front of the breaker.

**CAUTION!**

**Using the wrong breaker may cause damage to the protected equipment or the breaker/fuse panel. When installing a circuit breaker, make sure the breaker is the correct type, has the correct current rating, and does not exceed 100 Amps.**

**NOTE:**

**The continuous output load of the equipment during normal operation should not exceed 80% of the rated value of the circuit breaker. This allows some room for manufacturing tolerances and voltage fluctuations in the plant power mains.**

Use the following procedure to install a circuit breaker in an open breaker/fuse position:

1. Loosen the captive screw at the bottom of the specified circuit breaker holder until the holder is free of the breaker/fuse panel.
2. Remove the circuit breaker holder from the breaker/fuse panel as shown in Figure 22.

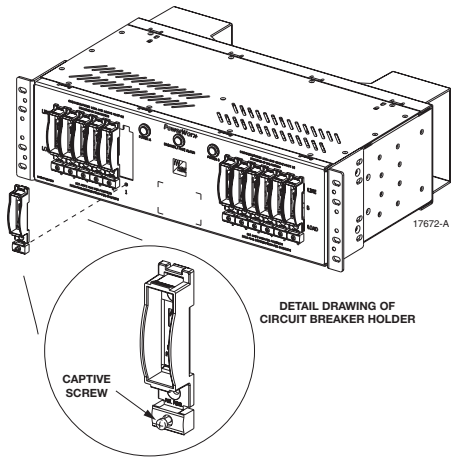



Figure 22 — Circuit Breaker Holder Removal

3. Push out and discard the center section of the circuit breaker holder as shown in Figure 23.
4. Align the circuit breaker with the circuit breaker holder (see Figure 23) placing the LINE terminal at the top and the LOAD terminal at the bottom.

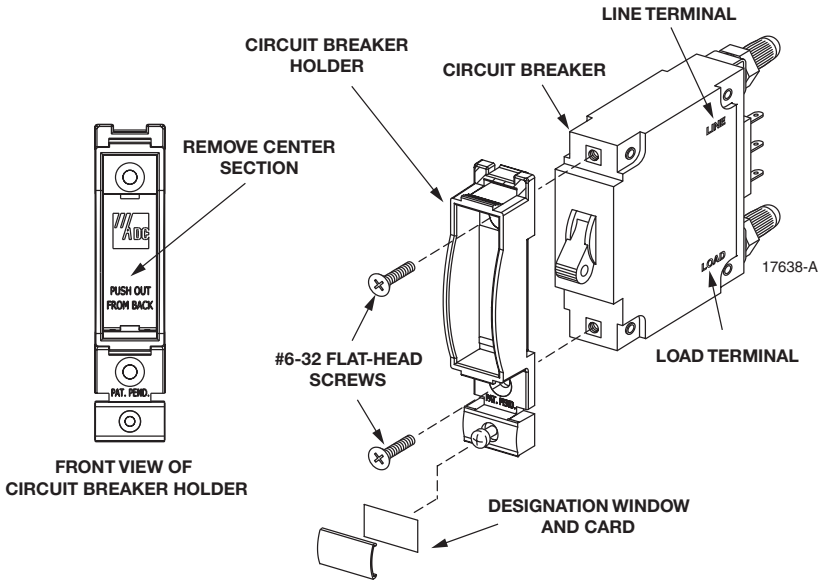



Figure 23 — Circuit Breaker Holder Assembly

5. Use two #6-32 flat-head screws (provided) to secure the circuit breaker to the circuit breaker holder.
6. Place the handle of the circuit breaker in the OFF position.
7. Carefully insert the circuit breaker/holder assembly into the breaker/fuse panel.
8. Tighten the captive screw at the bottom of the circuit breaker holder to secure the holder to the breaker/fuse

**NOTE:**

**Leave an empty breaker/fuse mounting position on both sides of any 100 Amp circuit breaker. This will prevent any excessive build-up of heat.**

panel.

9. Place the circuit breaker handle in the ON position.
10. Using a multimeter that is set to measure DC voltage, verify that the output voltage at the protected equipment is a nominal –48 Vdc and that the polarity of the BATT (–) and RTN (+) lead wires is correct.
11. Use the individual designation cards and designation windows (provided) to label each installed circuit breaker.

### 6.1.2 Resetting a Tripped Circuit Breaker

**Standard Circuit Breaker**: When a standard circuit breaker trips, the BREAKER/FUSE ALARM indicator will light (red) and the handle on the tripped breaker will move to the OFF position. Determine the problem that caused the breaker to trip and take the appropriate corrective action. When the problem has been corrected, reset the breaker by placing the circuit breaker handle in the ON position. The BREAKER/FUSE ALARM indicator will go out.

**Mid-trip Circuit Breaker**: When a mid-trip breaker trips, the BREAKER/FUSE ALARM indicator will light (red) and the handle on the tripped breaker will move to the CENTER position. Place the circuit breaker handle in the OFF position. The BREAKER/FUSE ALARM indicator will go out. Determine the problem that caused the breaker to trip and take the appropriate corrective action. When the problem has been corrected, reset the breaker by placing the circuit breaker handle in the ON position.

## 6.2 TPC Fuse Installation and Replacement Procedure

### 6.2.1 Initial TPC Fuse Installation

Install a TPC fuse of the recommended size and type (as specified by the equipment manufacturer) in each breaker/fuse position as needed. The current rating of the fuse (in Amperes) is indicated on the front of the fuse

**CAUTION!**

**Using the wrong fuse may cause damage to the protected equipment or the power distribution panel. When replacing a blown fuse, make sure the fuse-type and current rating of the replacement fuse complies with any recommendations provided by the manufacturer of the protected equipment and does not exceed 125 Amps.**

**NOTE:**

**The continuous output load of the equipment during normal operation should not exceed 80% of the rated value of the fuse. This allows some room for manufacturing tolerances and voltage fluctuations in the plant power mains.**

Use the following procedure to install a TPC fuse in an open breaker/fuse position:

1. Loosen the captive screw at the bottom of the circuit breaker until the holder is free of the breaker/fuse panel (refer to Figure 22 on Page 29).
2. Remove the circuit breaker holder from the breaker/fuse panel and place it aside (refer to Figure 22 on Page 29).
3. Locate the fuse holder adapters that are sent with the breaker/fuse panel as packaged hardware components.
4. Separate the fuse holder adapter into a top section and a bottom section by removing the center section as shown in Figure 24. Discard the center section.
5. Align the outer fuse holder with the top and bottom sections of the fuse holder adapter (see Figure 24) placing the LINE terminal at the top and the LOAD terminal at the bottom.
6. Use two #6-32 flat-head screws (provided) to secure the top and bottom sections of the fuse holder adapter to the fuse holder.
7. Remove the captive screw from the circuit breaker holder (removed in step 2) and thread it into the bottom section of the fuse holder adapter.

**NOTE:**

**Circuit breaker holders are not used when fuses are installed but should be saved for possible reuse.**

8. Carefully insert the fuse holder assembly into the breaker/fuse panel.

**NOTE:**

**Leave an empty breaker/fuse mounting position on both sides of any fuse or breaker that is rated at 100 or more Amps. This will prevent excessive heat from building up and affecting the operation of adjacent fuses.**

9. Tighten the captive screw at the bottom of the fuse holder assembly to secure the holder to the breaker/fuse panel.

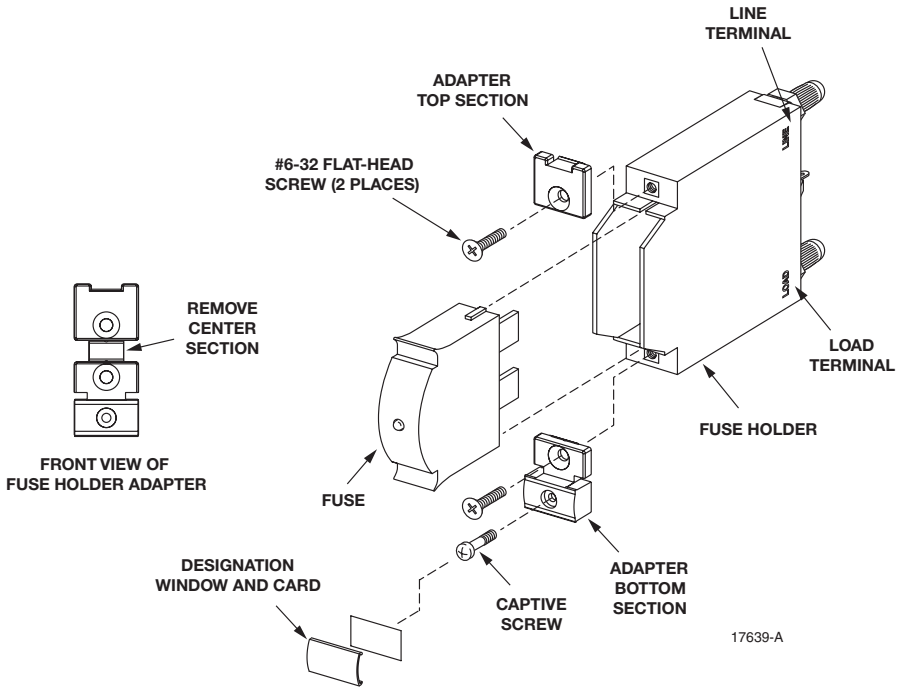



Figure 24 — TPC Fuse Holder Assembly

10. Insert the required TPC fuse into the fuse holder.
11. Using a multimeter that is set to measure DC voltage, verify that the output voltage at the protected equipment is a nominal –48 Vdc and that the polarity of the BATT (–) and RTN (+) lead wires is correct.
12. Use the individual designation cards and designation windows (provided) to label each installed fuse.

### 6.2.2 Replacing An Open TPC Fuse

When a fuse opens, the BREAKER/FUSE ALARM indicator will light (red) and the red LED indicator on the front of the failed fuse will also light. Remove the failed fuse from the fuse holder. The BREAKER/FUSE ALARM indicator should go out.

Determine the problem that caused the fuse to open and take the appropriate corrective action. When the problem has been corrected, install a replacement fuse. Make sure the fuse-type and current rating of the replacement fuse complies with any recommendations provided by the manufacturer of the protected equipment and does not exceed 125 Amps.

## 6.3 TLS/TPSFuse Installation and Replacement Procedure

### 6.3.1 Initial TLS/TPS Fuse Installation

Install a TLS/TPS fuse of the recommended size and type (as specified by the equipment manufacturer) in each breaker/fuse position as needed. The current rating of the fuse (in Amperes) is indicated on the front of the fuse.

**CAUTION!**

**Using the wrong fuse may cause damage to the protected equipment or the power distribution panel. When replacing a blown fuse, make sure the fuse-type and current rating of the replacement fuse complies with any recommendations provided by the manufacturer of the protected equipment and does not exceed 125 Amps.**

**NOTE:**

**The continuous output load of the equipment during normal operation should not exceed 80% of the rated value of the fuse. This allows some room for manufacturing tolerances and voltage fluctuations in the plant power mains.**

Use the following procedure to install a TLS/TPS fuse in an open breaker/fuse position:

1. Loosen the captive screw at the bottom of the circuit breaker until the holder is free of the breaker/fuse panel (refer to Figure 22 on Page 29).
2. Remove the circuit breaker holder from the breaker/fuse panel and place it aside (refer to Figure 22 on Page 29).
3. Locate the fuse holder adapters that are sent with the breaker/fuse panel as packaged hardware components.
4. Separate the fuse holder adapter into a top section and a bottom section by removing the center section as shown in Figure 24. Discard the center section.
5. Align the outer fuse holder with the top and bottom sections of the fuse holder adapter (see Figure 24) placing the LINE terminal at the top and the LOAD terminal at the bottom.
6. Use two #6-32 flat-head screws (provided) to secure the top and bottom sections of the fuse holder adapter to the inner fuse holder.
7. Remove the captive screw from the circuit breaker holder (removed in step 2) and thread it into the bottom section of the fuse holder adapter.

**NOTE:**

**Circuit breaker holders are not used when fuses are installed but should be saved for possible reuse.**

8. Carefully insert the inner fuse holder assembly into the breaker/fuse panel.

**NOTE:**

**Leave an empty breaker/fuse mounting position on both sides of any fuse that is rated at 100 or more Amps. This will prevent excessive heat from building up and affecting the operation of adjacent fuses.**

9. Tighten the captive screw at the bottom of the inner fuse holder assembly to secure the holder to the breaker/fuse panel.

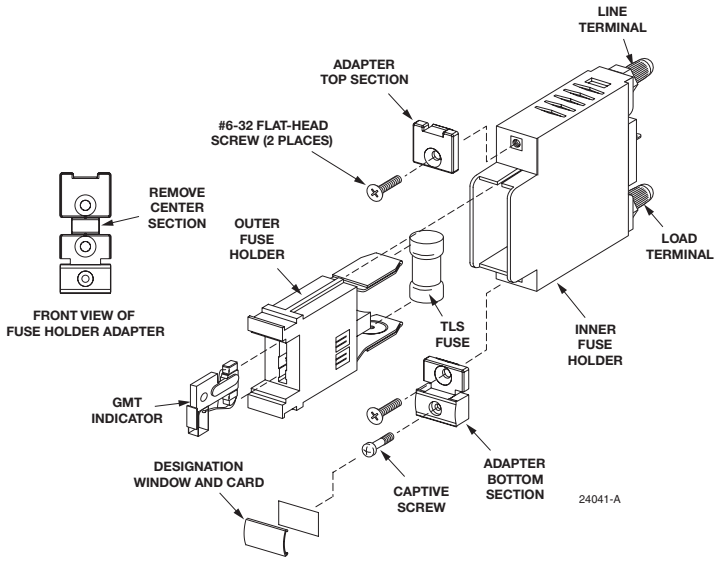



Figure 25 — TLS/TPS Fuse Holder Assembly

10. Insert the required TLS/TPS fuse into the outer fuse holder.
11. Insert the outer fuse holder assembly into the inner fuse holder.
12. Using a multimeter that is set to measure DC voltage, verify that the output voltage at the protected equipment is a nominal –48 Vdc and that the polarity of the BATT (–) and RTN (+) lead wires is correct.
13. Insert a GMT fuse in the outer fuse holder.
14. Use the individual designation cards and designation windows (provided) to label each installed fuse.

### 6.3.2 Replacing an Open TLS/TPS Fuse

When a TLS/TPS fuse opens, the GMT fuse alarm will also open, causing the BREAKER/ FUSE ALARM indicator to light (red). The yellow indicator in the GMT fuse will become visible in the see-through bottom section of the GMT fuse.

Remove the outer fuse holder from the inner fuse holder. Determine the problem that caused the TLS/TPS fuse to open and take the appropriate corrective action. When the problem has been corrected, install a TLS/TPS fuse in the back of the outer fuse holder and a GMT fuse (recommended size, 18/100) in the front of the outer fuse holder.

Make sure the fuse-type and current rating of the replacement TLS/TPS fuse complies with any recommendations provided by the manufacturer of the protected equipment and does not exceed 125 Amps. Re-insert the outer fuse holder in the inner fuse holder.

## 6.4 GMT Fuse Installation and Replacement Procedure

Install a GMT fuse of the recommended size and type (as specified by the equipment manufacturer) in each fuse position as needed. The current rating of the fuse (in Amperes) is indicated on the side of the fuse. The color of the indicator also corresponds to the fuse size. Refer to the color code chart provided with replacement fuses to identify the fuse size by color.

**CAUTION!**

**Using the wrong fuse may cause damage to the protected equipment or the power distribution panel. When replacing a blown fuse, make sure the fuse-type and current rating of the replacement fuse complies with any recommendations provided by the manufacturer of the protected equipment and does not exceed 15 Amps.**

The fuse manufacturer recommends that GMT fuses rated 8 to 15 Amps be continuously operated at no more than 70% of their nominal current rating. Table B indicates the nominal rating and continuous operation rating for the affected GMT fuses.

**Table B — GMT Fuse Ratings**

| Nominal Rating | Continous Operation Rating |
|---|---|
| GMT-10 Amp | 7 Amps |
| GMT-12 Amp | 8.4 Amps |
| GMT-15 Amp | 10.5 Amps |

Remove the dummy fuses from the GMT fuse positions that will supply power to the equipment. Orient each fuse so the indicator is on the bottom as shown in Figure 26. Insert the fuse into the appropriate fuse position in the GMT fuse holder.

When a fuse opens, the breaker/fuse alarm LED indicator will light (red). The indicator on the failed fuse will spring outward and should be visible on the bottom side of the fuse. Use a GMT fuse puller to remove the failed fuse from the fuse panel. The breaker/fuse alarm LED indicator should go out.

Determine the problem that caused the fuse to open and take the appropriate corrective action. When the problem has been corrected, install a replacement GMT fuse. Make sure the fuse- type and current rating of the replacement GMT fuse complies with any recommendations provided by the manufacturer of the protected equipment and does not exceed 15 Amps.

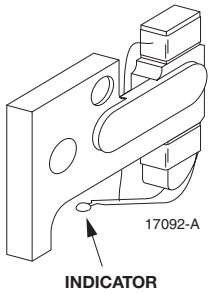



Figure 26 — GMT Fuse

# 7. Maintenance

**WARNING!**

**The breaker/fuse panel uses electrical voltage and current levels that may be considered an electrical hazard per GR-1089. Only qualified personnel should be allowed to install, operate, maintain, or otherwise come into contact with this equipment when energized. Only insulated tools should be used on energized elements of the panel.**

## 7.1 Inspection

Inspect the Advantage series breaker/fuse panel periodically (every six months is recommended) for damage to the breakers or fuses and for damaged or broken wires at the power and external alarm connections. If excessive dirt is found during the inspection, brush or wipe dust and dirt from the breaker/fuse panel with a soft bristle brush or soft cloth. Take care to avoid damaging the circuit breakers, fuses, or wiring. No adjustments are required. If a circuit is not operating properly, contact Alpha, see section 8 on page 43

# 8. Warranty and Service Information

## 8.1 Technical Support

**In Canada and the USA, call toll free 1-888-462-7487**

**Customers outside Canada and the USA, call +1-604-436-5547.**

## 8.2 Warranty Statement

For full information details review Alpha's online Warranty Statement at, www.alpha.ca

## 8.3 Limited Hardware Warranty

Alpha warrants that for a period of two (2) years from the date of shipment its products shall be free from defects under normal authorized use consistent with the product specifications and Alpha's instructions, unless otherwise specified in the product manual, in which case, the terms of the manual will take precedence

The warranty provides for repairing, replacing or issuing credit (at Alpha's discretion) for any equipment manufactured by it and returned by the customer to the factory or other authorized location during the warranty period.

There are limitations to this warranty coverage. The warranty does not provide to the customer or other parties any remedies other than the above. It does not provide coverage for any loss of profits, loss of use, costs for removal or installation of defective equipment, damages or consequential damages based upon equipment failure during or after the warranty period. No other obligations are expressed or implied. Warranty also does not cover damage or equipment failure due to cause(s) external to the unit including, but not limited to, environmental conditions, water damage, power surges or any other external influence.

The customer is responsible for all shipping and handling charges. Where products are covered under warranty Alpha will pay the cost of shipping the repaired or replacement unit back to the customer.

## 8.4 Battery Warranty

Note that battery warranty terms and conditions vary by battery and by intended use. Contact your Alpha sales representative or the Technical Support team at the above number to understand your entitlements under Battery Warranty.

## 8.5 Warranty Claims

Any claim under this Limited Warranty must be made in writing to Alpha BEFORE sending material back. Alpha will provide Product return instructions upon approval of return request. A Service Repair Order (SRO) and / or Return Authorization (RA) number will be issued ensuring that your service needs are handled promptly and efficiently. Claims must be made online at: www.alpha.ca

## 8.6 Service Centers

For a list of international service centers, refer to the Alpha website: www.alpha.ca

# 9. Certification

## About CSA and NRTL

CSA (Canadian Standards Association also known as CSA International) was established in 1919 as an independent testing laboratory in Canada. CSA received its recognition as an NRTL (Nationally Recognized Testing Laboratory) in 1992 from OSHA (Occupational Safety and Health Administration) in the United States of America (Docket No. NRTL-2-92). This was expanded and renewed in 1997, 1999, and 2001. The specific notifications were posted on OSHA's official website as follows:

- Federal Register #: 59:40602 - 40609 [08/09/1994]
- Federal Register #: 64:60240 - 60241 [11/04/1999]
- Federal Register #: 66:35271 - 35278 [07/03/2001]

When these marks appear with the indicator "C and US" or "NRTL/C" it means that the product is certified for both the US and Canadian markets, to the applicable US and Canadian standards. (1)

Alpha rectifier and power system products, bearing the aforementioned CSA marks, are certified to CSA C22.2 No. 60950-01 and UL 60950-01. Alpha UPS products, bearing the aforementioned CSA marks, are certified to CSA C22.2 No. 107.3 and UL 1778.

As part of the reciprocal, US/Canada agreement regarding testing laboratories, the Standards Council of Canada (Canada's national accreditation body) granted Underwriters Laboratories (UL) authority to certify products for sale in Canada. (2)

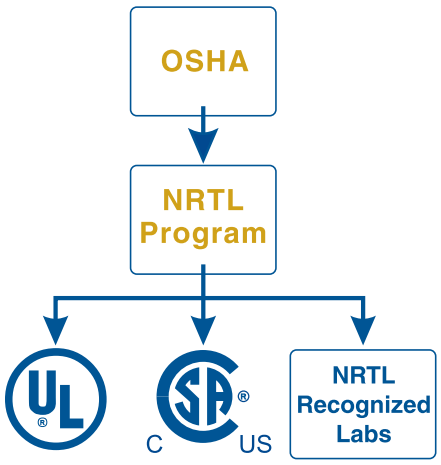
Only Underwriters Laboratories may grant a licence for the use of this mark, which indicates compliance with both Canadian and US requirements. (3)

## NRTLs capabilities

NRTLs are third party organizations recognized by OSHA, US Department of Labor, under the NRTL program.

The testing and certifications are based on product safety standards developed by US based standards developing organizations and are often issued by the American National Standards Institute (ANSI). (4)

The NRTL determines that a product meets the requirements of an appropriate consensus-based product safety standard either by successfully testing the product itself, or by verifying that a contract laboratory has done so, and the NRTL certifies that the product meets the requirements of the product safety standard. (4)




## Governance of NRTL

The NRTL Program is both national and international in scope with foreign labs permitted.

(1)www.csagroup.org
(2) www.scc.ca
(3) www.ulc.ca
(4) www.osha.gov

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