NetSure™ 512NGBB -48 VDC Power System

User Manual

Specification Number: 582137000
Model Number: 512NGBB

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Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit https://www.vertiv.com/en-us/support/ for additional assistance.

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Admonishments Used in this Document

DANGER! Warns of a hazard the reader ***will*** be exposed to that will ***likely*** result in death or serious injury if not avoided. (ANSI, OSHA)

WARNING! Warns of a potential hazard the reader ***may*** be exposed to that ***could*** result in death or serious injury if not avoided. This admonition is not used for situations that pose a risk only to equipment, software, data, or service. (ANSI)

CAUTION! Warns of a potential hazard the reader ***may*** be exposed to that ***could*** result in minor or moderate injury if not avoided. (ANSI, OSHA) This admonition is not used for situations that pose a risk only to equipment, data, or service, even if such use appears to be permitted in some of the applicable standards. (OSHA)

ALERT! Alerts the reader to an action that ***must be avoided*** in order to protect equipment, software, data, or service. (ISO)

ALERT! Alerts the reader to an action that ***must be performed*** in order to prevent equipment damage, software corruption, data loss, or service interruption. (ISO)

FIRE SAFETY! Informs the reader of fire safety information, reminders, precautions, or policies, or of the locations of fire-fighting and fire-safety equipment. (ISO)

SAFETY! Informs the reader of general safety information, reminders, precautions, or policies not related to a particular source of hazard or to fire safety. (ISO, ANSI, OSHA)

Important Safety Instructions

Safety Admonishments Definitions

Definitions of the safety admonishments used in this document are listed under “Admonishments Used in this Document” on page iv.

Safety and Regulatory Statements

Refer to Section 4154 (provided with your customer documentation) for Safety and Regulatory Statements.

Déclarations de Sécurité et de Réglementation

Reportez-vous à la Section 4154 (fourni avec les documents de votre client) pour les déclarations de sécurité et de réglementation.

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1 System Overview

1.1 Customer Documentation Package

This document (UM582137000) provides *User Instructions* for Vertiv™ NetSure™ -48 VDC Power System Model 512NGBB, Spec. No. 582137000.

The complete Customer Documentation Package consists of…

NetSure™ -48 VDC Power System Installation Manual

- Power System Installation Instructions: IM582137000
- Power System Quick Start Guide: QS582137000

Vertiv™ NetSure™ NCU Controller User Manual

- NCU Controller User Instructions: UM1M830BNA

USB Drive with All Customer Documentation

- Power System Installation Instructions: IM582137000
- Power System Quick Start Guide: QS582137000
- Power System User Instructions: UM582137000
- Power System "System Application Guide": SAG582137000
- Module Mounting Shelf Power Data Sheet: PD588705300
- NCU Controller User Instructions: UM1M830BNA
- Rectifier Instructions: UM1R482000E3
- -48 VDC to +24 VDC Converter Instructions: UM1C48241500
- -48 VDC to -58 VDC Converter Instructions: UM1C48582000P3
- Engineering Drawings
- Also provided on the USB drive is a controller configuration drawing and the controller configuration files loaded into the controller as shipped.

1.2 System Description

-48 VDC @ 200A / +24 VDC @ 50A Power System
(System with List 7 Distribution Cabinet)

Vertiv cabinets F2012504, F2015053, and F2016064:
-48 VDC @ 525A / +24 VDC @ 400A (400A per row)
(System with List 27 Distribution Cabinet)

Vertiv cabinet F2021019:
-48 VDC @ 525A / -58 VDC (max.) @ 274A (max.)
(400A per row for the -48 VDC and 274A per row for the -58 VDC)
(System with List 27 Distribution Cabinet)

Vertiv cabinets F2020029, F2020030:
-48 VDC @ 525A / -58 VDC (max.) @ 300A (max.)
(400A per row for the -48 VDC and 300A per row for the -58 VDC)
(System with List 27 Distribution Cabinet)

Non-Vertiv cabinet system:
Power system tested in 65° C ambient without airflow:
-48 VDC @ 400A / -58 VDC (max.) @ 300A (max.)
(300A per row for both -48 VDC and -58 VDC.)
(System with List 27 Distribution Cabinet)

The Vertiv™ NetSure™ 512NGBB DC Power System is an integrated power system containing rectifiers, optional converters, intelligent control, metering, monitoring, and distribution. A power system with List 27 distribution cabinet is usually a part of a configured cabinet system. However, there is a stand-alone model available which is tested in a 65°C ambient. It does not fit into a standard relay rack but can be mounted in non-Vertiv cabinets. A power system with List 7 distribution cabinet can be ordered as part of a configured system to be mounted into an equipment cabinet designed for the power system or as a stand-alone system to be mounted in a relay rack.

This power system is designed to power a load while charging a positive grounded battery. This power system is capable of operating in a batteryless installation or off battery for maintenance purposes. The power system is designed for operation with the positive output grounded.

This system consists of the following components.

Distribution Cabinet

The system always includes a distribution cabinet, which provides DC distribution through fuses and/or circuit breakers. The distribution cabinet may house the controller (depending on system configuration).

List 7: The List 7 distribution cabinet accepts one (1) distribution panel (List BW). List BW distribution panel provides dual voltage load distribution (-48 VDC primary voltage and +24 VDC secondary voltage) and -48 VDC battery disconnect positions. This distribution panel is configured to accept bullet nose type circuit breakers and TPS/TLS fuseholders.

List 27: The List 27 distribution cabinet accepts two (2) distribution panels. A variety of distribution panels are available that provide load distribution and dual voltage load distribution for use with -48 VDC to +24 VDC converters or -48 VDC to -58 VDC converters. These distribution panels are configured to accept bullet nose type circuit breakers and TPS/TLS fuseholders.

The distribution cabinet may be equipped with low voltage load disconnect (LVLD), low voltage battery disconnect (LVBD), and in a List 27 a manual battery disconnect (depending on available configuration options).

Controller

The controller controls the operation of the rectifier and converter modules. The controller also provides power system control, metering, monitoring, and alarm functions.

NCU (NetSure Control Unit): The controller provides power system control (including optional low voltage battery disconnect (LVBD) and low voltage load disconnect (LVLD) control), rectifier control (including a charge control function), converter control, metering functions, monitoring functions, and local/remote alarm functions. The controller also supports rectifier temperature compensation if the system is equipped with a temperature probe(s). Temperature probe(s) may also be designated to monitor ambient temperature and/or battery temperature. The controller also provides data acquisition, system alarm management, and advanced battery and energy management. The controller contains a color TFT display and keypad for local access. The controller provides an Ethernet port and comes with comprehensive webpages for remote access. The controller has SNMP V3 capability for remote system management. The controller supports software upgrade via its USB port. Refer to the NCU Controller Instructions (UM1M830BNA) for more information.

Module Mounting Shelf

The system contains one (1) to four (4) module mounting shelves (depending on system configuration, see SAG582137000), which may house rectifier modules, optional converter modules, and a controller (depending on shelf configuration, see PD588705300). Refer to PD588705300 for additional information.

Rectifier Modules

The system contains rectifier modules, which provide load power, battery float current, and battery recharge current during normal operating conditions. Refer to the Rectifier Instructions (UM1R482000E3) for more information.

Optional -48 VDC to +24 VDC Converter System

Where +24 VDC load power is also required, DC-DC converter modules are available. These converters operate from the main -48 VDC system bus to provide +24 VDC load power. Refer to the Converter Instructions (UM1C48241500) for more information.

Optional -48 VDC to -58 VDC Converter System

Where -58 VDC load power is also required, converter modules are available. These converters operate from the main -48 VDC system bus to provide -58 VDC load power. Refer to the Converter Instructions (UM1C48582000P3) for more information.

2 Operating Procedures

2.1 Controller, Rectifiers, and Optional Converters

For operation instructions on these units, refer to the following documents.

- NCU Controller Instructions (UM1M830BNA)
- Rectifier Instructions (UM1R482000E3)
- -48 VDC to +24 VDC Converter Instructions (UM1C48241500)
- -48 VDC to -58 VDC Converter Instructions (UM1C48582000P3)

2.2 ESTOP Function

If an ESTOP switch is wired to the IB2-1 Controller Interface Board, customer-furnished system ground applied to terminal DI8+ activates the ESTOP function. The ESTOP function shuts down and locks out the rectifiers, shuts down and locks out the optional -48 VDC to +24 VDC converters or optional -48 VDC to -58 VDC converters, and opens the optional low voltage disconnect (LVD) contactors (battery and load type). If the system has battery connected and does not contain a battery LVD or the controller power option is set to Battery Pwr (jumper J4 on the system interface board is set to Battery Pwr), the controller will remain operational. If the system does not contain battery or load LVD(s) and has battery connected, the loads will be sustained by the battery voltage.

For Systems NOT Containing a Battery LVD: When the ESTOP signal is removed, LVD contactors (load type) will close after the "LVD Reconnect Delay" has elapsed (customer configurable via the controller) if battery voltage is present on the bus. Rectifiers and optional -48 VDC to +24 VDC converters or optional -48 VDC to -58 VDC converters will remain off. The rectifiers will restart when the input power is removed and restored after 30 seconds or more (until the LEDs on the modules extinguish). To restart the -48 VDC to +24 VDC converters or -48 VDC to -58 VDC converters: remove the converter, wait 30 seconds or more (until the LEDs on the converter extinguish), then re-insert the converter.

For Systems Containing a Battery LVD: When the ESTOP signal is removed, LVD contactors (battery and load type) will remain open. Rectifiers and optional -48 VDC to +24 VDC converters or optional -48 VDC to -58 VDC converters will remain off. The rectifiers will restart when the input power is removed and restored after 30 seconds or more (until the LEDs on the modules extinguish). When the rectifiers restart, LVD contactors (battery and load type) will close after the "LVD Reconnect Delay" has elapsed (customer configurable via the controller) and the -48 VDC to +24 VDC converters or -48 VDC to -58 VDC converters will restart.

NOTE! *If a customer-furnished method to disconnect the input power to the system is not provided, the rectifiers will stay locked OFF until the input power is recycled. If the ESTOP signal is removed without recycling the input power, the rectifiers will remain off and have a local alarm visible on the module. The ESTOP alarm from the controller will extinguish. The controller will not issue an alarm for this condition.*

2.3 Controller Battery Charge Current Limit Feature

Functionality: After a commercial AC failure or when some battery cells are permanently damaged, the current to the batteries can be quite extensive. To avoid overheating or further damages to the battery, the controller can be programmed to limit the battery current to a preset level by limiting the charging voltage of the rectifiers. Should the battery current still exceed a higher preset value, an alarm is issued.

The controller limits the current going to the batteries based on the "Battery Current Limit" set point which is a percentage of the battery capacity in C10. For example, 0.1C10 would mean 10% of the battery capacity.

Refer to the NCU Instructions (UM1M830BNA) to program this feature. Battery charge current is limited to the value set in the controller, as long as battery voltage is above 47 VDC.

2.4 Local Controls and Indicators

2.4.1 General

Refer to the Controller, Rectifier, and Converter Instructions for descriptions of the local controls and indicators located on these units.

Refer to the next section for descriptions of the local controls and indicators located on the circuit cards installed inside the List 27 distribution cabinet.

2.4.2 List 27 Distribution Cabinet Local Controls and Indicators

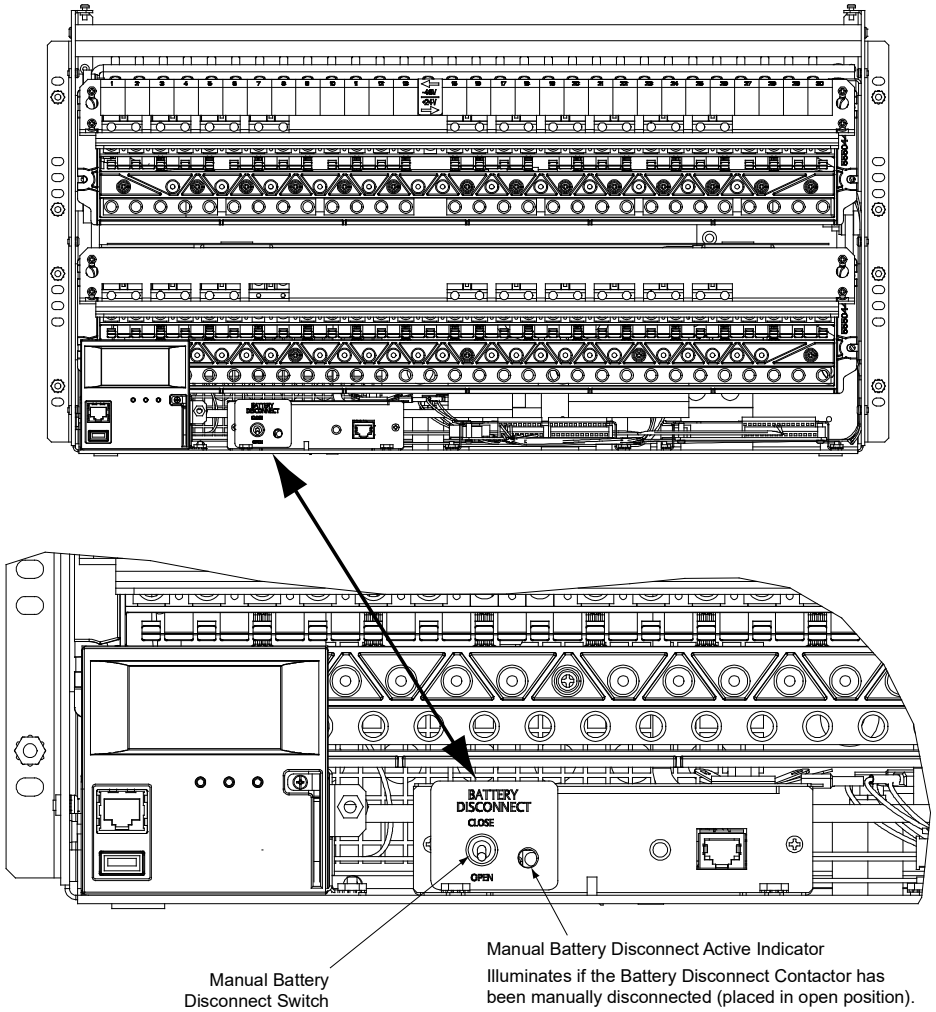
Optional Manual Battery Disconnect Circuit Card

The optional manual battery disconnect circuit card contains a manual battery disconnect switch and indicator. Refer to Figure 2.1.

Optional Critical Alarm Indicator

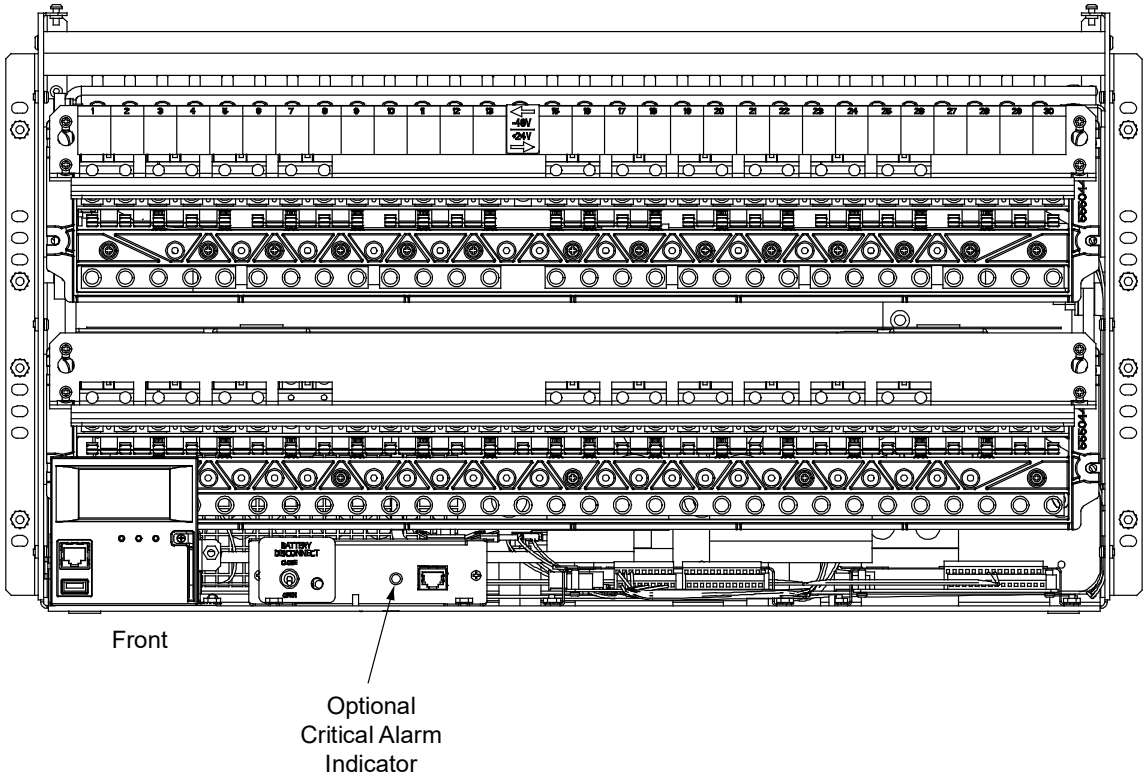
The system may be equipped with an optional critical alarm indicator which illuminates if the controller issues a critical alarm. Refer to Figure 2.2.

Figure 2.1 Optional Manual Battery Disconnect Circuit Card - List 27 Distribution Cabinet



Momentary UP / Middle / Momentary Down
Momentary UP Position: Closes (latches in close position) the Battery Disconnect Contactor.
Middle Position: Normal Operation.
Momentary DOWN Position: Opens (latches in open position) the Battery Disconnect Contactor.
Momentarily place switch in the UP position to close the contactor.

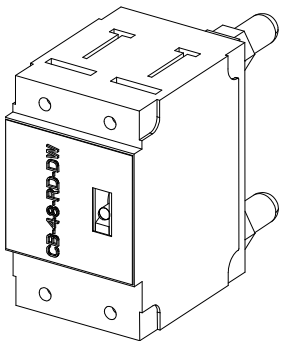
Figure 2.2 Optional Critical Alarm Indicator - List 27 Distribution Cabinet



2.4.3 Optional Transient Voltage Surge Suppressor Device (TVSS)

A TVSS device contains an indicator which illuminates when the circuit activates to suppress voltages. Refer to Figure 2.3.

Figure 2.3 Optional TVSS Device



3 Maintenance

3.1 System Maintenance Procedures

It is recommended to perform the maintenance procedures listed in Table 3.1 every 6 months to ensure continual system operation.

Table 3.1 Maintenance Procedures to be Performed at 6-Month Intervals

PROCEDURE	REFERENCED IN
Check ventilation openings for obstructions such as dust, papers, manuals, etc.	--
Inspect and tighten all installer's connections.	IM582137000

3.2 Adding a Module to an Existing Module Mounting Shelf

3.2.1 General

To increase system current capacity, a rectifier module can easily be added to an existing module mounting shelf that contains an empty rectifier module mounting position. Likewise, to increase subsystem capacity, a -48 VDC to +24 VDC DC-DC converter module can be added to a module mounting shelf that contains an -48 VDC to +24 VDC empty converter module mounting position. Also a -48 VDC to -58 VDC DC-DC converter module can be added to a module mounting shelf that contains an empty -48 VDC to -58 VDC converter module mounting position.

Rectifier and converter modules can be inserted or removed with power applied (hot swappable).

3.2.2 System with List 7 Distribution Cabinet

In the top module mounting shelf, rectifier modules can be installed in any mounting position except the far left. Converter modules (-48 VDC to +24 VDC) CANNOT be installed in the top shelf. See Figure 3.3.

In the bottom module mounting shelf, rectifier modules can be installed in any mounting position. Converter modules (-48 VDC to +24 VDC) can be installed in any of the three far right mounting positions (as viewed from the front). See Figure 3.3.

3.2.3 System with List 27 Distribution Cabinet

Rectifier modules can be installed in any mounting position of each module mounting shelf. Converter modules can be installed in any of the three far right mounting positions of each module mounting shelf (as viewed from the front). See Figure 3.4. See Alerts below for restrictions.

3.2.4 Adding a Module to an Existing Module Mounting Shelf

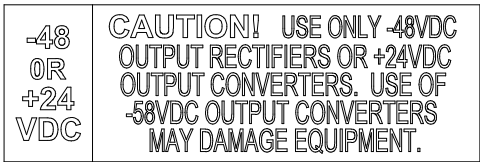
NOTE! *Each rectifier and converter module locks into the module mounting shelf by means of a latch located on the bottom of the module. The latch and module handle are interactive. Pushing the handle up into the module's front panel causes the latch to extend to the locking position; pulling the handle down out from the module's front panel causes the latch to retract. See Figure 3.3 or Figure 3.4.*

WARNING! To prevent damage to the latching mechanism, ensure the handle is in the open position when installing or removing a module. NEVER hold the handle in the closed position when installing a module into a shelf.

ALERT! The system can either have +24V DC-DC converters installed or -58V DC-DC converters installed. The system cannot have both types of converters installed at the same time.

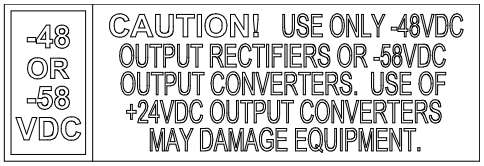
ALERT! The -48 VDC to +24 VDC converter modules must only be installed in a system position that accepts a +24V DC-DC converter. Refer to labeling on the system's module mounting shelf. A sample of this labeling is provided in Figure 3.1.

Figure 3.1 Sample Module Mounting Shelf Labeling



ALERT! The -48 VDC to -58 VDC converter modules must only be installed in a system position that accepts a -58V DC-DC converter. Refer to labeling on the system's module mounting shelf. A sample of this labeling is provided in Figure 3.2.

Figure 3.2 Sample Module Mounting Shelf Labeling



Procedure

1. Unpack the modules.
2. Note the model number located on the front of each module. Model numbers starting with the letter "R" are rectifier modules. Model numbers starting with the letter "C" are converter modules.
3. Place the module into an unoccupied mounting position without sliding it in completely. See Figure 3.3 or Figure 3.4 for acceptable positions. Each module mounting assembly may house rectifier modules, optional -48 VDC to +24 VDC converter modules, or optional -48 VDC to -58 VDC converter modules (depending on configuration).
4. Loosen the captive screw on the module's handle. Pull the handle down out from the module's front panel (this will also retract the latch mechanism). See Figure 3.3 or Figure 3.4.
5. Push the module completely into the shelf.
6. Push the handle up into the module's front panel. This will lock the module securely to the shelf. Tighten the captive screw on the handle.
7. Repeat the above steps for each module being installed in the system.
8. After the modules are physically installed in the mounting shelf(s), they are ready for operation immediately after power is supplied to them.

NOTE! *It is recommended that the current limit point be checked whenever a rectifier is added to or removed from the power system. Refer to "Checking the Controller's Current Limit Point after Adding or Removing a Rectifier."*

NOTE! *The rectifier or converter being added is assigned by the controller the lowest available identification number. If desired, you can change the identification number. Refer to the NCU Instructions (UM1M830BNA) for a procedure.*

Figure 3.3 Installing Rectifier and Converter Modules, System with List 7 Distribution Cabinet

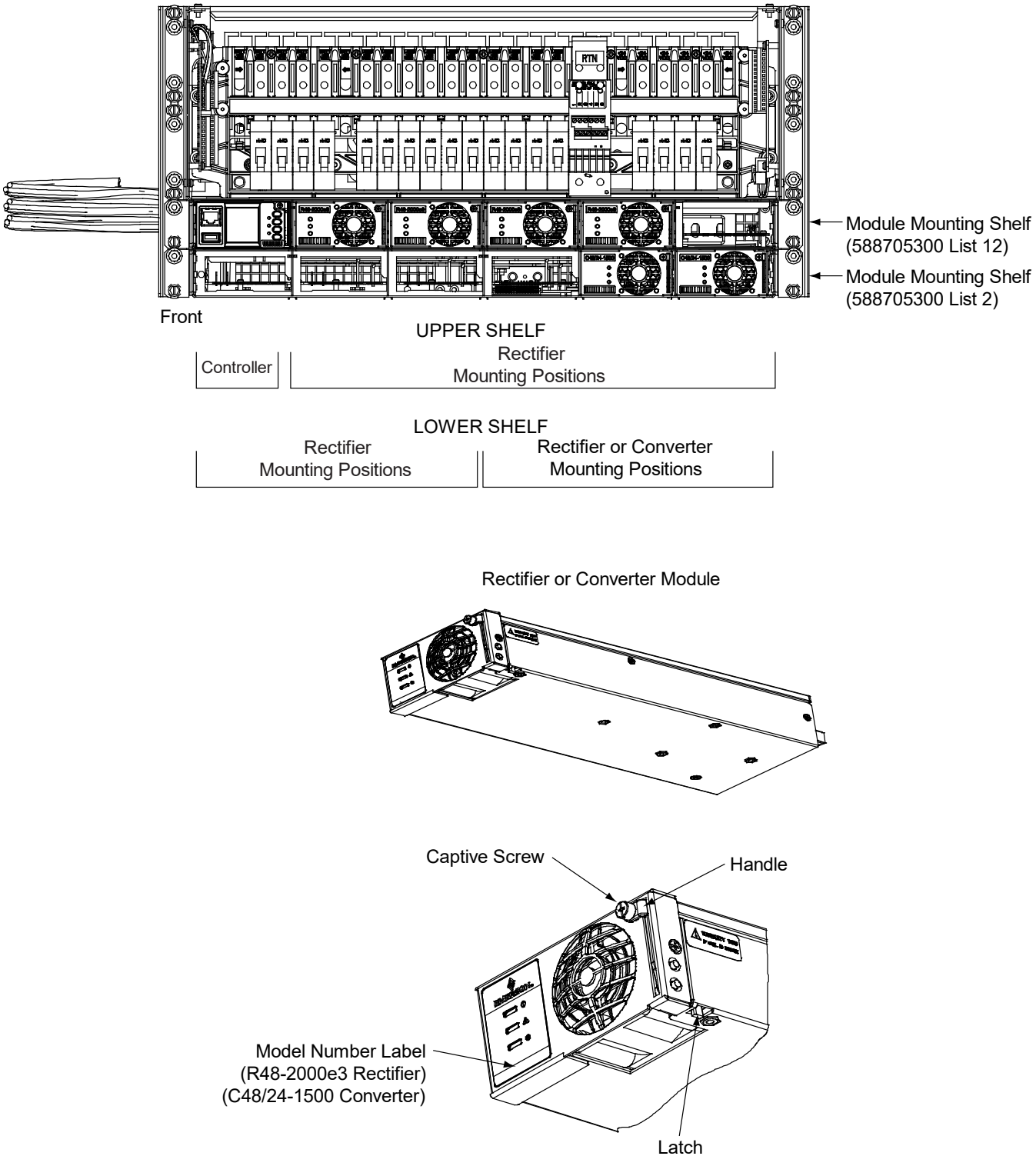
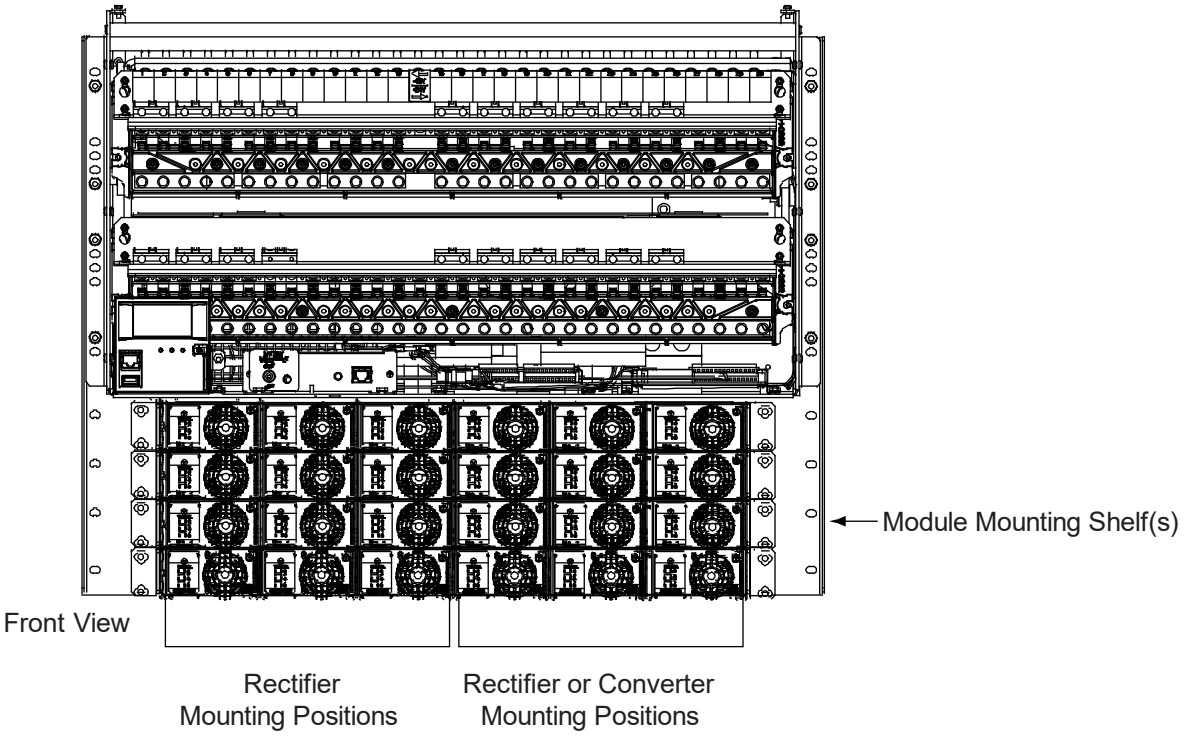
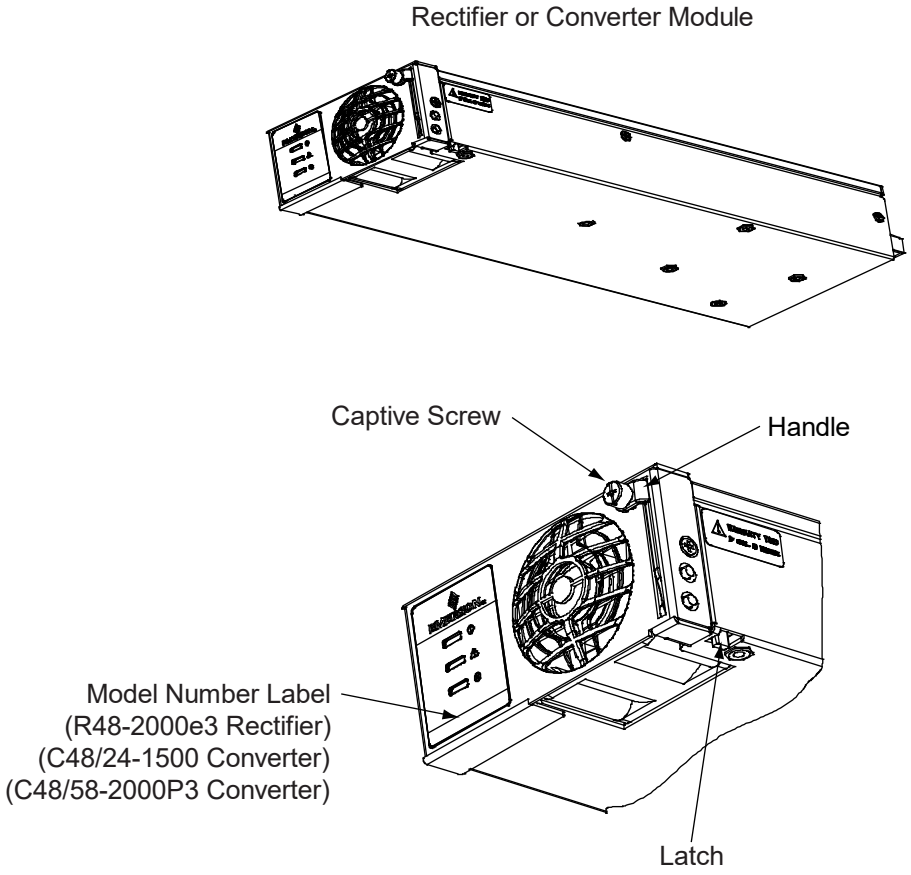


Figure 3.4 Installing Rectifier and Converter Modules, System with List 27 Distribution Cabinet





3.3 Installing a Field Expansion Module Mounting Shelf in a System with a List 27 Distribution Cabinet

NOTE! *A field expansion module mounting shelf CANNOT be installed in a system with a List 7 distribution cabinet.*

DANGER! Adhere to the "Important Safety Instructions" presented at the front of this document.

NOTE! *Refer to Figure 3.6 and Figure 3.7 as this procedure is performed.*

Procedure

1. Remove the busbar rear shield from the lowest module mounting shelf in the rack. Remove the bottom panel from the busbar rear shield by gently bending the panel until it snaps from the busbar rear shield.
2. Remove the hardware from the lowest module mounting shelf's -48V, return, and +24V or -58 V (if present) busbars.
   a) Remove the mounting angles attached to the shelf and replace with P/N 60056566. Place the mounting angle in position as shown in Figure 3.6. Discard the other mounting angles.
3. Install the expansion module mounting shelf directly below the bottom-most module mounting shelf in the rack. Use the mounting hardware provided with the expansion module mounting shelf.

   Hardware build-up is:
   12-24 x 3/4" screw and flat washer,
   (1) set per side.
   12-24 x 3/4" screw and ground washer,
   (1) set per side.

NOTE! *Install the ground washers so the teeth make contact with the metal on the mounting angles. Torque all screws to 65 in-lbs.*

4. Remove the busbar rear shield from the expansion module mounting shelf.

NOTE! *Apply electrical anti-oxidizing compound to busbar mating surfaces before performing the next step.*

5. Install the busbars provided with the expansion module mounting shelf between the studs on the expansion module mounting shelf and the studs on the shelf above it. Secure these busbars to the expansion module mounting shelf with the hardware provided with the expansion module mounting shelf. Secure these busbars to the shelf above the expansion module mounting shelf with the hardware previously removed. Torque to 60 in-lbs.

   Hardware build-up for these connections are:
   M6 Nut,
   M6 Belleville lock washer,
   M6 flat washer.
6. Disconnect the CAN cable coming from the distribution cabinet from the connector on the bottom-most existing module mounting shelf and connect this cable to the same connector on the expansion module mounting shelf.
7. Connect the open CAN connector on the bottom-most existing module mounting shelf to the open connector on the expansion module mounting shelf.

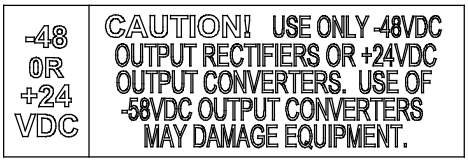
8. Re-install the rear busbar shield previously removed from the existing module mounting shelf. Re-install the rear busbar shield previously removed from the expansion module mounting shelf.

9. Refer to the Power System Installation Instructions (IM582137000) and connect AC input power to the expansion module mounting shelf.

10. Refer to the Power System Installation Instructions (IM582137000) and install rectifier and converter modules into the expansion module mounting shelf as required.

11. For the expansion shelf, two sets of converter polarity caution labels are provided loose. Based on the converter output voltage, apply the correct label to right three converter slots of the expansion shelf: "-48 VDC OR +24 VDC" label (P/N 60037065) for use with +24 VDC converters; "-48 VDC OR -58 VDC" label (P/N 60037064) for use with -58 VDC converters. A sample of this labeling is provided in Figure 3.5.

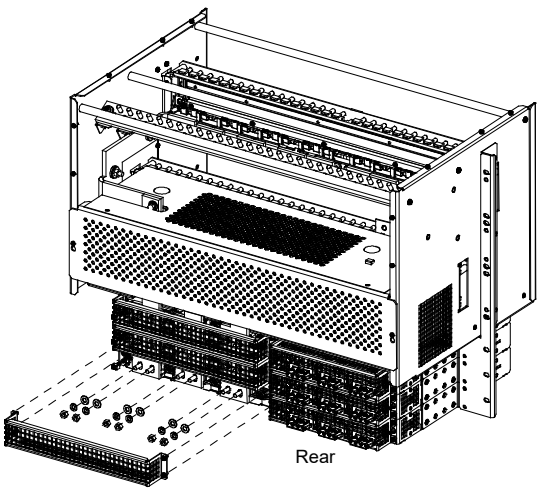
Figure 3.5 Caution Labels

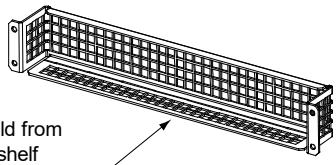


60037065 (-48VDC OR +24VDC Label)

60037064 (-48VDC OR -58VDC Label)

Figure 3.6 Installing a Field Expansion Module Mounting Shelf in a System with List 27 Distribution Cabinet

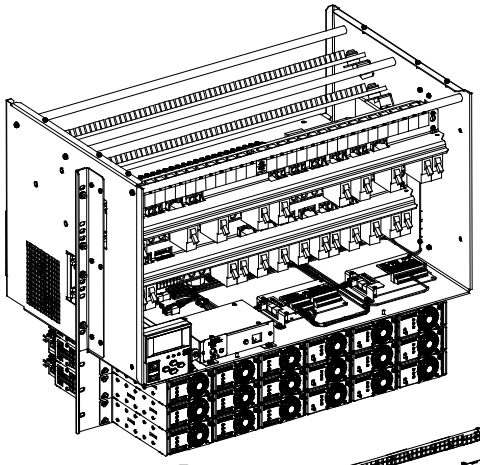




1. Remove busbar rear shield from lowest module mounting shelf in rack. Remove the bottom panel from the busbar rear shield.

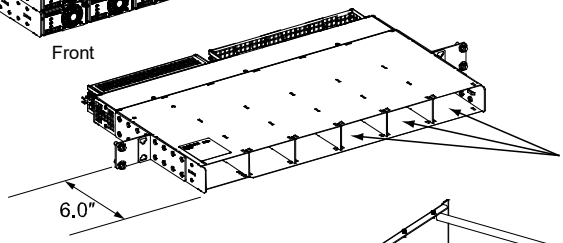
2. Remove hardware from the lowest module mounting shelf's -48V, return, and +24V or -58V (if present) busbars.

   a. Remove the mounting angles attached to the shelf and replace with P/N 60056566. Place the mounting angle in position as shown below.



3. Install the expansion module mounting shelf into the rack.

4. Remove busbar rear shield from expansion module mounting shelf.



Apply "-48 VDC OR -58 VDC" label or "-48 VDC OR +24 VDC" label to right three converter slots of the expansion shelf based on the converter output voltage.

5. Install the busbars provided with the expansion module mounting shelf between the shelves. Torque to 60 in-lbs.

6. Re-install the rear busbar shields previously removed.

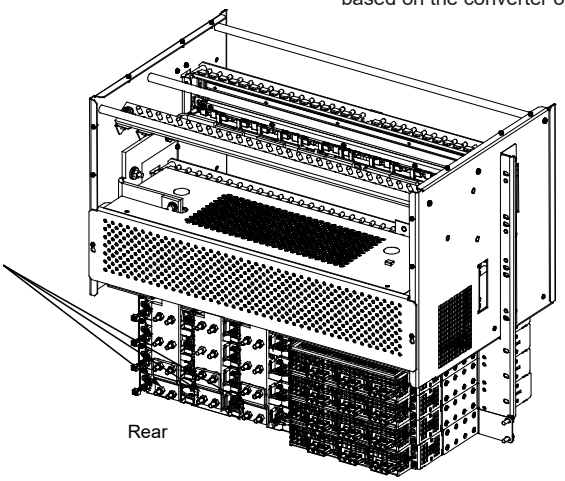
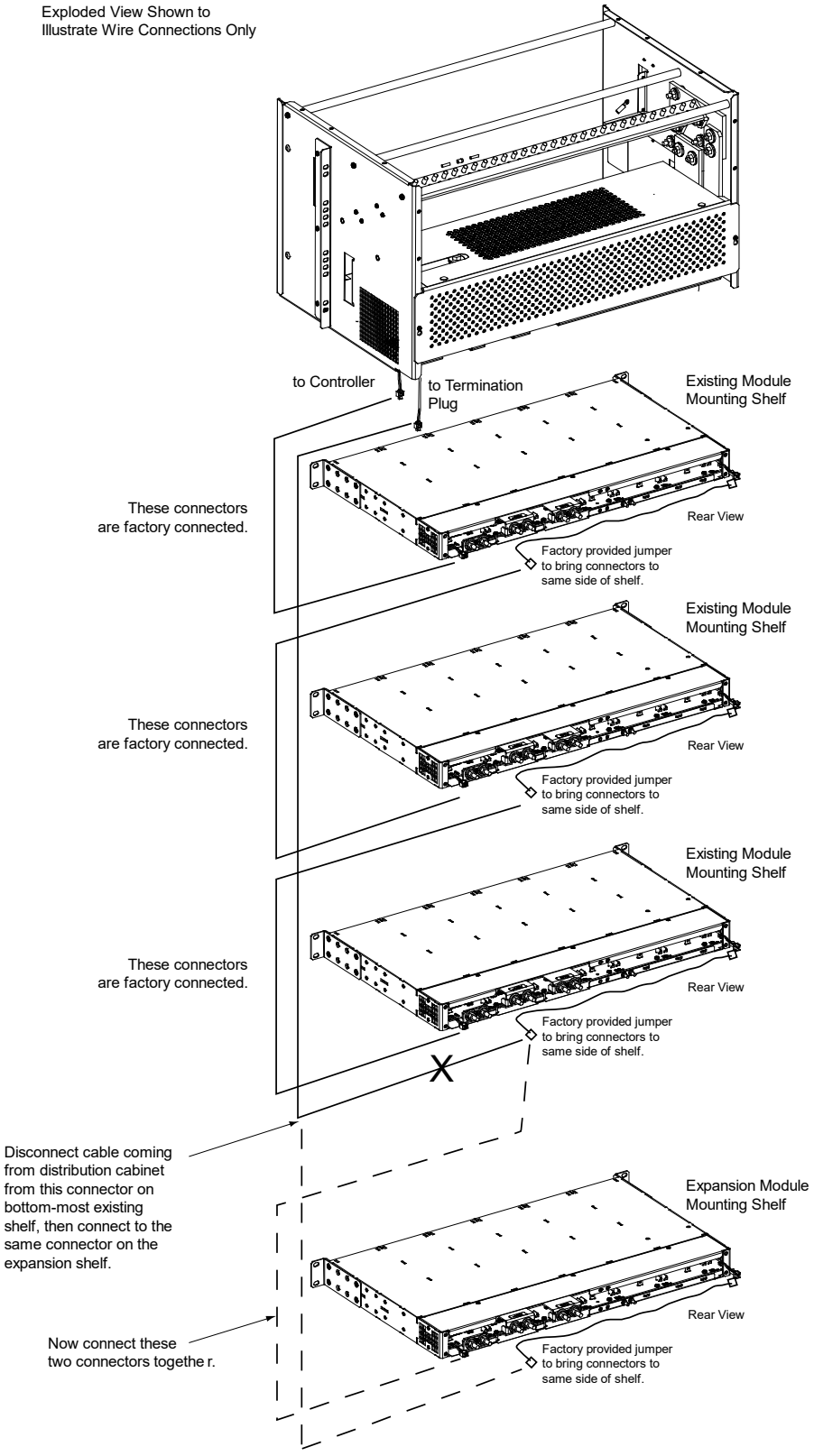


Figure 3.7 Installing a Field Expansion Module Mounting Shelf in a System with List 27 Distribution Cabinet - Controller CAN Bus



3.4 Reconfiguring a Dual Voltage Distribution Panel (List DH, DI, DJ, DK, DL, FG, FH, FI, FJ, FK, FL) in a 582137000 List 27 Distribution Cabinet

Perform the following procedure to reconfigure a dual voltage distribution panel (List DH, DI, DJ, DK, DL, FG, FH, FI, FJ, FK, FL) in the top row of a 582137000 List 27 distribution cabinet to move distribution positions from one voltage to another. Blocks of four (4) positions can be reconfigured from one (1) voltage to another. The panel can be completely converted over to twenty-nine (29) -48VDC positions if needed with the 564354 kit. See For Re-Configuring to a Single -48V Application (without +24V or -58V output) for this procedure.

DANGER! Performing this procedure exposes service personnel to battery potential. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.

NOTE! *Save all removed hardware. Hardware will be re-used.*

WARNING! Performing this procedure may activate external alarms. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any future alarms associated with this system while the procedure is being performed.

DANGER! All sources of AC and DC power must be completely disconnected from this power system before performing this procedure. Use a voltmeter to verify no DC voltage is present on the system busbars before proceeding.

DANGER! Follow local lockout/tagout procedures to ensure DC branch circuit protection devices remain de-energized during installation at loads, as required.

Procedure

1. Verify all AC and DC power sources are disconnected from the power system.
2. Open the cabinet door and rear access panel to cabinet.
3. Loosen the screws holding the Lexan cover over the breaker panel. Slightly lift the Lexan cover up and out of the distribution panel. Refer to Figure 3.8.
4. Locate the position in the panel where there is a gap between the two voltages.
5. If there are any breakers present, shut off and remove the bullet breakers from the positions you want to move to the new voltage.
6. Label the load leads that are affected.
7. Disconnect and insulate all affected load leads from the circuit breaker and/or fuse positions.
8. Disconnect and insulate all affected load return leads from the ground bus bar.
9. Remove the screws from the breaker line side bus bars from the positions that you will be reconfiguring to the new voltage. Refer to Figure 3.9.
10. From the rear of the unit, remove the shorting bar, FA alarm strap, and alarm spring at the point where you would like the voltage to the right and the left to be different. Refer to Figure 3.10.
11. For adding -48V positions, move the breaker line bus bar one position to the right and reconnect the shorting bar between the bar you are moving and the one directly to its right. Refer to Figure 3.11. Reconnect the FA alarm strap and alarm spring jumper so that the alarm spring directly over the breaker line bus bar you just moved will accept an alarm based on a -48VDC signal from the breaker.

For adding +24VDC or -58 VDC positions, move the breaker line bus bar one position to the left and reconnect the shorting bar between the bar you are moving and the one directly to its left. Reconnect the FA alarm strap, and alarm spring jumper so that the alarm spring directly over the line bus bar you just moved will accept an alarm based on a +24V or -58 VDC signal from the breaker.

12. Connect the hardware loosely when making these connections as it will be tightened after the breaker line bus bar is tightened. Refer to Figure 3.12.
13. From the front of the unit, attach the breaker line side bus bars to the panel with the screws that you removed previously. Tighten securely. See Figure 3.9.
14. Relocate the load side bus bar that is no longer over a line side bus bar to a position that is now over a line side bus bar. Refer to Figure 3.13.
15. Remove, flip over, and relocate the voltage indicating label so that the load side bus bars are indicating the correct voltage. Refer to Figure 3.14.
16. Re-Install the Lexan cover.
17. From the rear of the unit tighten the bolts and screws holding the shorting bar, FA alarm strap, and the alarm spring. Refer to Figure 3.12.
18. Reconnect all loads keeping in mind that some of the positions have changed voltages.
19. Ensure that there are no local or remote alarms active on the system.
20. Close any access panels and the cabinet front door.

Figure 3.8 Removing the Lexan Cover from the front of the Distribution Panel

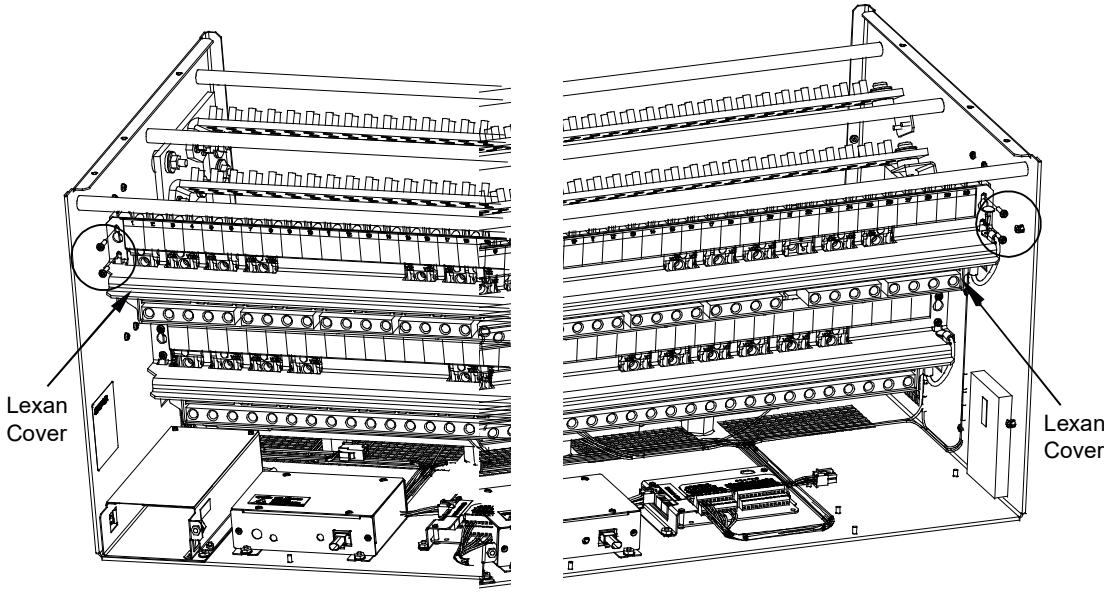


Figure 3.9 Removing and Securing the Breaker Line Side Bus Bar

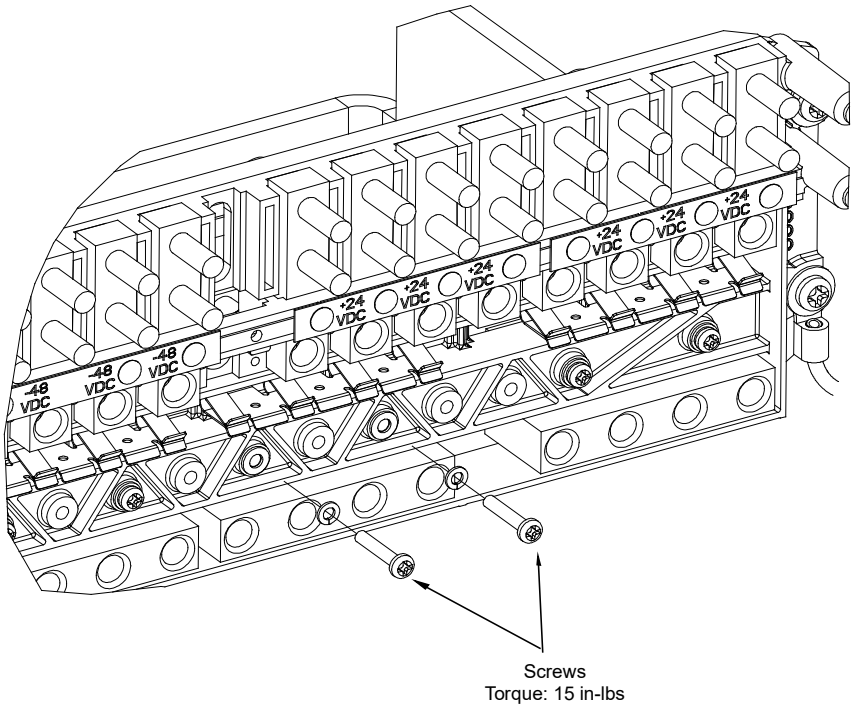


Figure 3.10 Removing the Shorting Bus Bar, Alarm Spring, and FA Alarm Strap

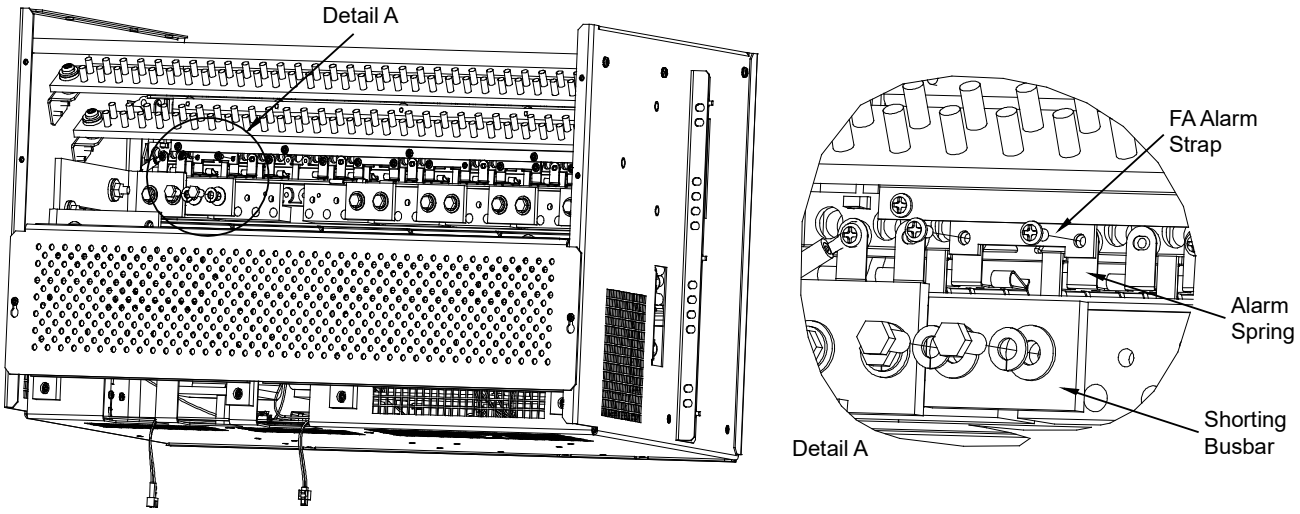


Figure 3.11 Moving the Shorting Bus Bar, Alarm Spring, and FA Alarm Strap

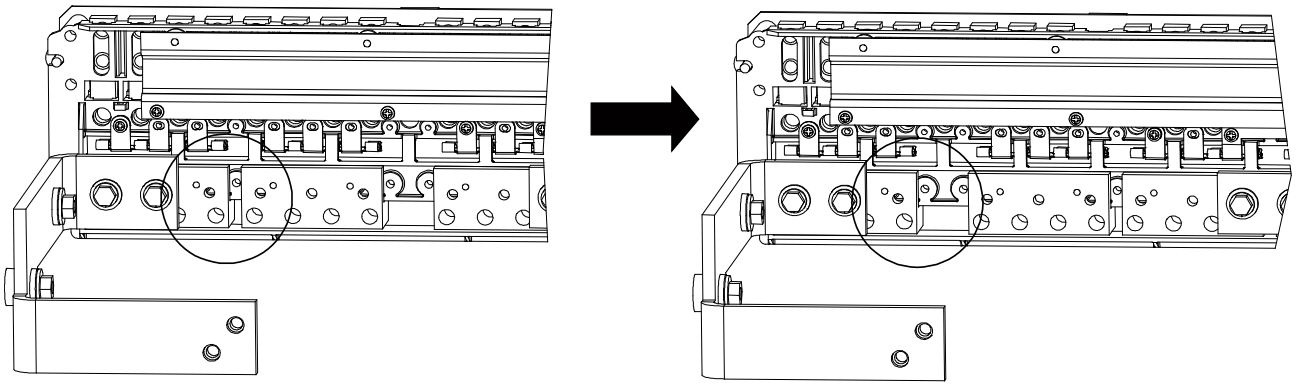


Figure 3.12 Securing the Shorting Bus Bar, Alarm Spring, and FA Alarm Strap

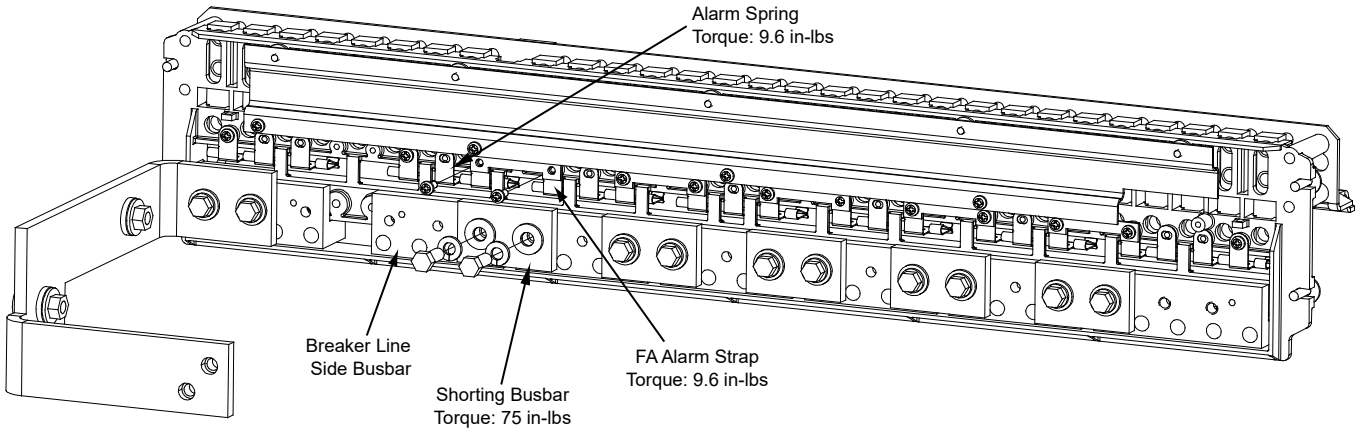


Figure 3.13 Relocating Load Side Bus Bar

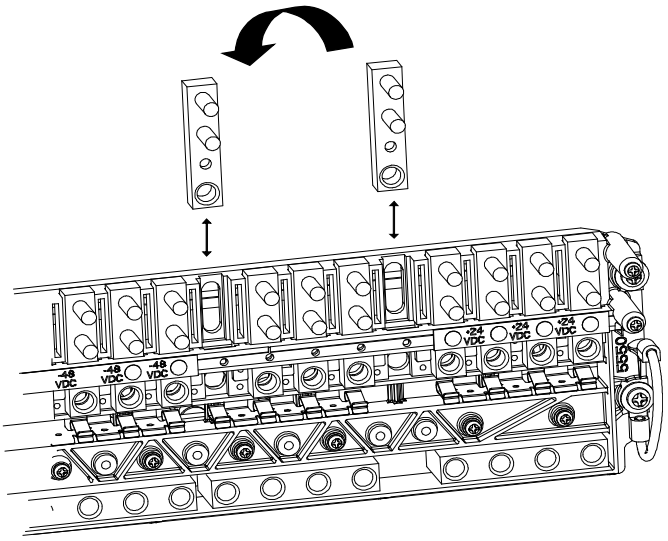
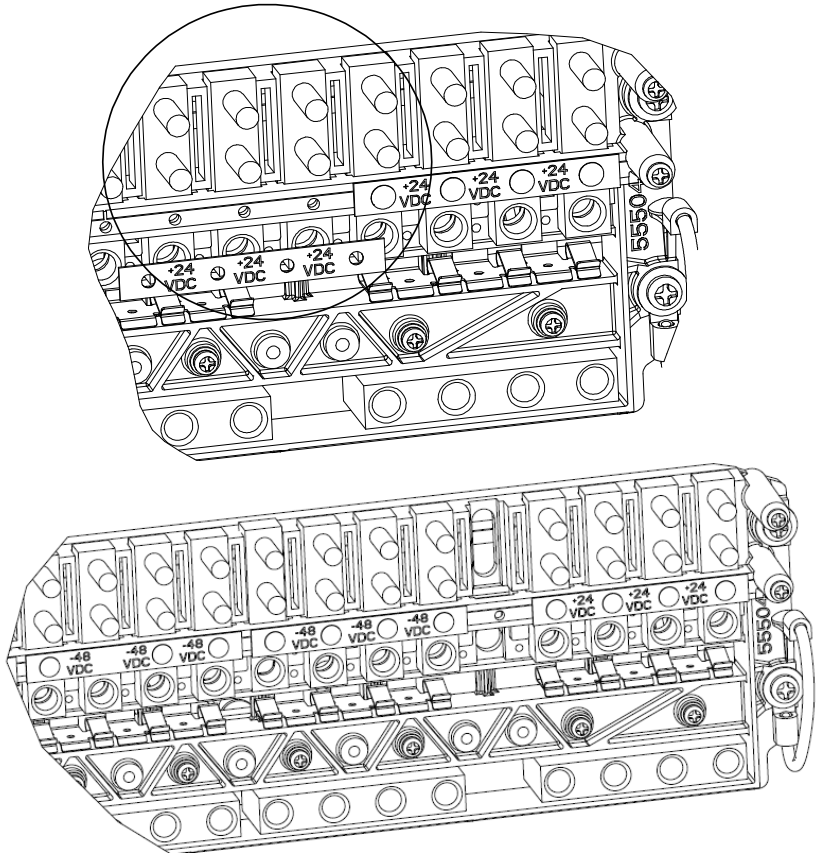


Figure 3.14 Setting the Correct Polarity



3.5 For Re-Configuring to a Single -48V Application (without +24V or -58V output)

Perform the following procedure to re-configure all the +24V or -58V breaker positions over to -48V positions.

DANGER! Performing this procedure exposes service personnel to battery potential. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.

DANGER! All sources of AC and DC power must be completely disconnected from this power system before performing this procedure. Use a voltmeter to verify no DC voltage is present on the system busbars before proceeding.

DANGER! Follow local lockout/tagout procedures to ensure DC branch circuit protection devices remain de-energized during installation at loads, as required.

NOTE! *Save all removed hardware. Hardware will be re-used.*

NOTE! *This procedure is not applicable when -58VDC distribution panel 582137000GC is installed in row 1.*

Procedure

1. Verify all AC and DC power sources are disconnected from the power system.
2. Remove the +24V or -58V link bus bar as shown in Figure 3.15.
3. Remove the Lexan cover from the front of the distribution panel and turn over all +24V or -58V labels to -48V to set the correct polarity.
4. Remove the +24V or -58V FA cable lug and cover or wrap it with the heat shrink tube as shown in Figure 3.16.
5. Order and install Kit 564354 where there currently is a gap between the -48VDC positions and the +24VDC or -58VDC positions. See Figure 3.17 and Figure 3.18.

Figure 3.15 Removing the +24V or -58V link Bus Bar

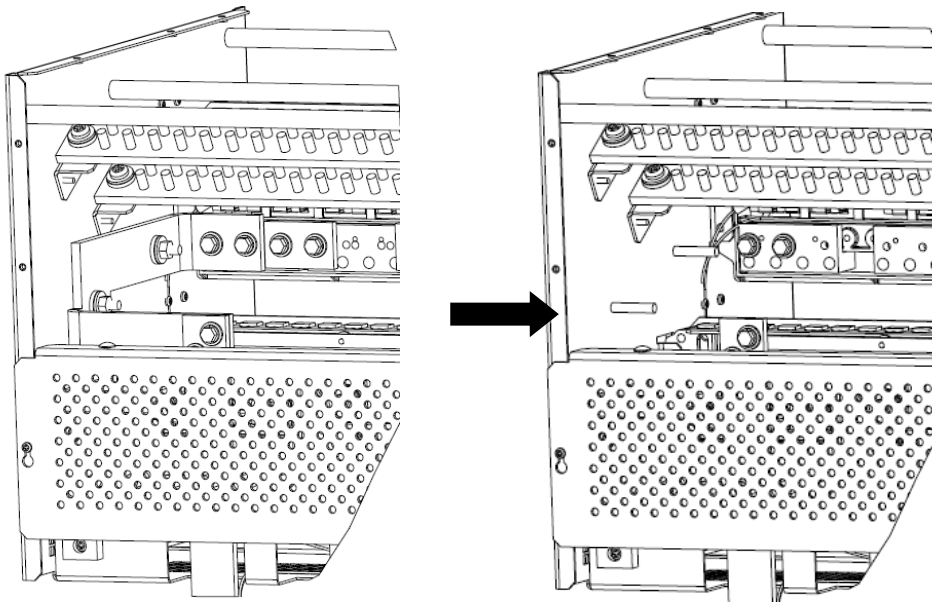


Figure 3.16 Removing and Sleeving the +24V or -58V FA Cable Lug with Heat Shrink Tube

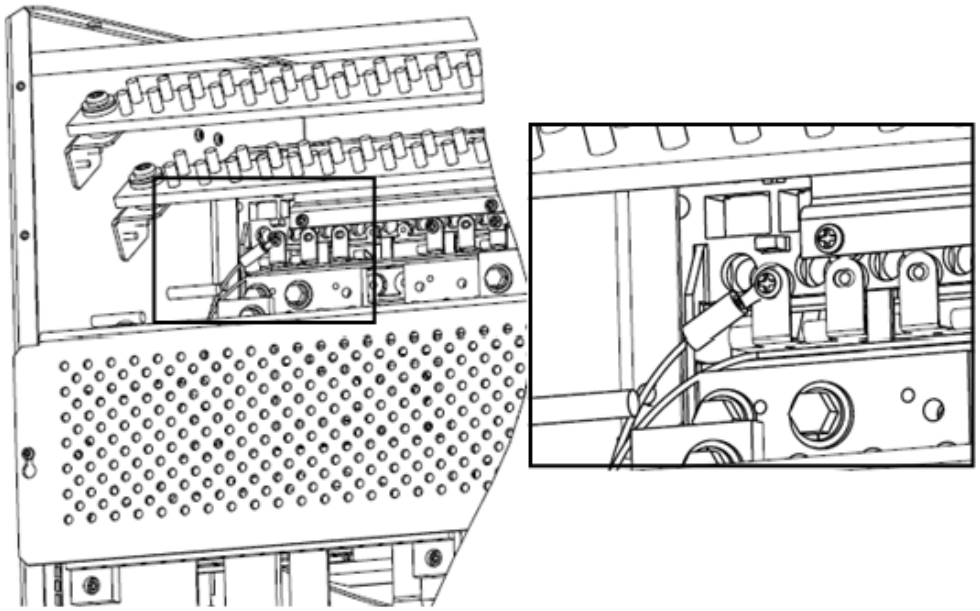


Figure 3.17 Kit 564354

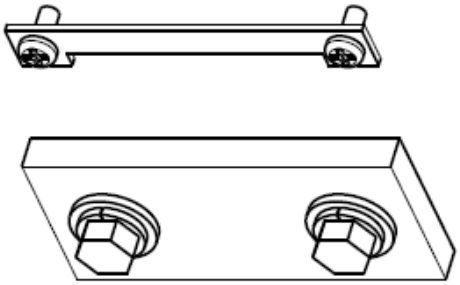
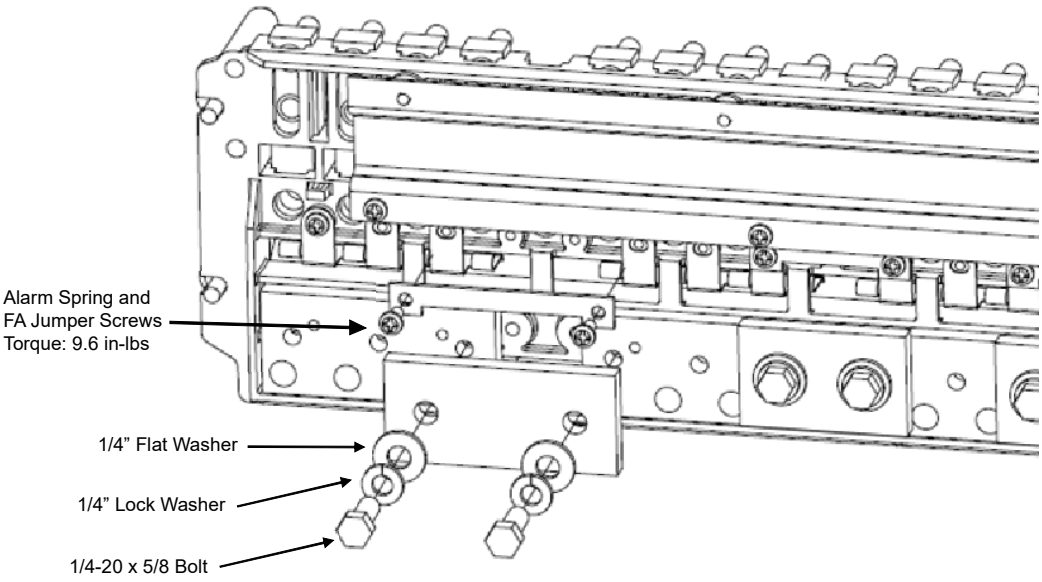


Figure 3.18 Installing Kit 564354



Note: Apply a thin coating of electrical anti-oxidizing compound to the mating surfaces of the busbars. Torque the bus bar to the mating area using 75 in-lbs.

4 Troubleshooting and Repair

4.1 Contact Information

Support contact information is provided at the back of this document.

4.2 Controller, Rectifiers, and Optional Converters

For troubleshooting and repair instructions on these units, refer to the following documents.

- NCU Controller Instructions (UM1M830BNA)
- Rectifier Instructions (UM1R482000E3)
- -48 VDC to +24 VDC Converter Instructions (UM1C48241500)
- -48 VDC to -58 VDC Converter Instructions (UM1C48582000P3)

4.3 Controller Configuration

If any controller configuration settings were changed, refer to the NCU Instructions (UM1M830BNA) and save a copy of the configuration file. This file can be used to restore the controller settings, if required, at a later date.

NOTE! *Provided on a USB drive furnished with the system is a controller configuration drawing (C-drawing) and the controller configuration files loaded into the controller as shipped.*

4.4 System Troubleshooting Information

General

This system is designed for ease in troubleshooting and repair. The various indicators as described in "Local Controls and Indicators" on page 5 and in the Controller, Rectifier, and Converter Instructions are designed to isolate failure to a specific element. Once the faulty element has been identified, refer to "Replacement Information" on page 24 and "Replacement Procedures" on page 25.

Troubleshooting Alarm Conditions on the Controller

The controller displays alarm conditions as listed in the "Available Alarms" or "Resolving Alarms" section of the controller's User Manual. Programmable external alarm relays are also available. Refer to the System Installation Instructions (IM582137000) and the configuration drawing (C-drawing) supplied with your power system documentation for your alarm relay configurations.

The controller's *Active Alarm* and *Alarm History* submenus allow the User to view alarm details. Refer to the NCU Instructions (UM1M830BNA) to access these menus.

Checking the Controller's Current Limit Point after Adding or Removing a Rectifier Module or Converter Module

If a rectifier module or converter module is added to the power system, the system current limit point will automatically increase by the percentage each existing rectifier or converter was set to provide prior to the addition.

If a rectifier module or converter module is removed from the system (and the Rect Comm Fail alarm is reset), the current limit point will remain unchanged unless the capacity of the remaining rectifiers or converters is not sufficient to maintain the present current limit point. If that happens, the current limit point will automatically increase to the maximum (121% of the remaining rectifiers or converters).

It is recommended that the current limit point be checked whenever a rectifier module or converter module is added to or removed from the power system.

When setting total rectifier or total converter current limit, the set point to each unit is the total set point divided by the number of units. For example, if the system contains five rectifiers and the current limit is set to 150 amps then each rectifier has a current limit set point of 30 amps. If one or more rectifiers or converters are removed or fail it will take several seconds for the individual set points to the remaining rectifiers or converters to be reset. In the example given, if one rectifier is removed the current limit set point will drop to 120 amps (30 amps times four remaining rectifiers) until the controller can send updated set points to the remaining rectifiers. This takes a couple communication cycles (several seconds) after which each rectifier would have a new set point of 37.5 amps for a total of 150 amps. The total current limit of the rectifiers and converters should not be set such that the loss of the redundant rectifiers or converters will cause this temporary set point to drop below the actual maximum expected load. If batteries are used on the rectifier output, the batteries should support the load until the current limit set points can be re-established due to loss of a rectifier.

Refer to the NCU Instructions (UM1M830BNA) for a procedure.

Clearing a Rectifier Communications Fail Alarm after Removing a Rectifier

If a rectifier module is removed from the system, a rectifier communications failure alarm is generated. If the rectifier module will not be replaced, the alarm should be cleared.

Refer to the NCU Instructions (UM1M830BNA) for a procedure.

Clearing a Converter Communications Fail Alarm after Removing a Converter

If a converter module is removed from the system, a converter communications failure alarm is generated. If the converter module will not be replaced, the alarm should be cleared.

Refer to NCU Instructions (UM1M830BNA) for a procedure.

Clearing a Rectifier Lost Alarm

If the controller resets while a rectifier communications fail alarm is active, the rectifier communications fail alarm is replaced with a rectifier lost alarm. The alarm should be cleared.

Refer to the NCU Instructions (UM1M830BNA) for a procedure to clear the alarm.

Clearing a Converter Lost Alarm

If the controller resets while a converter communications fail alarm is active, the converter communications fail alarm is replaced with a converter lost alarm. The alarm should be cleared.

Refer to the NCU Instructions (UM1M830BNA) for a procedure to clear the alarm.

4.5 Replacement Information

Replacement Assemblies

When a trouble symptom is localized to a faulty rectifier module, converter module, controller, or system circuit card; that particular device or circuit card should be replaced in its entirety. No attempt should be made to troubleshoot or repair individual components on any rectifier module, converter module, controller, or circuit card.

Refer to SAG582137000 (System Application Guide) for replacement part numbers.

4.6 Replacement Procedures

4.6.1 Important Safety Instructions

DANGER! Adhere to the "Important Safety Instructions" presented at the front of this document.

4.6.2 Replacing a Rectifier or Converter Module

Refer to the Rectifier Instructions (UM1R482000E3), -48 VDC to +24 VDC Converter Instructions (UM1C48241500), or -48 VDC to -58 VDC Converter Instructions (UM1C48582000P3) for a rectifier and converter module replacement procedure. Refer also to "*System Troubleshooting Information*" on page 23.

The rectifier or converter module being replaced is assigned by the controller the lowest available identification number. If desired, you can change the identification number. Refer to the NCU Instructions (UM1M830BNA) for a procedure.

4.6.3 Replacing the Controller

Refer to the NCU Instructions (UM1M830BNA) for a controller replacement procedure.

4.6.4 Replacing a Distribution Device

General

Replace distribution devices with the same type and rating. Refer to System Application Guide SAG582137000 for part numbers.

Distribution Fuse "Alarm Fuse" Replacement

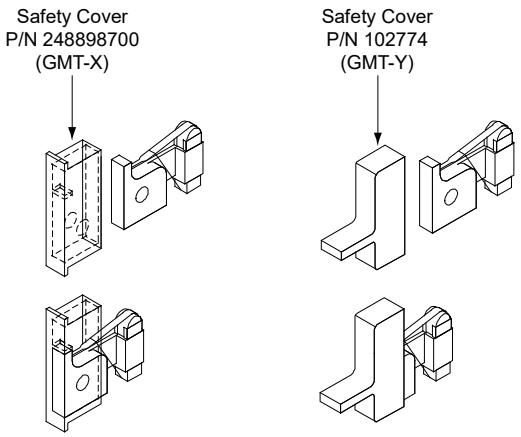
If a distribution fuse opens, the associated alarm fuse opens. Replace the distribution fuse before replacing the alarm fuse.

Procedure

1. An alarm fuse is removed by pulling it straight out of the fuseholder. If the alarm fuse is located in a modular fuse carrier, hold the fuse carrier in place with your thumb while pulling on the alarm fuse to prevent the entire carrier from inadvertently being pulled out.

2. Safety fuse covers are provided for all Bussmann GMT type fuses installed in the system. These covers snap onto the fuses and provide protection from exposed electrical terminations when a fuse opens. Insure that the safety fuse cover is installed after replacing a fuse. Refer to Figure 4.1 for installation details.

Figure 4.1 Installation of Safety Fuse Covers



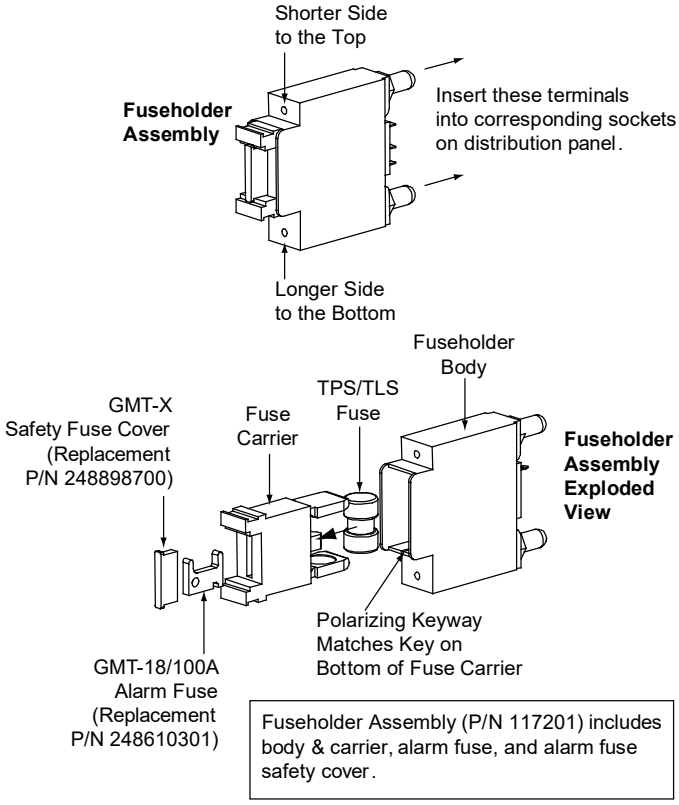
Replacing a TPS/TLS Fuse

Procedure

NOTE! *Refer to Figure 4.2 as this procedure is performed.*

1. Remove the fuse carrier from the mounted fuseholder body by pulling it straight out.
2. Remove the open fuse from the fuse carrier and replace it with the same type and rating.
3. Replace the alarm fuse located in the front of the fuse carrier with the same type and rating. Ensure that a plastic safety cover is installed on the alarm fuse.
4. Push the fuse carrier securely back into the mounted fuseholder body. Note that a polarizing key on the bottom of the carrier prevents the carrier from being inserted upside down.
5. Verify no Fuse Alarms are active.

Figure 4.2 Replacing a TPS/TLS Fuseholder and/or Fuse



Replacing a Bullet Nose Fuseholder

Procedure

NOTE! *Refer to Figure 4.2 as this procedure is performed.*

1. Remove the fuse carrier from the mounted fuseholder body by pulling it straight out. Hold the fuseholder body while you pull the fuse carrier from the body.
2. Gently rock the defective fuseholder up and down while pulling firmly outward until the fuseholder is free from the distribution panel.
3. Orient the fuseholder as shown in Figure 4.2. Insert the terminals on the rear of the fuseholder into their corresponding sockets on the distribution panel. Ensure the alarm contact on the back of the fuseholder makes contact with the alarm terminal on the spring strip. Push fuseholder in firmly until fully seated in the distribution panel.
4. Push the fuse carrier securely back into the mounted fuseholder body. Note that a polarizing key on the bottom of the carrier prevents the carrier from being inserted upside down.
5. Verify no Fuse Alarms are active.

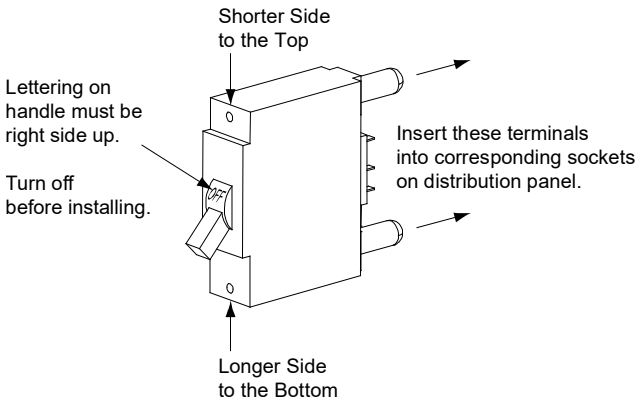
Replacing a Bullet Nose Circuit Breaker

Procedure

NOTE! *Refer to Figure 4.3 as this procedure is performed.*

1. Operate the defective circuit breaker to the OFF position.
2. Gently rock the defective circuit breaker up and down while pulling firmly outward until the breaker is free from the distribution panel.
3. Ensure that the circuit breaker is in the OFF position, and is of the correct rating.
4. Orient the circuit breaker as shown in Figure 4.3.
5. Insert the terminals on the rear of the circuit breaker into their corresponding sockets on the distribution panel. Ensure the alarm contact on the back of the circuit breaker makes contact with the alarm terminal on the spring strip. Push distribution device in firmly until fully seated in the distribution panel.
6. Operate the replacement circuit breaker to the ON position.
7. Verify no Circuit Breaker Alarms are active.

Figure 4.3 Replacing a Bullet Nose Circuit Breaker



4.6.5 Circuit Card Replacement Procedures

WARNING! Circuit cards used in this power system contain static-sensitive devices. Read the Static Warning at the front of this document before performing any of the following procedures.

General

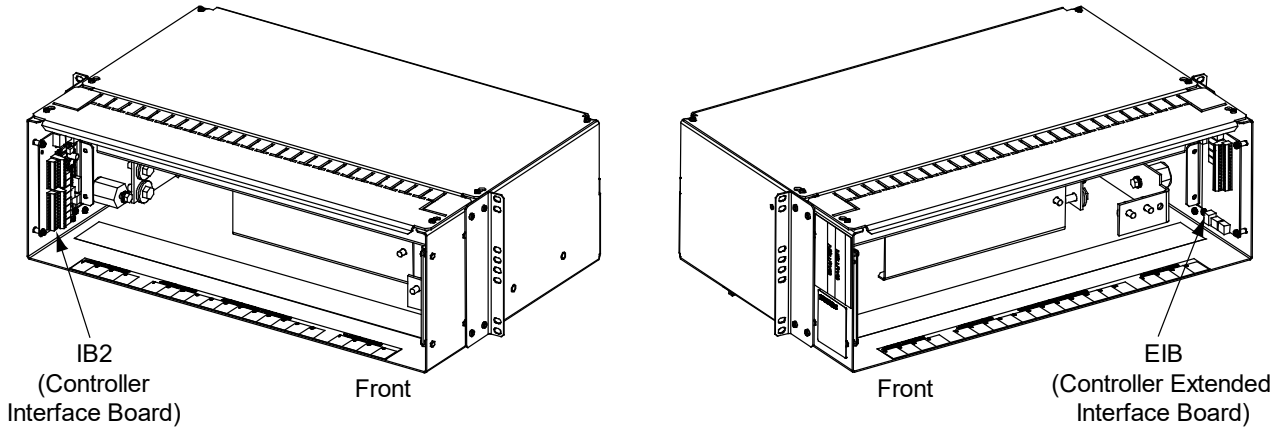
The following circuit card replacement procedures can be performed with the system operating.

Refer to Figure 4.4 or Figure 4.5 for circuit card locations.

CAUTION! When performing any step in these procedures that requires removal or installation of hardware, use caution to ensure no hardware is dropped and left inside the shelf; otherwise service interruption or equipment damage may occur.

NOTE! *When performing any step in these procedures that requires removal of existing hardware, retain all hardware for use in subsequent steps.*

Figure 4.4 Circuit Card Locations, System with a List 7 Distribution Cabinet



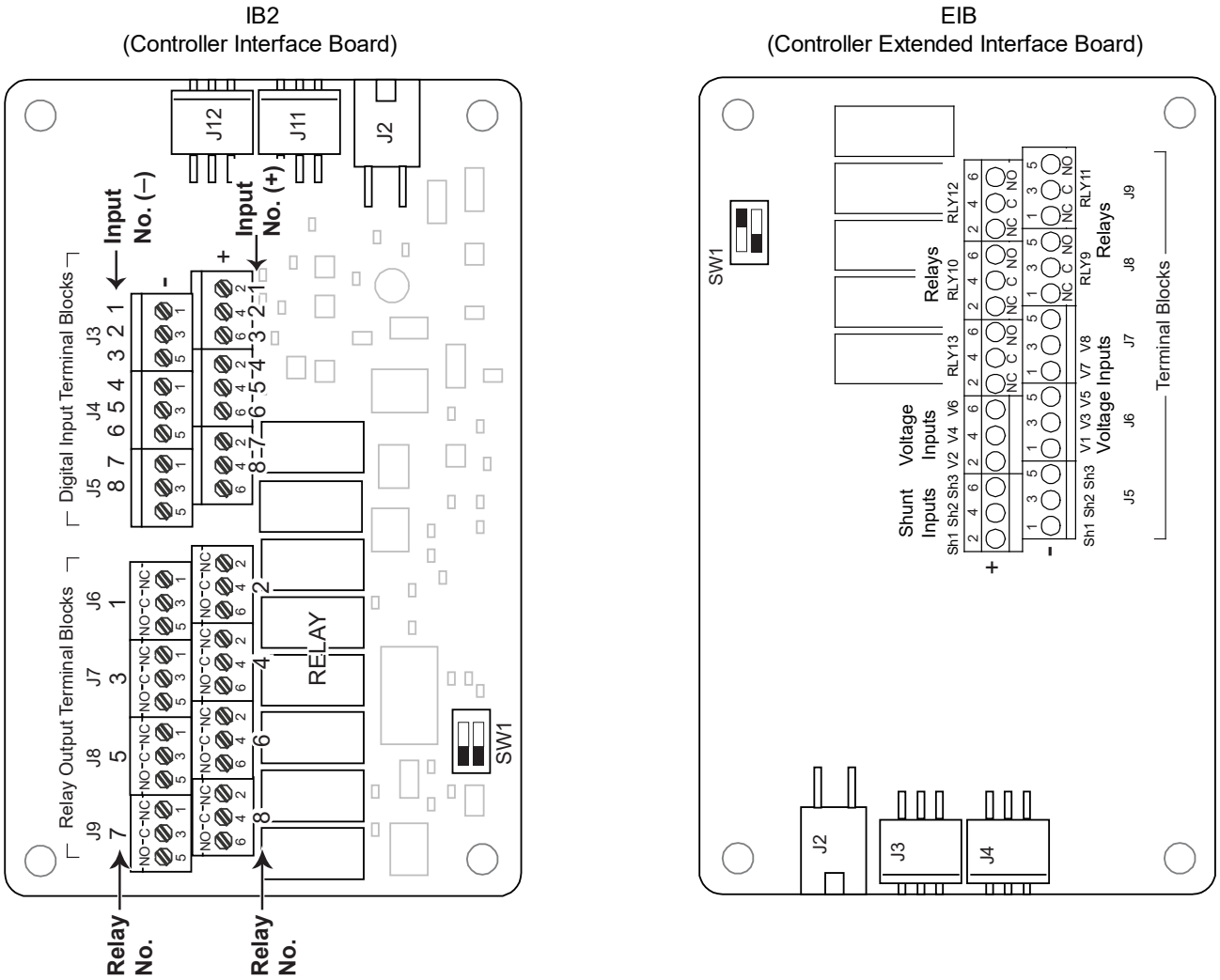
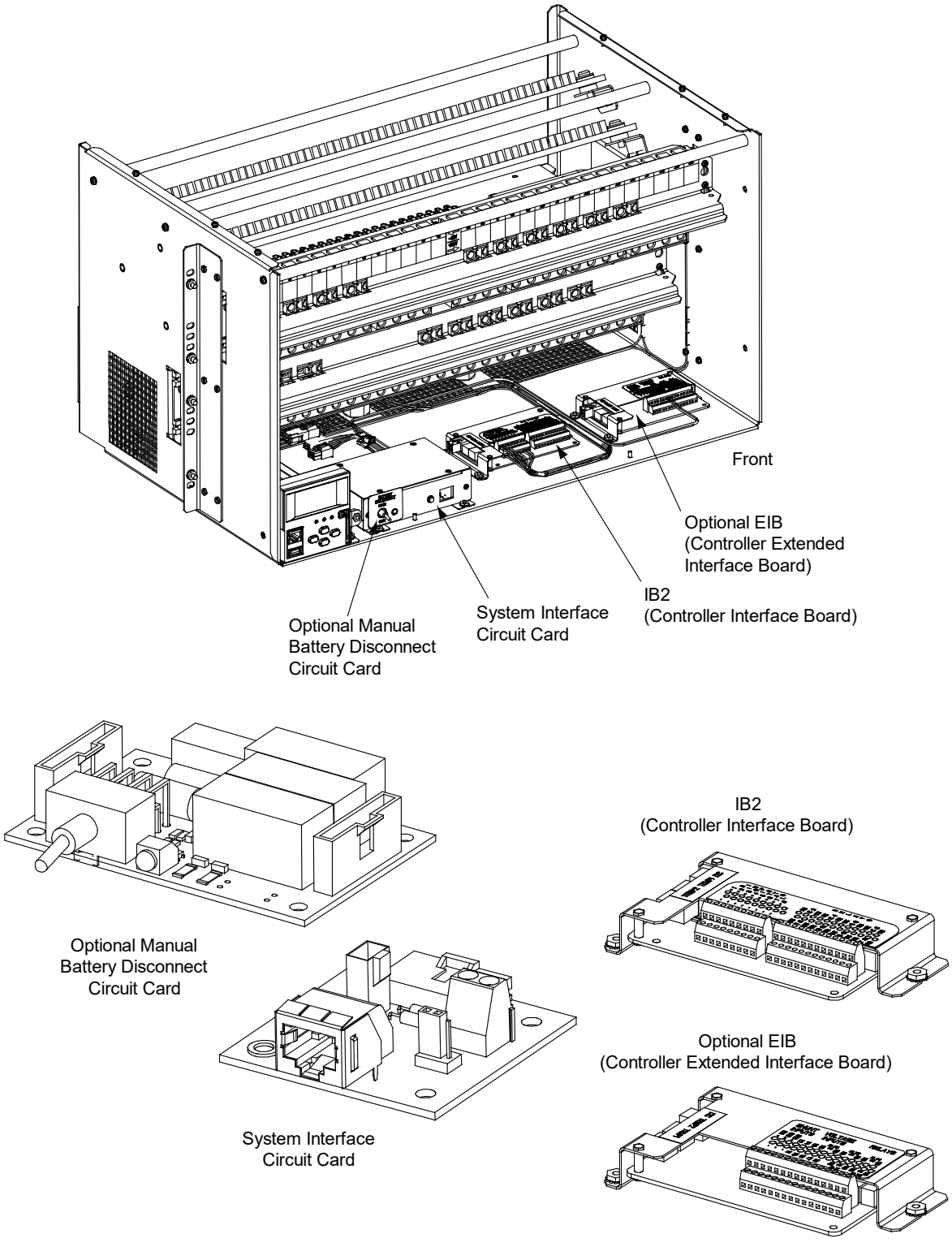


Figure 4.5 Circuit Card Locations, System with a List 27 Distribution Cabinet



System Interface Circuit Card Replacement in a List 27 Distribution Cabinet

Procedure

NOTE! *Refer to Figure 4.5 for circuit card location.*
Refer to Figure 4.6 as this procedure is performed.

1. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any future alarms associated with this system while the procedure is being performed.

DANGER! Performing the next steps exposes service personnel to battery potential. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.

WARNING! Damage to the circuit card may result if the next step is not followed.

2. Connect an approved grounding strap to your wrist. Attach the other end to a suitable ground.
3. Remove the top cover from the circuit card housing. Refer to Figure 4.6 for circuit card location.
4. Carefully label the connectors plugged into the circuit card. These connectors must be plugged into the same connectors on the replacement circuit card.
5. Unplug all connectors plugged into the circuit card.
6. Remove the screws securing the circuit card and remove the circuit card from the distribution cabinet.
7. In this step, ensure you do not intermix the old and replacement circuit cards. Set the shorting jumper on the replacement circuit card to match the location on the old circuit card. Jumper settings are documented in the "SETTING JUMPERS AND SWITCH OPTIONS" section of the Power System Installation Instructions (IM582137000).
8. Orient the replacement circuit card over its mounting position inside the distribution cabinet, and secure with the screws removed from the old circuit card.
9. Plug all connectors removed from the old circuit card into the same position on the replacement circuit card.
10. Remove the grounding wrist strap.
11. Reinstall the top cover to the circuit card housing.
12. Enable the external alarms, or notify appropriate personnel that this procedure is finished.
13. Ensure that there are no local or remote alarms active on the system.

Optional Manual Battery Disconnect Circuit Card Replacement in a List 27 Distribution Cabinet

Procedure

NOTE! *Refer to Figure 4.5 for circuit card location.*
Refer to Figure 4.6 as this procedure is performed.

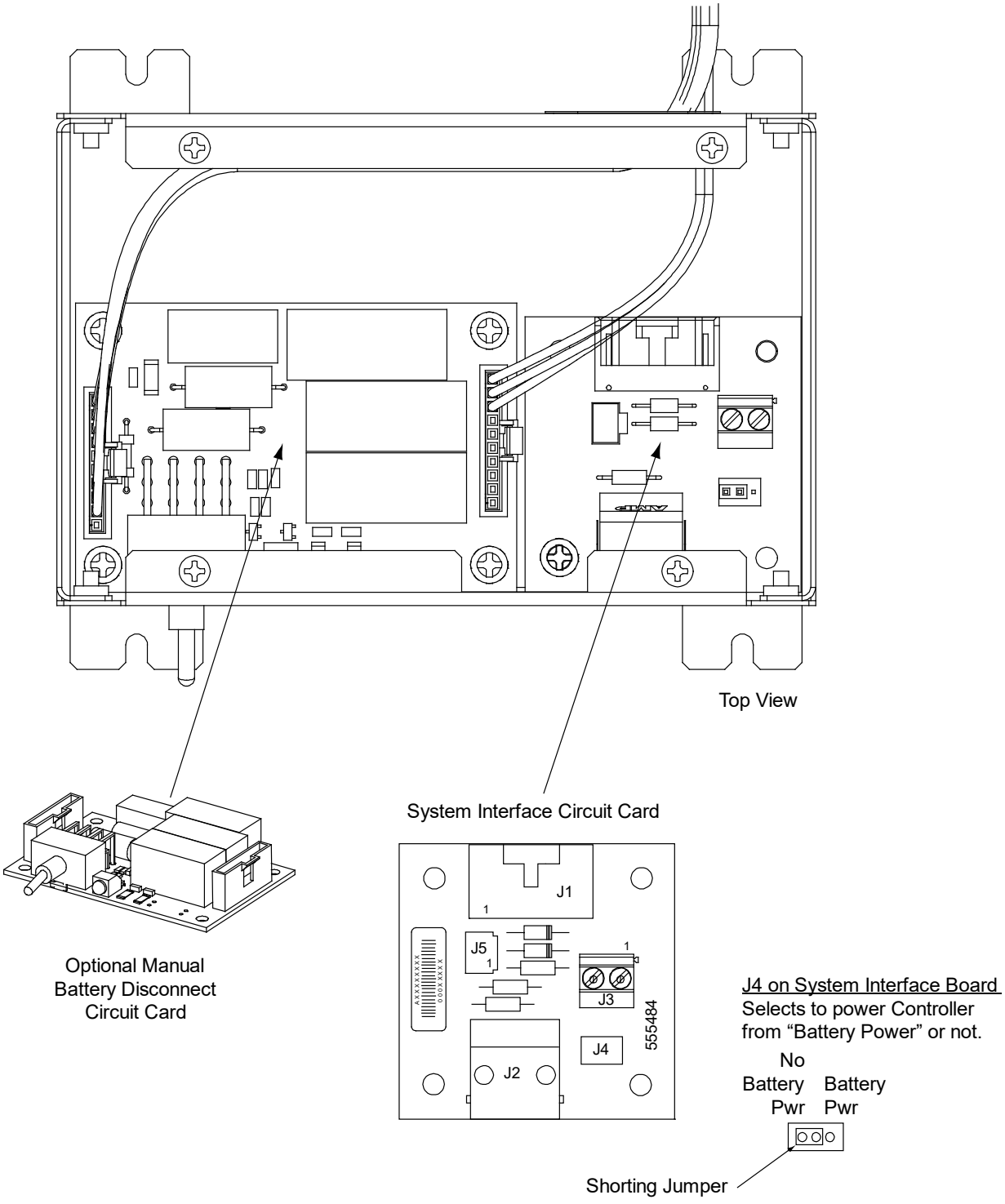
1. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any future alarms associated with this system while the procedure is being performed.

DANGER! Performing the next steps exposes service personnel to battery potential. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.

WARNING! Damage to the circuit card may result if the next step is not followed.

2. Connect an approved grounding strap to your wrist. Attach the other end to a suitable ground.
3. Remove the top cover from the circuit card housing. Refer to Figure 4.6 for circuit card location.
4. Unplug all connectors plugged into the circuit card.
5. Remove the screws securing the circuit card and remove the circuit card from the distribution cabinet.
6. Orient the replacement circuit card over its mounting position inside the distribution cabinet, and secure with the screws removed from the old circuit card.
7. Plug all connectors removed from the old circuit card into the same position on the replacement circuit card.
8. Remove the grounding wrist strap.
9. Reinstall the top cover to the circuit card housing.
10. Enable the external alarms, or notify appropriate personnel that this procedure is finished.
11. Ensure that there are no local or remote alarms active on the system.

Figure 4.6 System Interface Circuit Card and Optional Battery Disconnect Circuit Card Replacement in a List 27 Distribution Cabinet



IB2 (Controller Interface Board) and EIB (Controller Extended Interface Board) Replacement in a List 7 or List 27 Distribution Cabinet

Procedure

NOTE! *Refer to Figure 4.4 or Figure 4.5 for circuit card locations.*
Refer to Figure 4.7 or Figure 4.8 as this procedure is performed.

1. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any future alarms associated with this system while the procedure is being performed.

DANGER! Performing the next steps exposes service personnel to battery potential. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact any energized electrical termination.

WARNING! Damage to the circuit card may result if the next step is not followed.

2. Connect an approved grounding strap to your wrist. Attach the other end to a suitable ground.
3. Carefully label the wires connected to the customer connection terminal blocks on the circuit card. These wires must be connected to the same terminals on the replacement circuit card. Refer to Figure 4.7 or Figure 4.8.
4. Carefully label the connectors plugged into the circuit card. These connectors must be plugged into the same connectors on the replacement circuit card. Refer to Figure 4.7 or Figure 4.8.

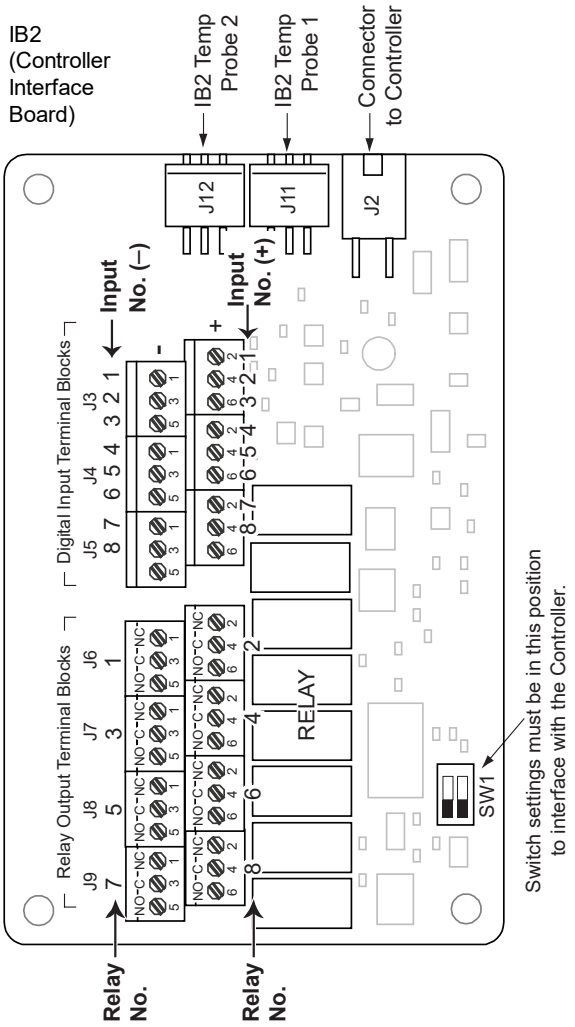
DANGER! In the next step, external alarm wiring may be energized from an external source. DO NOT allow bare wire ends to contact any grounded or energized object.

5. Remove the external wiring from the customer connection terminal blocks. DO NOT allow the bare wire end to contact any grounded or energized object. Isolate the wire end with electrical tape. Repeat for each wire to be removed.
6. Unplug all connectors plugged into the circuit card.
7. Remove the circuit card from the distribution cabinet.
    a) In a List 7 distribution cabinet, remove the circuit card by removing the screws securing it to the cabinet side wall.
    b) In a List 27 distribution cabinet, remove the circuit card by removing the bracket the circuit card is mounted to from the cabinet. Remove the circuit card from the bracket.
8. In this step, ensure you do not intermix the old and replacement circuit cards. Set the switch on the replacement circuit card to the same setting as the old circuit card. Switch settings are documented in the “SETTING JUMPERS AND SWITCH OPTIONS” section of the Power System Installation Instructions (IM582137000).
9. Secure the replacement circuit card to the distribution cabinet.
    a) In a List 7 distribution cabinet, secure the replacement circuit card to the cabinet side wall using the screws removed above.
    b) In a List 27 distribution cabinet, secure the replacement circuit card to the mounting bracket then secure the mounting bracket with circuit card to the distribution cabinet.
10. Plug all connectors removed from the old circuit card into the same position on the replacement circuit card.

DANGER! In the next step, external alarm wiring may be energized from an external source. DO NOT allow bare wire ends to contact any grounded or energized object.

11. Reconnect the external wiring to the correct terminals on the customer connection terminal block. First remove the electrical tape that was applied to the bare wire end in a previous step. DO NOT allow the bare wire end to contact any grounded or energized object. After securing the wire, gently tug on the wire to ensure that it cannot be pulled out of the terminal block. Repeat for each wire to be reconnected.
12. Remove the grounding wrist strap.
13. Enable the external alarms, or notify appropriate personnel that this procedure is finished.
14. Ensure that there are no local or remote alarms active on the system.

Figure 4.7 IB2 (Controller Interface Board) Circuit Card Replacement



J3-J9:
Wire Size Capacity: 16-26 AWG.
Recommended Torque: 2.2 in-lbs.

IB2 Assembly
(582137000 List 27
Distribution Cabinet)

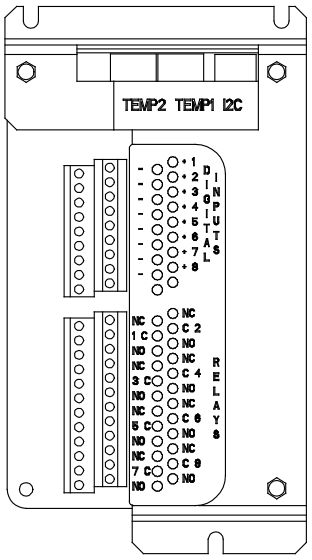
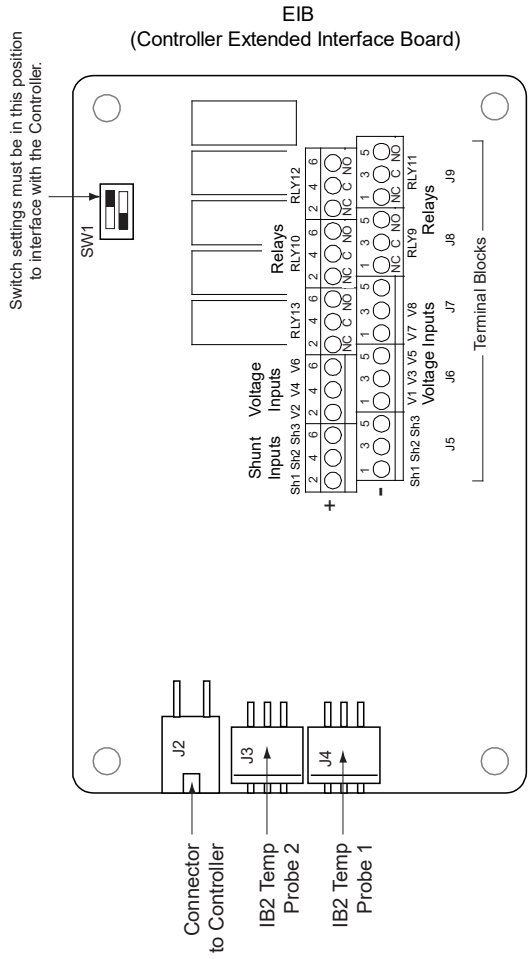
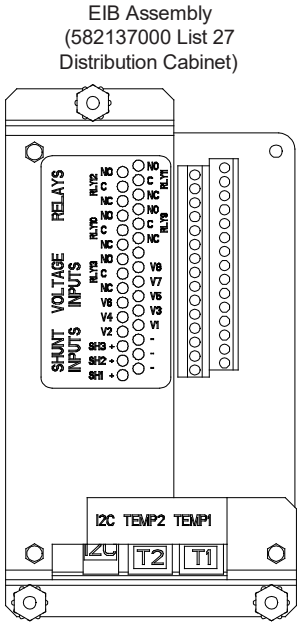


Figure 4.8 EIB (Controller Extended Interface Board) Circuit Card Replacement



J5-J9
Wire Size Capacity: 16-26 AWG.
Recommended Torque: 2.2 in-lbs.



Replacing a Distribution Panel in a List 7 Distribution Cabinet

DANGER! All sources of AC and DC power must be completely disconnected from this power system before performing this procedure. Use a voltmeter to verify no DC voltage is present on the system busbars before proceeding.

Procedure

NOTE! *Refer to Figure 4.9 as this procedure is performed.*

Removing the Distribution Panel

1. Disconnect all system load, sub-system load, and battery wiring from the circuit breaker/fuse positions on the distribution panel.
2. Refer to "IB2 (Controller Interface Board) and EIB (Controller Extended Interface Board) Replacement in a List 7 or List 27 Distribution Cabinet" on page 34 and remove the IB2 and EIB assemblies.
3. Remove access panel(s) as required to access the following connections.
4. Refer to Figure 4.9 and locate the three position in-line alarm wiring connector. Separate the two halves of this connector.
5. Refer to Figure 4.9 and remove the hardware securing the system load distribution device busbar to the panel.
6. Refer to Figure 4.9 and remove the hardware securing the sub-system load distribution device busbar to the panel.
7. Refer to Figure 4.9 and remove the hardware securing the battery disconnect device busbar to the panel.
8. Refer to Figure 4.9 and remove the hardware securing the distribution panel to the distribution cabinet. Remove the distribution panel from the distribution cabinet.

Installing the Distribution Panel

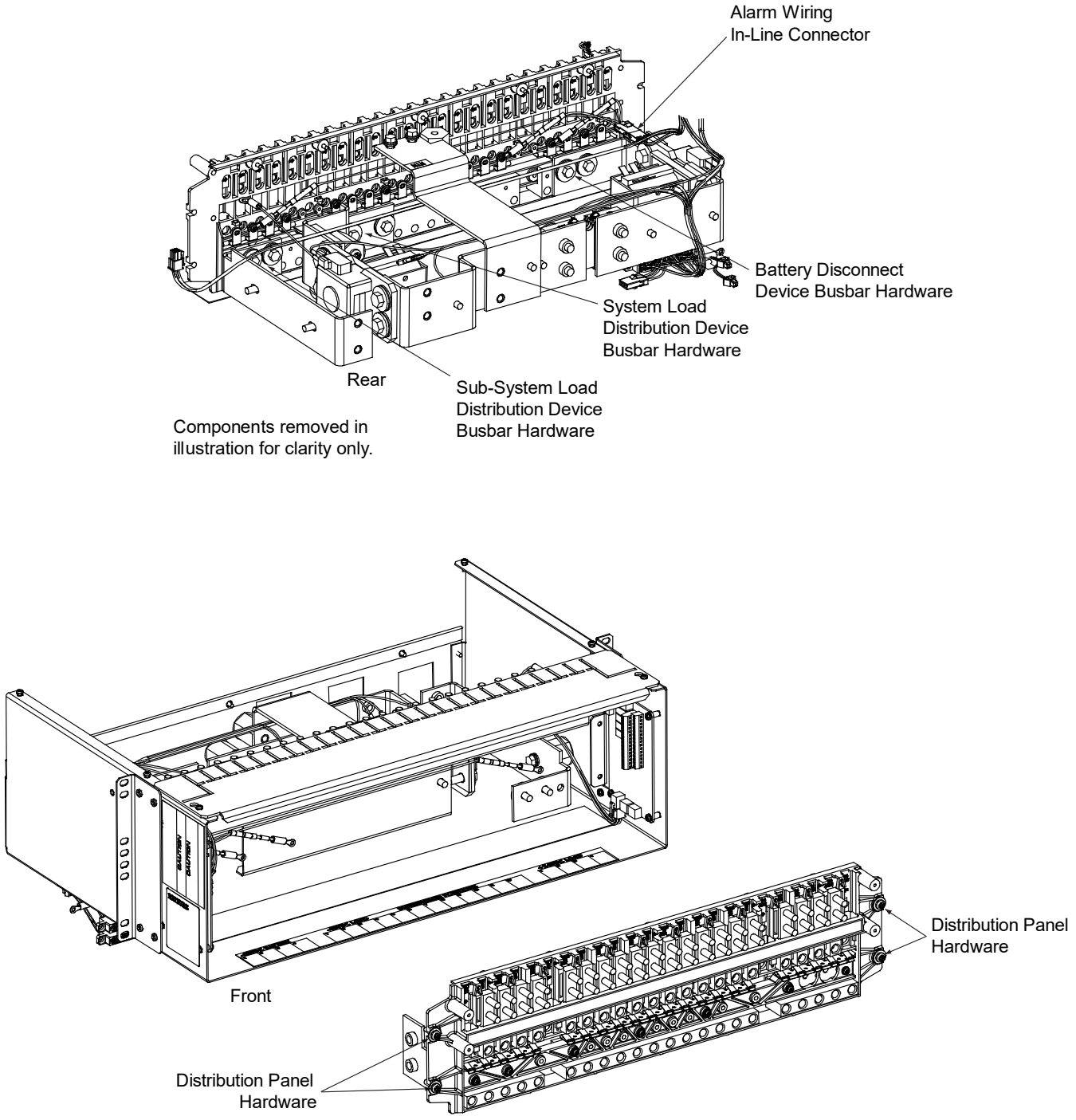
NOTE! *In the following procedure, before making busbar-to-busbar connections, apply a thin coating of electrical anti-oxidizing compound to the mating surfaces of the busbars.*

1. Orient the replacement distribution panel into distribution cabinet, checking to ensure no wires are pinched. Replace the hardware securing the distribution panel to the distribution cabinet (10-32 x 5/8" bolt, #10 flat washer, 4-places).
2. Replace the hardware securing the system load distribution device busbar to the distribution panel (1/4-20 x 7/8" bolt, 1/4" Belleville lock washer, 1/4" hardened flat washer, 2-places). Torque to 60 in-lbs.
3. Replace the hardware securing the sub-system load distribution device busbar to the distribution panel (1/4-20 x 7/8" bolt, 1/4" Belleville lock washer, 1/4" hardened flat washer, 2-places). Torque to 60 in-lbs.
4. Replace the hardware securing the battery disconnect device busbar to the distribution panel (1/4-20 x 7/8" bolt, 1/4" Belleville lock washer, 1/4" hardened flat washer, 2-places). Torque to 60 in-lbs.
5. Plug the two halves of the three position in-line alarm wiring connector together.
6. Replace the access panel(s) removed above.
7. Refer to "IB2 (Controller Interface Board) and EIB (Controller Extended Interface Board) Replacement in a List 7 or List 27 Distribution Cabinet" on page 34 and replace the IB2 and EIB assemblies.
8. Reconnect the load distribution, sub-system load distribution, and battery wiring to the circuit breaker/fuse positions on the distribution panel.
9. Transfer the plug-in circuit breakers or fuses from the old distribution panel to the replacement distribution panel.

Restarting the Power System

1. Reconnect the AC and DC power sources to the power system.
2. Start the power system. Refer to the separate *Installation Instructions* (IM582137000) for a startup procedure.
3. Verify no alarms are active.

Figure 4.9 Replacing a Distribution Panel in a List 7 Distribution Cabinet



Replacing a Distribution Panel in a List 27 Distribution Cabinet

DANGER! All sources of AC and DC power must be completely disconnected from this power system before performing this procedure. Use a voltmeter to verify no DC voltage is present on the system busbars before proceeding.

Procedure

NOTE! *Refer to Figure 4.10 as this procedure is performed.*

Removing the Distribution Panel

1. Remove the plastic shield covering the circuit breakers or fuseholders on the distribution panel to be removed by loosening the screws holding the shield and sliding the shield upwards.
2. Disconnect all load or battery wiring from the circuit breaker/fuse positions on the distribution panel.
3. Locate the FA/CBA alarm lead connected to each distribution panel, note that a dual voltage panel has two connections. Remove this lead(s) from the distribution panel.
4. Refer to Figure 4.10 and remove the hardware securing the system load distribution device busbar to the distribution panel. For dual voltage load distribution panels, refer to Figure 4.10 and remove the hardware securing the sub-system load distribution device busbar to the distribution panel.
5. Refer to Figure 4.10 and remove the hardware securing the distribution panel to the distribution cabinet. Remove the distribution panel from the distribution cabinet.

Installing the Distribution Panel

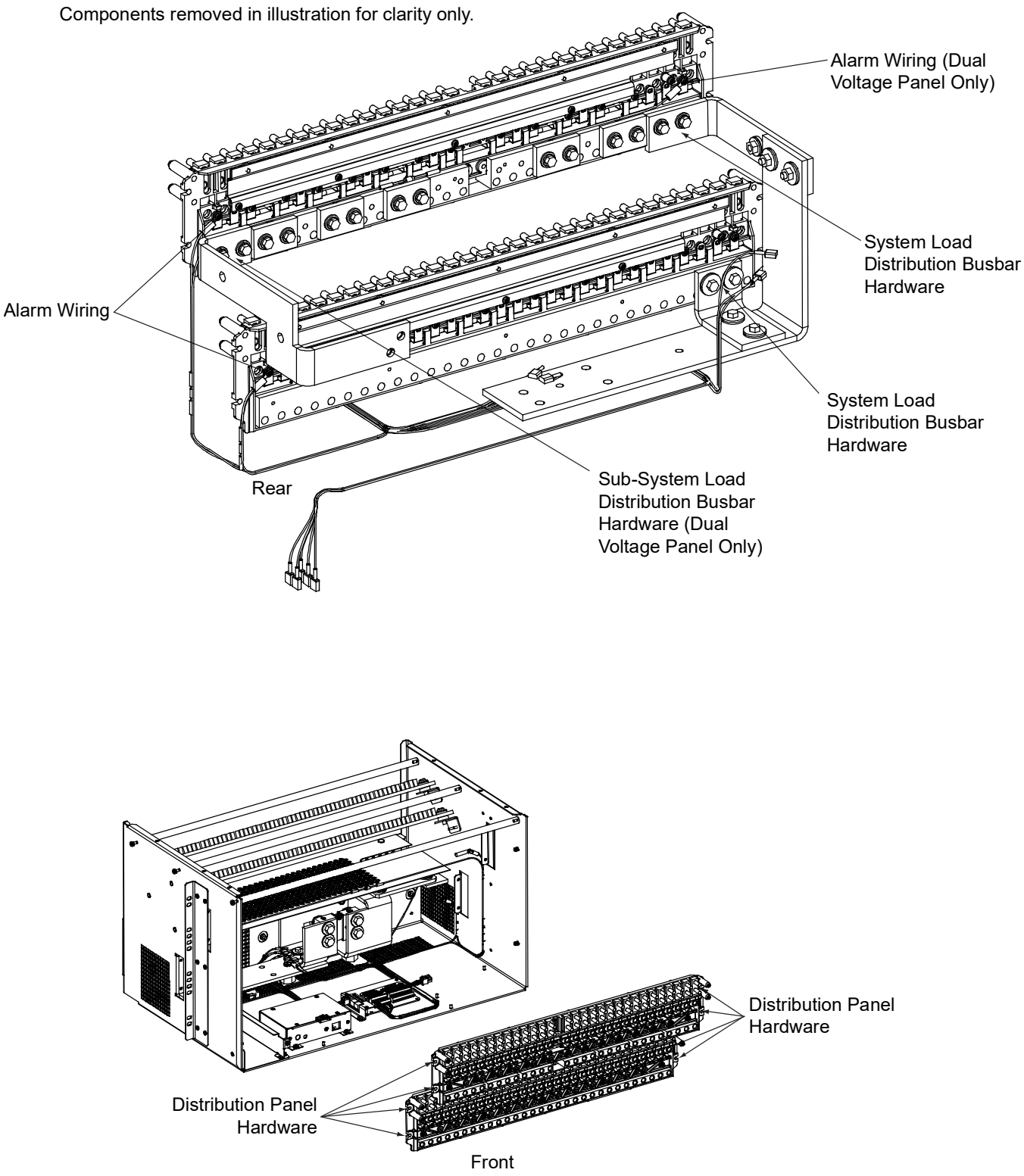
NOTE! *In the following procedure, before making busbar-to-busbar connections, apply a thin coating of electrical anti-oxidizing compound to the mating surfaces of the busbars.*

1. Orient the replacement distribution panel into distribution cabinet, checking to ensure no wires are pinched. Replace the hardware securing the distribution panel to the distribution cabinet (10-32 x 5/8" bolt, #10 flat washer, 4-places).
2. Replace the hardware securing the system load distribution device busbar to the distribution panel (1/4-20 x 7/8" bolt, 1/4" Belleville lock washer, 1/4" hardened flat washer, 2-places). Torque to 60 in-lbs. For dual voltage load distribution panels, replace the hardware securing the sub-system load distribution device busbar to the distribution panel (1/4-20 x 7/8" bolt, 1/4" Belleville lock washer, 1/4" hardened flat washer, 2-places). Torque to 60 in-lbs.
3. Reconnect the FA/CBA alarm lead to each distribution panel. Note that a dual voltage distribution panel has two connections.
4. Reconnect the load or battery wiring to the circuit breaker/fuse positions on the distribution panel.
5. Transfer the plug-in circuit breakers or fuses from the old distribution panel to the replacement distribution panel.
6. Replace the plastic shield covering the circuit breakers or fuseholders on the replacement distribution panel.

Restarting the Power System

1. Reconnect the AC and DC power sources to the power system.
2. Start the power system. Refer to the separate *Installation Instructions* (IM582137000) for a startup procedure.
3. Verify no alarms are active.

Figure 4.10 Replacing a Distribution Panel in a List 27 Distribution Cabinet



Replacing a Battery or Load Disconnect Contactor

DANGER! All sources of AC and DC power must be completely disconnected from this power system before performing this procedure. Use a voltmeter to verify no DC voltage is present on the system busbars before proceeding.

NOTE! *In the following procedure, before making busbar-to-busbar connections, apply a thin coating of electrical anti-oxidizing compound to the mating surfaces of the busbars.*

Procedure

NOTE! *Refer to Figure 4.11 or Figure 4.12 as this procedure is performed.*

Removing the Contactor

1. Verify all AC and DC power sources are disconnected from the power system.
2. Remove access panel(s) as required to access the following connections.
3. Disconnect the wiring to the contactor by unplugging the quick disconnects.
4. Note the orientation of the contactor to ensure the replacement is installed the same way. Unbolt the contactor (4-places) and remove. Save all hardware.

Installing the Replacement Contactor

1. Position the replacement contactor oriented the same way as the old.
2. Secure the contactor with the hardware removed above. Refer to Figure 4.11 or Figure 4.12 for hardware build-up and recommended torque.
3. Replace the wiring to the contactor by plugging-in the quick disconnects. Refer to Figure 4.11 or Figure 4.12.
4. Replace the access panel(s) removed above.

Restarting the Power System

1. Reconnect the AC and DC power sources to the power system.
2. Start the power system. Refer to the separate *Installation Instructions* (IM582137000) for a startup procedure.
3. Verify no alarms are active.

Figure 4.11 Replacing a Battery or Load Disconnect Contactor in a List 7 Distribution Cabinet (cont'd on next page)

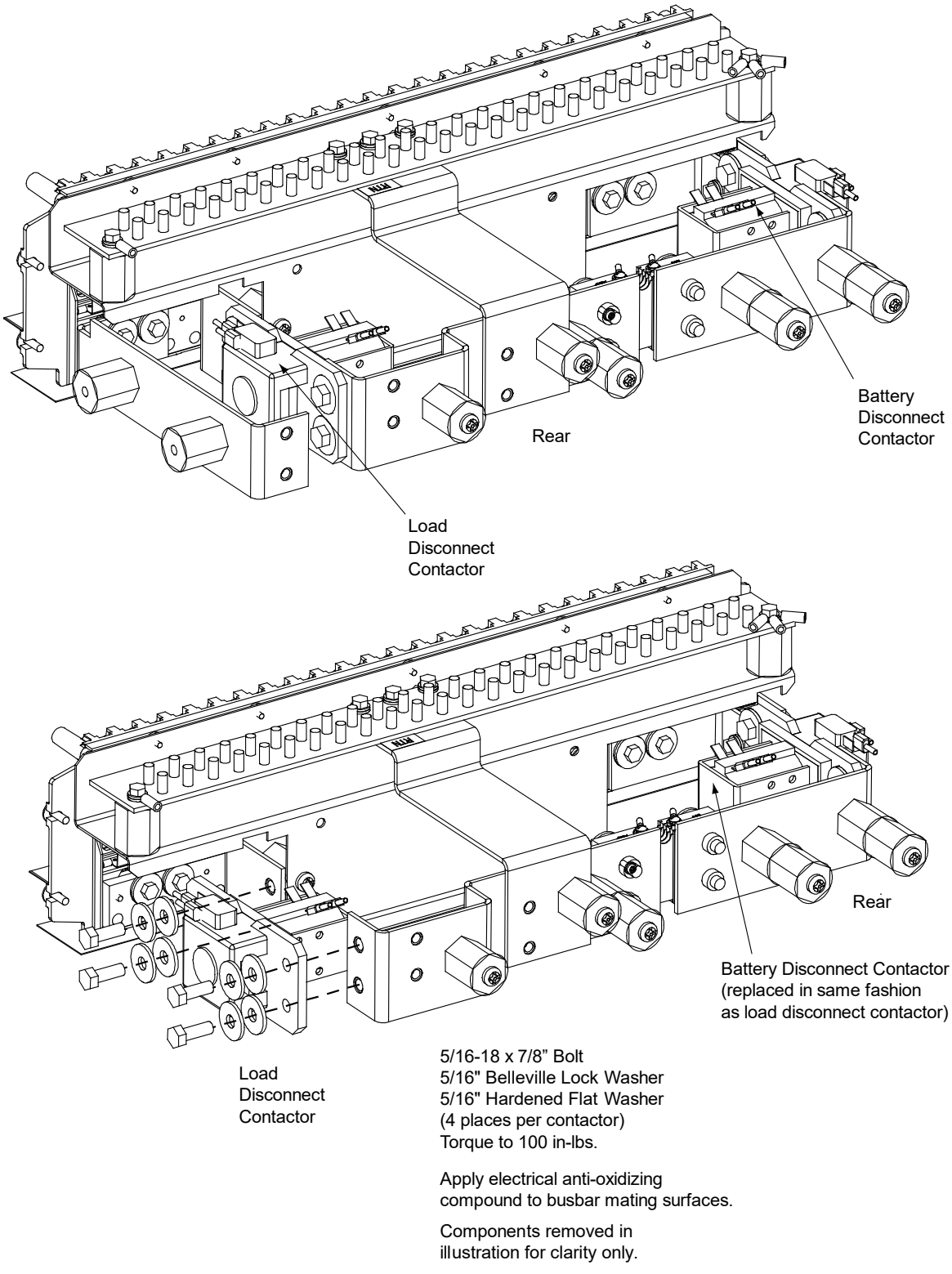
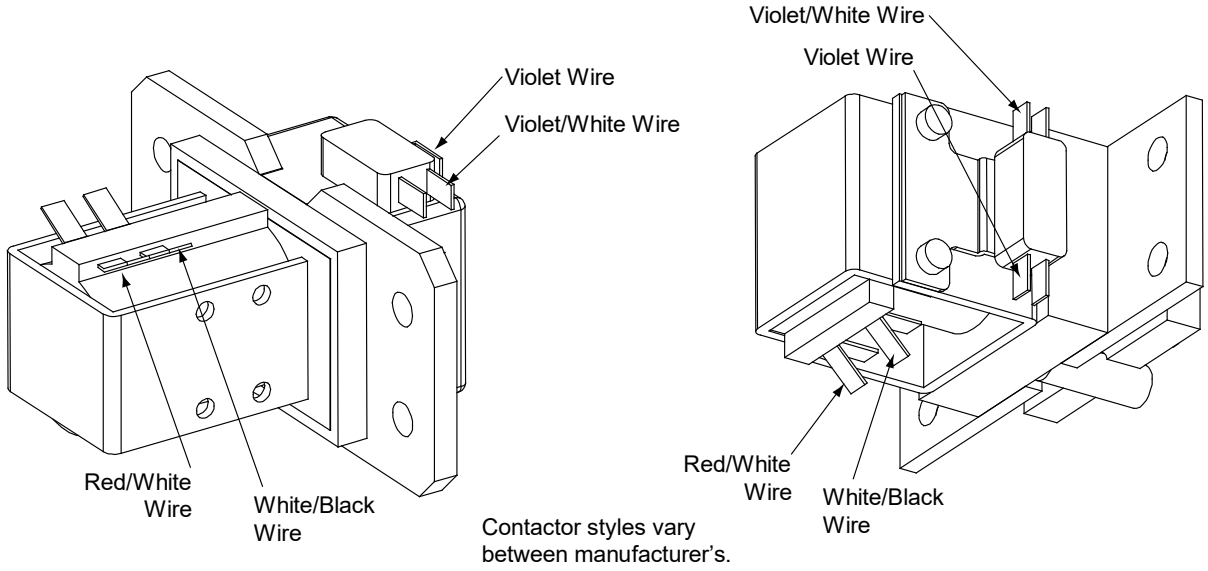


Figure 4.11 Replacing a Battery or Load Disconnect Contactor in a List 7 Distribution Cabinet (cont'd from previous page)

Battery Disconnect Contactor



Load Disconnect Contactor

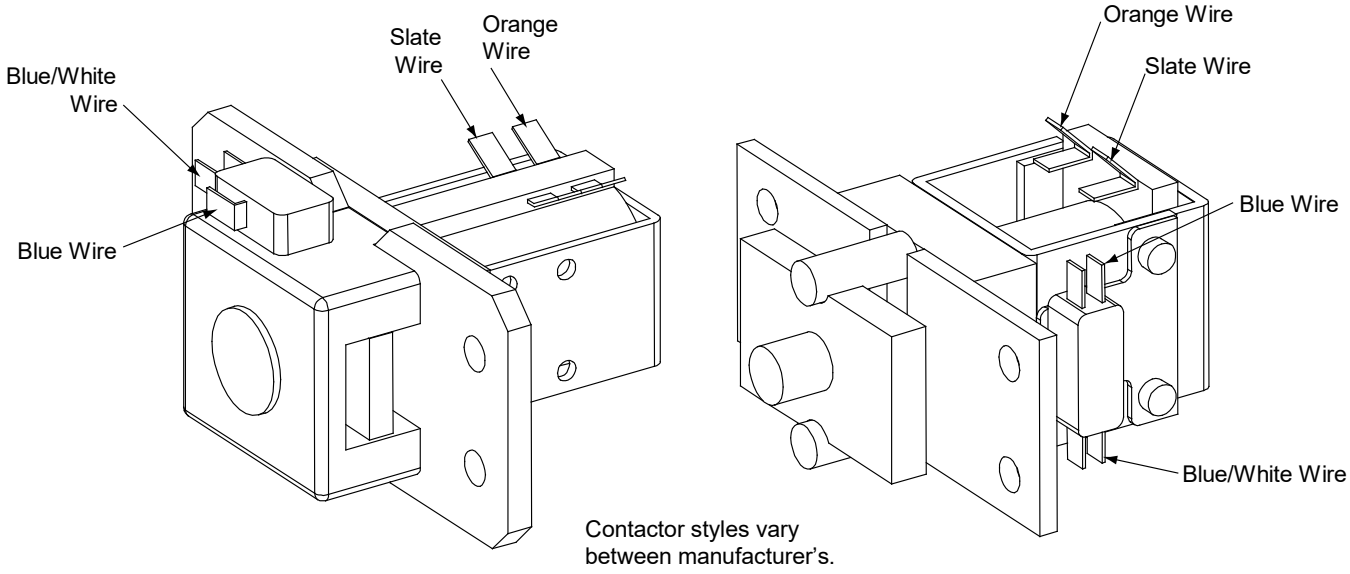


Figure 4.12 Replacing a Battery or Load Disconnect Contactor in a List 27 Distribution Cabinet (cont'd on next page)

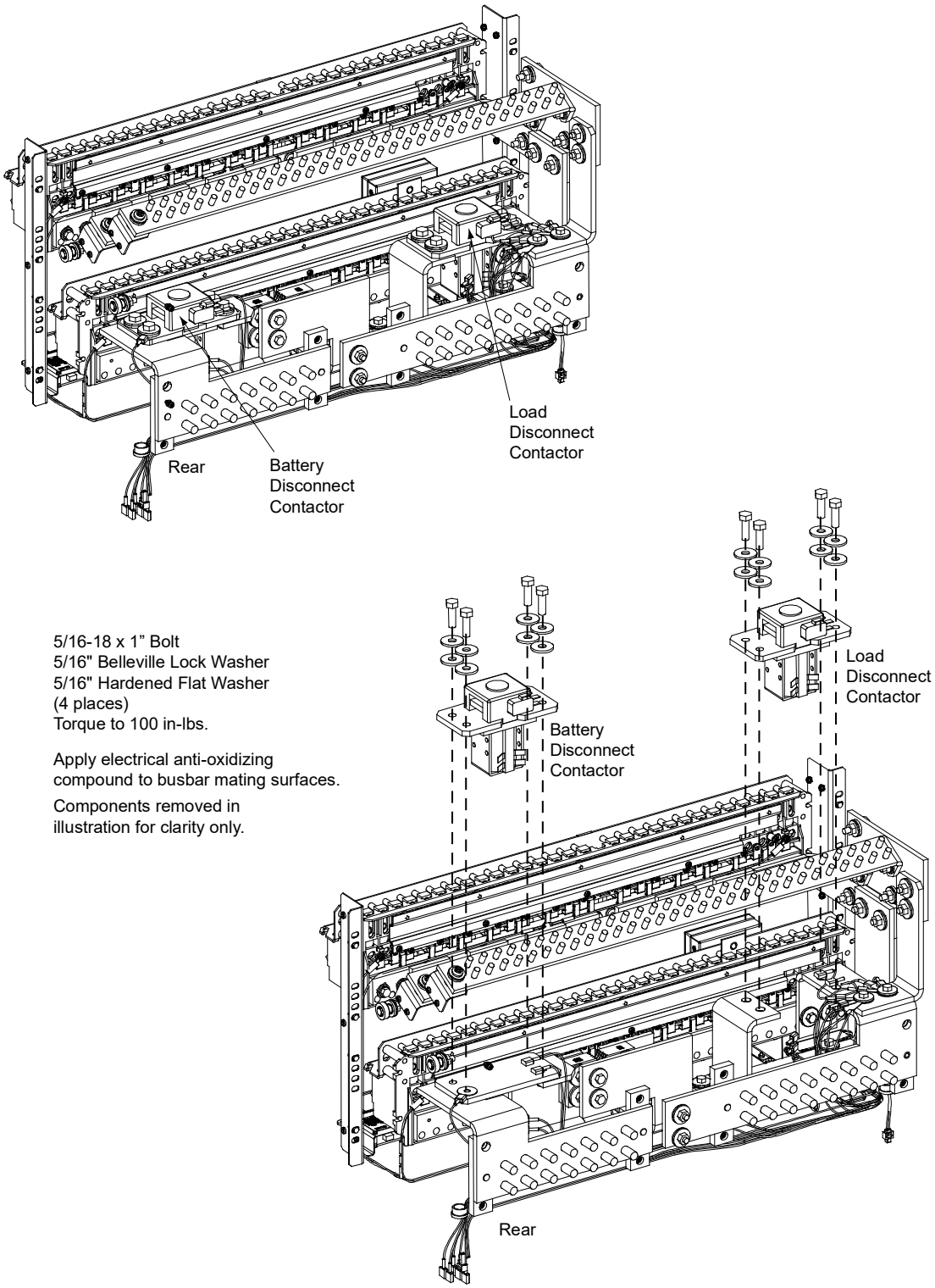
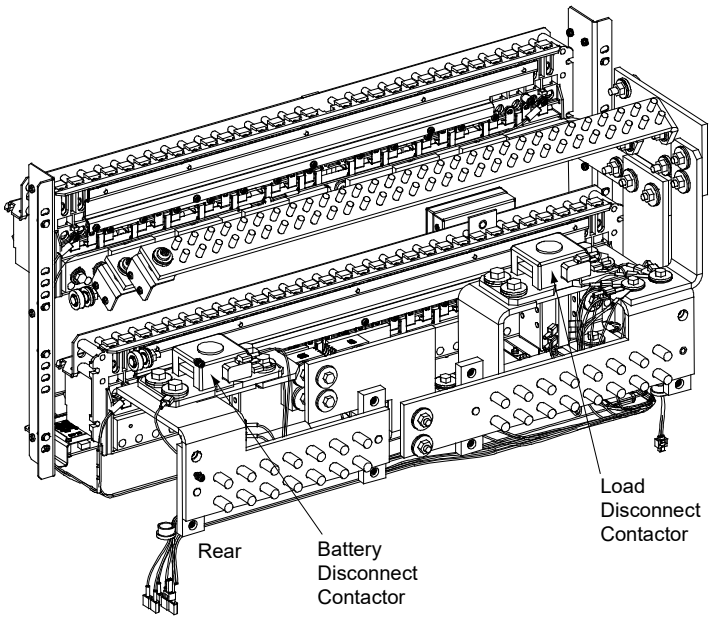


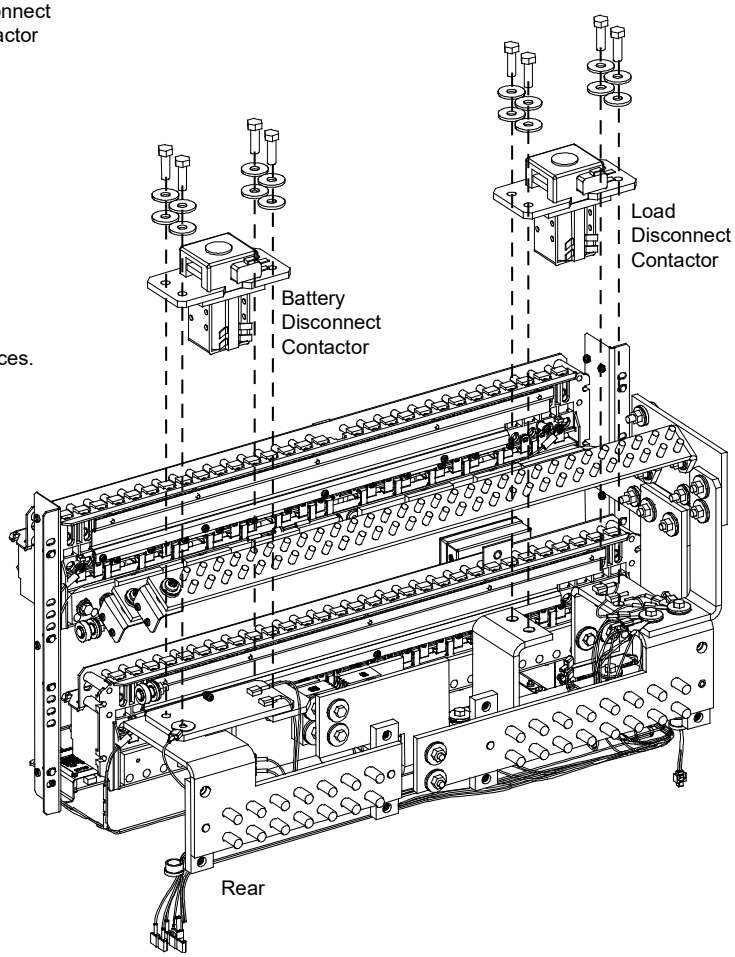
Figure 4.12 Replacing a Battery or Load Disconnect Contactor in a List 27 Distribution Cabinet (cont'd from previous page)



5/16-18 x 1" Bolt
5/16" Belleville Lock Washer
5/16" Hardened Flat Washer
(4 places)
Torque to 100 in-lbs.

Apply electrical anti-oxidizing compound to busbar mating surfaces.

Components removed in illustration for clarity only.



4.6.6 Replacing an SPD (Surge Protection Device) (if furnished)

The power system may be equipped with SPD (Surge Protection Device) Assemblies mounted external to the power system. Refer to Figure 4.13. Each SPD (Surge Protection Device) Assembly consists of a mounting base and two (2) plug-in SPD modules. The individual SPD plug-in modules can be replaced, as well as the entire base assembly.

SPD Plug-In Module (P/N 10035033) Replacement

Perform the following steps to replace an SPD plug-in module. It is recommended to replace both SPD plug-in modules connected to the same point/polarity, even if only one shows a fault. Refer to Figure 4.13 as this procedure is performed.

Procedure

1. Check the status indicators on the SPD plug-in modules. If the color of a status indicator has changed from green to red, then that SPD plug-in module is damaged.
2. Locate and turn OFF the circuit breaker connected to the SPD Assembly being replaced.
   - 582137000 List 501 typically located in Row 1 of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
3. Locate the defective SPD plug-in module.
4. Using a small flat-blade screwdriver, pop-out the defective SPD plug-in module from the mounting base. See Figure 4.13.
5. Orient the replacement SPD plug-in module over its mounting position and press it into place. See Figure 4.13.
6. Repeat the above steps for any other SPD plug-in module being replaced.
7. Locate and turn ON the circuit breaker connected to the SPD Assembly.
   - 582137000 List 501 typically located in Row 1 of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
8. Verify there are no alarms being generated by the system.

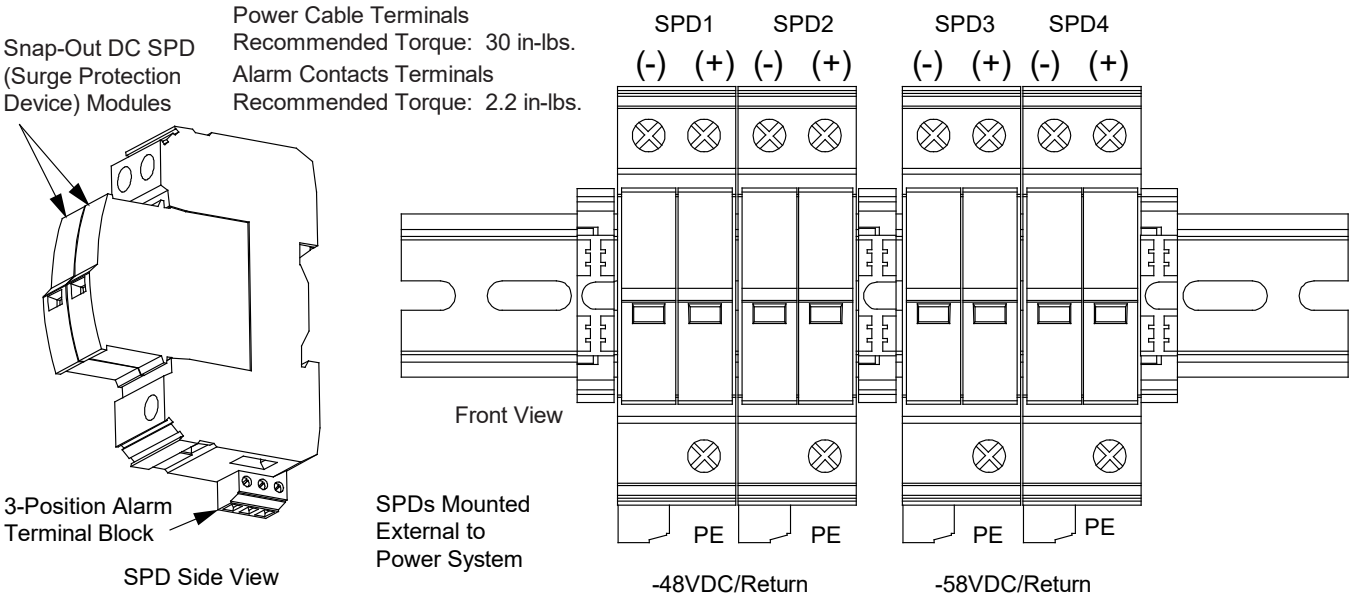
SPD Base with Plug-In Modules (P/N 10034885) Replacement

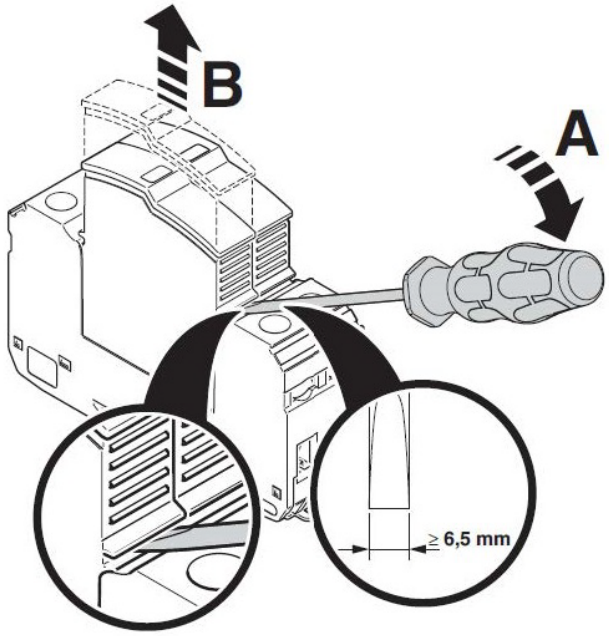
Check SPD mounting base. If the mounting base is damaged, then replace the complete SPD Assembly (mounting base and plug-in modules). Refer to Figure 4.13 as this procedure is performed.

Procedure

1. Locate the defective SPD Assembly.
2. Locate and turn OFF the circuit breaker connected to the SPD Assembly to be replaced.
   - 582137000 List 501 typically located in Row 1 of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
3. If not already done, label the power cables ("+", "-", and "earth ground") connected to the defective SPD Assembly.
4. Disconnect the power cables from the "+", "-", and "earth ground" terminals of the defective SPD Assembly.
5. Remove the 3-position alarm terminal block half from the defective SPD Assembly. Do not remove the wires from the 3-position alarm terminal block.
6. Using a small flat-blade screwdriver, slide the clip securing the defective SPD Assembly to the DIN rail. Remove the defective SPD Assembly from the DIN rail.
7. Remove the 3-position alarm terminal block half from the replacement SPD Assembly. This will not be used and may be saved.
8. Orient the replacement SPD Assembly on the DIN rail by sliding the fix end into the DIN rail. Using a small flat-blade screwdriver, slide the clip on the other end of the SPD Assembly and snap the SPD Assembly to the DIN rail.
9. Reinsert the existing alarm wiring 3-position terminal block into the replacement SPD Assembly.
10. Reconnect the power cables ("+", "-", and "earth ground") (with wire end ferrules) to the replacement SPD Assembly. The recommended torque is 30 in-lbs.
11. Locate and turn ON the circuit breaker connected to the SPD Assembly.
    - 582137000 List 501 typically located in Row 1 of the power system distribution cabinet (-48 VDC bus) and in Row 2 of the power system distribution cabinet (-58 VDC bus).
12. Verify there are no alarms being generated by the system.

Figure 4.13 SPD Replacement (P/N 10035033 Plug-In Module or P/N 10034885 Mounting Base and Plug-In Modules) (582137000501)





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