

# Altivar® 61/71

## Adjustable Speed Drives

### Spare Parts Kits

Instruction Bulletin

30072-452-82

Retain for future use.



**For Frame Size 15:**

**ATV61HC63N4 and ATV71HC50N4**



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## Hazard Categories and Special Symbols

The following symbols and special messages may appear in this document or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

A lightning bolt or ANSI man symbol in a “Danger” or “Warning” safety label on the equipment indicates an electrical hazard which, as indicated below, can or will result in personal injury if the instructions are not followed.

The exclamation point symbol in a safety message in a manual indicates potential personal injury hazards. Obey all safety messages introduced by this symbol to avoid possible injury or death.

Symbol	Name
	Lightning Bolt
	ANSI Man
	Exclamation Point

<b>⚠ DANGER</b>
<b>DANGER</b> indicates an imminently hazardous situation which, if not avoided, <b>will result in</b> death or serious injury.

<b>⚠ WARNING</b>
<b>WARNING</b> indicates a potentially hazardous situation which, if not avoided, <b>can result in</b> death or serious injury.

<b>⚠ CAUTION</b>
<b>CAUTION</b> indicates a potentially hazardous situation which, if not avoided, <b>can result in</b> minor or moderate injury.

<b>CAUTION</b>
<b>CAUTION</b> , used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, <b>can result in</b> property damage.

## Product Support

For support and assistance, contact the Product Support Group. The Product Support Group is staffed from Monday through Friday, 8:00 am until 6:00 pm Eastern time, to assist with product selection, start-up, and diagnosis of product or application problems. Emergency phone support is available 24 hours a day, 365 days a year.

Toll free: 888-SquareD (888-778-2733)  
 E-Mail: drive.products.support@us.schneider-electric.com  
 Fax: 919-217-6508

## Before You Begin

Read and follow these precautions before performing any procedure with this drive.

The word “drive” as used in this bulletin refers to the controller portion of the adjustable speed drive as defined in the National Electrical Code (NEC).

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand this manual before installing or operating the Altivar 61 or 71 drive. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- The user is responsible for compliance with all international and national electrical code requirements with respect to grounding of all equipment.
- Many parts of this drive, including the printed circuit boards, operate at the line voltage. **DO NOT TOUCH.** Use only electrically insulated tools.
- **DO NOT** touch unshielded components or terminal strip screw connections with voltage present.
- **DO NOT** short across terminals PA/+ and PC/- or across the DC bus capacitors.
- Before servicing the drive:
  - Disconnect all power, including external control power that may be present.
  - Place a “DO NOT TURN ON” label on all power disconnects.
  - Lock all power disconnects in the open position.
  - **WAIT 15 MINUTES** to allow the DC bus capacitors to discharge. Then follow the “Bus Voltage Measurement Procedure” on page 11 to verify that the DC voltage is less than 42 V. The drive LED is not an indicator of the absence of DC bus voltage.
- Install and close all covers before applying power or starting and stopping the drive.

**Failure to follow these instructions will result in death or serious injury.**



## Introduction

This instruction bulletin contains replacement procedures for the Altivar<sup>®</sup> 61 and 71 spare parts kits identified in Table 1. Read and understand the instructions in this document and other referenced documents before installing the kits.

**Table 1: Altivar<sup>®</sup> 61 and 71 Spare Parts Kits<sup>1</sup>**

Kit Catalog No.	Description	For Use On Drive:	For Location of Parts, See:
VY1A1217	Front Cover Assembly	ATV61HC63N4, ATV71HC50N4	page 28
VY1A1407	Plastic Parts Kit	ATV61HC63N4, ATV71HC50N4	pages 13 and 17
VZ3V1213	Internal Fan	ATV61HC63N4, ATV71HC50N4	page 13
VX5A1300	Soft Charge Board	ATV61HC63N4, ATV71HC50N4	page 13
VX5A1400	Fan Control Board	ATV61HC63N4, ATV71HC50N4	page 14
VZ3F1113	Brake Board	ATV61HC63N4, ATV71HC50N4	page 14
VX4A1117	Filter Board	ATV61HC63N4, ATV71HC50N4	page 13
VX5A1HC5063	Power Board	ATV61HC63N4, ATV71HC50N4	page 14
VY1A1109	Motor Current Sensor	ATV61HC63N4, ATV71HC50N4	page 15
VX5A1204	Gate Driver Board	ATV61HC63N4, ATV71HC50N4	page 15
VZ3G1104	Temperature Sensors	ATV61HC63N4, ATV71HC50N4	page 16
VZ3IM1604M1271	Power IGBT <sup>2</sup> Module	ATV61HC63N4, ATV71HC50N4	page 16
VY1ADV1111	Screw Kit	ATV61HC63N4, ATV71HC50N4	—
VY1ADC1112	Capacitors	ATV61HC63N4, ATV71HC50N4	page 16
VX4A1200	SCR Snubber Board	ATV61HC63N4, ATV71HC50N4	page 17
VZ3TM1600M1671	SCR <sup>3</sup> Module	ATV61HC63N4, ATV71HC50N4	page 18
VZ3DM1600M1671	Diode Module	ATV61HC63N4, ATV71HC50N4	page 18
VZ3N1334	Wire Kit	ATV61HC63N4, ATV71HC50N4	—

<sup>1</sup> For kit contents, refer to document 30072-452-44.

<sup>2</sup> IGBT: Insulated-gate bipolar transistor

<sup>3</sup> SCR: Silicon controlled rectifier

## Related Documentation

**NOTE:** All documentation referenced in this bulletin is provided with the drive or on the CD-ROM included with the spare parts kits. You can also download the documentation from the Technical Library at [www.schneider-electric.us](http://www.schneider-electric.us).

For drive installation instructions, refer to the following documents:

- *Altivar<sup>®</sup> 61 Installation Manual 0.5 to 100 HP*, module no. 1760643
- *Supplementary Instructions to ATV61 Variable Speed Drives Installation Manual—Low Horsepower*, document no. 30072-452-63
- *Altivar<sup>®</sup> 61 Installation Manual 75 to 900 HP*, module no. 1760655
- *Supplementary Instructions to ATV61 Variable Speed Drives Installation Manual—High Horsepower*, document no. 30072-452-49
- *Altivar<sup>®</sup> 71 Installation Manual 0.5 to 100 HP*, module no. 1755843
- *Altivar<sup>®</sup> 71 Installation Manual 75 to 700 HP*, module no. 1755849
- *Altivar<sup>®</sup> 71 Drive Controllers Errata to Bulletin atv71e\_installation\_manual\_en\_v3*, document no. 30072-452-25

## Receiving, Handling, and Storage

### Electrostatic Precautions

#### **⚠ CAUTION**

##### **STATIC SENSITIVE COMPONENTS**

Circuit boards and option cards can be damaged by static electricity. Observe the electrostatic precautions below when handling controller circuit boards or testing components.

**Failure to follow these instructions can result in injury or equipment damage.**

Observe the following precautions for handling static-sensitive components:

- Keep static-producing material such as plastic, upholstery, and carpeting out of the immediate work area.
- Store static-sensitive components in protective packaging when they are not installed in the drive.
- When handling a static-sensitive component, wear a conductive wrist strap connected to the component or drive through a minimum of 1 megohm resistance.
- Avoid touching exposed conductors and component leads with skin or clothing.

### Inspecting the Spare Part Kits

After receiving the ATV61/ATV71 spare parts kit:

- Ensure that the catalog number printed on the kit label is the same as that on the packing slip and corresponding purchase order. Contact your Schneider Electric representative if there are any errors.
- Remove the kit from its packaging and inspect it for damage. If any damage is found, notify the carrier and your Schneider Electric representative.
- To store the kit, replace any static-sensitive parts in their protective packaging and store them at -25 to +70 °C (-13 to +158 °F).

#### **⚠ WARNING**

##### **DAMAGED EQUIPMENT**

Do not install or operate any equipment that appears damaged.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**



## Preliminary Recommendations

Before beginning the installation procedures, read and understand all the information in this section.

## Qualified Personnel

For the protection of personnel and equipment, a qualified person must perform the procedures detailed in this instruction bulletin.

A qualified person is one who has skills and knowledge related to the construction and operation of this electrical equipment and the installation, and has received safety training to recognize and avoid the hazards involved. Refer to the most current release of NFPA 70E®, “Standard for Electrical Safety in the Workplace,” for safety training requirements.

In addition, the person must be:

- Able to read, interpret, and follow the instructions and precautions in this instruction bulletin and the other documentation referenced.
- Able to use the required tools listed in this instruction bulletin in a safe and correct manner.

## Working Procedures

Observe the following working procedures:

- Use only the components provided with the kits listed in Table 1 beginning on page 7. Do not attempt to repair the drive with other spare parts or equipment.
- If the part being replaced includes labels, ensure that the labels are applied to the replacement part. If the labels are not available in the kit, contact your Schneider Electric representative.
- Mount the spare parts only in the locations specified in the installation procedures.
- Route and position the wires as shown in the instructions. Use the wires and cables provided with the spare parts kits or with the drive. Do not modify the wires and cables. Do not route wires and cables outside of the drive enclosure.
- Install all shields as described in the installation procedures.
- Observe the hardware and torque requirements specified in the installation procedures. Do not substitute hardware. Carefully segregate and label all removed hardware and parts for use in reassembly of the drive.
- Mount all panels and covers as specified in the installation procedures.

## Tools Required

- Needle-nose pliers
- Torque wrench, 0–45 N•m (0–398 lb-in)
- Voltmeter, 1–1000 Vdc
- Driver bits:
  - T-10 Torx<sup>®</sup> driver
  - T-20 Torx<sup>®</sup> driver
  - T-30 Torx<sup>®</sup> driver
  - T-30 right-angle Torx<sup>®</sup> driver
  - Size 2 magnetic tip Phillips<sup>®</sup> driver
  - Size 3 magnetic tip Phillips<sup>®</sup> driver
- Socket wrenches:
  - 7 mm
  - 10 mm
  - 16 mm
  - 18 mm
  - 21 mm
- Open-end wrenches:
  - 18 mm
  - 21 mm

## Power Removal and Bus Voltage Measurement

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

Read and understand the precautions in "Before You Begin" starting on page 5 before performing this procedure.

**Failure to follow these instructions will result in death or serious injury.**

The DC bus voltage can exceed 1,000 Vdc. Use a properly rated voltage-sensing device when performing this procedure. To measure the DC bus voltage:

1. Disconnect all power.
2. Wait 15 minutes to allow the DC bus to discharge.
3. Measure the voltage of the DC bus between the PA/+ and PC/- terminals to ensure that the voltage is less than 42 Vdc. These terminals are clearly labeled on each drive.
4. If the DC bus capacitors do not discharge completely, contact your local Schneider Electric representative. Do not repair or operate the drive.

### **⚠ CAUTION**

#### **IMPROPER DRIVE OPERATION**

- If no power is applied to the drive for a long period, the performance of its electrolytic capacitors will be reduced.
- If the drive is not in active service, apply power to the drive every two years using the following procedure. Do not initially connect the drive directly to full line voltage. Without a motor connected to the drive, gradually increase the voltage using an adjustable AC source connected between drive terminals L1 and L2:
  - 25% of rated voltage for 30 minutes
  - 50% of rated voltage for 30 minutes
  - 75% of rated voltage for 30 minutes
  - 100% of rated voltage for at least 5 hours
- Check drive operation before placing the drive into service.

**Failure to follow these instructions can result in injury or equipment damage.**

## Discharging Stored Energy in Capacitors

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- When the controller is damaged, voltage may remain on certain energy storage capacitors after de-energization of the controller and discharge of the main capacitor bank.
- Before working on or near assemblies containing energy storage capacitors, verify that the capacitor voltages are less than 42 Vdc.
- The following assemblies have energy-storing capacitors:
  - Filter board
  - SCR snubber board
- Always check for the presence of voltage using a voltmeter set to the 1000 Vdc scale. When voltage is present, allow the voltmeter to discharge the capacitor's stored charge.

**Failure to follow these instructions will result in death or serious injury.**

Capacitors are used throughout the drive as energy storage devices. Some of the capacitors can store potentially lethal amounts of energy during normal controller operation.

When power is removed from an undamaged controller, the stored energy in these capacitors is automatically discharged to nonhazardous levels. However, the discharge mechanisms in a damaged controller may not be operating properly, and stored energy may be present on printed circuit boards.

**Do not** touch traces on printed circuit boards, such as the line filter board and SCR snubber board, unless you have first checked for voltage with a voltmeter!

To discharge the filter board and SCR snubber board capacitors, use a voltmeter set to the 1000 Vdc scale. It will take approximately 6.6 minutes for a 10 megohm input impedance voltmeter to discharge a 10 microfarad capacitor from 700 V to less than 42 V. It will take approximately 40 seconds for a 1 megohm input impedance voltmeter to discharge a 10 microfarad capacitor from 700 V to less than 50 V.

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Do not use a voltmeter to discharge stored energy on the DC bus capacitors.
- If the energy on the DC bus capacitors remains greater than 42 Vdc after 15 minutes, contact Product Support.

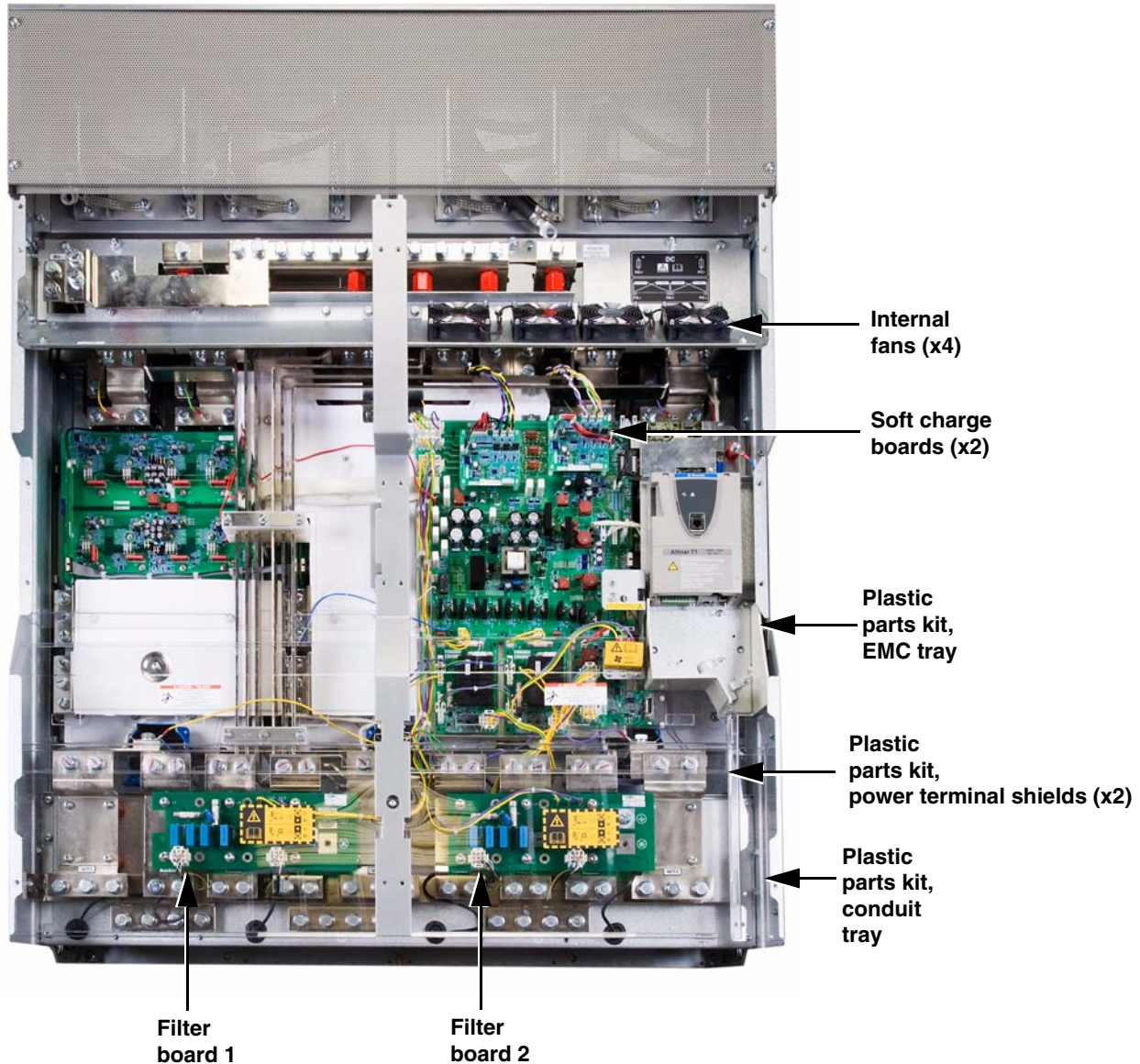
**Failure to follow these instructions will result in death or serious injury.**

## Parts Locations

Refer to the figures in this section to familiarize yourself with the layout of the drive and the location of the parts before performing the installation procedures.

### Level 1 Parts

Figure 1: Level 1 Parts



## Level 2 Parts

Figure 2: Power Board, Brake Board, and Fan Control Boards

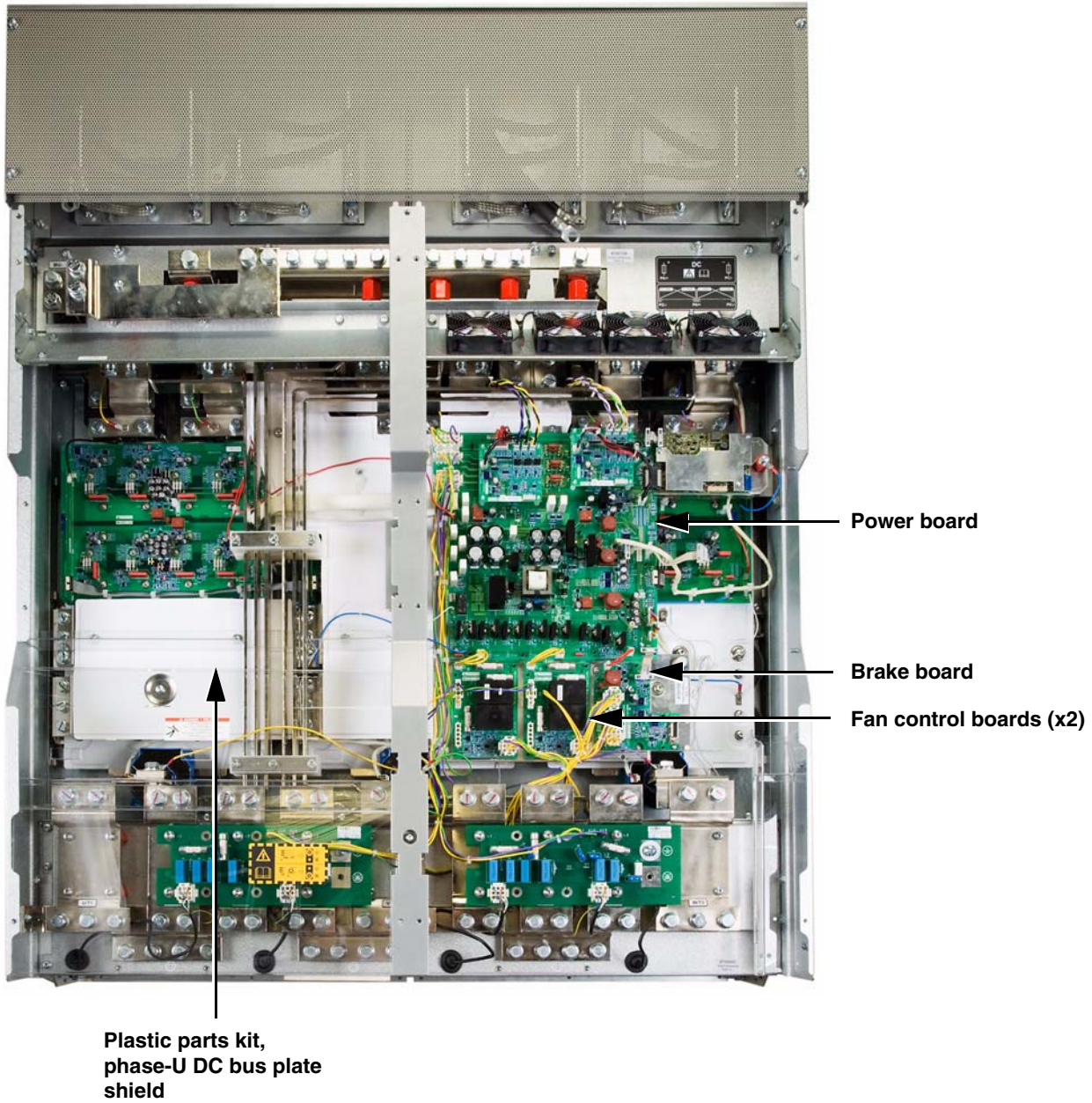




Figure 3: Gate Driver Boards and Motor Current Sensors

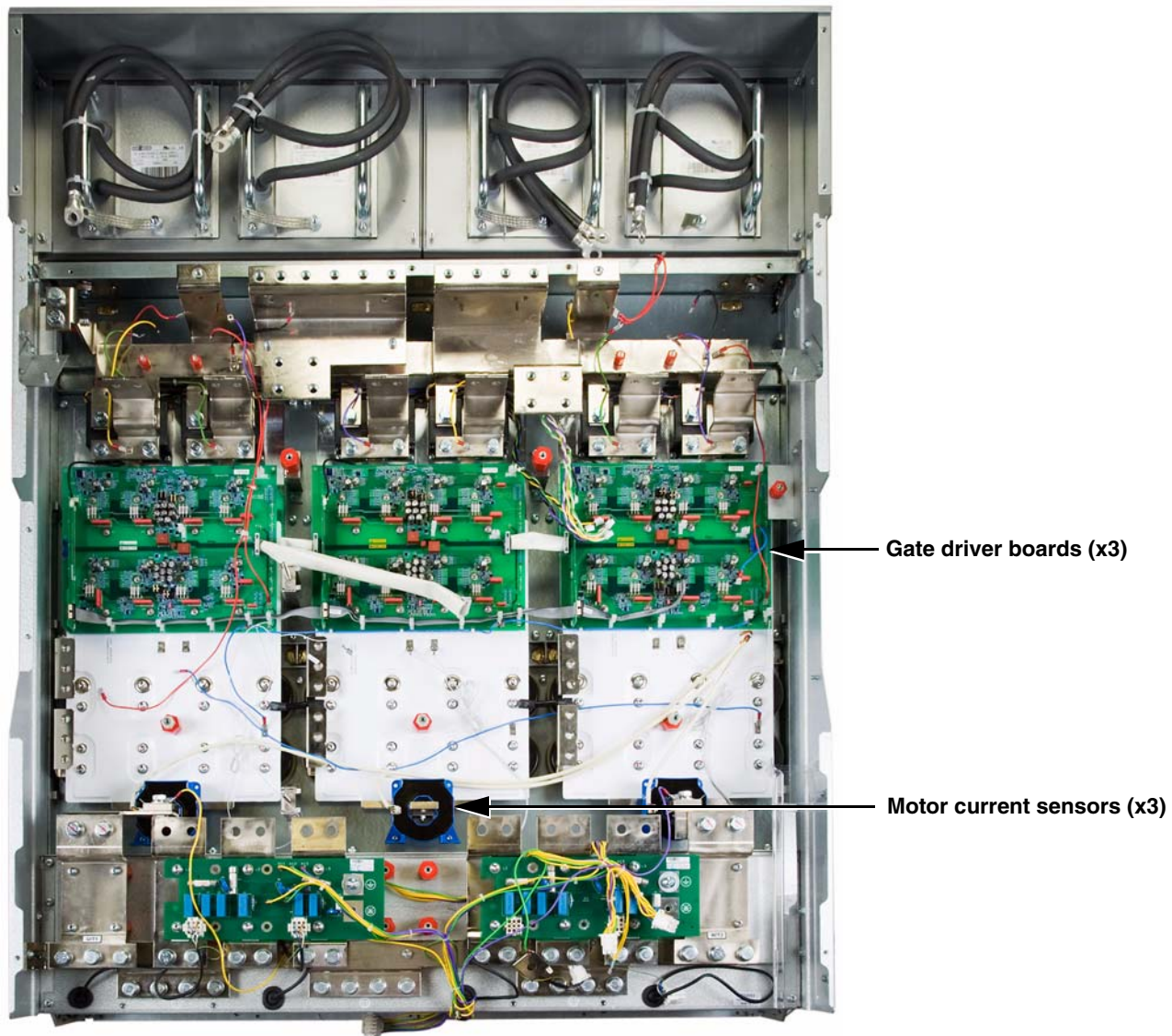


Figure 4: Temperature Sensors, Power IGBT Modules, and Capacitors

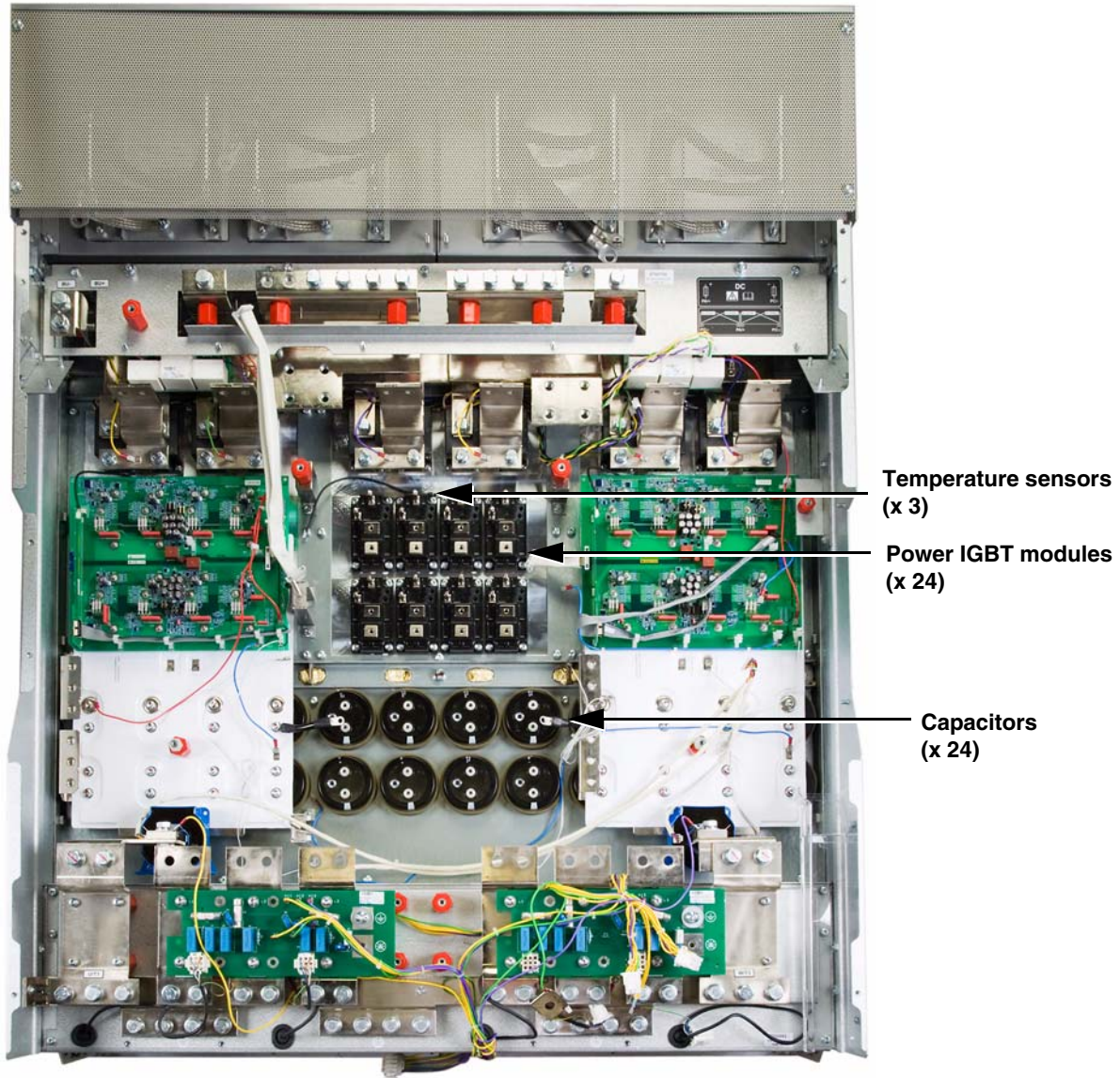




Figure 5: Rectifier Shield and SCR Snubber Boards

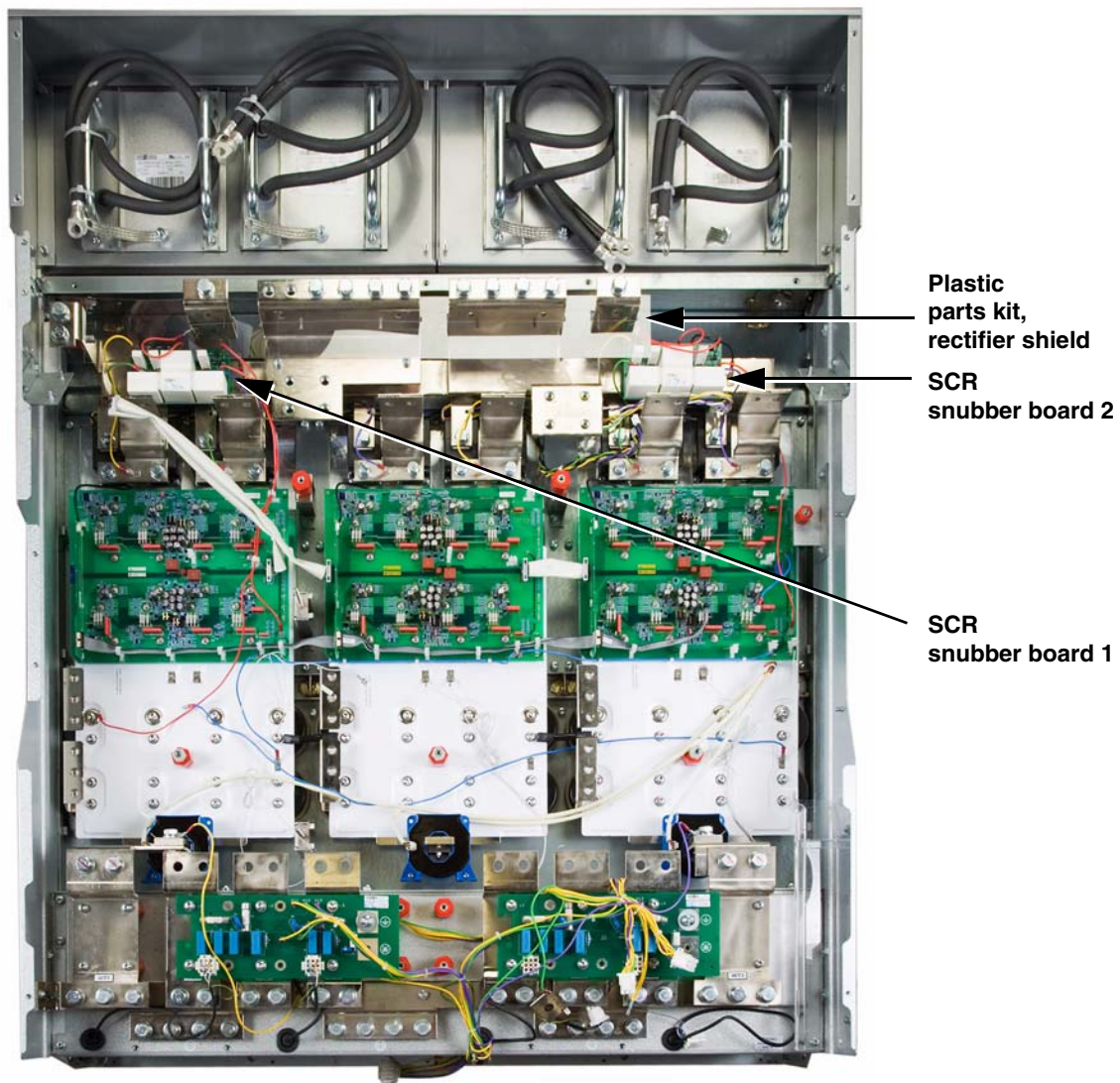
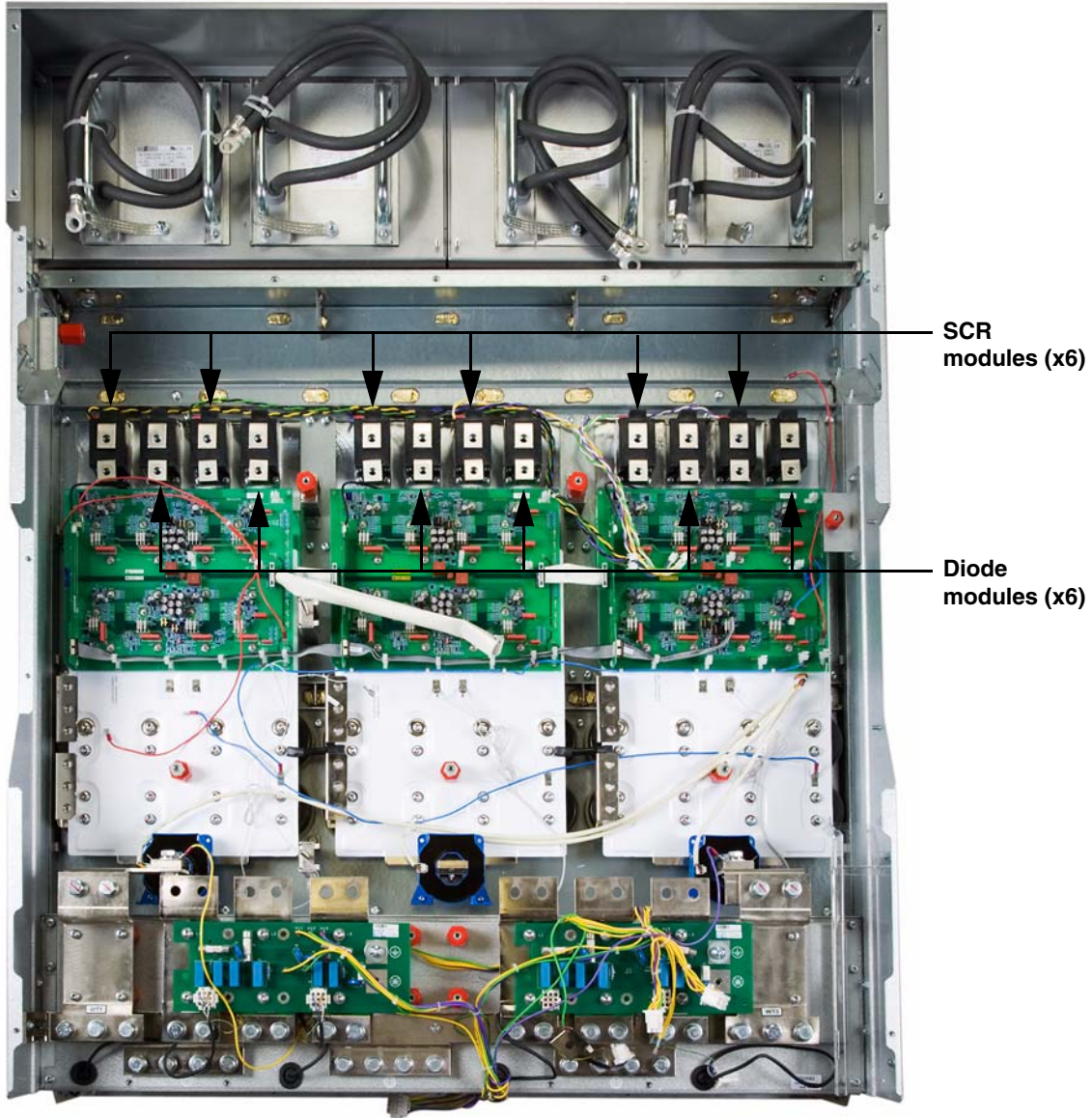


Figure 6: SCR Modules and Diode Modules



## Installation Procedures for Level 1 Parts

Level 1 parts consist of the front cover and parts that are accessible directly under the front cover. They are:

Front cover	Internal fans
Power terminal shield (plastic kit)	Soft charge board
Conduit tray (plastic kit)	Fan control board
EMC tray (plastic kit)	Filter board

## Removing and Replacing the Front Cover VY1A1217

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

### DANGER

#### HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

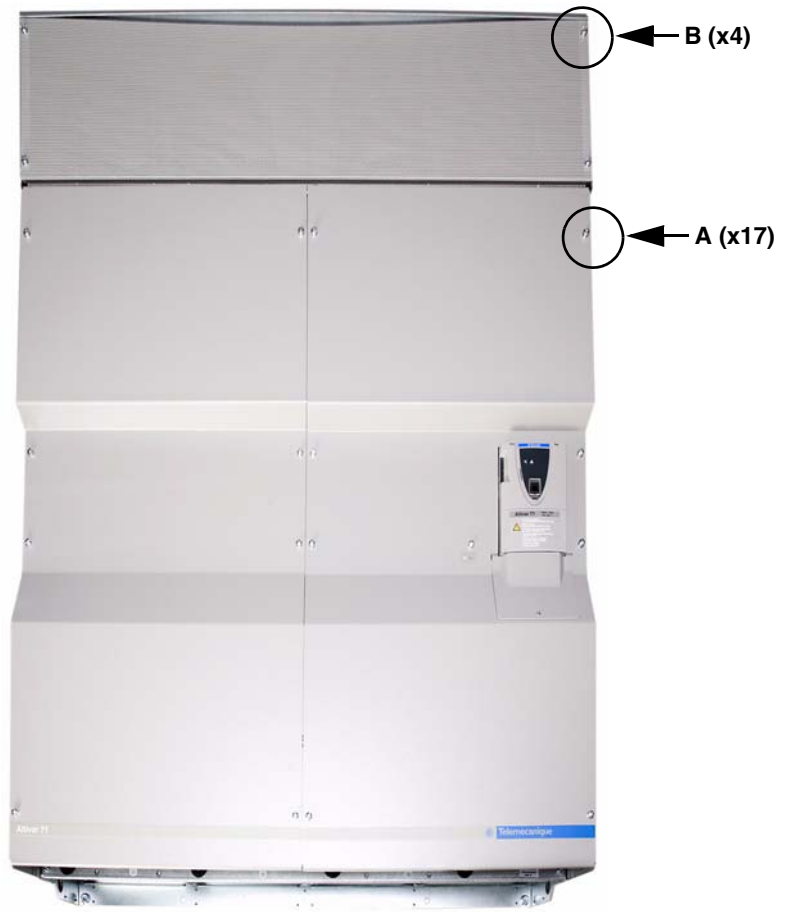
All of the procedures in this manual require removal and replacement of the front cover. See Figure 7 on page 20.

- To remove the front cover, using a size 2 Phillips driver, remove 17 screws (**A**) and take the front cover off the drive.
- To replace the front cover, using a size 2 Phillips driver secure the front cover with 17 screws (**A**). Tighten the screws to 5.5 N•m (48.7 lb-in).

If you are replacing the rectifier snubber board, SCR modules, or diode modules, you may also need to remove the top grille as follows. See Figure 7 on page 20.

- Using a size 2 Phillips driver, remove four screws (**B**) securing the top grille to the drive frame.
- To replace the top grille, using a size 2 Phillips driver secure the grille to the drive frame with four screws (**B**). Tighten the screws to 5.5 N•m (48.7 lb-in).

Figure 7: Front Cover



## Replacing the Internal Fans VZ3V1213

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

### Remove the Front Cover

### Replace the Internal Fan

### Replace the Front Cover

## **⚠ DANGER**

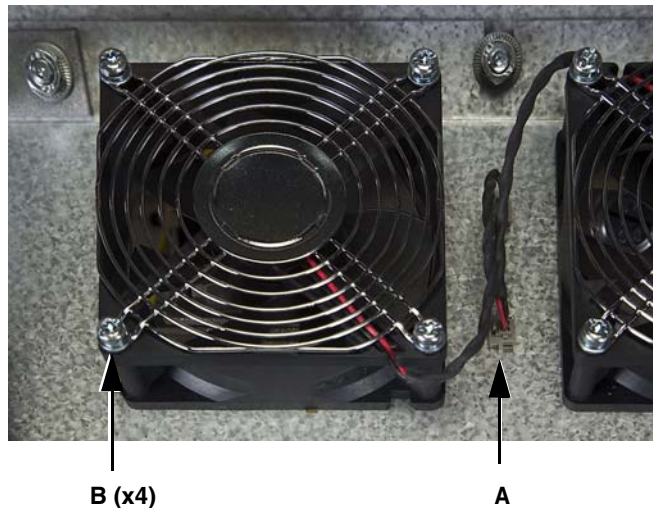
### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

1. Using a size 2 Phillips driver, remove 17 screws and take the front cover off the drive. See Figure 7 on page 20.
2. Remove the internal fan you are replacing as follows. See Figure 8.
  - Using needle-nose pliers, carefully unplug the fan’s 2-pin connector (**A**) from the fan bracket.
  - Using a T-20 Torx driver, remove four screws (**B**) securing the fan to the fan bracket, and remove the fan from the drive.

**Figure 8: Internal Fans**



3. Install the new fan as follows. See Figure 8.
  - Using a T-20 Torx driver, secure the fan to the fan bracket with four screws (**B**). Tighten the screws to 1.1–1.7 N•m (9.7–15 lb-in).
  - Plug the fan’s 2-pin connector (**A**) into the terminal on the fan bracket.
4. Replace the front cover. Using a size 2 Phillips driver, secure the front cover with 17 screws. See Figure 7 on page 20. Tighten the screws to 5.5 N•m (48.7 lb-in).



## Replacing the Soft Charge Boards VX5A1300

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

**Table 2: Soft Charge Board Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
<b>Soft Charge Board 1 (Left Board)</b>			
E110	CN2A	9-pin, red	PB <sup>2</sup> X30 (9-pin)
E109	CNL3G	2-pin, violet/black	SCR <sup>3</sup> L3.1 Terms. 4 & 5
E108	CNL2G	2-pin, green/black	SCR L2.1 Terms. 4 & 5
E107	CNL1G	2-pin, yellow/black	SCR L1.1 Terms. 4 & 5
E111	CN7A	2-pin, black	PB X31
—	CNP	Not used	—
<b>Soft Charge Board 2 (Right Board)</b>			
E156	CN2A	9-pin, red	PB <sup>2</sup> X40 (9-pin)
E152	CNL3G	2-pin, violet/white	SCR <sup>3</sup> L3.2 Terms. 4 & 5
E153	CNL2G	2-pin, green/white	SCR L2.2 Terms. 4 & 5
E154	CNL1G	2-pin, yellow/white	SCR L1.2 Terms. 4 & 5
E155	CN7A	2-pin, black	PB <sup>2</sup> X41
—	CNP	Not used	—

<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

<sup>2</sup> PB: Power board

<sup>3</sup> SCR: Silicon controlled rectifier. L1.1, L2.1, and L3.1 are associated with input rectifier 1; L1.2, L2.2, and L3.2 are associated with input rectifier 2.

### ⚠ DANGER

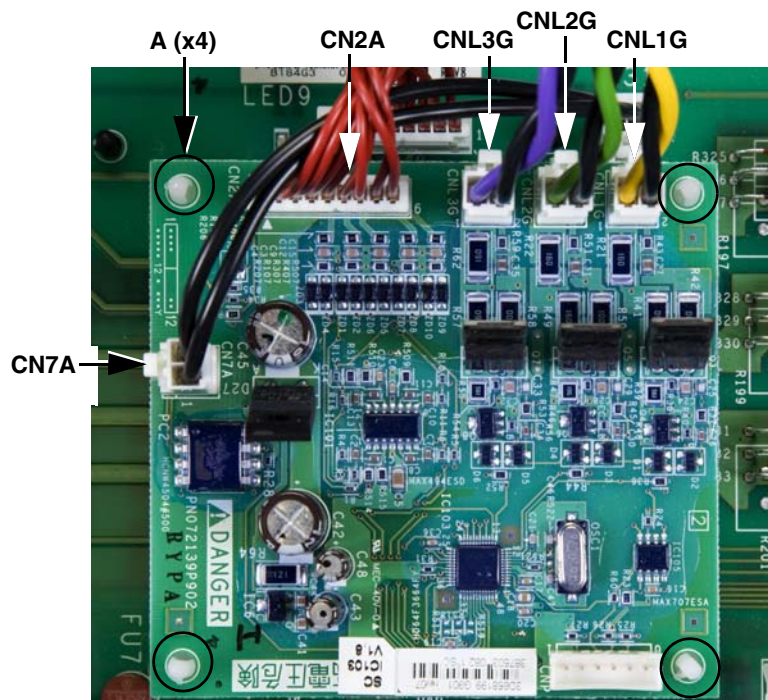
**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

1. Using a size 2 Phillips driver, remove 17 screws and take the front cover off the drive. See Figure 7 on page 20.
2. Using needle-nose pliers, carefully remove the following connections from the soft charge board you are replacing. See Table 2 and Figure 9 for connector locations.
  - At the top of the soft charge board, from left to right remove the connectors from terminals CN2A, CNL3G, CNL2G, and CNL1G.
  - At the left side of the board, remove the connector from terminal CN7A.

**Figure 9: Soft Charge Board: Board 1 (Left) Shown**



3. Using needle-nose pliers, compress the four plastic mounting posts (A, Figure 9), one at a time, while lifting the soft charge board off the posts. Remove the soft charge board from the drive.
4. Press the new soft charge board down over the four mounting posts (A, Figure 9) until it is securely seated.
5. Install five connections on the new soft charge board. See Table 2 and Figure 9 for connector locations.
6. Replace the front cover. Using a size 2 Phillips driver, secure the front cover with 17 screws. See Figure 7 on page 20. Tighten the screws to 5.5 N•m (48.7 lb-in).

## Replacing the Plastic Parts Kit VY1A1407

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

**⚠ DANGER**

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

The replacement steps for some parts of the plastic kit are covered in other procedures. See Table 3.

**Table 3: Plastic Kit Contents**

Description	For replacement steps, see
Power terminal shields	“Replacing the Power Terminal Shields” beginning on page 23
EMC tray	“Replacing the EMC Tray” beginning on page 25
Conduit tray	“Replacing the Conduit Tray” on page 26
Rectifier shield	“Replace the Rectifier Shield” on page 39
Phase-U DC bus plate shield	“Replace the Top Phase-U DC Bus Plate” on page 147
Input bus bar brackets	“Replace the Input Bus Bar Brackets (Bottom)” on page 148 and “Replace the Input Bus Bar Brackets (Top)” on page 156
Power board assembly shields	“Replacing the Power Board Assembly Shields” beginning on page 77

### Replacing the Power Terminal Shields

If the transparent terminal shields are cracked, broken, or damaged, replace them as follows.

**⚠ DANGER**

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Install the power terminal shields as shown in Figures 10 and 11 on page 24.
- Before installing the shields, ensure that they have no tears or cracks. If the shields are damaged, install new pieces from the plastic kit.
- Do not install a damaged shield.

**Failure to follow these instructions will result in death or serious injury.**

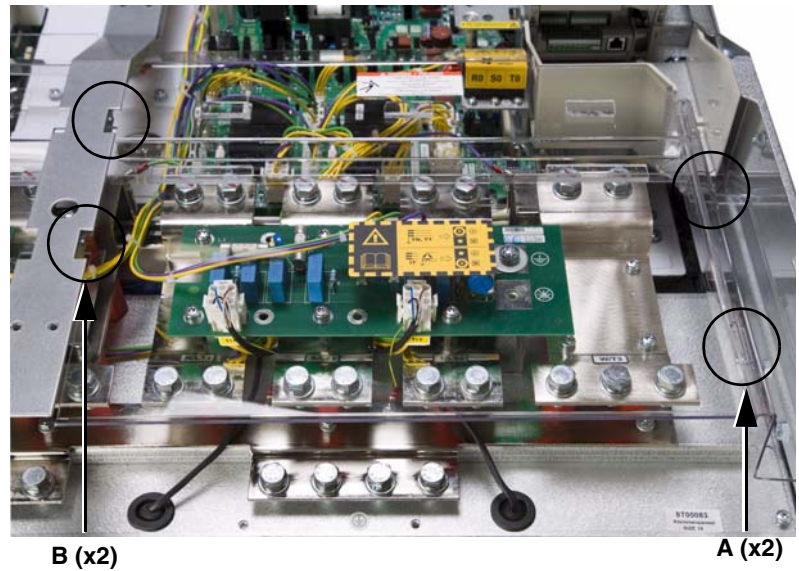
1. Using a size 2 Phillips driver, remove 17 screws and take the front cover off the drive. See Figure 7 on page 20.
2. The right terminal shield has two tabs (**A**) on the right side that fit into slots on the conduit tray, and two tabs (**B**) on the left side that fit into slots on the middle crossbrace. See Figure 10 on page 24.  
The left terminal shield has two tabs on the right (**C**) that fit into retaining slots in the middle crossbrace and three mounting holes (**D**) on the left that fit over posts on the side panel of the drive. See Figure 11 on page 24. Disengage the shields and remove them from the drive.

**NEXT STEP:** If you are also replacing the EMC tray, perform the steps in “Replacing the EMC Tray” beginning on page 25 before installing the new power terminal shields.

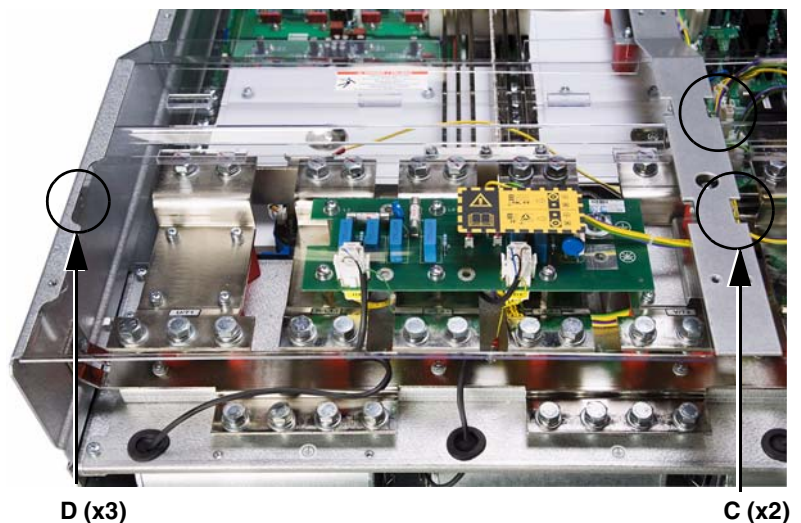
If you are replacing the conduit tray, perform the steps in “Replacing the Conduit Tray” on page 26 before installing the new power terminal shields.

3. If you are only replacing the power terminal shields, install the new shields as shown in Figures 10 and 11.  
Labels for the new shield are included in the plastic kit. Add the new labels in the same positions as on the old shield.
4. Replace the front cover. Using a size 2 Phillips driver, secure the front cover with 17 screws. See Figure 7 on page 20. Tighten the screws to 5.5 N•m (48.7 lb-in).

**Figure 10: Right Terminal Shield**



**Figure 11: Left Terminal Shield**





## Replacing the EMC Tray

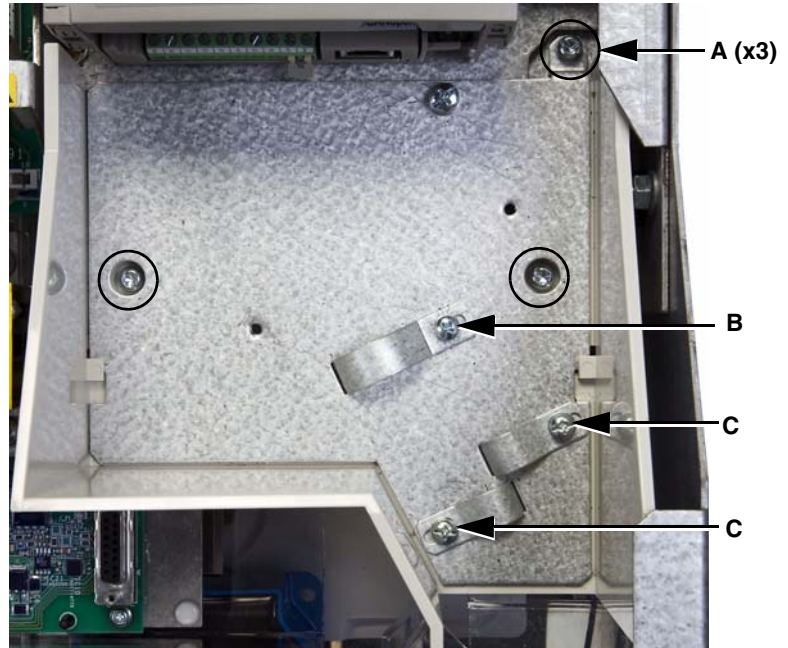
Replace the EMC tray as follows.

1. Using a size 2 Phillips driver, remove 17 screws and take the front cover off the drive. See Figure 7 on page 20.
2. Remove the right power terminal shield. See Step 2 on page 23.
3. Using a T-20 Torx driver, remove three screws (**A**) securing the EMC tray to the control module mounting plate and remove the tray from the drive. See Figure 12.

**Figure 12: EMC Tray**

**Table 4: EMC Tray Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
<b>A</b>	(3) T-20 screws	0.4–0.6	3.5–5.3
<b>B</b>	(1) Size 2 Phillips screw (20 mm length)	0.4–0.6	3.5–5.3
<b>C</b>	(2) Size 2 Phillips screws (10 mm length)	0.4–0.6	3.5–5.3



4. Using a size 2 Phillips driver, remove three screws (**B** and **C**) securing the cable clamps to the metal EMC plate, and remove the clamps from the plate. See Figure 12.

**NOTE:** Note the differences in the cable clamps and screws. The screw (**B**) in the large clamp is longer than the screws (**C**) in the two shorter clamps.

5. Remove the metal EMC plate from the plastic tray and discard the plastic tray.
6. Place the metal EMC plate into the new plastic tray.
7. Using a size 2 Phillips driver, install the cable clamps on the EMC plate with three screws (**B** and **C**). See Figure 12.
8. Using a T-20 Torx driver, secure the plastic EMC tray to the control module mounting plate with mounting three screws (**A**). See Figure 12.
9. Tighten the hardware to the torque values listed in Table 4.

**NEXT STEP:** If you are also replacing the conduit tray, install it before replacing the power terminal shield. See page 26.

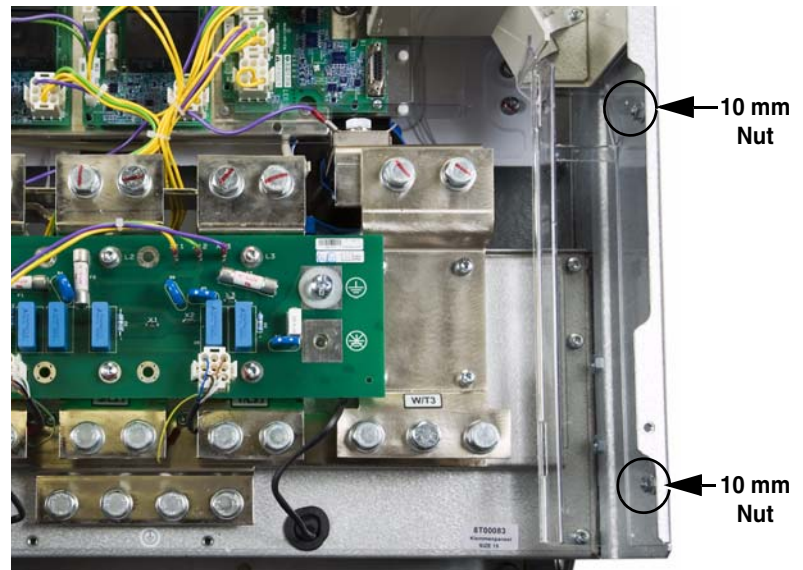
10. Replace the right terminal shield as illustrated in Step 3 on page 24.
11. Replace the front cover. Using a size 2 Phillips driver, secure the front cover with 17 screws. See Figure 7 on page 20. Tighten the screws to 5.5 N•m (48.7 lb-in).

## Replacing the Conduit Tray

Replace the conduit tray as follows.

1. Using a size 2 Phillips driver, remove 17 screws and take the front cover off the drive. See Figure 7 on page 20.
2. Remove the right power terminal shield. See Step 2 on page 23.
3. Using a 10 mm socket wrench, remove two nuts securing the conduit tray to the drive frame. See Figure 13.
4. Install the new conduit tray and secure it with the two 10 mm nuts as illustrated in Figure 13. Tighten the nuts to 5.5 N•m (48.7 lb-in).
5. Replace the right terminal shield as illustrated in Step 3 on page 24.
6. Replace the front cover. Using a size 2 Phillips driver, secure the front cover with 17 screws. See Figure 7 on page 20. Tighten the screws to 5.5 N•m (48.7 lb-in).

**Figure 13: Conduit Tray**



## Replacing the Fan Control Boards VX5A1400

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

1. Using a size 2 Phillips driver, remove 17 screws and take off the front cover of the drive. See Figure 7 on page 20.
2. Remove the right power terminal shield as illustrated in “Replacing the Power Terminal Shields” on page 23.
3. The drive has two fan control boards. Remove the connections from the fan control board you are replacing. See Table 5 and Figure 14 on page 27 for the connections.

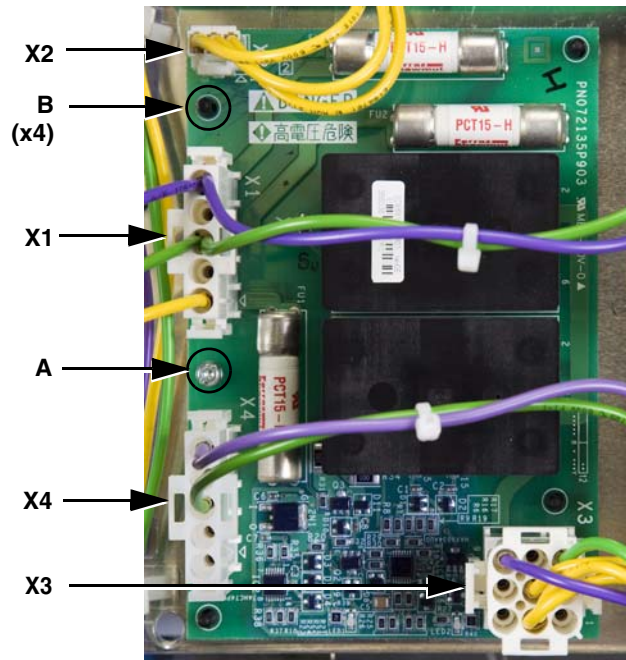
**Table 5: Fan Control Board Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
<b>Fan Control Board 1 (Left Board)</b>			
E105	X2	3-pin, yellow	PB <sup>2</sup> X14
E120	X1	5-pin, 2 wire, violet/green/yellow	FCB <sup>3</sup> X1 & FB <sup>4</sup> X1, X2, X3
E124	X4	5-pin, 2 wire, violet/green	TB <sup>5</sup> X1 & FCB <sup>2</sup> X4
E114	X3	9-pin, green/yellow/violet with yellow and green ground wire	FB <sup>4</sup> X11, X12, X13 & BB <sup>6</sup> X3
—	X6	Not used	—
<b>Fan Control Board 2 (Right Board)</b>			
E147	X2	3-pin, yellow	PB <sup>2</sup> X15
E120	X1	5-pin, 2 wire, violet/green/yellow	FCB <sup>3</sup> X1 & FB <sup>4</sup> X1, X2, X3
E124	X4	5-pin, violet/green/yellow	TB <sup>5</sup> X1 & FCB <sup>3</sup> X4
E151	X3	9-pin, green/yellow/violet with yellow and green ground wire	BB <sup>5</sup> X3
E114	X6	1-pin, 2-wire, yellow	Harness to FB <sup>4</sup> X1 & 2

<sup>1</sup> See the schematic on page 169 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

<sup>2</sup> PB: Power board  
<sup>3</sup> FCB: Fan control board  
<sup>4</sup> FB: Filter board  
<sup>5</sup> TB: Terminal block  
<sup>6</sup> BB: Brake board

**Figure 14: Fan Control Board: Board 1 (Left Board) Shown**



- Using a T-10 Torx driver, remove 1 screw (A, Figure 14) from the board between connectors X1 and X4.
- Using needle-nose pliers, compress the four plastic mounting posts (B, Figure 14), one at a time, while lifting the board off the posts. Remove the board from the drive.
- Press the new fan control board down over the four mounting posts until it is securely seated.
- Using a T-10 Torx driver secure the board to the assembly plate with one screw (A, Figure 14). Tighten the screw to 0.8 N•m (7.1 lb-in).
- Install the connections on the new fan control board. See Table 5 and Figure 14 on page 27 for connection locations.
- Replace the right power terminal shield as illustrated in “Replacing the Power Terminal Shields” on page 23.
- Replace the front cover. Using a size 2 Phillips driver, secure the front cover with 17 screws. See Figure 7 on page 20. Tighten the screws to 5.5 N•m (48.7 lb-in).

## Replacing the Filter Boards VX4A1117

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- When the controller is damaged, voltage may remain on certain energy storage capacitors after de-energization of the controller and discharge of the main capacitor bank.
- Before working on or near assemblies containing energy storage capacitors, verify that the capacitor voltages are less than 42 Vdc.
- The following assemblies have energy-storing capacitors:
  - Filter board. See Figures 15 and 16 on page 29.
- Always check for the presence of voltage using a voltmeter set to the 1000 Vdc scale. When voltage is present, allow the voltmeter to discharge the capacitor’s stored charge. Refer to “Discharging Stored Energy in Capacitors” on page 12.

**Failure to follow these instructions will result in death or serious injury.**

### Remove the Front Cover

1. Using a size 2 Phillips driver, remove 17 screws and take the front cover off the drive. See Figure 7 on page 20.

### Remove the Power Terminal Shields

2. Remove the power terminal shields as illustrated in “Replacing the Power Terminal Shields” on page 23.



### Remove the Filter Board and Fan Connections

**Table 6: Filter Board Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
<b>Filter Board 1 (Left)</b>			
E120	X1	Yellow, 0.25 in. connector	FCB <sup>2</sup> X1
	X2	Green, 0.25 in. connector	
	X3	Violet, 0.25 in. connector	
E120	X11	Yellow, 0.19 in. connector	PB <sup>3</sup> X7
	X12	Green, 0.19 in. connector	
	X13	Violet, 0.19 in. connector	
E115	X11	Black sleeve, 9-pin	Heatsink fan 1
E125	X12	Black sleeve, 9-pin	Heatsink fan 2
<b>Filter Board 2 (Right)</b>			
E120	X11	Yellow, 0.19 in. connector	PB <sup>3</sup> X7
	X12	Green, 0.19 in. connector	
	X13	Violet, 0.19 in. connector	
E165	X13	Black sleeve, 9-pin	Heatsink fan 3
E166	X14	Black sleeve, 9-pin	Heatsink fan 4

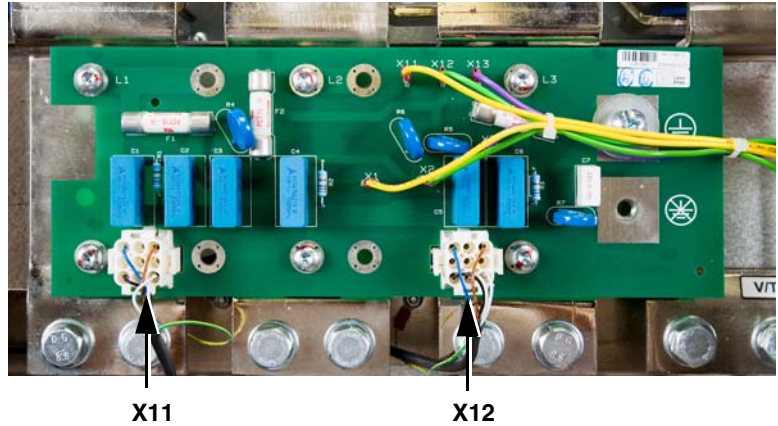
<sup>1</sup> See the schematic on page 169 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

<sup>2</sup> FCB: Fan control board

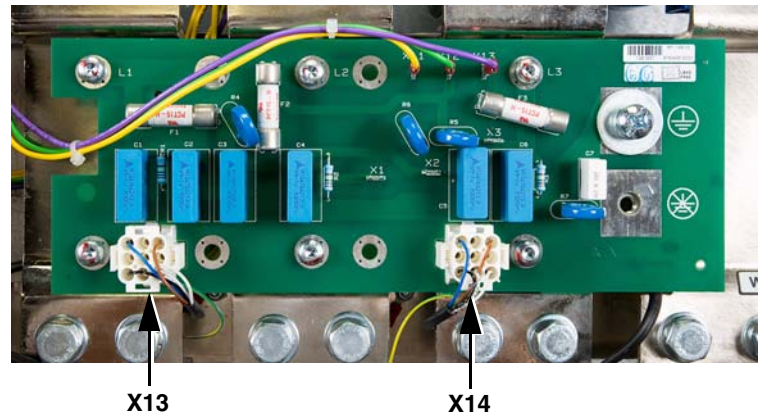
<sup>3</sup> PB: Power board

- Using needle-nose pliers, remove the six (filter board 1) or three (filter board 2) 1-pin connections from the filter board you are replacing. See Table 6 and Figures 15 or 16 for connector locations.
- Disconnect the two 9-pin fan connectors from terminals X11 and X12 (filter board 1, Figure 15) or terminals X13 and X14 (filter board 2, Figure 16).

**Figure 15: Filter Board 1**

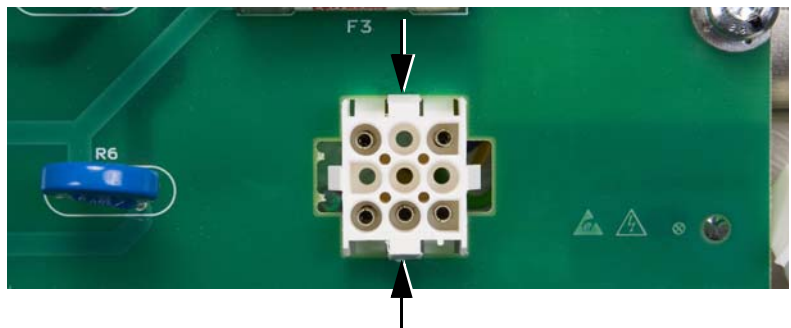


**Figure 16: Filter Board 2**



- Gently press in on the tabs at the top and bottom of the fan connectors and push the connectors down through the cutouts in the filter board. See Figure 17.

**Figure 17: Fan Connector Detail**



### Remove the Filter Board

6. Remove the filter board you are replacing as follows.
  - Using a T-30 Torx driver, remove six screws (**A**, Figure 18) securing the filter board to the input bus bars R/L1, S/L2, and T/L3.

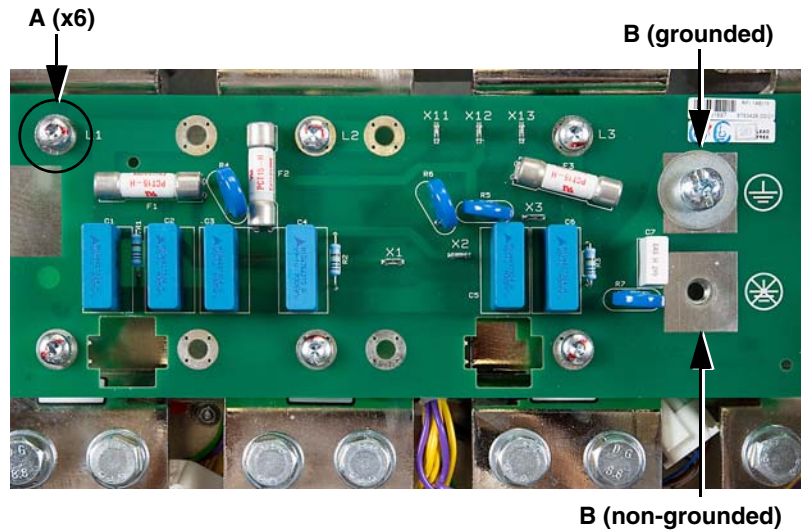
**NOTE:** Note whether the grounding screw (**B**) is installed in the grounded or non-grounded position for reinstallation. Figure 18 shows the screw in the grounded position.

- Using a size 3 Phillips driver, remove the grounding screw and washer (**B**, Figure 18) securing the filter board to the drive frame.
- Remove the filter board from the drive.

**Figure 18: Filter Board Mounting Hardware**

**Table 7: Filter Board Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
<b>A</b>	(6) T-30 screws	5.5	48.7
<b>B</b>	(1) Size 3 Phillips screw and washer	5.5	48.7



### Install the New Filter Board

7. Install the new filter board as follows:
  - Position the filter board in the drive as shown in Figure 18.
  - Using a T-30 Torx driver, secure the filter board to the input bus bars R/L1, S/L2, and T/L3 with six screws (**A**, Figure 18).

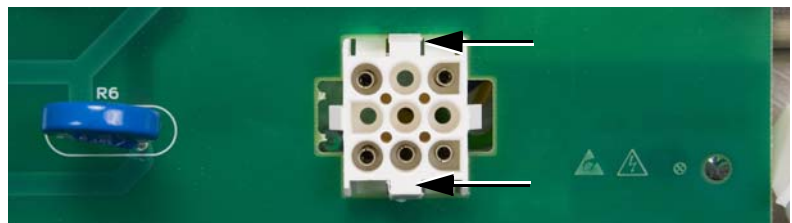
**NOTE:** Be sure to install the size 3 Phillips screw and washer (**B**) in the original position. Figure 18 shows the screw in the grounded position.

- Using a size 3 Phillips driver, install the grounding screw and washer (**B**, Figure 18).
- Tighten the hardware to the torque values specified in Table 7.

### Replace the Filter Board and Fan Connections

8. Gently press the top and bottom tabs on the fan connectors and push them up through the cutouts on the filter board. See Figure 19.

**Figure 19: Fan Connector Detail**



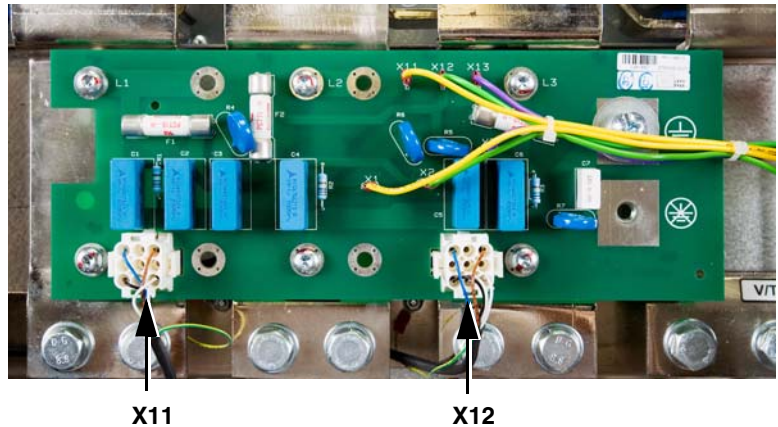
**Table 8: Filter Board Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
<b>Filter Board 1 (Left)</b>			
E120	X1	Yellow, 0.25 in. connector	FCB <sup>2</sup> 1 X1
	X2	Green, 0.25 in. connector	
	X3	Violet, 0.25 in. connector	
E120	X11	Yellow, 0.19 in. connector	PB <sup>3</sup> X7
	X12	Green, 0.19 in. connector	
	X13	Violet, 0.19 in. connector	
E115	X11	Black sleeve, 9-pin	Heatsink fan 1
E125	X12	Black sleeve, 9-pin	Heatsink fan 2
<b>Filter Board 2 (Right)</b>			
E120	X11	Yellow, 0.19 in. connector	PB <sup>3</sup> X7
	X12	Green, 0.19 in. connector	
	X13	Violet, 0.19 in. connector	
E165	X13	Black sleeve, 9-pin	Heatsink fan 3
E166	X14	Black sleeve, 9-pin	Heatsink fan 4

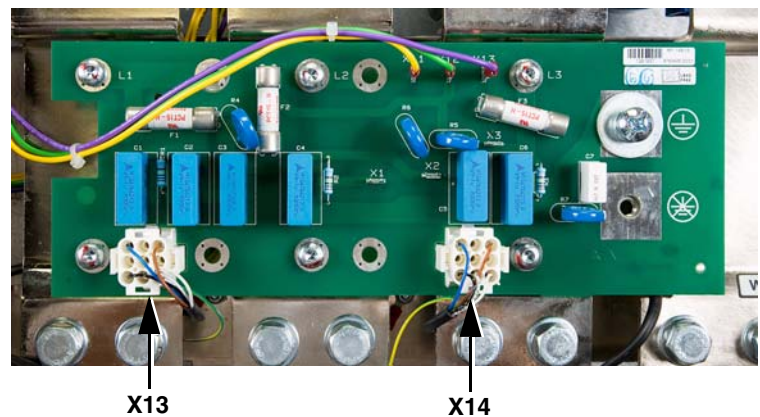
<sup>1</sup> See the schematic on page 169 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.  
<sup>2</sup> FCB: Fan control board  
<sup>3</sup> PB: Power board

9. Connect the two 9-pin fan connectors at terminals X11 and X12 (filter board 1, Figure 20) or X13 and X14 (filter board 2, Figure 21).
10. Replace the six (filter board 1) or three (filter board 2) 1-pin connections on the filter board. See Table 8 and Figures 20 and 21 for connector locations.

**Figure 20: Filter Board 1**



**Figure 21: Filter Board 2**



**Replace the Power Terminal Shields**

11. Replace the power terminal shields as illustrated in “Replacing the Power Terminal Shields” on page 23.

**Replace the Front Cover**

12. Replace the front cover. Using a size 2 Phillips driver, secure the front cover with 17 screws. See Figure 7 on page 20. Tighten the screws to 5.5 N•m (48.7 lb-in).

## Replacing the SCR Snubber Board VX4A1200

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- When the controller is damaged, voltage may remain on certain energy storage capacitors after de-energization of the controller and discharge of the main capacitor bank.
- Before working on or near assemblies containing energy storage capacitors, verify that the capacitor voltages are less than 42 Vdc.
- The following assemblies have energy-storing capacitors:
  - SCR snubber board. See Figures 30 and 32 on pages 37–38.
- Always check for the presence of voltage using a voltmeter set to the 1000 Vdc scale. When voltage is present, allow the voltmeter to discharge the capacitor’s stored charge. Refer to “Discharging Stored Energy in Capacitors” on page 12.

**Failure to follow these instructions will result in death or serious injury.**

### Remove the Front Cover

1. Using a size 2 Phillips driver, remove 17 screws and take the front cover off the drive. See Figure 7 on page 20.

### Remove the Power Terminal Shields

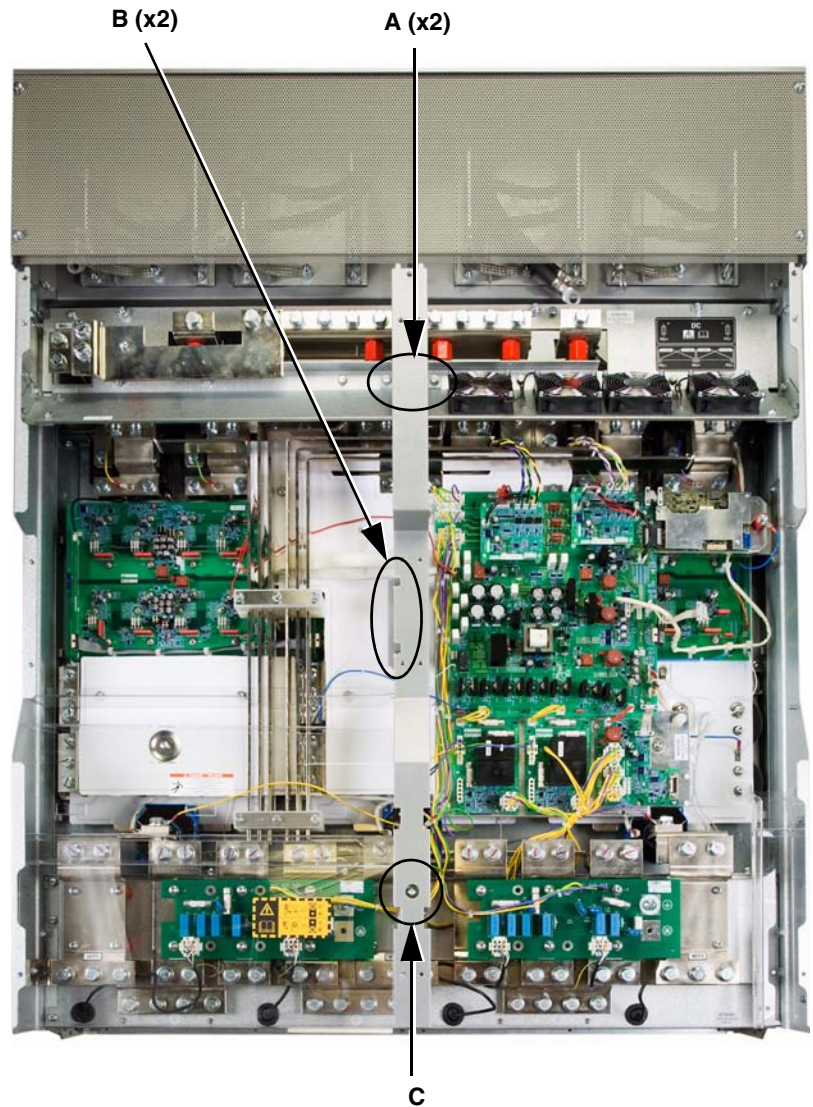
2. Remove the power terminal shields as illustrated in “Replacing the Power Terminal Shields” on page 23.



### Remove the Middle Crossbrace

3. Remove the middle crossbrace as follows. See Figure 22.
  - Using a 10 mm socket wrench, remove two nuts (A) securing the crossbrace to the fan bracket.
  - Using a T-30 Torx driver, remove two screws (B) securing the crossbrace to top DC bus plate.
  - Using a T-30 Torx driver, remove one screw (C) securing the crossbrace to the red insulator on the V/T2 bus.
  - Remove the crossbrace from the drive.

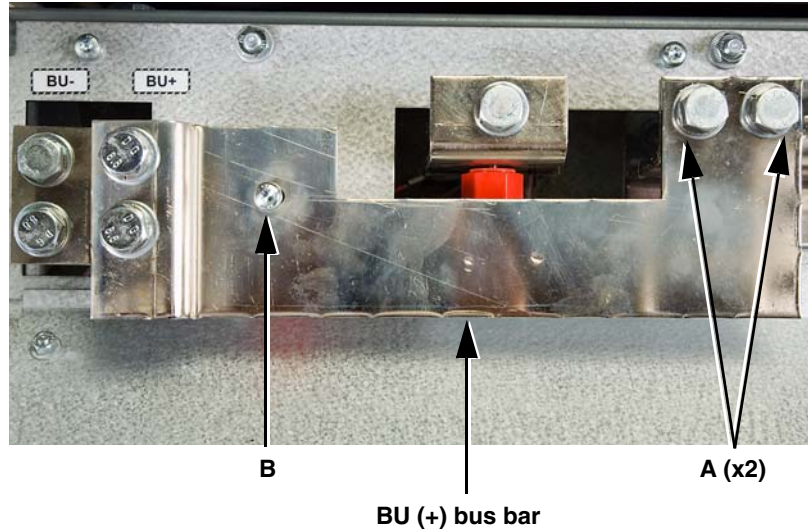
Figure 22: Middle Crossbrace



### Remove the BU (+) Bus Bar

4. Remove the BU (+) bus bar (located at the top of the drive) as follows. See Figure 23.
  - Using an 18 mm socket wrench, remove two bolts and washers (A) securing the BU (+) bus bar to the PA/+ bus.
  - Using a T-30 Torx driver, remove one screw (B) securing the BU (+) bus bar to the red insulator on the top terminal bracket.

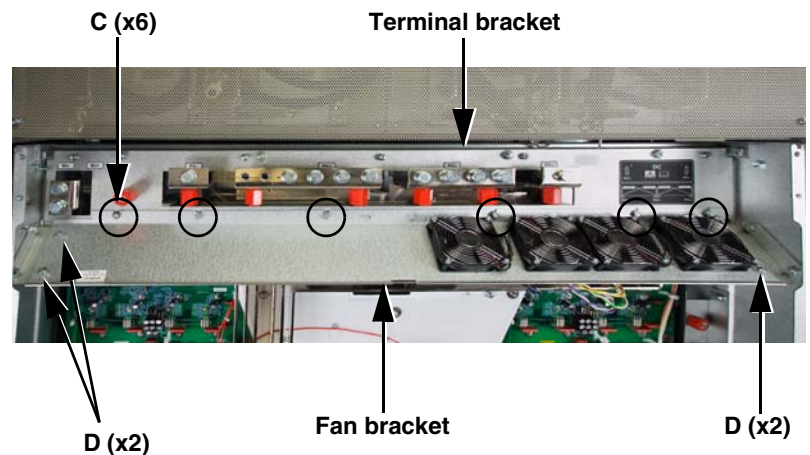
Figure 23: BU (+) Bus Bar



### Remove the Fan Bracket

5. Remove the fan bracket as follows.
  - Remove the connections from power board terminals X21 and X22. See Figure 49 on page 51 for terminal locations.
  - Using a 10 mm socket wrench, remove ten nuts securing the fan bracket to the top terminal bracket (C) and the drive frame (D) and remove the fan bracket. See Figure 24.

Figure 24: Fan Bracket



### Remove the Top Terminal Bracket

6. Remove the top terminal bracket as follows.
  - Using a T-30 right-angle Torx driver, remove six screws (**A**, Figures 25 and 26) securing the PO.1, PA/+, PC/-, and PO.2 bus bars to the red insulators on the terminal bracket.
  - Using a T-30 Torx driver, remove five screws (**B**, Figure 27) securing the terminal bracket to the drive frame and remove the terminal bracket from the drive.
  - Using an 18 mm socket wrench, remove ten bolts (**C**, Figure 28 on page 36) from the PO.1, PA/+, PC/-, and PO.2 bus bars.

Figure 25: Top Terminal Bracket Bus Bar Connections

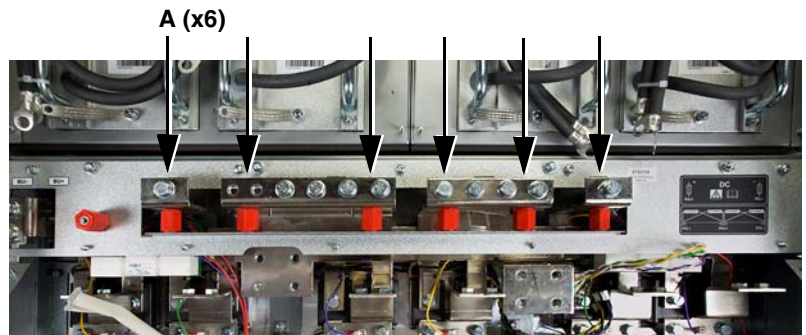


Figure 26: Bus Bar Connection Detail

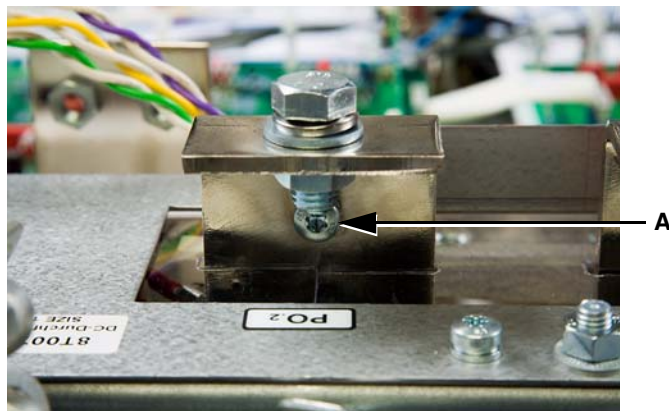


Figure 27: Top Terminal Bracket Mounting Hardware

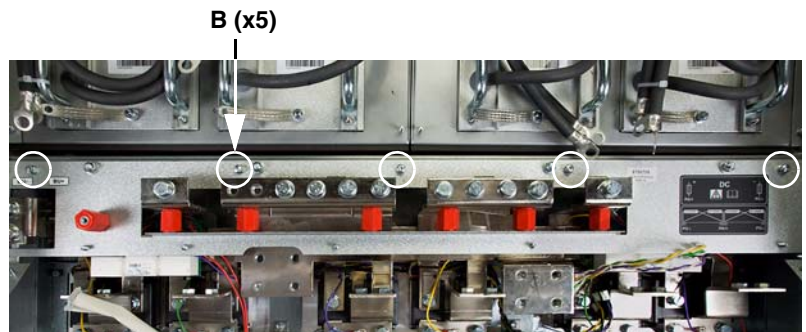
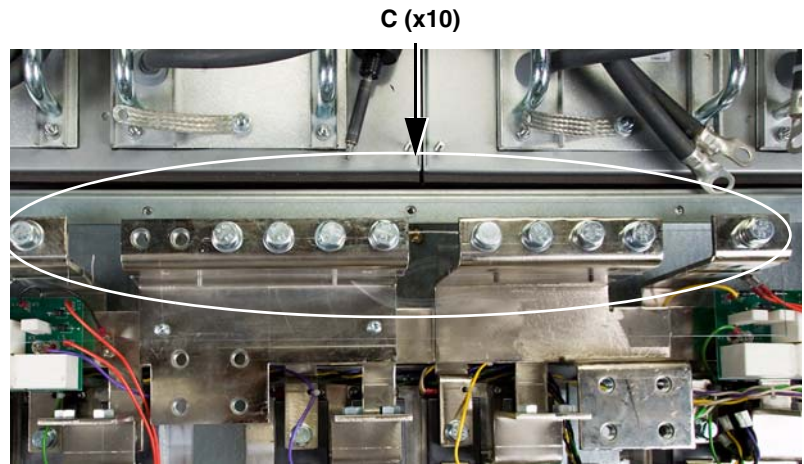




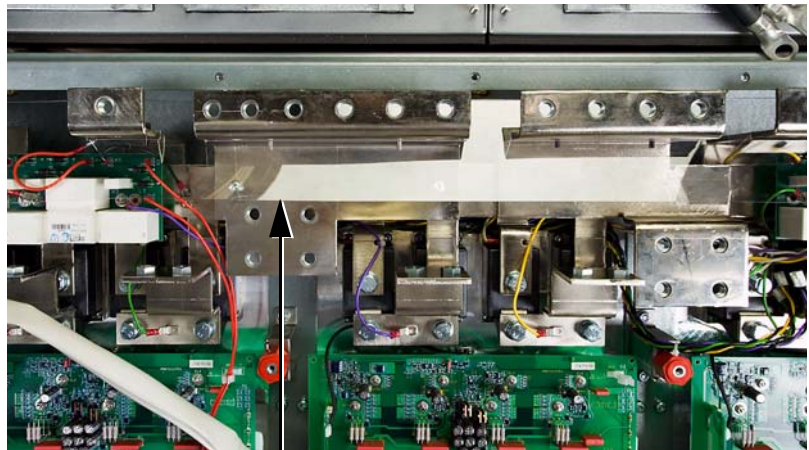
Figure 28: Bus Bar Connections



**Remove the Rectifier Shield**

7. Remove the plastic rectifier shield from the bus bars. See Figure 29.

Figure 29: Rectifier Shield



Shield

### Replace SCR Snubber Board 1

**Table 9: SCR Snubber Board 1 Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
E131	X1	Yellow, 1-pin	L1.1 rectifier
E130	X4	Red, 1-pin	PO.1 rectifier bus bar
E133	X5	Black, 1-pin	PC/- rectifier bus bar
E126	X10	Red, 0.25 in., 1-pin	GDB <sup>2</sup> U X61
E126	X11	Red, 0.19 in., 1-pin	PB <sup>3</sup> RFS31-X11
E167	L2	Green, 1-pin	L2.1 Line input bar
E168	X3	Violet, 1-pin	L3.1 Line input bar

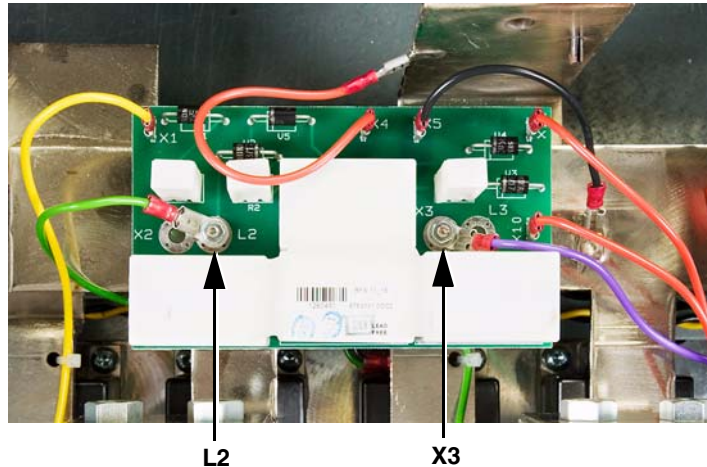
<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

<sup>2</sup> GDB: Gate driver board

<sup>3</sup> PB: Power board

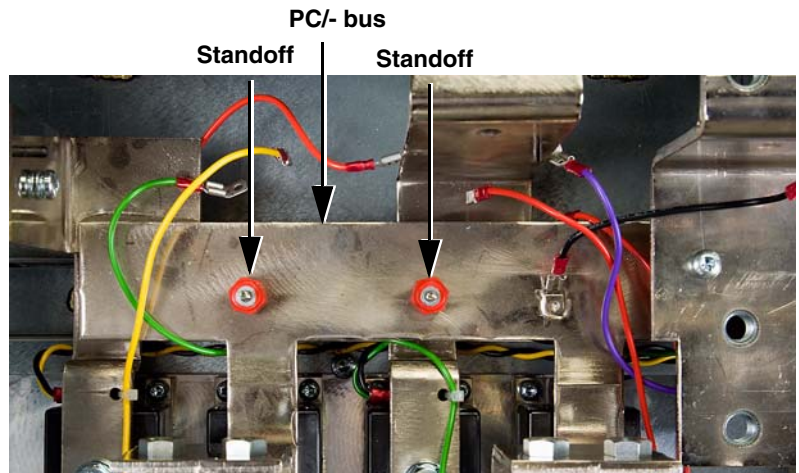
8. Remove SCR snubber board 1 (left board) as follows.
  - Using needle-nose pliers, carefully remove the connections from SCR snubber board 1 (left board) terminals X1, X4, X5, X10, and X11. See Table 9 and Figure 30 for the connection locations.
  - Using a 7 mm socket wrench, remove two nuts securing the snubber board to the insulators on the PC/- bus and remove the wires from terminals L2 and X3. See Figure 30.
  - Remove the snubber board from the drive.

**Figure 30: SCR Snubber Board 1**



9. Replace SCR snubber board 1 (left board) as follows.
  - Seat the SCR snubber board on the PC/- bus standoffs. See Figure 31.
  - Replace the wires at terminals L2 and X3. Using a 7 mm socket wrench, secure the wires and the snubber board to the PC/- bus with two bolts. See Figure 30. Tighten the bolts to 1.2 N•m (10.6 lb-in).
  - Replace the connections on SCR snubber board terminals X1, X4, X5, X10, and X11. See Table 9 and Figure 30 for the terminal locations.

**Figure 31: PC/- Bus**



## Replace SCR Snubber Board 2

**Table 10: SCR Snubber Board 2 Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
E157	X1	Yellow, 1-pin	L1.2 rectifier
E158	X4	Red, 1-pin	PO.2 rectifier bus bar
E159	X5	Black, 1-pin	PC/- rectifier bus bar
E160	X10	Red, 0.25 in., 1-pin	GDB <sup>2</sup> W X61
E158	X11	Red, 0.19 in., 1-pin	PO.2 rectifier bus bar
E169	L2	Green, 1-pin	L2.2 line input bar
E170	X3	Violet, 1-pin	L3.2 Line input bar

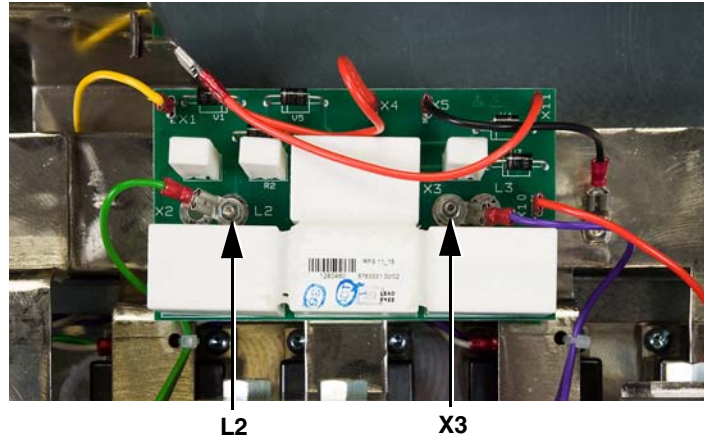
<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

<sup>2</sup> GDB: Gate driver board

10. Remove SCR snubber board 2 (right board) from the drive as follows.

- Using needle-nose pliers, carefully remove the connections from SCR snubber board 2 (right board) terminals X1, X4, X5, X10, and X11. See Table 10 and Figure 32 for the connection locations.
- Using a 7 mm socket wrench, remove two nuts securing the snubber board to the insulators on the PC/- bus and remove the wires from terminals L2 and X3. See Figure 32.
- Remove the board from the drive.

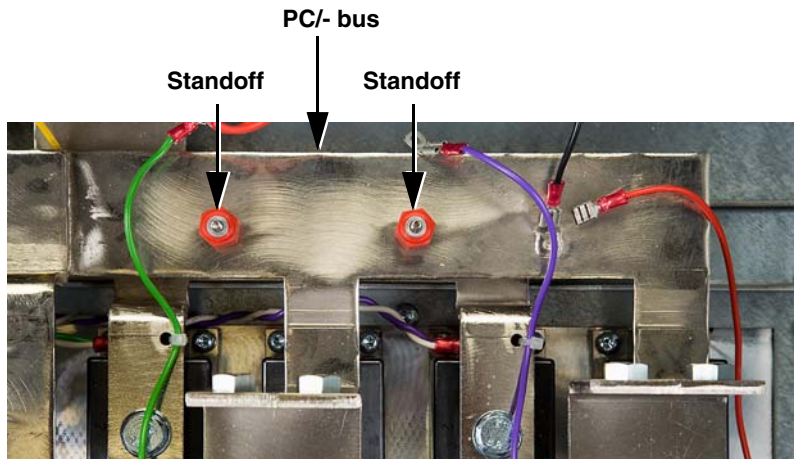
**Figure 32: SCR Snubber Board 2**



11. Replace SCR snubber board 2 (left board) as follows.

- Seat the SCR snubber board on the PC/- bus standoffs. See Figure 33.
- Replace the wires at terminals L2 and X3. Using a 7 mm socket wrench, secure the wires and the snubber board to the PC/- bus with two bolts. See Figure 32. Tighten the bolts to 1.2 N•m (10.6 lb-in).
- Replace the connections on SCR snubber board terminals X1, X4, X5, X10, and X11. See Table 10 and Figure 32 for the terminal locations.

**Figure 33: PC/- Bus**



## Replace the Rectifier Shield

12. Replace the plastic rectifier shield over the bus bars. See Figure 34. If the rectifier shield is cracked, broken, or damaged, replace it with a piece from the plastic kit. See "Replacing the Plastic Parts Kit VY1A1407" on page 23.

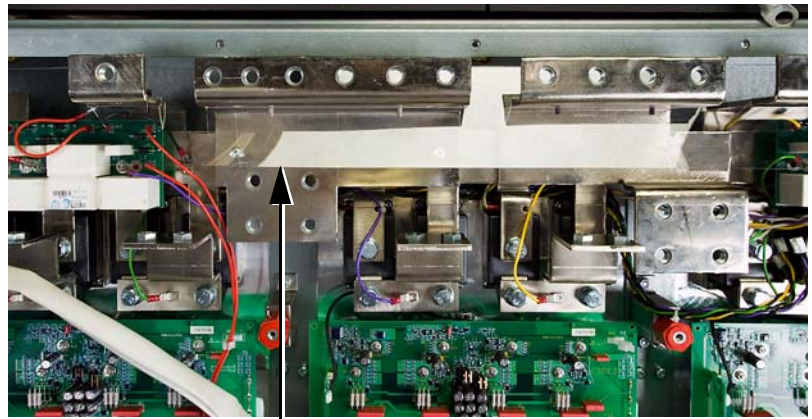
**⚠ DANGER**

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Install the rectifier shield as shown in Figure 34.
- Before installing the shield, ensure that it has no tears or cracks. If the shield is damaged, install a new piece from the plastic kit. See page 23.
- Do not install a damaged shield.

**Failure to follow these instructions will result in death or serious injury.**

Figure 34: Rectifier Shield



Shield



**Replace the Top Terminal Bracket**

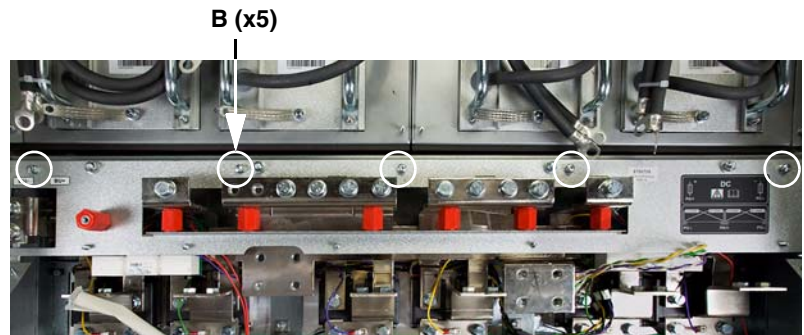
**Table 11: Top Terminal Bracket and Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
A	(6) T-30 screws	5.5	48.7
B	(5) T-30 screws	5.5	48.7
C	(10) 18-mm bolts	45	398

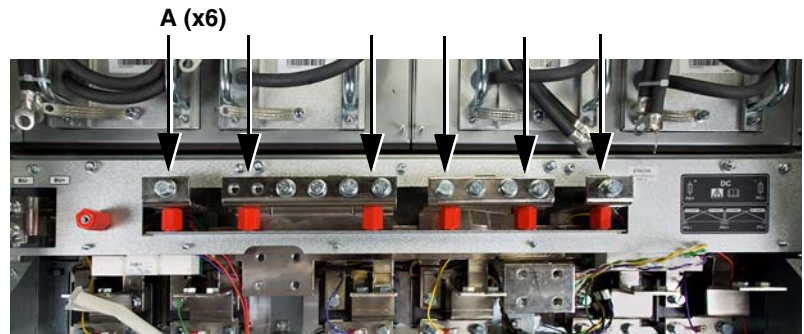
13. Replace the top terminal bracket as follows.

- Using a T-30 Torx driver, secure the terminal bracket to the drive frame with five screws (**B**, Figure 35). Tighten the screws to the values specified in Table 11.
- Using a T-30 right-angle Torx driver, secure the PO.1, PA/+, PC/-, and PO.2 bus bars to the red insulators on the terminal bracket with six screws (**A**, Figures 36 and 37). Tighten the screws to the torque values specified in Table 11.
- Using an 18 mm socket wrench, replace ten bolts (**C**, Figure 38 on page 41) in the PO.1, PA/+, PC/-, and PO.2 bus bars. Tighten the bolts to the torque values specified in Table 11.

**Figure 35: Top Terminal Bracket Mounting Hardware**



**Figure 36: Top Terminal Bracket Bus Bar Connections**

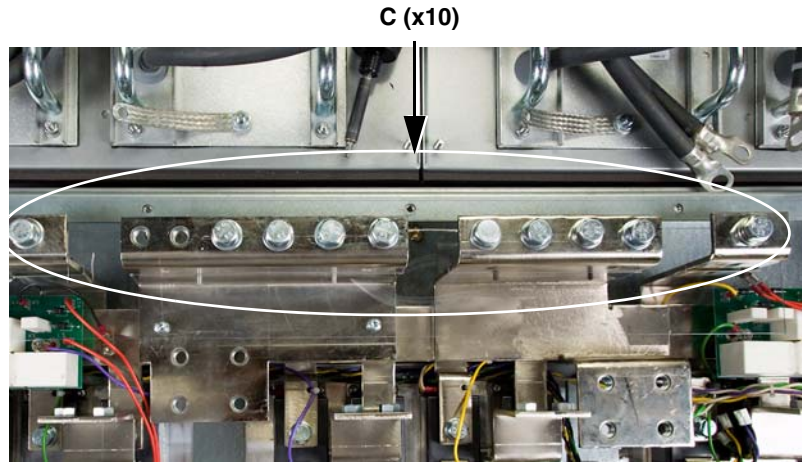


**Figure 37: Bus Bar Connection Detail**





Figure 38: Bus Bar Connections



**Replace the Fan Bracket**

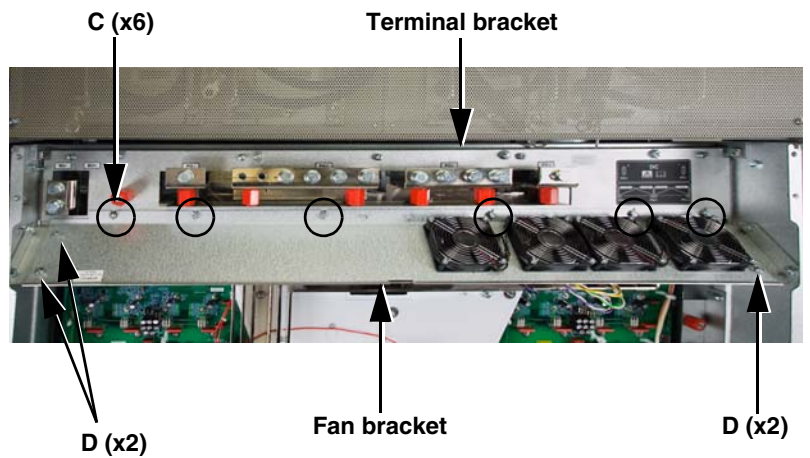
14. Replace the fan bracket as follows.

- Using a 10 mm socket wrench, secure the fan bracket to the top terminal bracket (C) and the drive frame (D) with ten nuts. See Figure 39. Tighten the nuts to the torque values specified in Table 12.
- Replace the connections to power board terminals X21 and X22. See Figure 49 on page 51 for terminal locations.

Table 12: Fan Bracket and BU (+) Bus Bar Hardware Torque Values

Item	Description	Torque Range	
		N•m	lb-in
C	(6) 10-mm nuts	5.5	48.7
D	(4) 10-mm nuts	5.5	48.7

Figure 39: Fan Bracket



### Replace the BU (+) Bus Bar

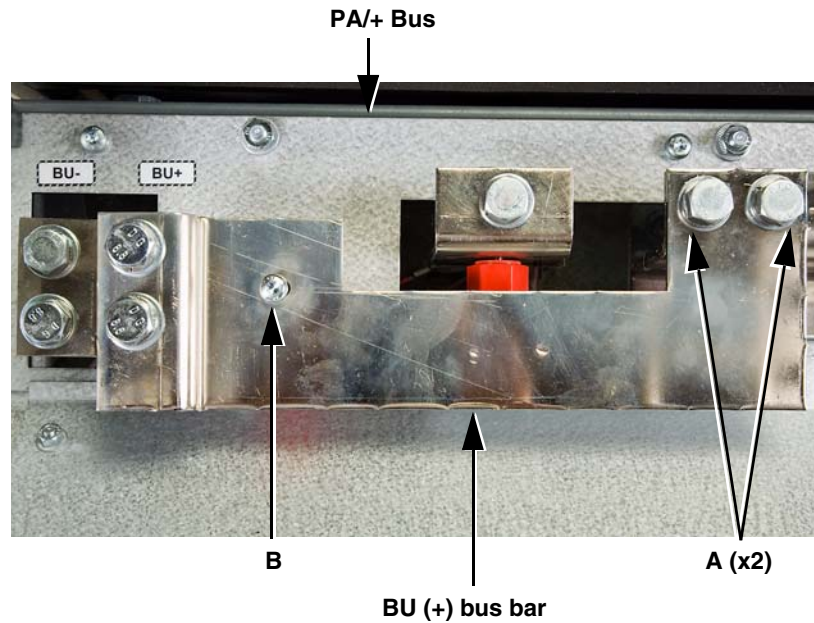
**Table 13: Fan Bracket and BU (+) Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
A	(2) 18-mm bolts and washers	45	398
B	(1) T-30 screw	5.5	48.7

15. Replace the BU (+) bus bar as follows. See Figure 40.

- Using an 18 mm socket wrench, secure the BU (+) bus bar to the PA/+ bus with two bolts and washers (A).
- Using a T-30 Torx driver, secure the BU (+) bus bar to the red insulator on the top terminal bracket with one screw (B).
- Tighten the hardware to the torque values specified in Table 13.

**Figure 40: BU (+) Bus Bar**



### Replace the Middle Crossbrace

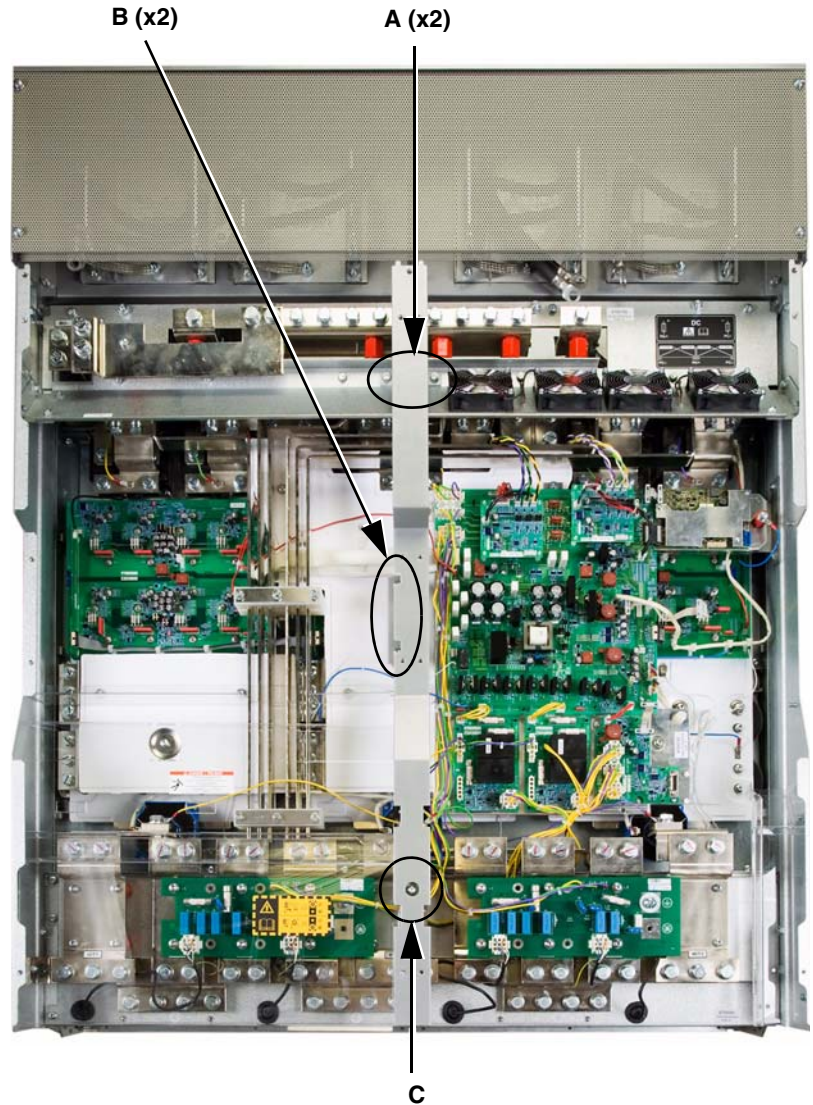
**Table 14: Crossbrace Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
A	(2) 10 mm nuts	5.5	48.7
B	(2) T-30 screws	5.5	48.7
C	(1) T-30 screw	5.5	48.7

16. Replace the middle crossbrace as follows. See Figure 41.

- Using a 10 mm socket wrench, secure the crossbrace to the fan bracket with two nuts (A).
- Using a T-30 Torx driver, secure the crossbrace to the top DC bus plate with two screws (B).
- Using a T-30 Torx driver, secure the crossbrace to the red insulator on the V/T2 bus with one screw (C).
- Tighten the hardware to the torque values specified in Table 14.

Figure 41: Middle Crossbrace



**Replace the Power Terminal Shields**

17. Replace the power terminal shields as illustrated in “Replacing the Power Terminal Shields” on page 23.

**Replace the Front Cover**

18. Replace the front cover. Using a size 2 Phillips driver, secure the front cover with 17 screws. See Figure 7 on page 20. Tighten the screws to 5.5 N•m (48.7 lb-in).

## Installation Procedures for Level 2 Parts

The level 2 parts are under the control module assembly, the bus assembly, or the fan plate. They are:

Power board	Temperature sensors
Brake board	Power IGBT modules
Power board assembly shields	Capacitors
Motor current sensors	SCR modules
Gate driver boards	Diode modules

You must remove equipment from the drive as described in the following section to access the level 2 parts.

## Disassembly Steps for Accessing Level 2 Parts

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

### DANGER

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

This section contains instructions for removing the following parts from the drive:

- |  |   |
|--|---|
| <input type="checkbox"/> Front cover                   | <input type="checkbox"/> BU (+) bus bar           |
| <input type="checkbox"/> Power terminal shields        | <input type="checkbox"/> Fan bracket              |
| <input type="checkbox"/> EMC tray                      | <input type="checkbox"/> Input bus bar brackets   |
| <input type="checkbox"/> Control module assembly       | <input type="checkbox"/> Input bus bars           |
| <input type="checkbox"/> Soft charge board connections | <input type="checkbox"/> Top phase-U DC bus plate |
| <input type="checkbox"/> Power board connections       | <input type="checkbox"/> Top DC bus plate         |
| <input type="checkbox"/> Fan control board connections | <input type="checkbox"/> Gate driver boards       |
| <input type="checkbox"/> Power board assembly          | <input type="checkbox"/> Bottom DC bus plate      |
| <input type="checkbox"/> Middle crossbrace             |   |

You must perform some or all of the steps in this section to access the level 2 parts. Consult Table 15 for the disassembly steps that must be performed to access the spare parts you are replacing.

**Table 15: Disassembly Steps**

If you are replacing:	Perform disassembly steps:	Then follow procedure:
Power board VX5A1HC5063	<b>Steps 1–4</b>	“Replacing the Power Board VX5A1HC5063” beginning on page 71
Brake Board VZ3F1113	<b>Steps 1–4</b>	“Replacing the Brake Board VZ3F1113” beginning on page 76

**Table 15: Disassembly Steps** *(continued)*

If you are replacing:	Perform disassembly steps:	Then follow procedure:
Power board assembly shields (Plastic Parts Kit VY1A1407)	<b>Steps 1–8</b>	“Replacing the Power Board Assembly Shields” beginning on page 77
Motor current sensors VY1A1109	<b>Steps 1–11</b>	“Replacing the Motor Current Sensors VY1A1109” beginning on page 88
Gate driver boards VX5A1204	<b>Steps 1–21</b>	“Replacing the Gate Driver Boards VX5A1204” beginning on page 114
SCR modules VZ3TM1600M1671	<b>Steps 1–21</b>	“Replacing the SCR Modules and Diode Modules (VZ3TM1600M1671 and VZ3DM1600M1671)” beginning on page 125
Diode modules VZ3DM1600M1671		
Temperature sensors VZ3G1104	<b>Steps 1–22</b>	“Replacing the Temperature Sensors, VZ3G1104” beginning on page 118
Power IGBT modules VZ3IM1604M1271	<b>Steps 1–23</b>	“Replacing the Power IGBT Modules VZ3IM1604M1271” beginning on page 120
Capacitors VY1ADC1112		“Replacing the Capacitors VY1ADC1112” beginning on page 123



### Remove the Front Cover

1. Using a size 2 Phillips driver, remove 17 screws and take the front cover off the drive. See Figure 7 on page 20.

### Remove the Power Terminal Shields

2. Remove the power terminal shields as follows:
  - The right terminal shield has two tabs (A) on the right side that fit into slots on the conduit tray, and two tabs (B) on the left side that fit into slots on the middle crossbrace. See Figure 42.
  - The left terminal shield has two tabs on the right (C) that fit into retaining slots in the middle crossbrace and three mounting holes (D) on the left that fit over posts on the side panel of the drive. See Figure 43.
  - Disengage the shields and remove them from the drive.

Figure 42: Right Terminal Shield

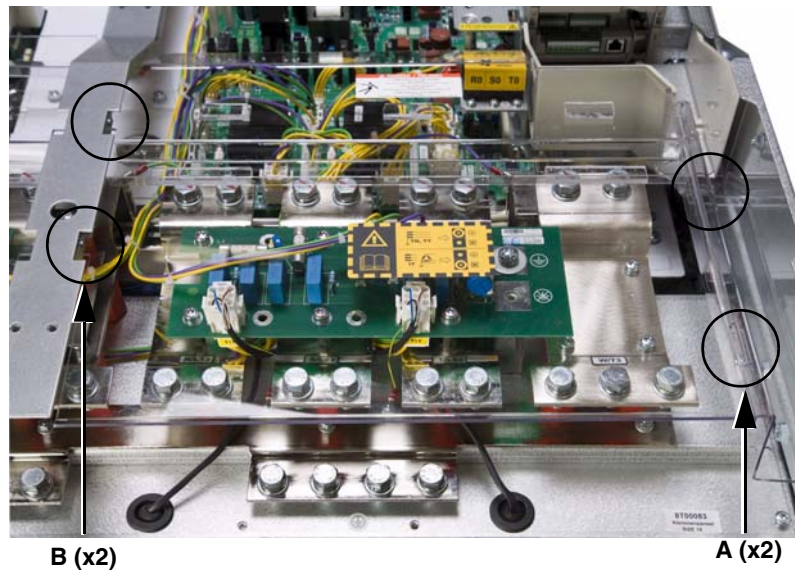
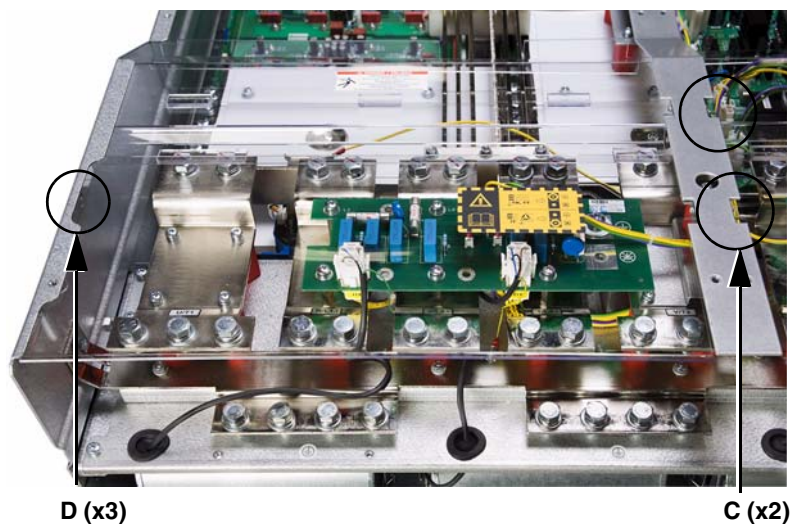


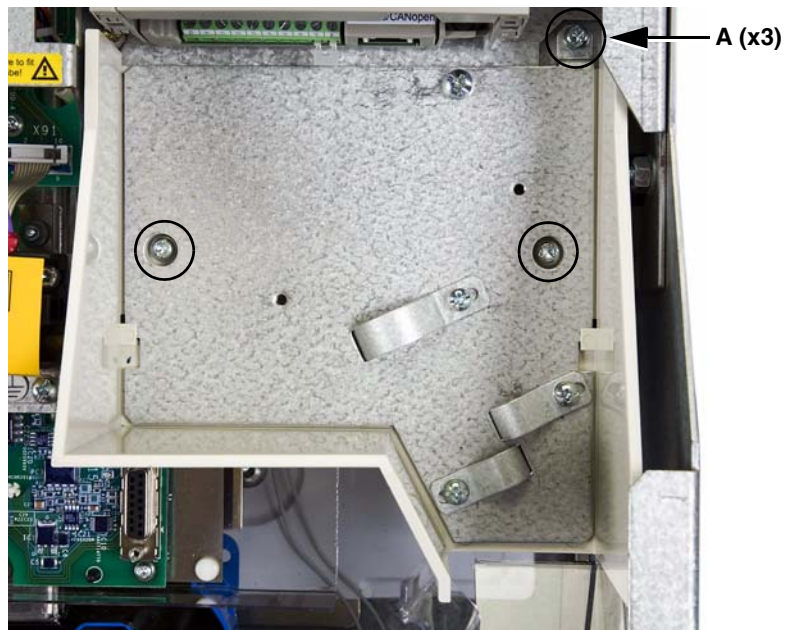
Figure 43: Left Terminal Shield



### Remove the EMC Tray

- Using a T-20 Torx driver, remove three screws (A) securing the EMC tray to the control module mounting plate and remove the tray from the drive. See Figure 44.

Figure 44: EMC Tray



## Remove the Control Module Assembly

4. Remove the control module assembly as follows.
  - Remove the 5-pin connector from terminal X4 of fan control boards 1 and 2. See Figure 45.
  - Remove the 26-pin ribbon cable from motor control board terminal X3. See Figure 46 on page 49.
  - Using a 10 mm socket wrench, remove two nuts securing the control module assembly to the drive frame. See Figure 46 on page 49.
  - Turn the assembly over, disconnect the ribbon cable from the back (wire E112, Figure 47 on page 49), and remove the assembly from the drive. Wire E112 connects to terminal X4 on the power board.

**Figure 45: Fan Control Boards 1 and 2, Terminal X4**

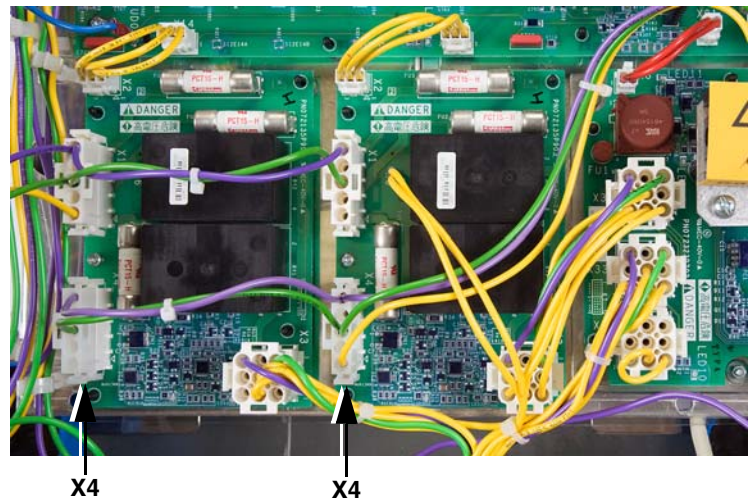


Figure 46: Control Module Assembly, Front

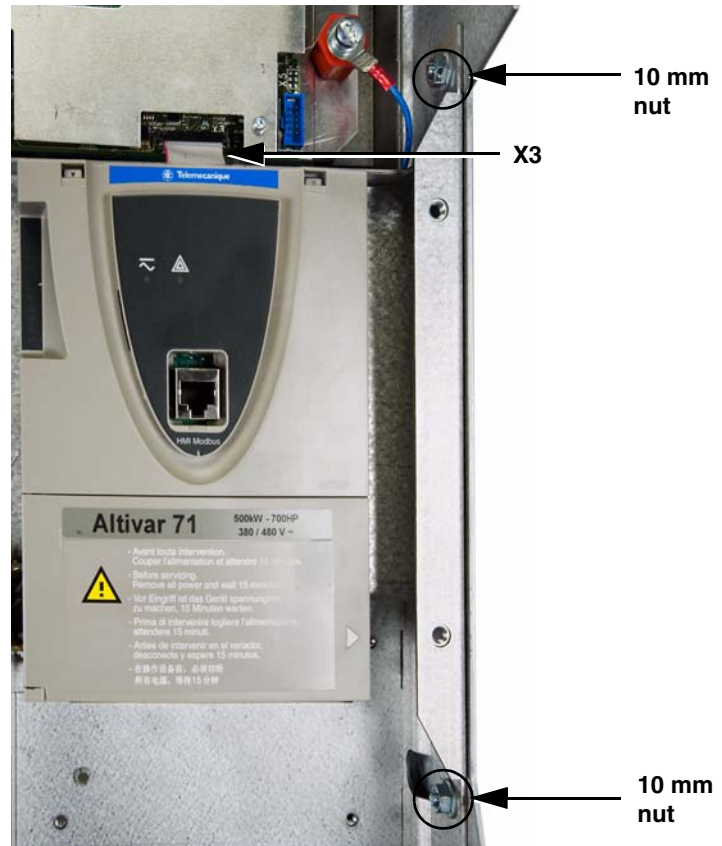
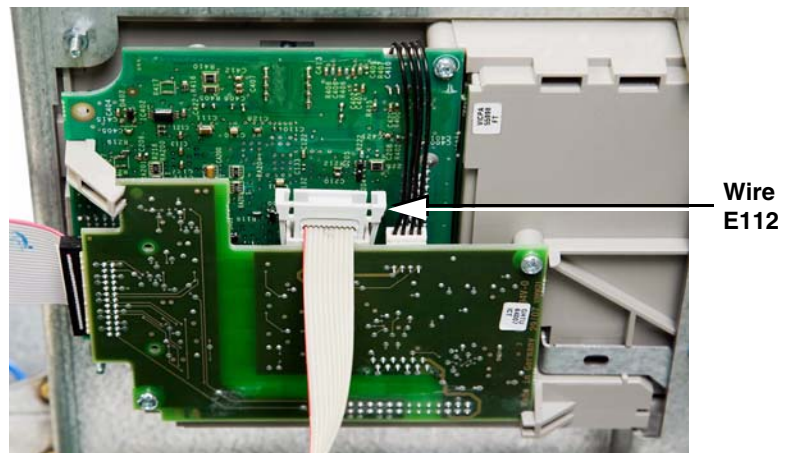


Figure 47: Control Module Assembly, Back



**NEXT STEP:** If you are replacing the power board, skip to “Replacing the Power Board VX5A1HC5063” beginning on page 71.  
If you are replacing the brake board, skip to “Replacing the Brake Board VZ3F1113” on page 76.



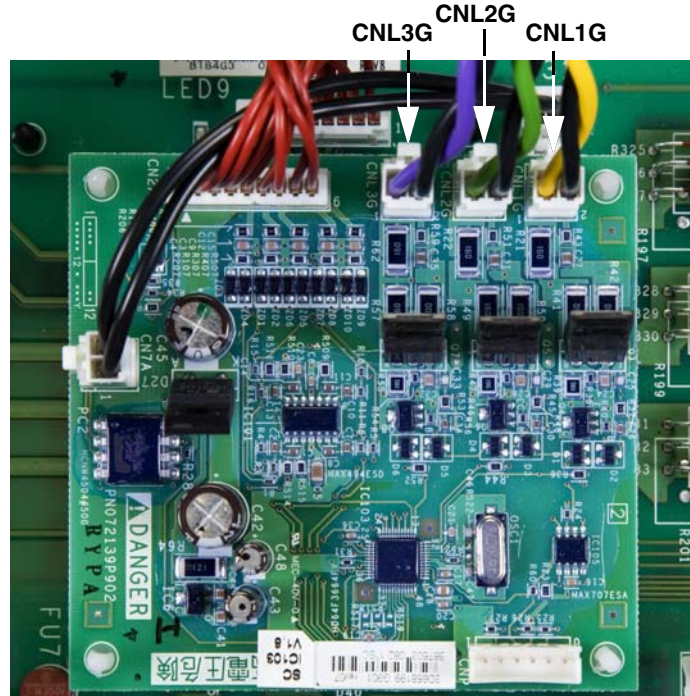
**Remove the Connections from Soft Charge Boards 1 and 2**

- Using needle-nose pliers, carefully remove connections CNL1G, CNL2G, and CNL3G from soft charge boards 1 and 2. See Table 16 for wiring and Figure 48 for terminal locations.

**Figure 48: Soft Charge Board: Board 1 (Left) Shown**

**Table 16: Soft Charge Board Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
<b>Soft Charge Board 1 (Left Board)</b>			
E110	CN2A	9-pin, red	PB <sup>2</sup> X30 (9-pin)
E109	CNL3G	2-pin, violet/black	SCR <sup>3</sup> L3.1 Terms. 4 & 5
E108	CNL2G	2-pin, green/black	SCR L2.1 Terms. 4 & 5
E107	CNL1G	2-pin, yellow/black	SCR L1.1 Terms. 4 & 5
E111	CN7A	2-pin, black	PB X31
—	CNP	Not used	—
<b>Soft Charge Board 2 (Right Board)</b>			
E156	CN2A	9-pin, red	PB <sup>2</sup> X40 (9-pin)
E152	CNL3G	2-pin, violet/white	SCR <sup>3</sup> L3.2 Terms. 4 & 5
E153	CNL2G	2-pin, green/white	SCR L2.2 Terms. 4 & 5
E154	CNL1G	2-pin, yellow/white	SCR L1.2 Terms. 4 & 5
E155	CN7A	2-pin, black	PB <sup>2</sup> X41
—	CNP	Not used	—



<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

<sup>2</sup> PB: Power board

<sup>3</sup> SCR: Silicon controlled rectifier. L1.1, L2.1, and L3.1 are associated with input rectifier 1; L1.2, L2.2, and L3.2 are associated with input rectifier 2.



**Remove the Power Board Connections**

**Table 17: Power Board Wiring**

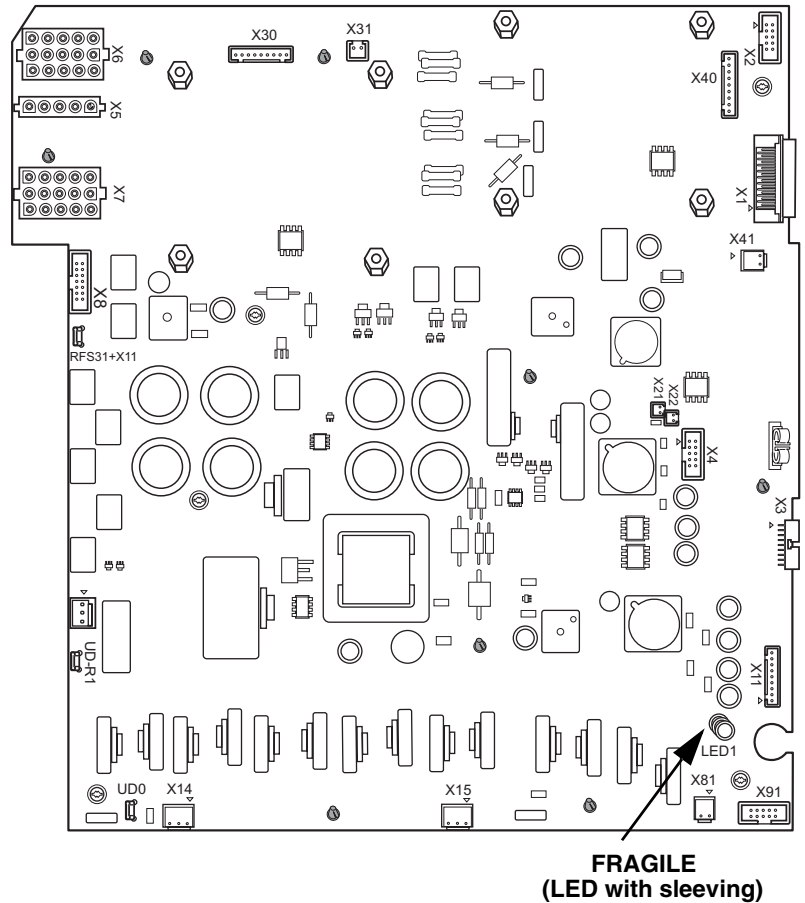
Wire No. <sup>1</sup>	Terminal No.	Description	To:
E103	X11	9-pin, multi color	Motor current sensors
E136	UD0	1-pin, blue	Phase-W DC bus plate
E126	RFS 31+ X11	1-pin, red	SB <sup>2</sup> X11
E141	UD -R1	1-pin, white	Bleeder resistor 1
E142	X3	18-pin, gray	GDB <sup>3</sup> W X32
E112	X4	10-pin, gray	Control module
E150	X5	5-pin, yellow/green/violet	Output bus bars T1, T2, T3
E120	X7	15-pin, yellow/green/violet	FB <sup>4</sup> 1 & 2 X11, X12, X13
E100	X8	14-pin, white	GDB U X82
E106	X21	2-pin, red/black	Internal fan
E106	X22	2-pin, red/black	Internal fan

<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.  
<sup>2</sup> SB: SCR Snubber board  
<sup>3</sup> GDB: Gate driver board  
<sup>4</sup> FB: Filter board

**NOTE:** Take care not to damage the LED (see Figure 49) when removing, handling, or installing the power board.

6. Using needle-nose pliers, carefully remove the power board connections listed in Table 17. See Figure 49 for the connection locations.

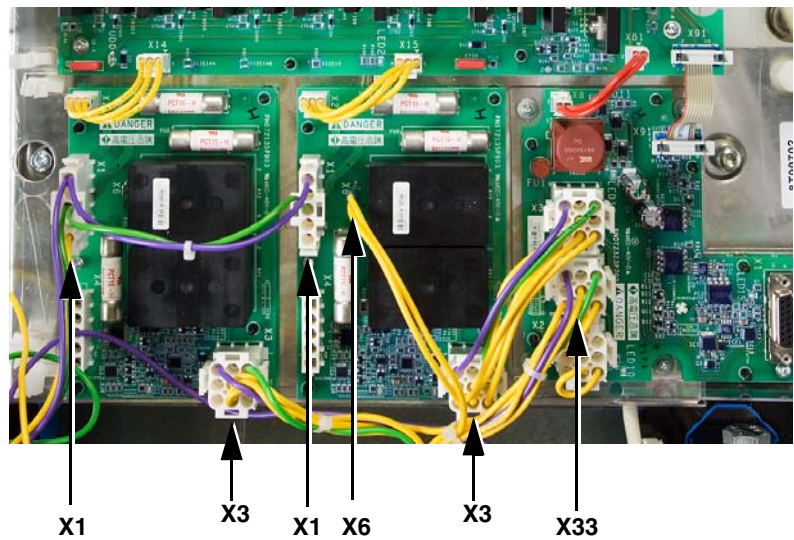
**Figure 49: Power Board Connections**



### Remove the Fan Control Board Connections

7. Remove the following connections. See Figure 50 for terminal locations.
  - Remove the connections from terminal X1 of fan control boards 1 and 2.
  - Remove the connection from terminal X3 of fan control board 1.
  - Remove the connection from terminal X33 of the brake board.
  - Remove the connection from terminal X6 of fan control board 2.

**Figure 50: Fan Control Board and Brake Board Connections**

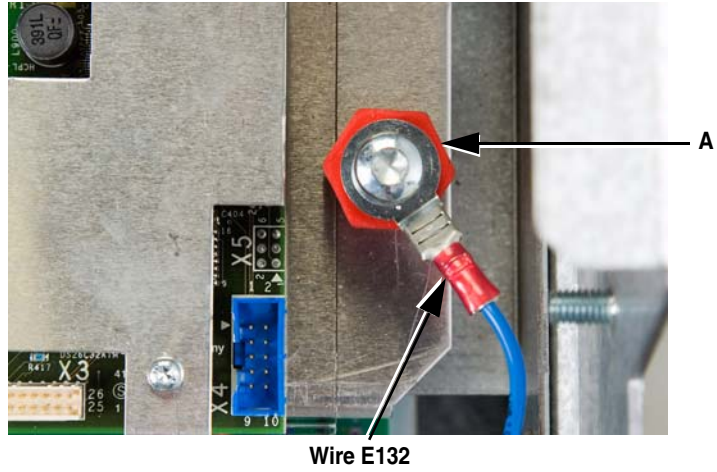


### Remove the Power Board Assembly

**NOTE:** The power board assembly consists of the power board, the motor control board, fan control boards 1 and 2, and the brake board.

8. Remove the power board assembly as follows.
  - Disconnect wire E132 (see Figure 51) near the motor control board. The wire originates from terminal X53 on gate driver board W.
  - Using a 21 mm socket wrench, remove the red insulator (A, Figure 51).

Figure 51: Wire E132 Connection



- Using a T-10 Torx driver, remove one screw (B, Figure 52) from power board terminal UD+1.
- Using a 10 mm socket wrench, remove three nuts (C, Figure 53 on page 54) securing the power board assembly to the bus plate assembly.
- Using a T-30 Torx driver, remove one screw and washer (D, Figure 53 on page 54) securing the power board assembly to the phase-W DC bus plate.
- Remove the power board assembly from the drive.

Figure 52: Power Board, Terminal UD+1

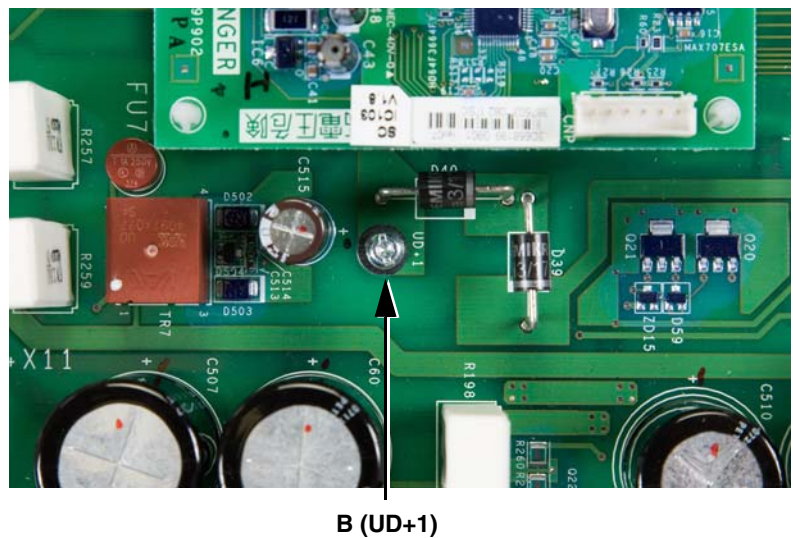
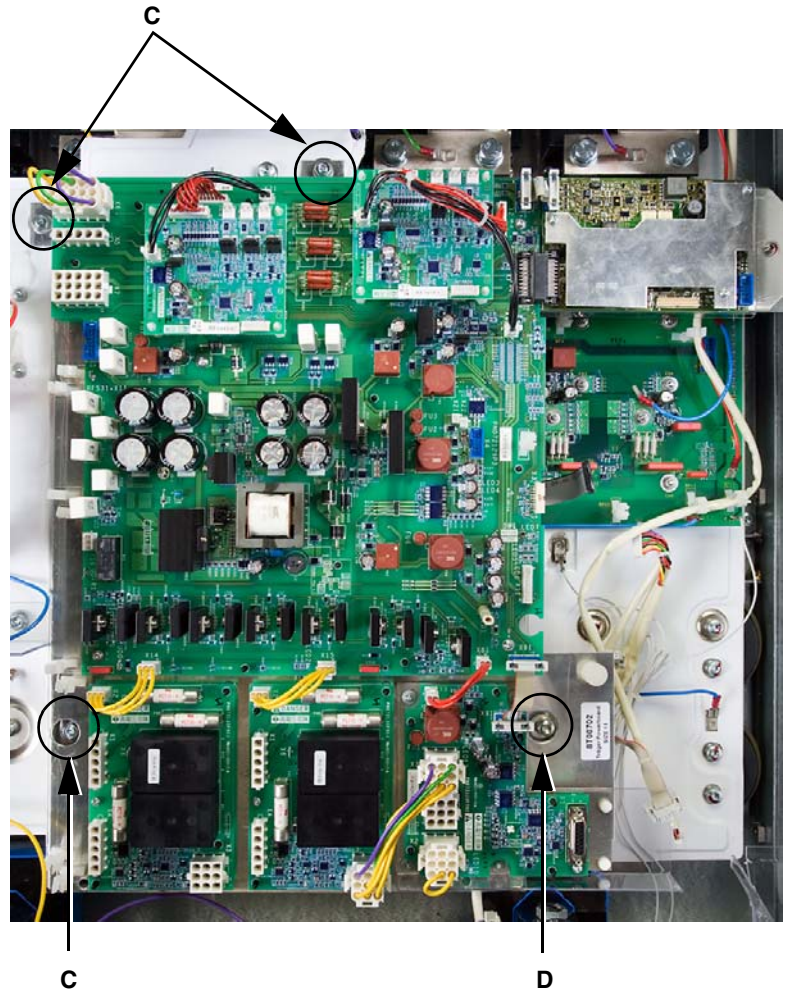


Figure 53: Power Board Assembly



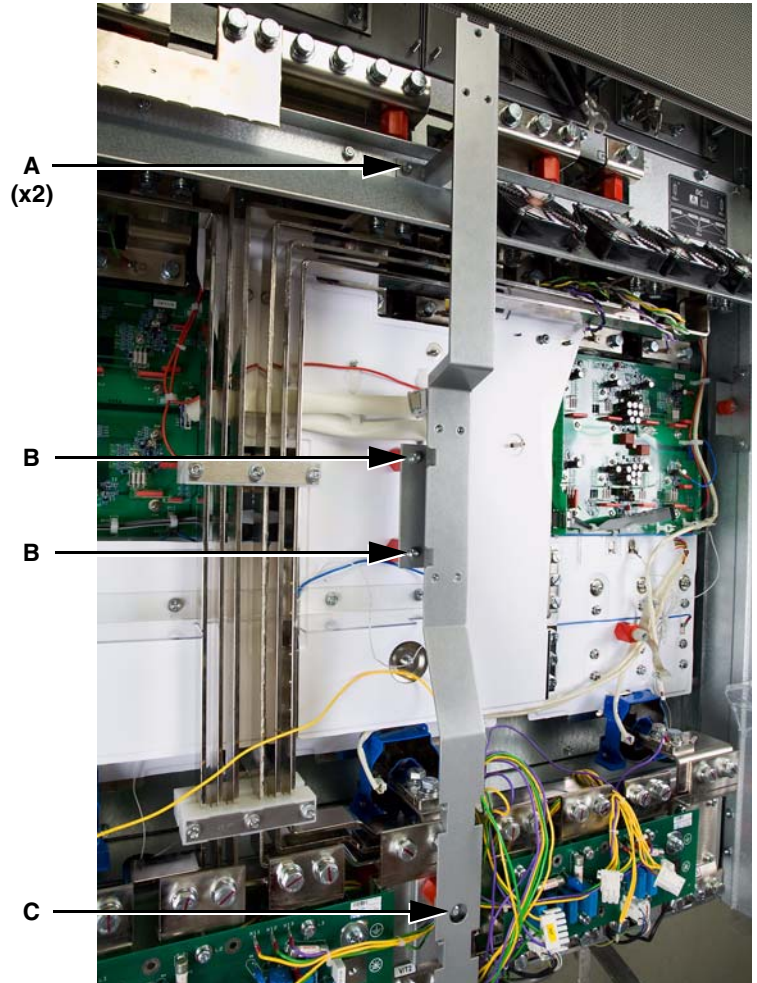
**NEXT STEP:** If you are replacing the power board assembly shields, skip to “Replacing the Power Board Assembly Shields” beginning on page 77.



### Remove the Middle Crossbrace

9. Remove the middle crossbrace as follows. See Figure 54.
  - Using a 10 mm socket wrench, remove two nuts (**A**) securing the crossbrace to the fan bracket.
  - Using a T-30 Torx driver, remove two screws (**B**) securing the crossbrace to top DC bus plate.
  - Using a T-30 Torx driver, remove one screw securing the crossbrace to the red insulator on the V/T2 bus (**C**).
  - Remove the crossbrace from the drive.

Figure 54: Middle Crossbrace

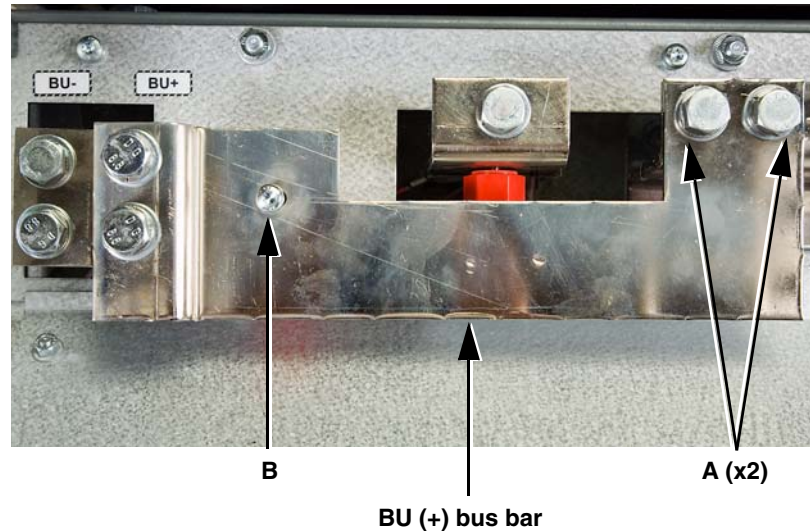




### Remove the BU (+) Bus Bar

10. Remove the BU (+) bus bar (located at the top of the drive) as follows. See Figure 55.
- Using an 18 mm socket wrench, remove two bolts and washers (A) securing the BU (+) bus bar to the PA/+ bus.
  - Using a T-30 Torx driver, remove one screw (B) securing the BU (+) bus bar to the red insulator on the top terminal bracket.

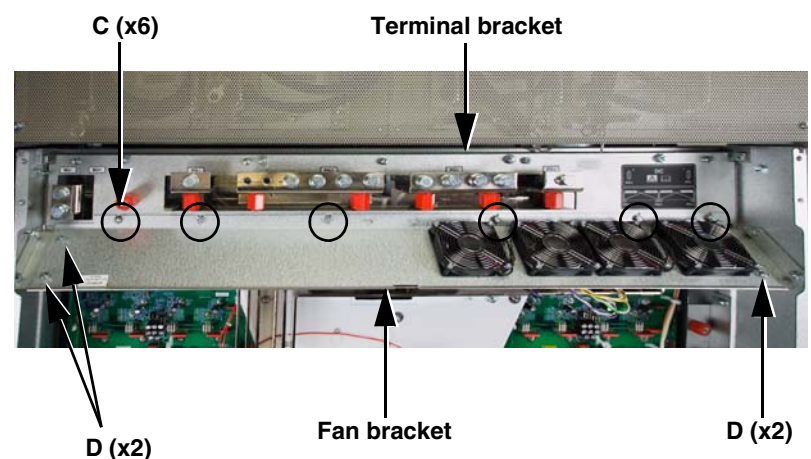
Figure 55: BU (+) Bus Bar



### Remove the Fan Bracket

11. Using a 10 mm socket wrench, remove ten nuts securing the fan bracket to the top terminal bracket (C) and the drive frame (D) and remove the fan bracket. See Figure 56.

Figure 56: Fan Bracket

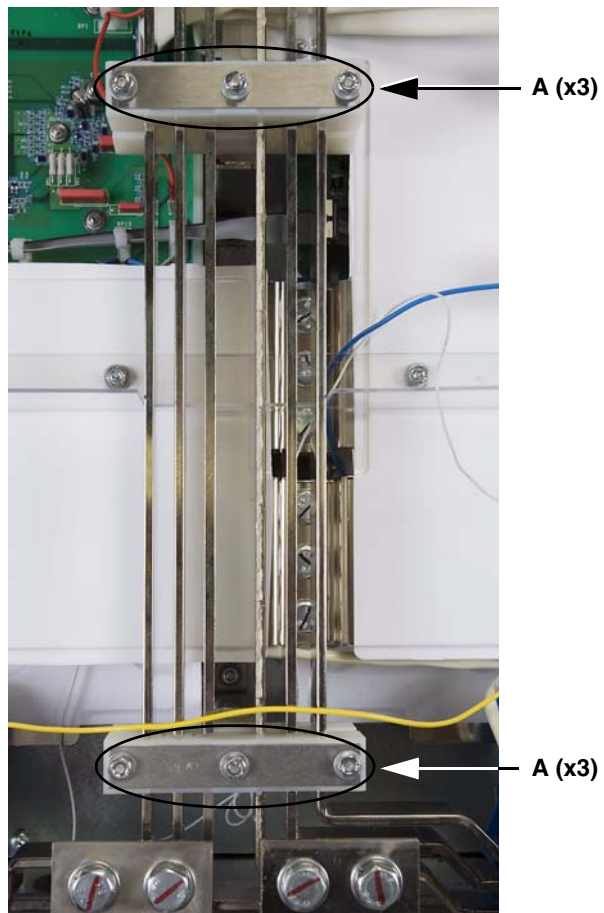


**NEXT STEP:** If you are replacing motor current sensors, skip to “Replacing the Motor Current Sensors VY1A1109” beginning on page 88.

### Remove the Input Bus Bar Brackets (Top)

- Using a 10 mm socket wrench, remove six nuts (**A**, Figure 57) securing the top half of the input bus bar brackets to the bottom half, and remove the top part of the brackets.

**Figure 57: Input Bus Bar Brackets (Top)**



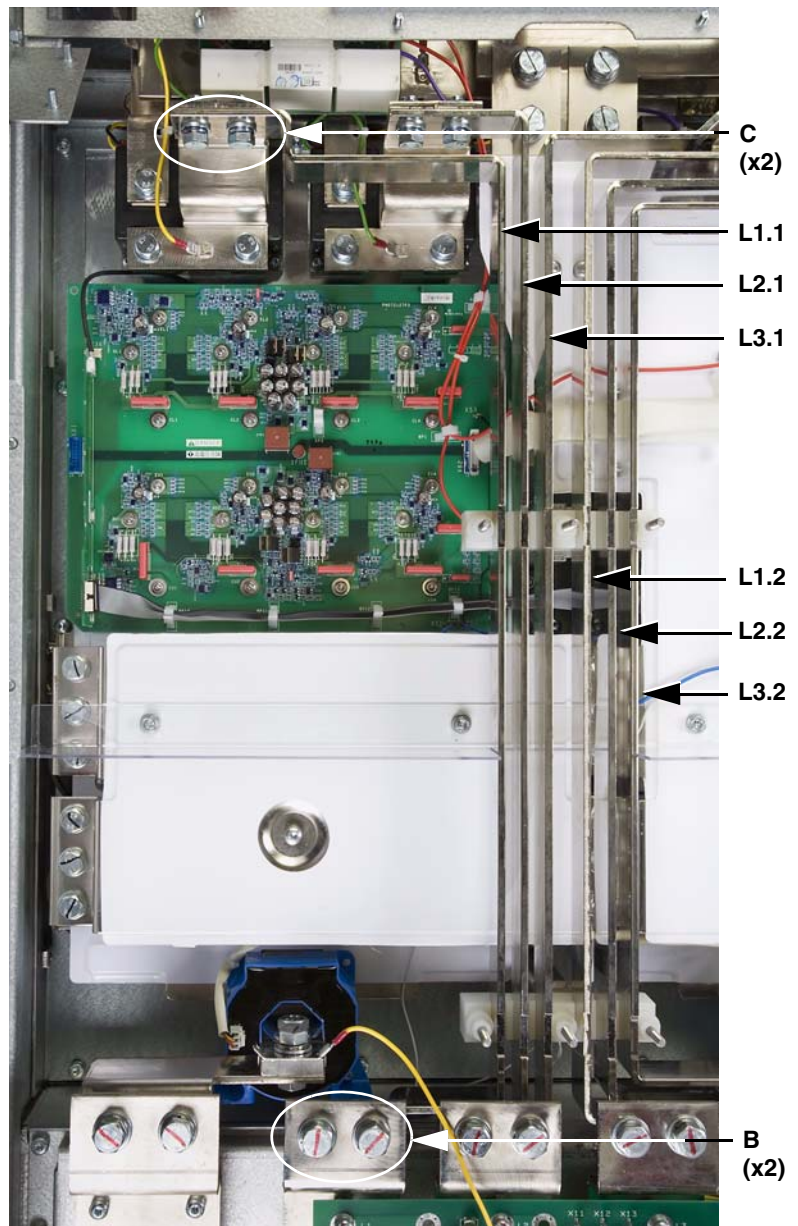
### Remove the Input Bus Bars

**NOTE:** L1.1, L2.1, and L3.1 are associated with input rectifier 1. L1.2, L2.2, and L3.2 are associated with input rectifier 2.

13. Remove the L1.1 input bus bar as follows.

- Using an 18 mm socket wrench, remove two bolts and washers (**B**, Figure 58) securing the bottom of the L1.1 input bus bar to the R/L1.1 bus bar.
- Using a 16 mm socket wrench, remove two bolts (**C**, Figure 58) securing the top of the L1.1 input bus bar to the L1.1 rectifier and remove the bus bar.

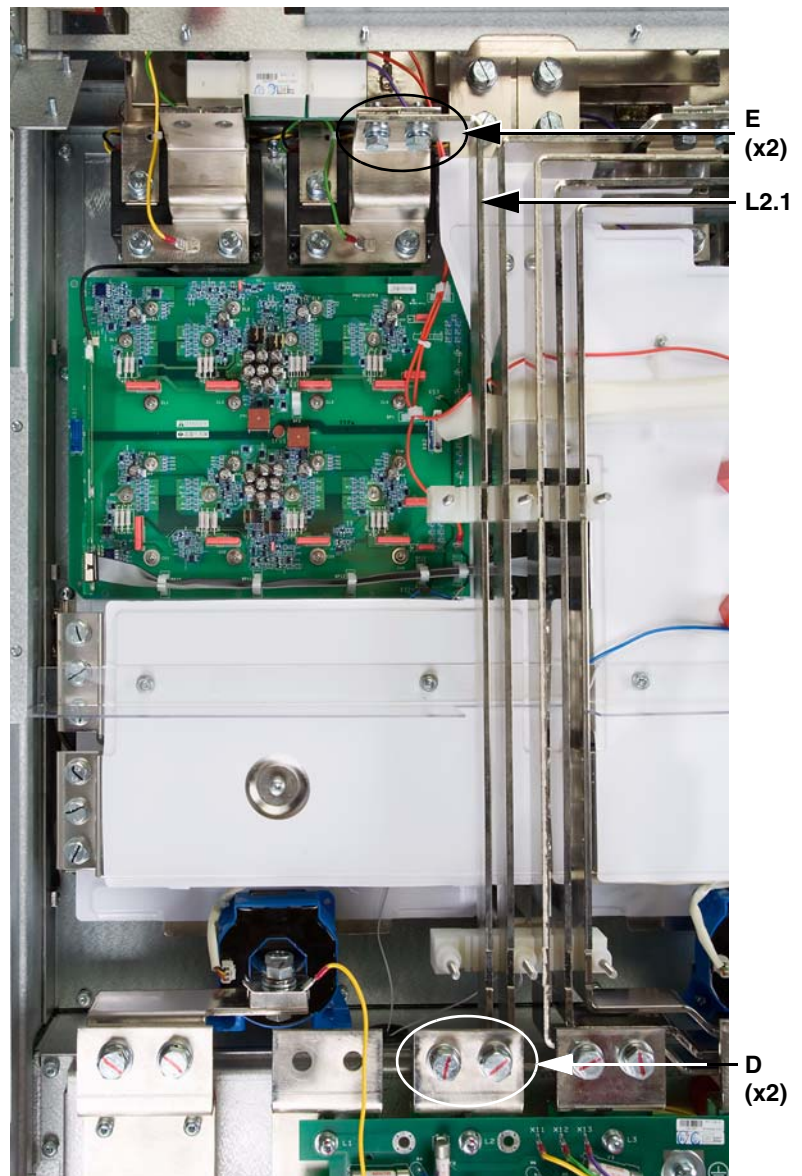
**Figure 58: L1.1 Input Bus Bar**



14. Remove the L2.1 input bus bar as follows.

- Using an 18 mm socket wrench, remove two bolts and washers (**D**, Figure 59) securing the bottom of the L2.1 input bus bar to the S/L2.1 bus bar.
- Using a 16 mm socket wrench, remove two bolts (**E**, Figure 59) securing the top of the L2.1 input bus bar to the L2.1 rectifier and remove the bus bar.

**Figure 59: L2.1 Input Bus Bar**





15. Remove the V/T2 bus bar as follows. See Figure 60.

- Using an 18 mm socket wrench, remove two bolts and washers (F, Figure 60) securing the output from the V-phase DC bus plate to the V/T2 bus bar.

**NOTE:** An output sensor plate (G, Figures 60 and 61) with a green lead is under the front bolt. Remove the sensor plate.

- Using a T-30 Torx driver, remove two screws (H, Figure 60) securing the insulator plate to the V/T2 bus bar and remove the plate.
- Using a T-30 Torx driver, remove two screws and washers (J, Figure 61) securing the V/T2 bus bar to the insulators on the bottom terminal bracket and remove the bus bar.

Figure 60: V/T2 Bus Bar

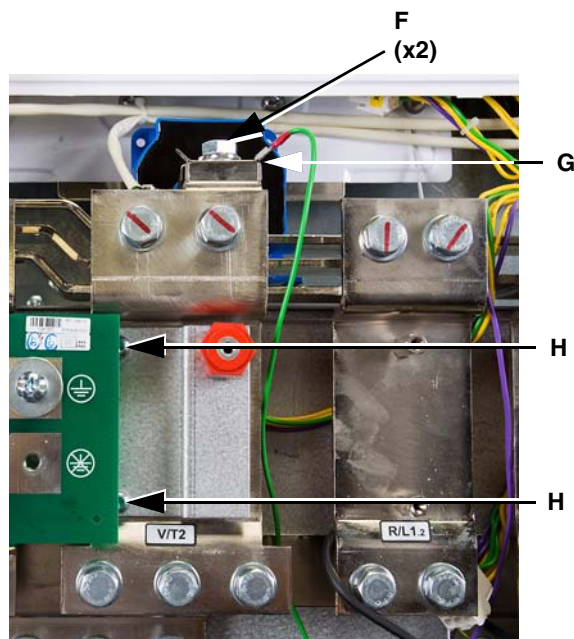
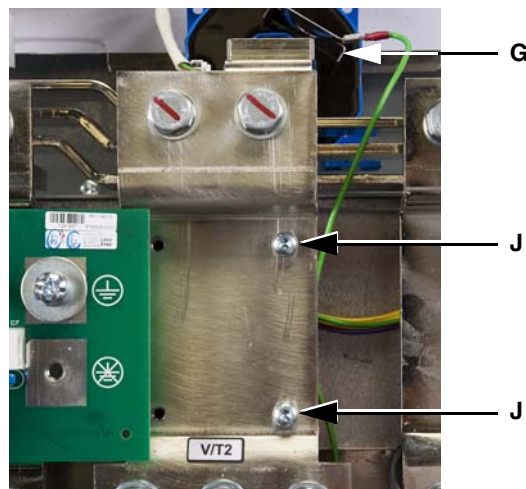


Figure 61: V/T2 Bus Bar

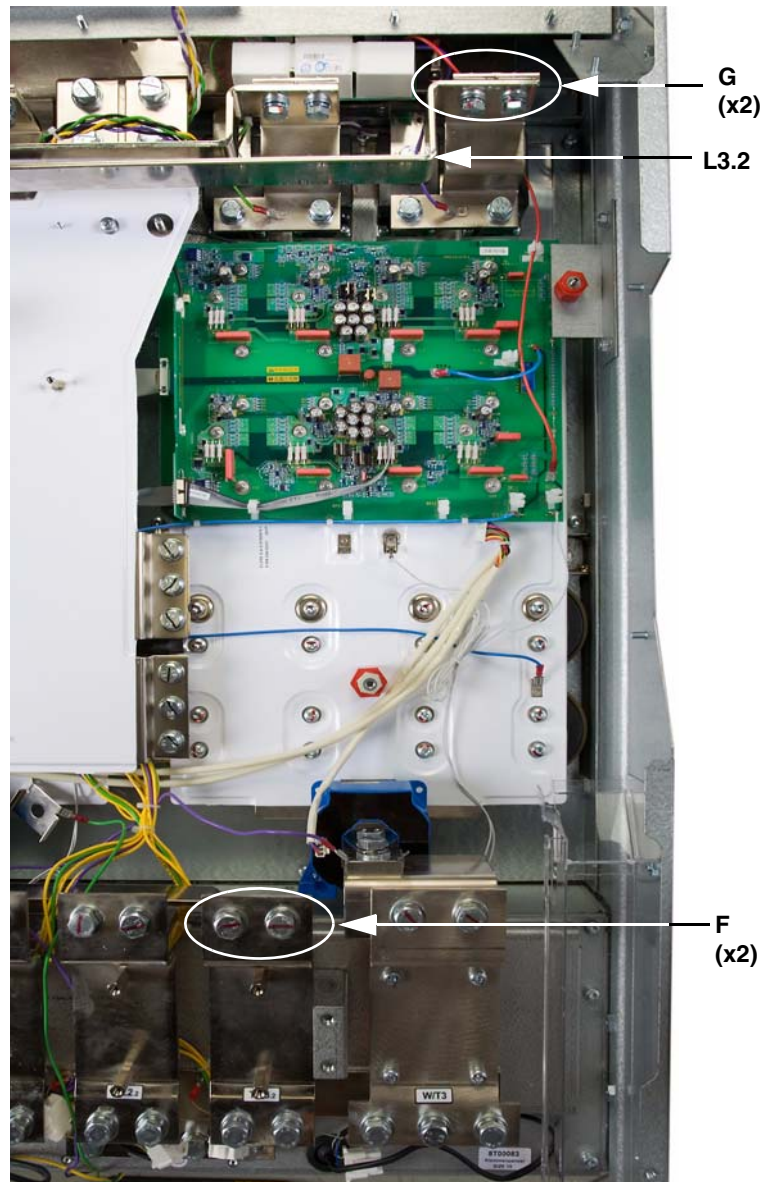




16. Remove the L3.2 input bus bar as follows.

- Using an 18 mm socket wrench, remove two bolts and washers (**F**, Figure 62) securing the bottom of the L3.2 input bus bar to the T/L3.2 bus bar.
- Using a 16 mm socket wrench, remove two bolts (**G**, Figure 62) securing the top of the L3.2 input bus bar to the L3.2 rectifier and remove the bus bar.

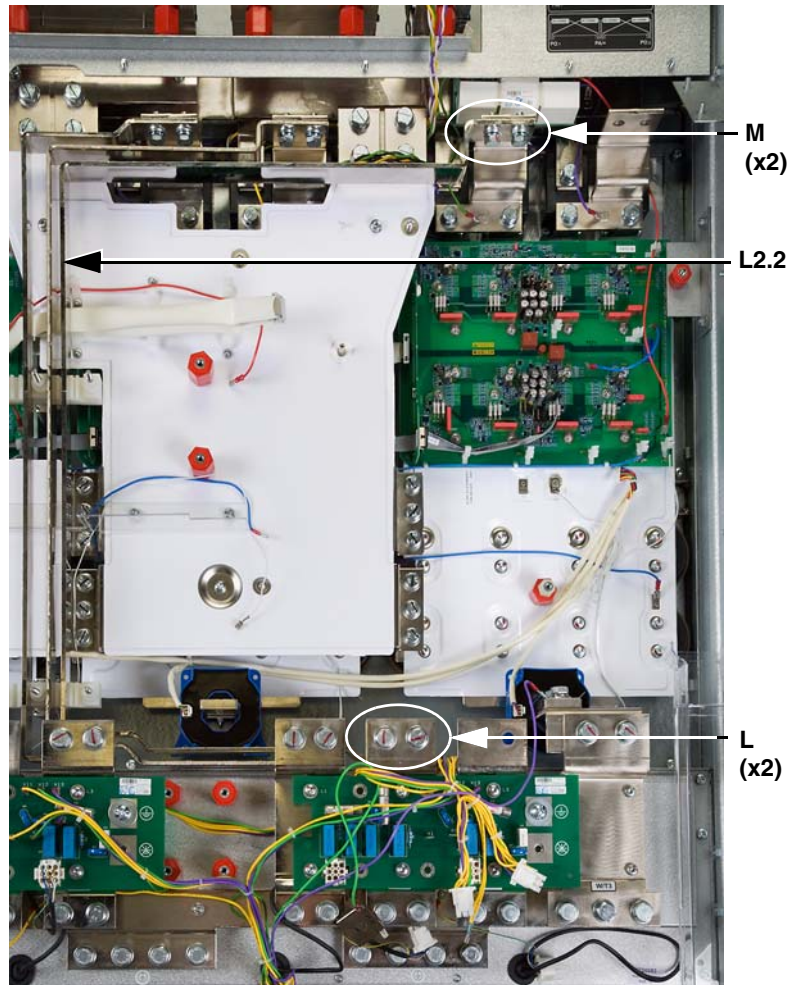
**Figure 62: L3.2 Input Bus Bar**



17. Remove the L2.2 input bus bar as follows. See Figure 63.

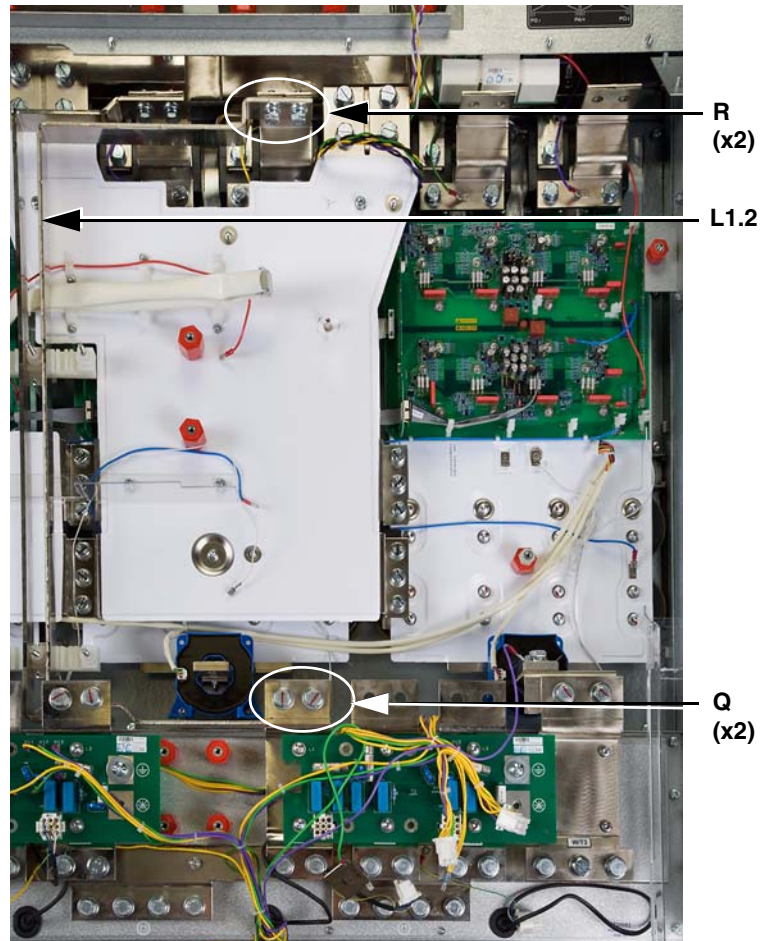
- Using an 18 mm socket wrench, remove two bolts and washers (**L**, Figure 63) securing the bottom of the L2.2 input bus bar to the S/L2.2 bus bar.
- Using a 16 mm socket wrench, remove two bolts (**M**, Figure 63) securing the top of the L2.2 input bus bar to the L2.2 rectifier and remove the bus bar.

**Figure 63: L2.2 Input Bus Bar**



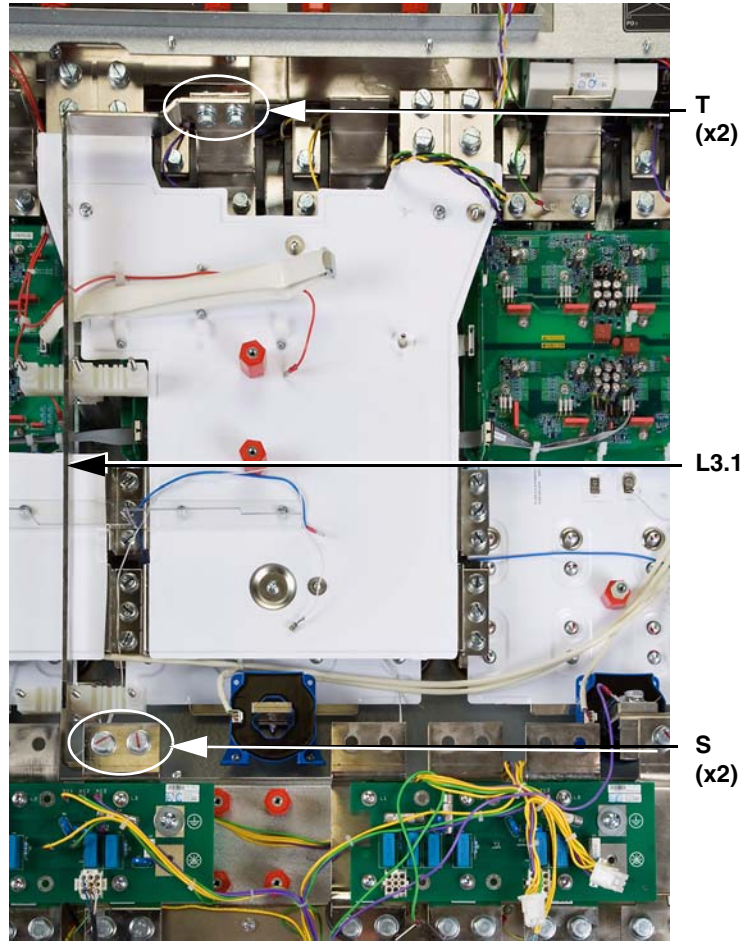
18. Remove the L1.2 input bus bar as follows. See Figure 64.
- Using an 18 mm socket wrench, remove two bolts and washers (**Q**, Figure 64) securing the bottom of the L1.2 input bus bar to the R/L1.2 bus bar.
  - Using a 16 mm socket wrench, remove two bolts (**R**, Figure 64) securing the top of the L1.2 input bus bar to the L1.2 rectifier and remove the bus bar.

**Figure 64: L1.2 Input Bus Bar**



19. Remove the L3.1 input bus bar as follows. See Figure 65.
- Using an 18 mm socket wrench, remove two bolts and washers (**S**, Figure 65) securing the bottom of the L3.1 input bus bar to the T/L3.1 bus bar.
  - Using a 16 mm socket wrench, remove two bolts (**T**, Figure 65) securing the top of the L3.1 input bus bar to the L3.1 rectifier and remove the bus bar.

**Figure 65: L3.1 Input Bus Bar**

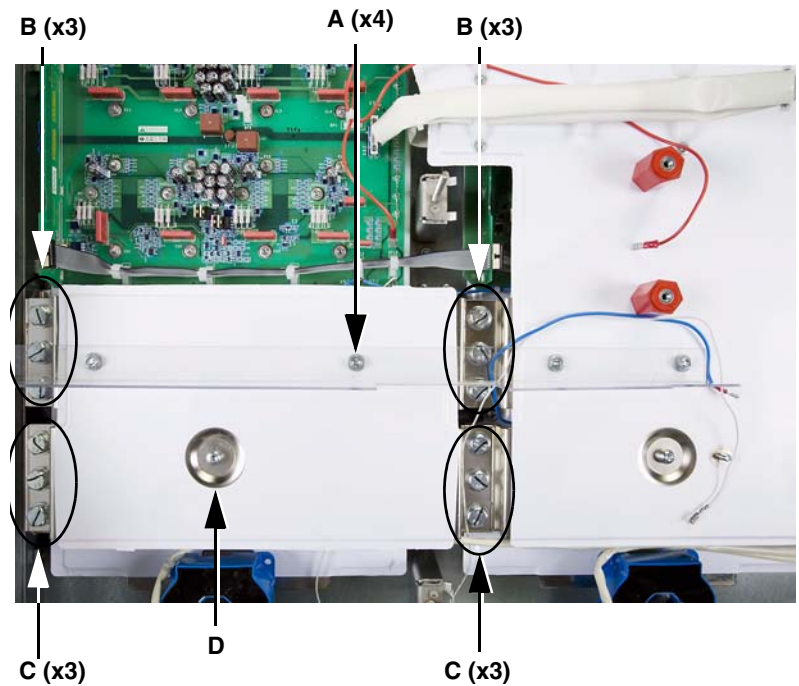




### Remove the Top Phase-U DC Bus Plate

20. Remove the top phase-U DC bus plate as follows. See Figure 66.
- Using a 10 mm socket wrench, remove four screws (A) securing the plastic shield to the bus plates and remove the shield.
  - Using a 16 mm socket wrench, remove twelve bolts securing the bus plate to the positive (+) bus at the top (B) and to the negative (-) bus (C) at the bottom.
  - Using a T-30 Torx driver, remove one screw (D) securing the bus plate to the standoff on the bottom DC bus plate.
  - Remove the bus plate from the drive.

Figure 66: Top Phase-U DC Bus Plate

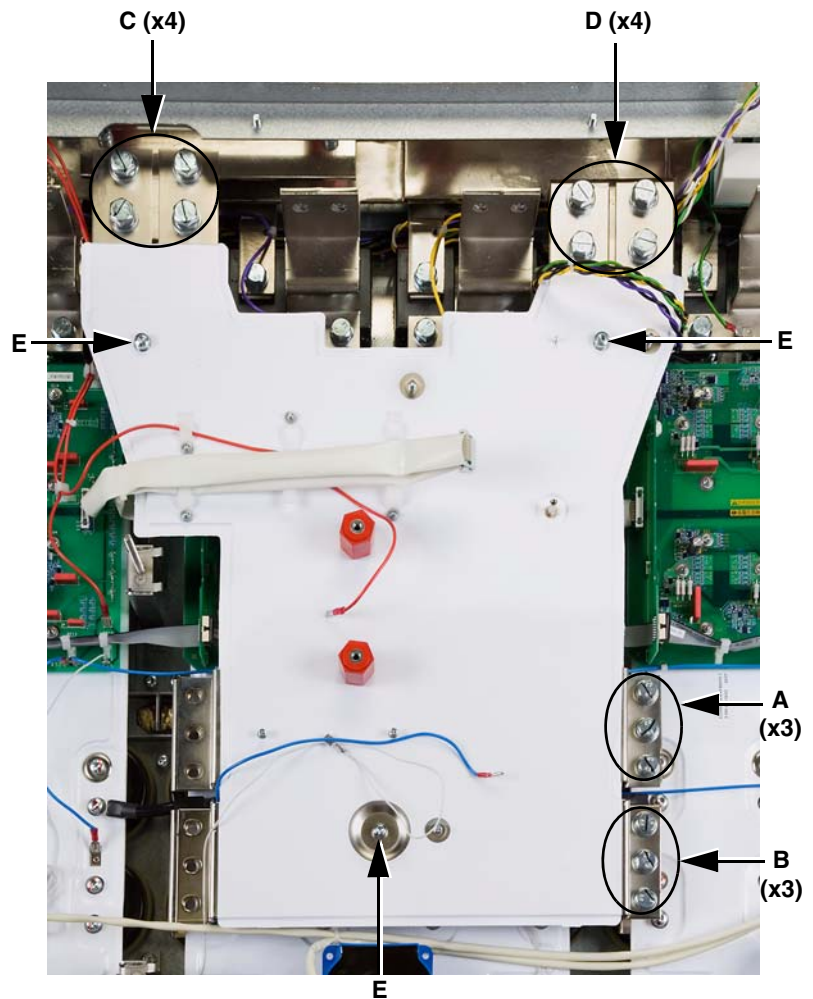




## Remove the Top DC Bus Plate

21. Remove the top DC bus plate as follows. See Figure 67.
  - Using a 16 mm socket wrench, remove six bolts securing the bus plate to the positive (+) (A) and negative (-) (B) phase-W DC bus.
  - Using an 18 mm socket wrench, remove four bolts securing the bus plate to the positive (+) rectifier bus (C).
  - Using an 18 mm socket wrench, remove four bolts securing the bus plate to the negative (-) rectifier bus (D).
  - Using a T-30 Torx driver, remove three screws (E) securing the bus plate to the red insulators on the heatsink and the phase-V bus plate.
  - Remove the bus plate.

Figure 67: Top DC Bus Plate



**NEXT STEP:** If you are replacing a gate driver board, skip to “Replacing the Gate Driver Boards VX5A1204” beginning on page 114.  
If you are replacing an SCR or Diode module, skip to “Replacing the SCR Modules and Diode Modules (VZ3TM1600M1671 and VZ3DM1600M1671)” beginning on page 125.

### Remove the Gate Driver Boards

**NOTE:** Perform the steps in this section if you are removing a gate driver board to access parts under the DC bus plate.

If you are replacing a gate driver board, skip to “Replacing the Gate Driver Boards VX5A1204” on page 114.

If you are removing equipment to make repairs in **phase U**, remove the left gate driver board.

If you are removing equipment to make repairs in **phase V**, remove the center gate driver board.

If you are removing equipment to make repairs in **phase W**, remove the right gate driver board.

22. Remove the gate driver board in the phase that you are repairing as follows.

- Remove the connections from the gate driver board in the phase you are replacing. See Table 18.
- Using a 7 mm socket wrench, remove 24 nuts securing the gate driver board to the power IGBT modules and the DC bus plate and remove the board from the drive. See Figure 69 on page 68.

**NEXT STEP:** If you are replacing a temperature sensor, skip to “Replacing the Temperature Sensors, VZ3G1104” beginning on page 118.

**Table 18: Gate Driver Board Wiring<sup>1</sup>**

Wire No. <sup>2</sup>	Terminal No.	Description	To:
<b>Gate Driver Board U (Left)</b>			
E144	X4	2-pin, black	Temperature sensor U
E138	X32	18-pin, gray	GDB <sup>3</sup> V, X31
E129	X51	1-pin, blue	UD0 (neutral) on DC bus plate
E127	X52	1-pin, blue	GDB V, X51
E126	X61	1-pin, red	SB <sup>4</sup> 1, X10
E139	X62	1-pin, white	Bleeder resistor 1
E100	X82	14-pin, white	GDB V, X81 and PB <sup>5</sup> , X8
<b>Gate Driver Board V (Center)</b>			
E128	X4	2-pin, black	Temperature sensor V
E138	X31	18-pin, gray	GDB <sup>3</sup> U, X32
E146	X32	18-pin, gray	GDB W, X31
E127	X51	1-pin, blue	GDB U, X52
E123	X52	1-pin, blue	GDB W, X51
E100	X81	14-pin, white	GDB U, X82 and PB <sup>5</sup> , X8
E102	X82	14-pin, white	GDB W, X81
<b>Gate Driver Board W (Right)</b>			
E145	X4	2-pin, black	Temperature sensor W
E146	X31	18-pin, gray	GDB <sup>3</sup> V, X32
E142	X32	18-pin, gray	PB <sup>5</sup> , X3
E123	X51	1-pin, blue	GDB V, X52
E102	X81	14-pin, white	GDB V, X82
E132	X53	1-pin, blue	Insulator near MCB <sup>6</sup>
E164	X62	1-pin, white	Bleeder resistor 3
E160	X61	1-pin, red	SB <sup>4</sup> 2, X10

<sup>1</sup> Terminals X4 and X32 are connected to a daughter board on the gate driver board assembly.  
<sup>2</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.  
<sup>3</sup> GDB: Gate driver board  
<sup>4</sup> SB: SCR snubber board  
<sup>5</sup> PB: Power board  
<sup>6</sup> MCB: Motor control board

Figure 68: Gate Driver Boards

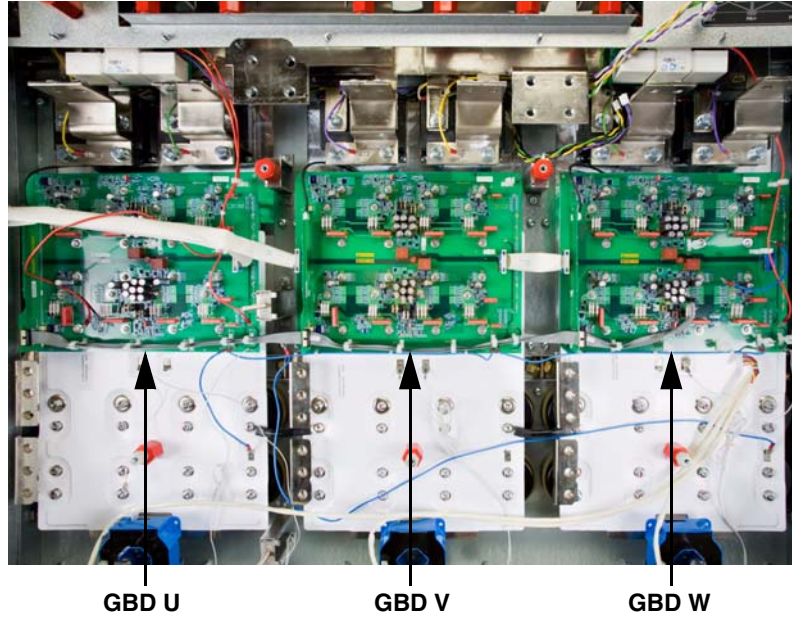
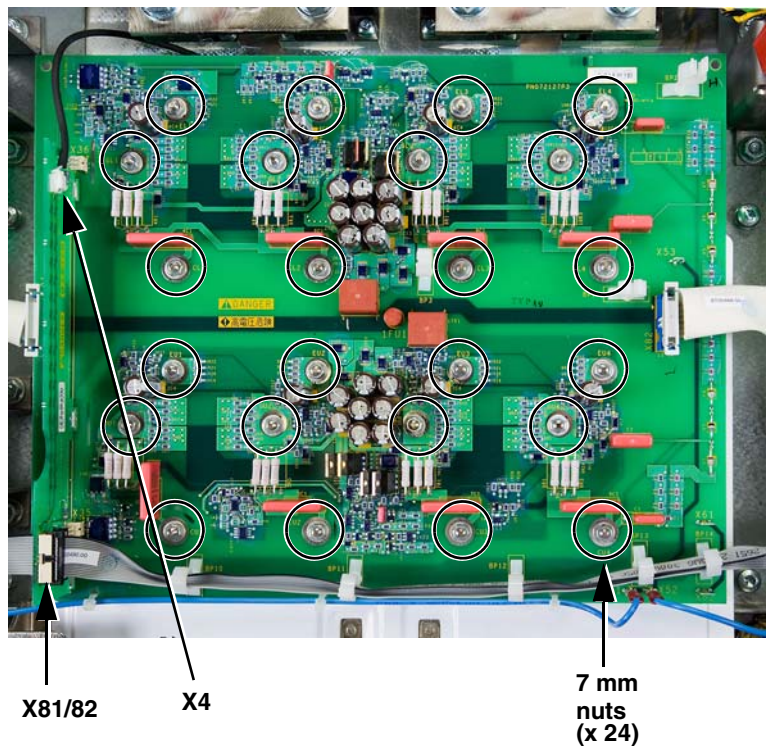


Figure 69: Gate Driver Board Detail, Phase V Shown



### Remove the Bottom DC Bus Plate

**NOTE:** If you are removing equipment to make repairs in **phase U**, remove the left DC bus plate.

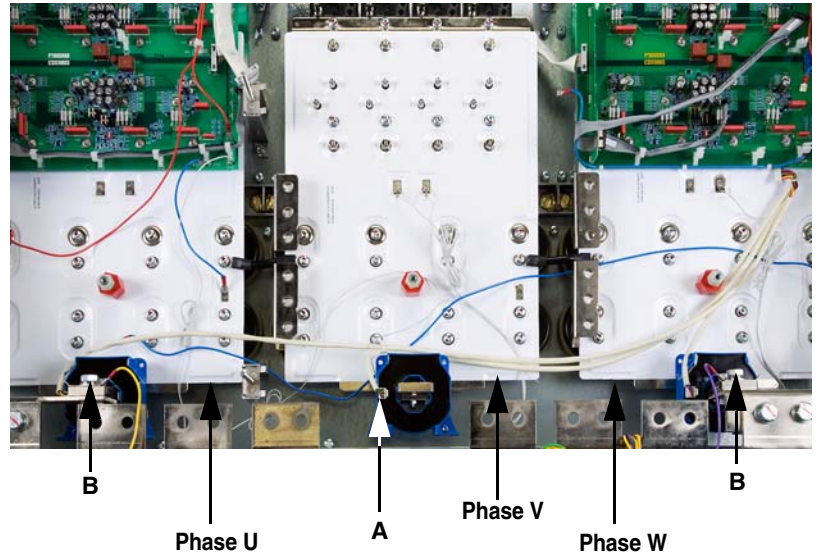
If you are removing equipment to make repairs in **phase V**, remove the center DC bus plate.

If you are removing equipment to make repairs in **phase W**, remove the right DC bus plate.

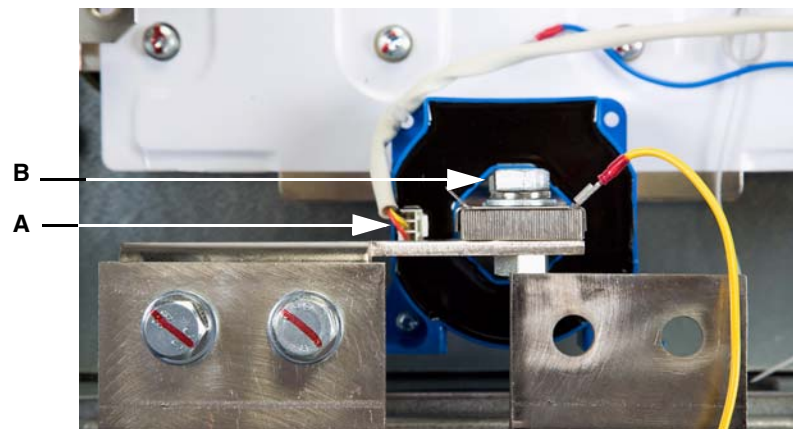
23. Remove the bottom DC bus plate as follows

- Remove the connector (**A**, Figure 71) from the motor current sensor in the phase.
- If you are removing the phase-U or W bus plate, using an 18 mm socket wrench, remove two bolts and washers (**B**, Figures 70 and 71) securing the DC bus plate output to the associated output bus bar. If you are removing the phase-V bus plate, this step is not necessary.

**Figure 70: DC Bus Plates, Phase V Shown**



**Figure 71: DC Bus Plate and Motor Current Sensor Detail**



- Using a T-30 Torx driver, remove twenty 14 mm screws securing the DC bus plate to terminal E on the IGBT modules (**C**, Figure 72 on page 70) and to the capacitors (**D**, Figure 72).

**NOTE:** Note the position of the jumpers (**E**, Figure 72) between the three bus plates.

- Using a T-30 Torx driver, remove four 20 mm screws (**F**, Figure 72) securing the DC bus plate to terminal E on the IGBT modules.

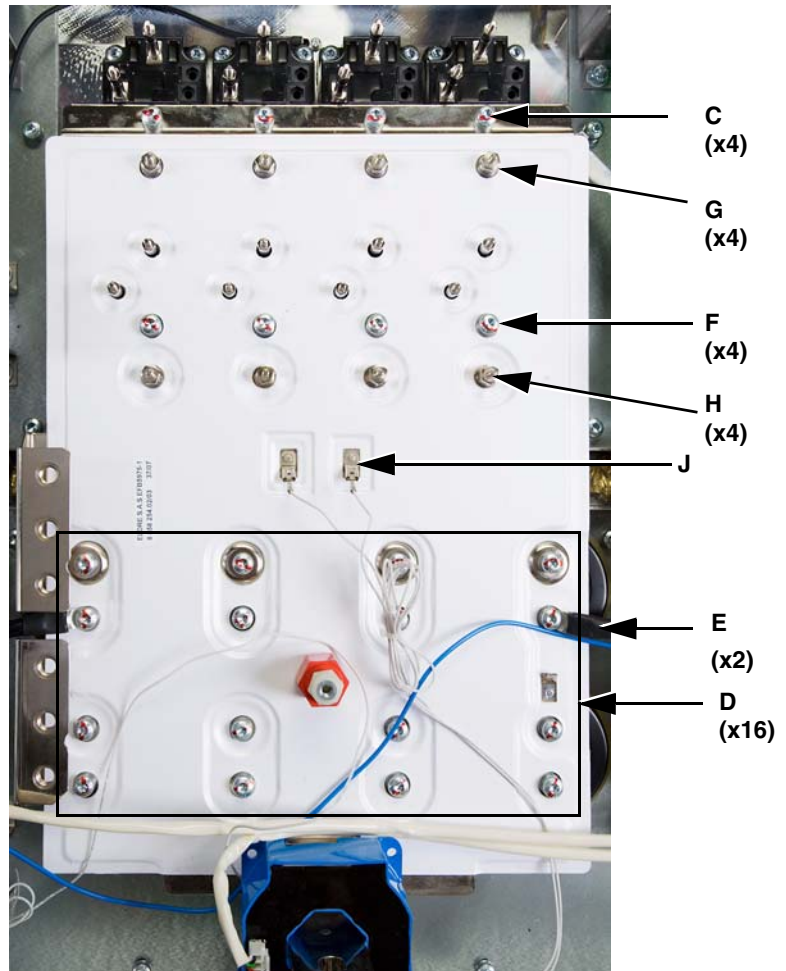


- Using a 10 mm socket wrench, remove four short (6 mm) standoffs (**G**, Figure 72) and four long (11 mm) standoffs (**H**, Figure 72).
- If you are removing the phase-V bus plate, remove two bleeder resistor connections, wires E161 and E162 (**J**, Figure 72). If you are removing the phase-W bus plate, remove one bleeder resistor connection, wire E163. The phase-U bus plate does not have a bleeder resistor connections.
- Remove the DC bus plate from the drive.

**NEXT STEP:** If you are replacing the power IGBT modules, skip to “Replacing the Power IGBT Modules VZ3IM1604M1271” beginning on page 120.

If you are replacing the capacitors, skip to “Replacing the Capacitors VY1ADC1112” beginning on page 123.

Figure 72: DC Bus Plate (Phase V Shown)





## Replacing the Power Board VX5A1HC5063

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

Before performing the steps in this procedure, perform Steps 1–4 of “Disassembly Steps for Accessing Level 2 Parts” beginning on page 44 to remove the following parts from the drive:

- Front cover
- EMC tray
- Power terminal shields
- Control module assembly

### Remove the Soft Charge Boards

**Table 19: Soft Charge Board Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
<b>Soft Charge Board 1 (Left Board)</b>			
E110	CN2A	9-pin, red	PB <sup>2</sup> X30 (9-pin)
E109	CNL3G	2-pin, violet/black	SCR <sup>3</sup> L3.1 Terms. 4 & 5
E108	CNL2G	2-pin, green/black	SCR L2.1 Terms. 4 & 5
E107	CNL1G	2-pin, yellow/black	SCR L1.1 Terms. 4 & 5
E111	CN7A	2-pin, black	PB X31
—	CNP	Not used	—
<b>Soft Charge Board 2 (Right Board)</b>			
E156	CN2A	9-pin, red	PB <sup>2</sup> X40 (9-pin)
E152	CNL3G	2-pin, violet/white	SCR <sup>3</sup> L3.2 Terms. 4 & 5
E153	CNL2G	2-pin, green/white	SCR L2.2 Terms. 4 & 5
E154	CNL1G	2-pin, yellow/white	SCR L1.2 Terms. 4 & 5
E155	CN7A	2-pin, black	PB <sup>2</sup> X41
—	CNP	Not used	—

<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

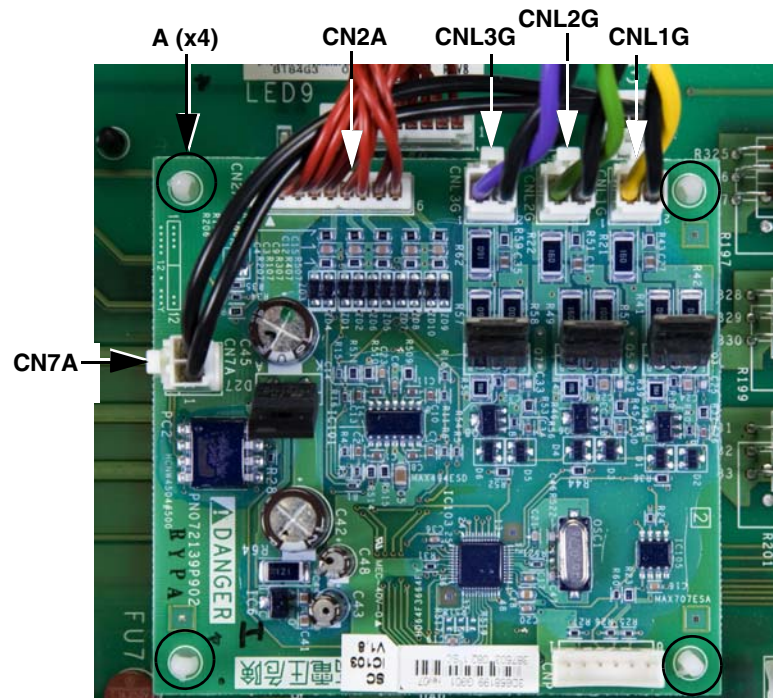
<sup>2</sup> PB: Power board

<sup>3</sup> SCR: Silicon controlled rectifier. L1.1, L2.1, and L3.1 are associated with input rectifier 1; L1.2, L2.2, and L3.2 are associated with input rectifier 2.

1. Using needle-nose pliers, carefully remove the following connections from soft charge boards 1 and 2. See Table 19 and Figure 73 for connector locations.

- At the top of the soft charge boards, from left to right remove the connectors from terminals CN2A, CNL3G, CNL2G, and CNL1G.
- At the left side of the boards, remove the connector from terminal CN7A.

**Figure 73: Soft Charge Board: Board 1 (Left) Shown**



- Remove both soft charge boards from the drive. Using needle-nose pliers, compress the four plastic mounting posts (A, Figure 73), one at a time, while lifting the soft charge board off the posts.

**Remove the Power Board Connections**

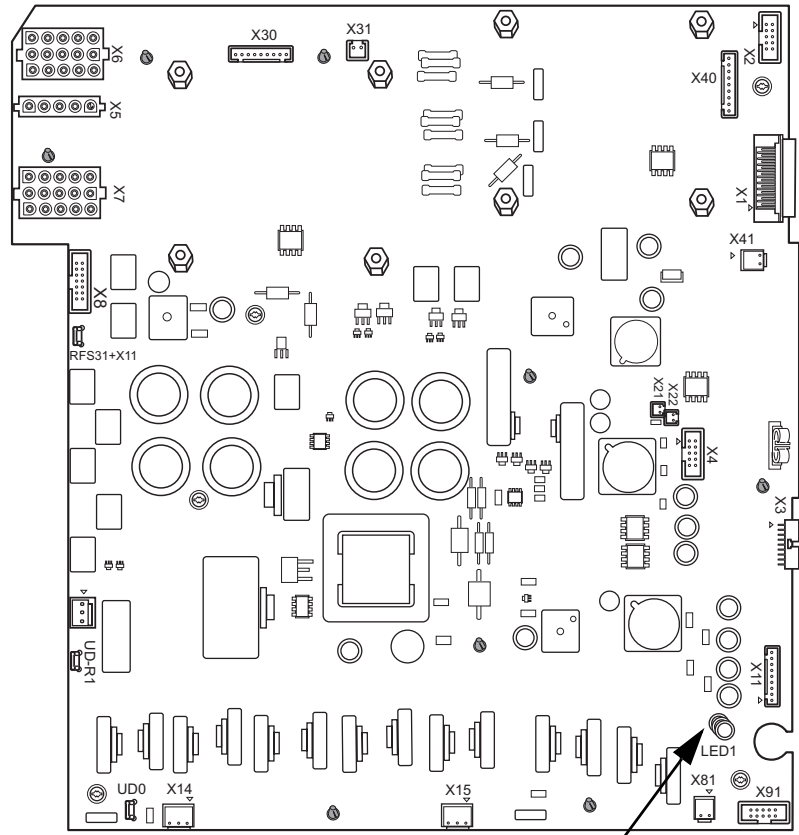
**Table 20: Power Board Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
E103	X11	9-pin, multi color	Motor current sensors
E105	X14	3-pin, yellow	FCB <sup>2</sup> X2
E136	UD0	1-pin, blue	Phase-W DC bus plate
E126	RFS 31+ X11	1-pin, red	SB <sup>3</sup> X11
E141	UD -R1	1-pin, white	Bleeder resistor 1
—	X2	10-pin, gray	MCB <sup>4</sup> X2
E142	X3	18-pin, gray	GDB <sup>5</sup> W X32
E112	X4	10-pin, gray	Control module
E150	X5	5-pin, yellow/green/violet	Output bus bars T1, T2, T3
—	X6	15-pin, yellow/green/violet	Retain plug and install in new board
E120	X7	15-pin, yellow/green/violet	FB <sup>6</sup> 1 & 2 X11, X12, X13
E100	X8	14-pin, white	GDB U X82
E106	X21	2-pin, red/black	Internal fan
E106	X22	2-pin, red/black	Internal fan
E110	X30	9-pin, red	SCB <sup>7</sup> 1 CN2A
E111	X31	2-pin, black	SCB1 CN7A
E148	X81	2-pin, red	BB <sup>8</sup> X8
E149	X91	10-pin, gray	BB X91
E147	X15	3-pin, yellow	FCB2 X2
E156	X40	9-pin, red	SCB2 CN2A
E155	X41	2-pin, black	SCB2 CN7A

**NOTE:** Take care not to damage the LED (see Figure 74) when removing, handling, or installing the power board.

- Using needle-nose pliers, carefully remove all connections from the power board **except** the connections at terminals X6, X30, X31, X40, and X41. See Table 20 and Figure 74 for the connection locations.

**Figure 74: Power Board Connections**



**FRAGILE**  
 (LED with sleeving)

<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

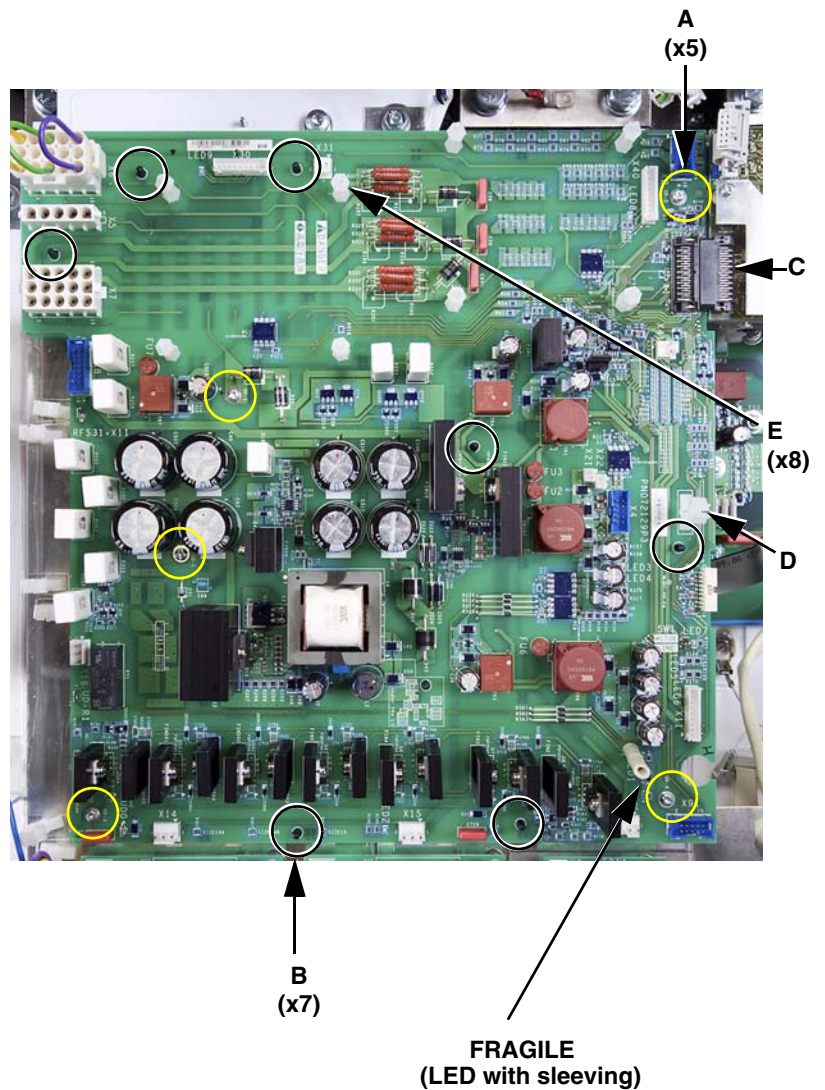
<sup>2</sup> FCB: Fan control board  
<sup>3</sup> SB: SCR Snubber board  
<sup>4</sup> MCB: Motor control board  
<sup>5</sup> GDB: Gate driver board  
<sup>6</sup> FB: Filter board  
<sup>7</sup> SCB: Soft charge board  
<sup>8</sup> BB: Brake board

### Remove the Power Board

**NOTE:** Take care not to damage the LED (see Figure 75) when removing, handling, or installing the power board.

3. Remove the power board as follows. See Figure 75.
  - Using a T-10 Torx driver, remove five screws (A) securing the power board to the assembly plate.
  - Using needle-nose pliers, gently compress the seven plastic mounting posts (B), one at a time, while lifting the power board off the posts. Carefully disconnect the power board from the motor control board (C) as you remove the power board.

**Figure 75: Power Board**



## Install the New Power Board

4. Transfer the jumper and cables from terminals X6, X30, X31, X40, and X41 of the old power board to the corresponding terminals on the new board. See Figure 74 on page 72 for terminal locations.
5. Transfer the plastic cable clamp (**D**, Figure 75) from the old power board onto the new one as follows.
  - Pinch the clamp on the bottom side of the board and push it up through the mounting hole.
  - Snap the cable clamp into the mounting holes on the new board.
6. Transfer the eight soft charge board mounting posts (**E**, Figure 75 on page 73) from the old power board onto the new one as follows:
  - Using a 7 mm socket wrench, remove the plastic nuts securing the soft charge board mounting posts to the power board. The nuts are on the back of the board.
  - Push the posts into the corresponding mounting holes from the front of the new power board and secure them at the back with the 7 mm nuts. Tighten the nuts to 0.4–0.6 N•m (3.5–5.3 lb-in).
7. Gently push the new power board down over the seven plastic mounting posts (**B**, Figure 75 on page 73) until it is securely seated. Carefully connect the power board to the motor control board (**C**) as you push it into place.
8. Using a T-10 Torx driver, secure the power board to the assembly plate with five screws (**A**, Figure 75 on page 73). Tighten the screws to 0.5–0.7 N•m (4.4–6.2 lb-in).
9. Replace the power board wiring. See Table 20 and Figure 74 on page 72 for the connection locations.



**Replace the Soft Charge Board**

**Table 21: Soft Charge Board Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
<b>Soft Charge Board 1 (Left Board)</b>			
E110	CN2A	9-pin, red	PB <sup>2</sup> X30 (9-pin)
E109	CNL3G	2-pin, violet/black	SCR <sup>3</sup> L3.1 Terms. 4 & 5
E108	CNL2G	2-pin, green/black	SCR L2.1 Terms. 4 & 5
E107	CNL1G	2-pin, yellow/black	SCR L1.1 Terms. 4 & 5
E111	CN7A	2-pin, black	PB X31
—	CNP	Not used	—
<b>Soft Charge Board 2 (Right Board)</b>			
E156	CN2A	9-pin, red	PB <sup>2</sup> X40 (9-pin)
E152	CNL3G	2-pin, violet/white	SCR <sup>3</sup> L3.2 Terms. 4 & 5
E153	CNL2G	2-pin, green/white	SCR L2.2 Terms. 4 & 5
E154	CNL1G	2-pin, yellow/white	SCR L1.2 Terms. 4 & 5
E155	CN7A	2-pin, black	PB <sup>2</sup> X41
—	CNP	Not used	—

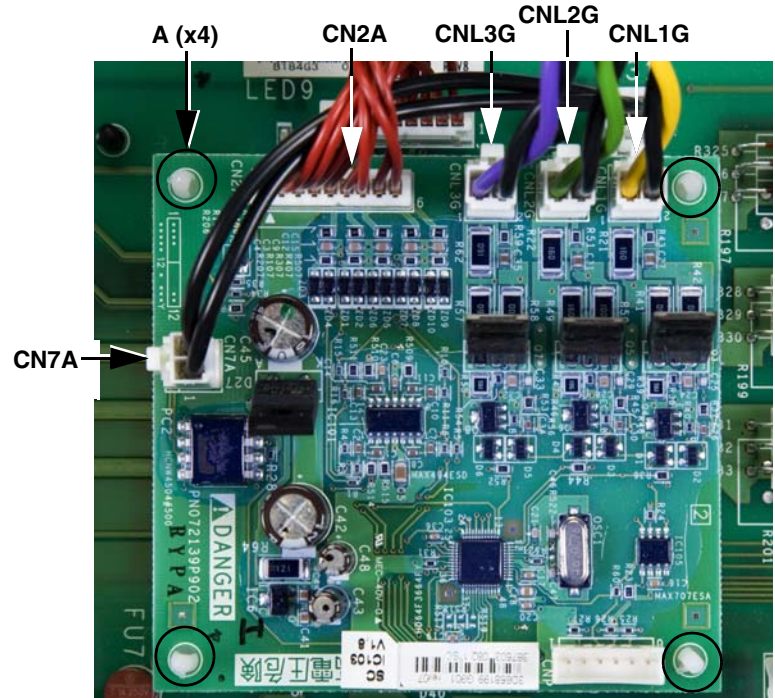
<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.  
<sup>2</sup> PB: Power board  
<sup>3</sup> SCR: Silicon controlled rectifier. L1.1, L2.1, and L3.1 are associated with input rectifier 1; L1.2, L2.2, and L3.2 are associated with input rectifier 2.

**Reassemble the Drive**

10. Replace soft charge boards 1 and 2 as follows.

- Press the soft charge board down over the four mounting posts (A, Figure 76) until it is securely seated.
- Replace the five connections to the board. See Table 21 and Figure 76 for connector locations.

**Figure 76: Soft Charge Board: Board 1 (Left) Shown**



If you are only replacing the power board, perform Steps 21–24 of “Reassembly Steps for Level 2 Parts” beginning on page 141 to replace the following parts.

- Control module assembly
- Power terminal shields
- EMC tray
- Front cover



## Replacing the Brake Board VZ3F1113

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

**Table 22: Brake Board Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
E149	X91	10-pin, gray	PB <sup>2</sup> X91
E148	X8	2-pin, red	PB X81
E151	X3	9-pin, violet/green/yellow	FCB <sup>3</sup> 2 X3
E114	X33	9-pin, violet/green/yellow	Fan harness to FB <sup>4</sup> & FCB 1
—	X2	9-pin, yellow jumper	Retain and install in new board
—	X1	15-pin	Not used

<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

<sup>2</sup> PB: Power board

<sup>3</sup> FCB: Fan control board

<sup>4</sup> FB: Filter board

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

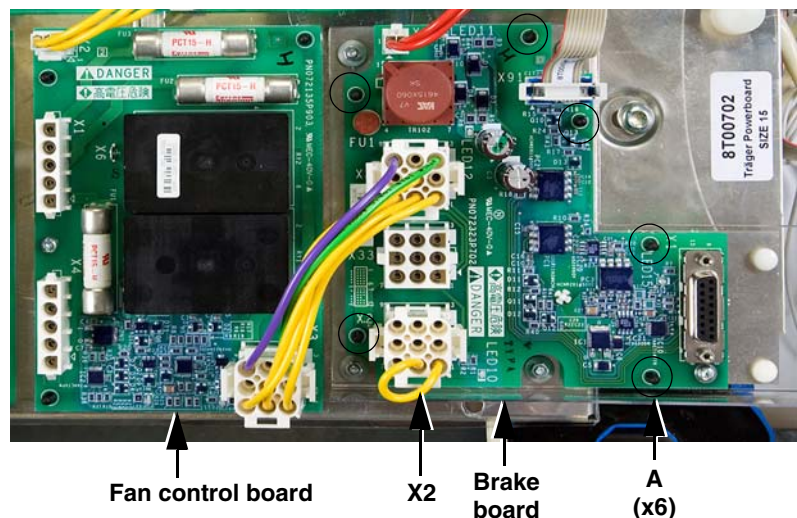
**Failure to follow these instructions will result in death or serious injury.**

Before performing the steps in this procedure, perform Steps 1–4 of “Disassembly Steps for Accessing Level 2 Parts” beginning on page 44 to remove the following parts from the drive:

- Front cover
- EMC tray
- Power terminal shields
- Control module assembly

1. Using needle-nose pliers, carefully remove all connections from the brake board. See Table 22 and Figure 77 for connector locations.
2. Using needle-nose pliers, gently compress the six plastic mounting posts (**A**), one at a time, while lifting the brake board off the posts.
3. Transfer the jumper at terminal X2 from the old brake board to the new one.
4. Gently push the new brake board down over the six plastic mounting posts (**A**) until it is securely seated.
5. Replace the brake board wiring. See Table 22 and Figure 77 for the connection locations.

**Figure 77: Brake Board**



### Reassemble the Drive

If you are only replacing the brake board, perform Steps 21–24 of “Reassembly Steps for Level 2 Parts” beginning on page 141 to replace the following parts.

- Control module assembly
- Power terminal shields
- EMC tray
- Front cover

## Replacing the Power Board Assembly Shields

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

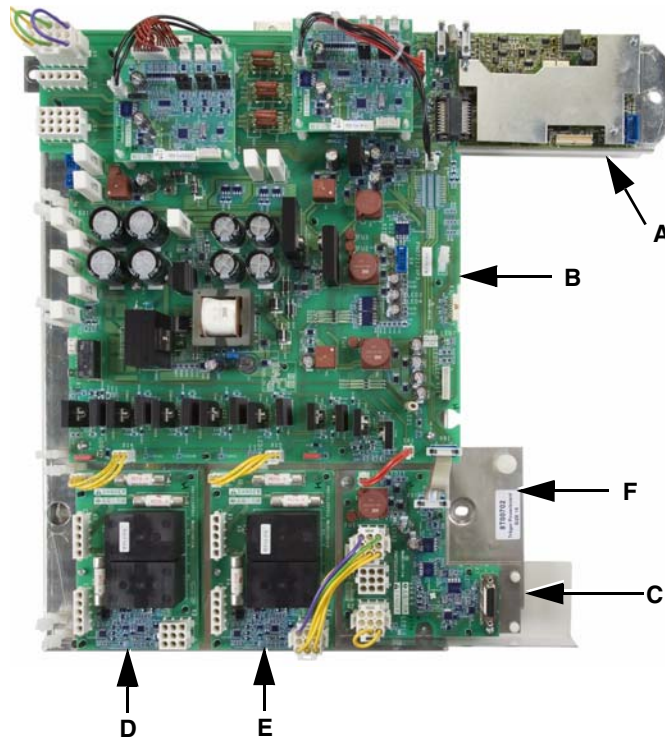
Before performing the steps in this procedure, perform Steps 1–8 of “Disassembly Steps for Accessing Level 2 Parts” beginning on page 44 to remove the following parts from the drive:

- |  |  |
|--|--|
| <input type="checkbox"/> Front cover             | <input type="checkbox"/> Soft charge board connections |
| <input type="checkbox"/> Power terminal shields  | <input type="checkbox"/> Power board connections       |
| <input type="checkbox"/> EMC tray                | <input type="checkbox"/> Fan control board connections |
| <input type="checkbox"/> Control module assembly | <input type="checkbox"/> Power board assembly          |

The power board assembly consists of the motor control board (**A**), the power board (**B**), the brake board assembly (**C**), fan control boards 1 (**D**) and 2 (**E**), and the power board assembly plate (**F**). See Figure 78.

There are three plastic shields in the power board assembly: one under the power board, one under the motor control board, and one under the brake board.

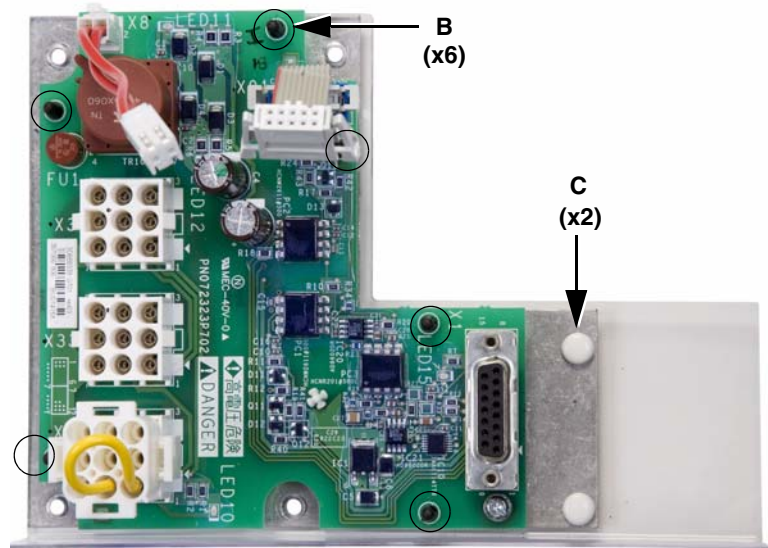
**Figure 78: Power Board Assembly**





- Using needle-nose pliers, gently compress the six plastic mounting posts (B), one at a time, while lifting the brake board off the posts. See Figure 80.

Figure 80: Brake Board



- Remove the two white fasteners (C, Figures 80 and 81) securing the plastic shield to the metal plate, and remove the shield from the plate.
- Replace the shield with a new piece from the plastic kit and secure it with the two fasteners (C, Figures 80 and 81).
- Gently push the brake board down over the plastic mounting posts on the shield assembly (B, Figure 80) until it is securely seated.

**NEXT STEP:** Set the brake board assembly aside and continue with Step 7 on page 80 to replace the other plastic shields.

**⚠ DANGER**

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Install the shield as shown in Figure 81.
- Before installing the shield, ensure that it has no tears or cracks. If the shield is damaged, install a new piece from the plastic kit.
- Do not install a damaged shield.

**Failure to follow these instructions will result in death or serious injury.**

Figure 81: Brake Board Plate

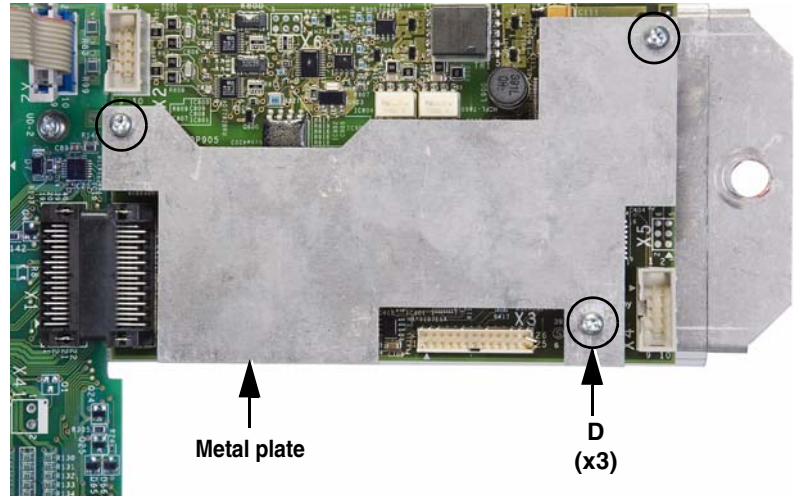




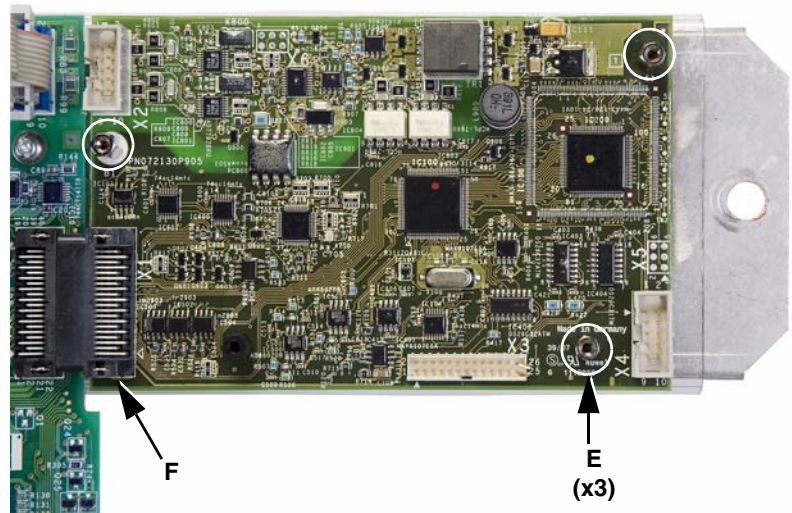
### Remove the Motor Control Board

7. Remove the motor control board as follows.
  - Using a T-10 Torx driver, remove three screws (**D**, Figure 82) securing the metal plate to the standoffs on the motor control board.
  - Using a 7/32 in. socket wrench, remove the three standoffs (**E**, Figure 83) securing the motor control board to the power board assembly plate, and remove the motor control board.
  - Carefully disconnect the motor control board from the power board (**F**, Figure 83) as you remove the motor control board.

**Figure 82: Motor Control Board Plate**



**Figure 83: Motor Control Board**

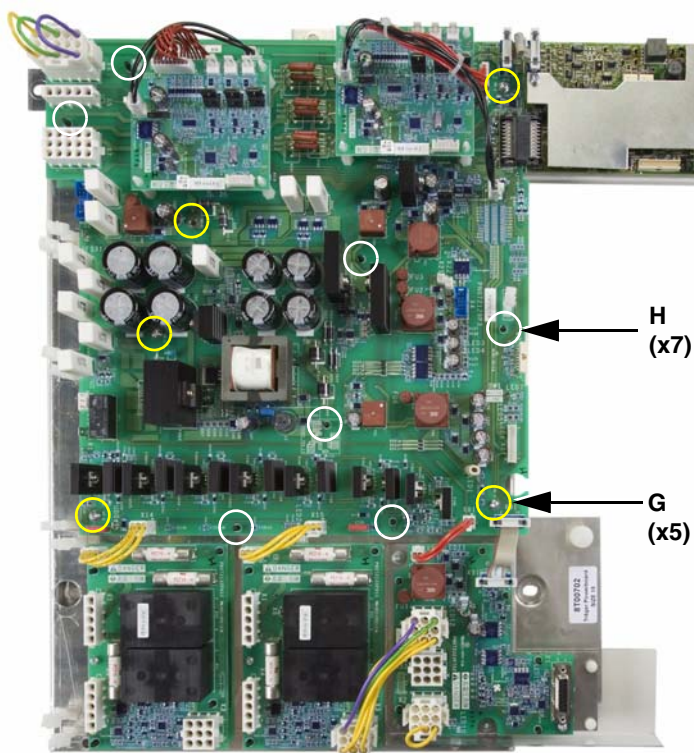




## Remove the Power Board

8. Remove the power board as follows. See Figure 84.
  - Using a T-10 Torx driver, remove five screws (G) securing the power board to the assembly plate.
  - Using needle-nose pliers, gently compress the seven plastic mounting posts (H), one at a time, while lifting the power board off the posts.

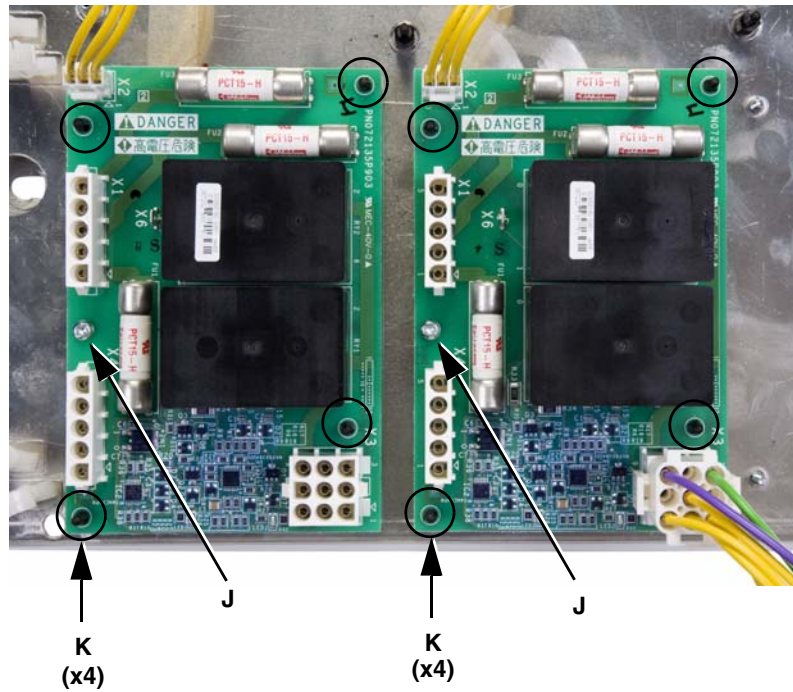
Figure 84: Power Board



### Remove Fan Control Boards 1 and 2

9. Remove fan control boards 1 and 2 from the assembly plate as follows. See Figure 85.
  - Using a T-10 Torx driver, remove 1 screw (**J**) from each board.
  - Using needle-nose pliers, compress the four plastic mounting posts (**K**), one at a time, while lifting the board off the posts. Remove the boards from the assembly plate.

**Figure 85: Fan Control Boards**



### Replace the Plastic Shields

## **⚠ DANGER**

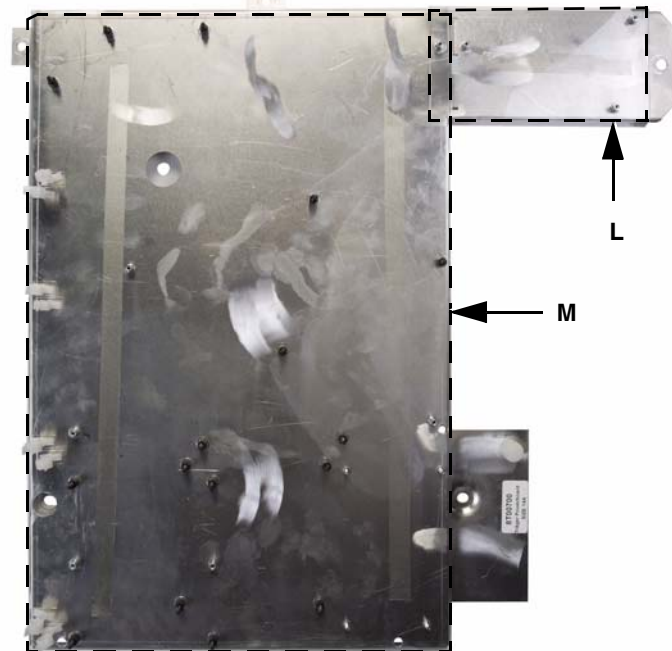
### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Install the shields as shown in Figure 86.
- Before installing the shield, ensure that it has no tears or cracks. If the shield is damaged, install a new piece from the plastic kit.
- Do not install a damaged shield.

**Failure to follow these instructions will result in death or serious injury.**

10. Remove the two plastic shields (L and M) from the power board assembly plate and replace them with new pieces from the plastic kit. See Figure 86.

Figure 86: Power Board Assembly Plate

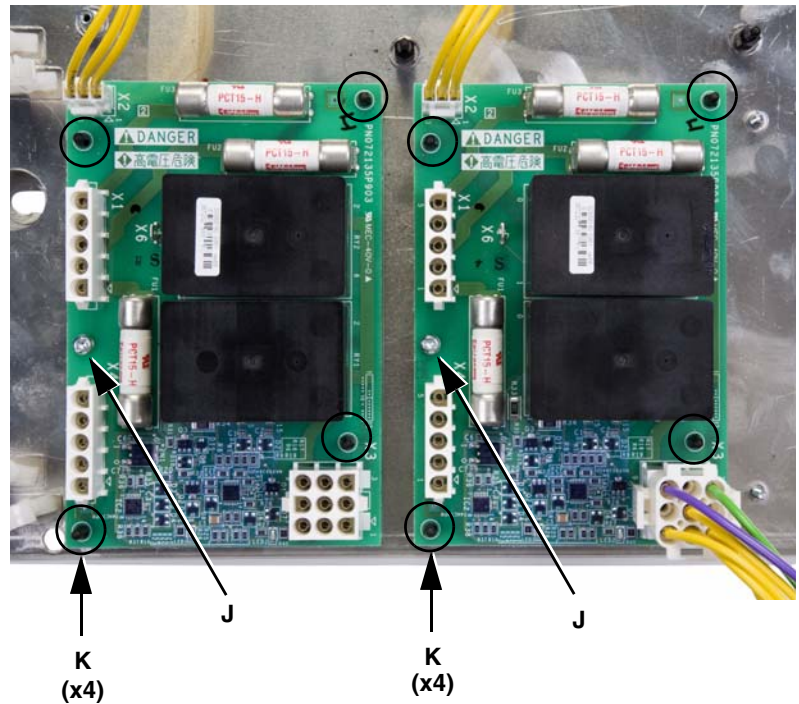


### Reinstall Fan Control Boards 1 and 2

11. Reinstall fan control boards 1 and 2 on the assembly plate as follows. See Figure 87.

- Gently push the fan control boards down over the four plastic mounting posts (**K**) until they are securely seated.
- Using a T-10 Torx driver, secure the fan control boards to the assembly plate with one screw each (**J**).
- Tighten the screws to 0.8 N•m (7.1 lb-in).

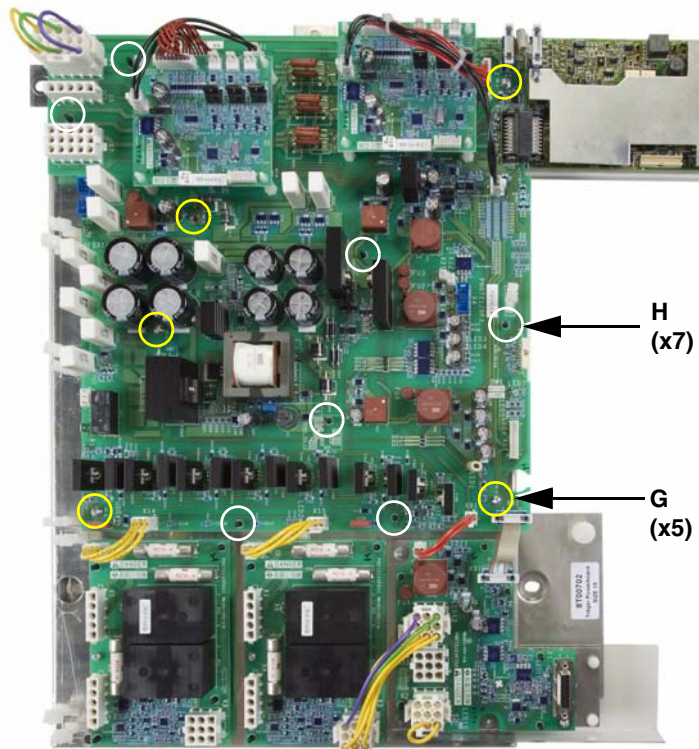
**Figure 87: Fan Control Boards**



## Reinstall the Power Board

12. Reinstall the power board as follows. See Figure 88.
  - Gently push the new power board down over the seven plastic mounting posts (**H**) until it is securely seated.
  - Using a T-10 Torx driver, secure the power board to the assembly plate with five screws (**G**). Tighten the screws to 0.5–0.7 N•m (4.4–6.2 lb-in).

**Figure 88: Power Board**





### Reinstall the Motor Control Board

13. Reinstall the motor control board as follows.

- Carefully connect the motor control board to the power board (F, Figure 89).
- Using a 7/32 in. socket wrench, secure the motor control board to the power board assembly plate with the three standoffs (E, Figure 89). Tighten the standoffs to 0.8 N•m (7.1 lb-in).
- Using a T-10 Torx driver, secure the metal plate to the standoffs on the motor control board with three screws (D). See Figure 90. Tighten the screws to 0.8 N•m (7.1 lb-in).

Figure 89: Motor Control Board

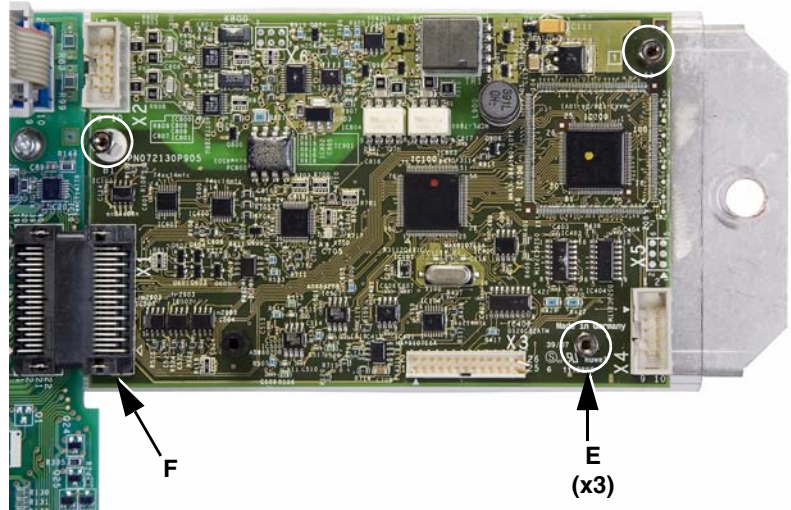
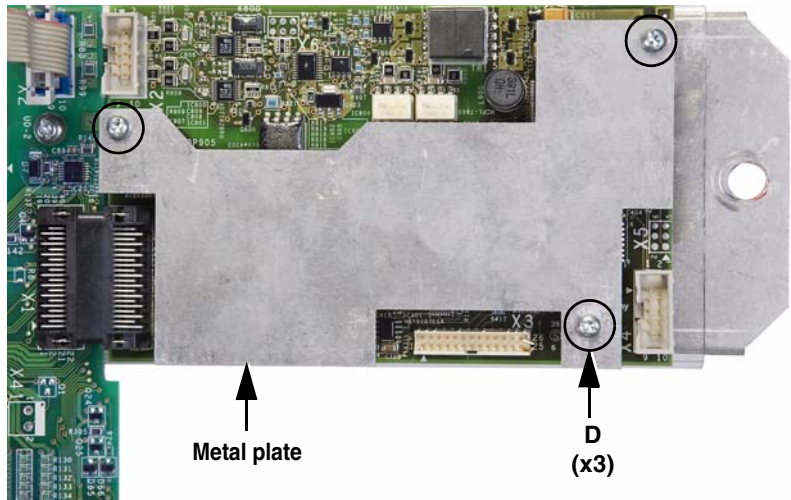


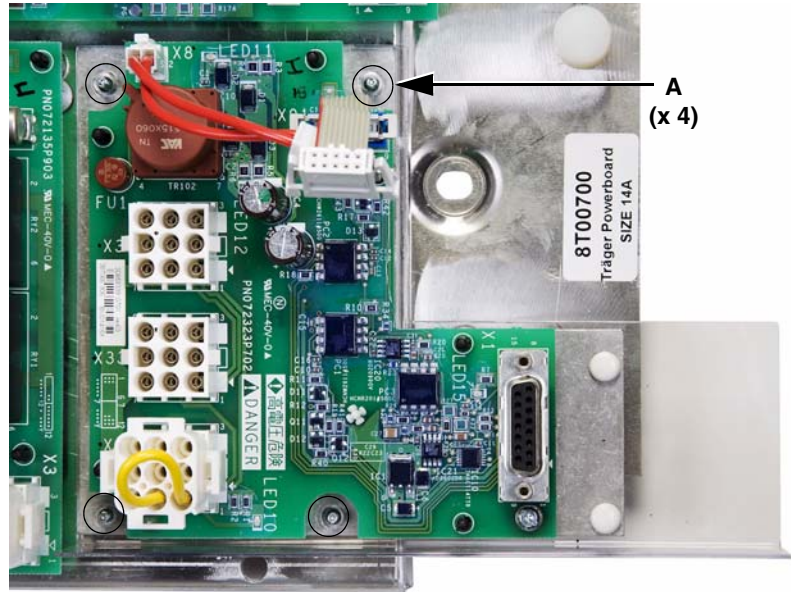
Figure 90: Motor Control Board Plate



**Reinstall the Brake Board Assembly**

14. Using a 7/32 in. socket wrench, secure the brake board assembly to the power board assembly plate with four nuts (A). See Figure 91. Tighten the nuts to 0.8 N•m (7.1 lb-in).

**Figure 91: Brake Board Assembly**



**Replace the Power Board Assembly Connections**

15. Replace the connections listed in Table 24.

**Table 24: Power Board Assembly Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
—	MCB <sup>2</sup> X2	10-pin, white	PB X2
E105	PB <sup>3</sup> X14	3-pin, yellow	FCB 1, X2
E147	PB X15	3-pin, yellow	FCB 2, X2
E148	PB X81	2-pin, red	BB <sup>4</sup> X8
E149	PB X91	10-pin, gray	BB X91
E151	FCB <sup>5</sup> X3	9-pin, green/yellow/violet with yellow/green ground wire	BB X3

<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

<sup>2</sup> MCB: Motor control board

<sup>3</sup> PB: Power board

<sup>4</sup> BB: Brake board

<sup>5</sup> FCB: Fan control board

**Reassemble the Drive**

If you are only replacing the power board assembly shields, perform Steps 17–24 of “Reassembly Steps for Level 2 Parts” beginning on page 141 to replace the following parts:

- Power board assembly
- Fan control board connections
- Power board connections
- Soft charge board connections
- Control module assembly
- EMC tray
- Power terminal shields
- Front cover

## Replacing the Motor Current Sensors VY1A1109

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

Before performing the steps in this procedure, perform Steps 1–11 of “Disassembly Steps for Accessing Level 2 Parts” beginning on page 44 to remove the following parts from the drive:

- |  |  |
|--|--|
| <input type="checkbox"/> Front cover                   | <input type="checkbox"/> Fan control board connections |
| <input type="checkbox"/> Power terminal shields        | <input type="checkbox"/> Power board assembly          |
| <input type="checkbox"/> EMC tray                      | <input type="checkbox"/> Middle crossbrace             |
| <input type="checkbox"/> Control module assembly       | <input type="checkbox"/> BU (+) bus bar                |
| <input type="checkbox"/> Soft charge board connections | <input type="checkbox"/> Fan bracket                   |
| <input type="checkbox"/> Power board connections       |  |

## Replacing the Phase-U Motor Current Sensor

Remove Filter Board 1 (Left Board)

1. Remove filter board 1 (the left board) as follows.
  - Using a T-30 Torx driver, remove six screws (**A**, Figure 92) securing the filter board to input bus bars R/L1.1, S/L2.1, and T/L3.1.

**NOTE:** Note whether the grounding screw (**B**) is installed in the grounded or non-grounded position for reinstallation. Figure 92 shows the screw in the grounded position.

- Using a size 3 Phillips driver, remove the grounding screw and washer (**B**, Figure 92) securing the filter board to the drive frame.
- Unplug fan connections X11 and X12 from the filter board.
- Gently press in on the tabs at the top and bottom of the fan connectors and push them down through the cutouts in the filter board. See Figure 93.
- Move the filter board under the terminals and out of the way.

Figure 92: Filter Board 1 (Left Board)

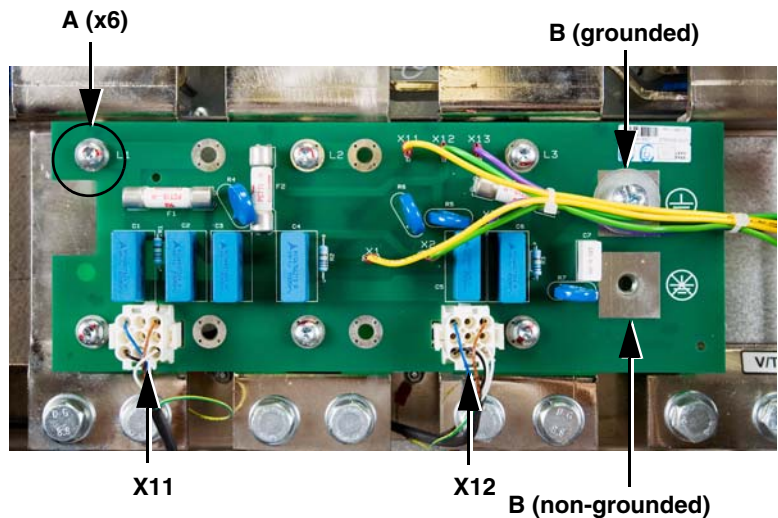
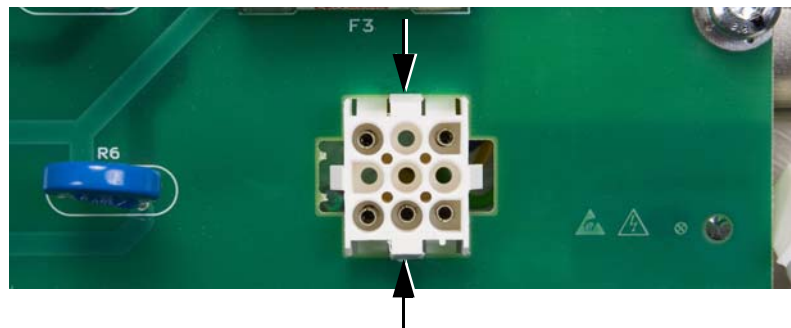


Figure 93: Fan Connector Detail



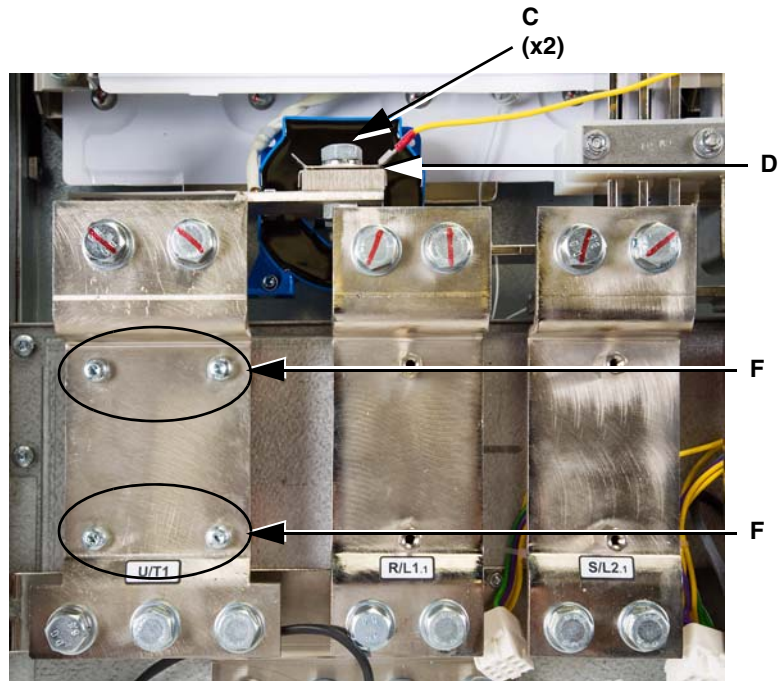
Remove the U/T1 Bus Bar

2. Remove the U/T1 bus bar as follows.
  - Using an 18 mm socket wrench, remove two bolts and washers (C, Figure 94) securing the output from the U-phase DC bus plate to the U/T1 bus bar.

**NOTE:** An output sensor plate (D, Figure 94) with a yellow lead is under the front bolt. Remove the sensor plate.

- Using a T-30 Torx driver, remove four screws and washers (F, Figure 94) securing the U/T1 bus bar to the insulators on the bottom terminal bracket and remove the U/T1 bus bar.

Figure 94: U/T1 Bus Bar

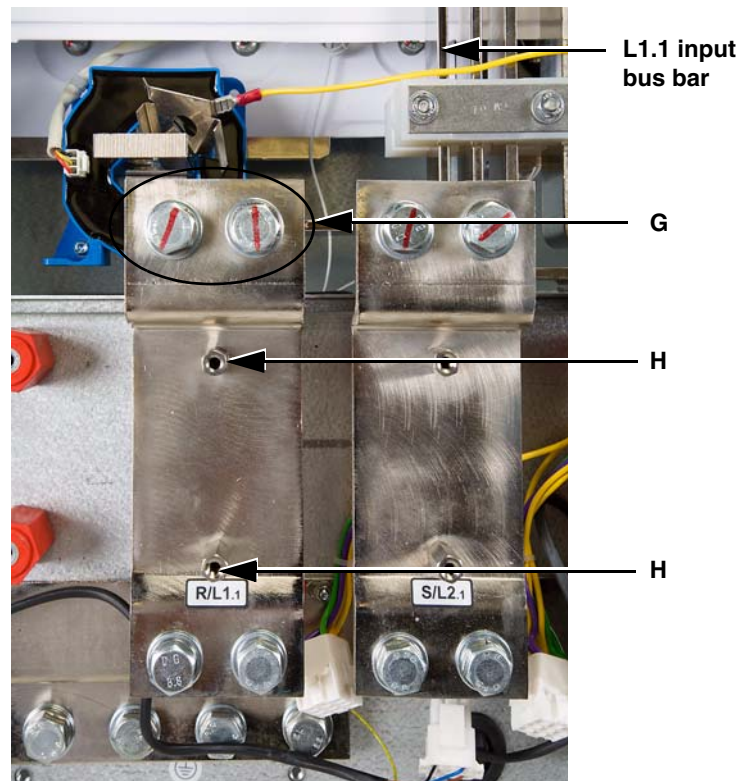




Remove the R/L1.1 Bus Bar

3. Remove the R/L1.1 bus bar as follows.
  - Using an 18 mm socket wrench, remove two bolts and washers (**G**, Figure 95) securing the bottom of the L1.1 input bus bar to the R/L1.1 bus bar.
  - Using a 10 mm socket wrench, remove two standoffs (**H**, Figure 95) securing the R/L1.1 bus bar to the red insulators on the bottom terminal bracket and remove the bus bar.

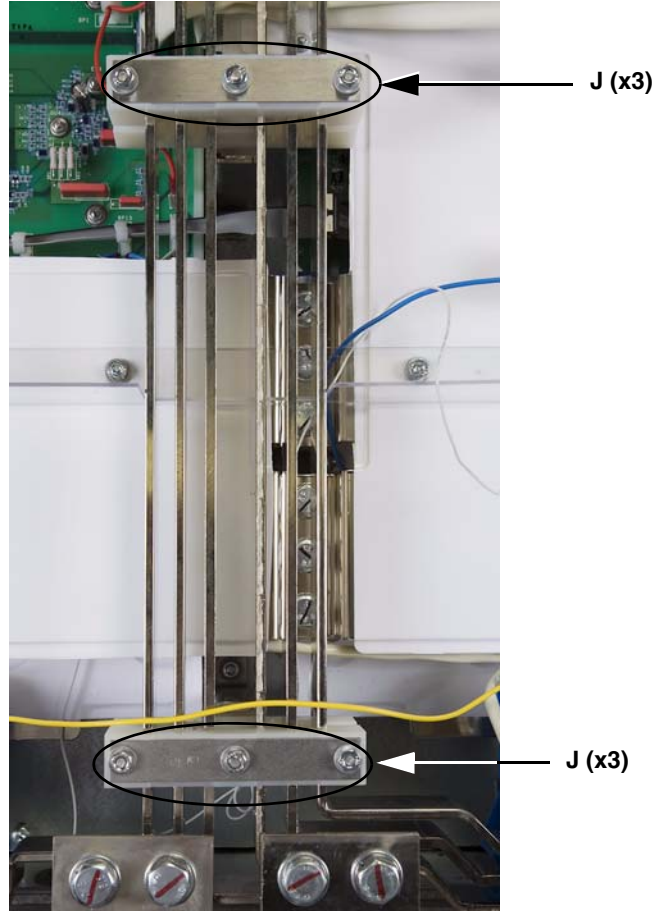
Figure 95: R/L1.1 Bus Bar



Remove the Input Bus Bar Brackets

- Using a 10 mm socket wrench, remove six nuts (**J**, Figure 96) securing the top half of the input bus bar brackets to the bottom half, and remove the top part of the brackets.

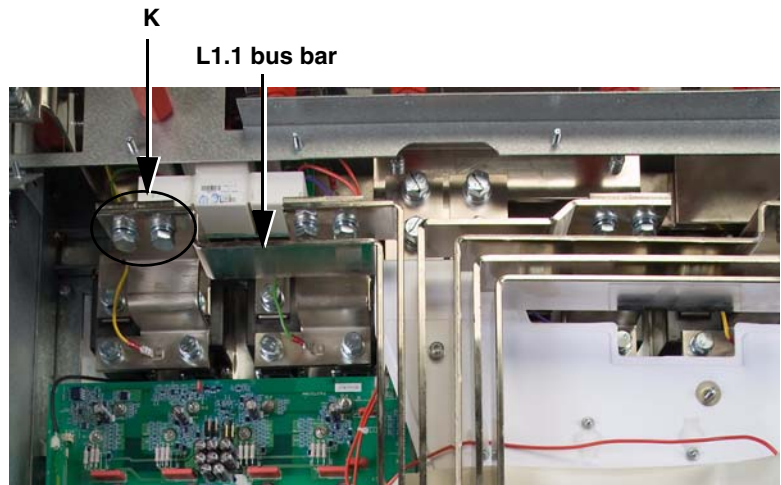
**Figure 96: Input Bus Bar Brackets (Top)**



Remove the L1.1 Input Bus Bar

- Using a 16 mm socket wrench, remove two bolts (**K**, Figure 97) securing the top of the L1.1 input bus bar to the L1.1 rectifier and remove the bus bar.

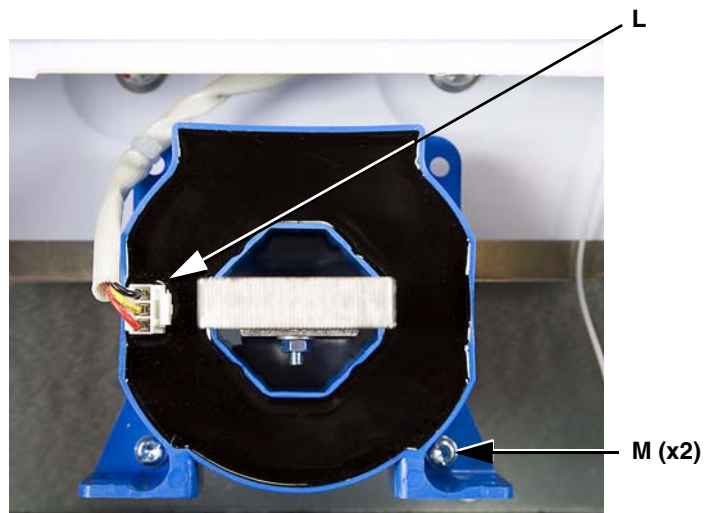
**Figure 97: L1.1 Input Bus Bar**



Replace the Phase-U Motor Current Sensor

- Replace the phase-U motor current sensor as follows.
  - Unplug the connection (**L**, Figure 98) from the phase-U motor current sensor.
  - Using a T-20 Torx driver, remove two screws (**M**, Figure 98) securing the motor current sensor to the brace on the phase-U bus plate.
  - Install the new motor current sensor on the brace and secure it with two T-20 screws. Tighten the screws to 1.2 N•m (10.6 lb-in).
  - Plug the connector (**L**, Figure 98) into the new motor current sensor.

**Figure 98: U-Phase Motor Current Sensor**



**NEXT STEP:** If you are only replacing the phase-U motor current sensor, skip to Step 13 on page 110 to replace the L1.1 input bus bar and other removed equipment.

If you are also replacing the phase-W motor current sensor, continue with “Replacing the Phase-W Motor Current Sensor” on page 94.

## Replacing the Phase-W Motor Current Sensor

Remove Filter Board 2 (Right Board)

1. Remove filter board 2 (the right board) as follows.

- Using a T-30 Torx driver, remove six screws (**A**, Figure 99) securing the filter board to input bus bars R/L1.2, S/L2.2, and T/L3.2.

**NOTE:** Note whether the grounding screw (**B**) is installed in the grounded or non-grounded position for reinstallation. Figure 99 shows the screw in the grounded position.

- Using a size 3 Phillips driver, remove the grounding screw and washer (**B**, Figure 99) securing the filter board to the drive frame.
- Unplug fan connections X13 and X14 (Figure 99) from the filter board.
- Gently press in on the tabs at the top and bottom of the fan connectors and push them down through the cutouts in the filter board. See Figure 100.
- Move the filter board under the terminals and out of the way.

Figure 99: Filter Board 2 (Right Board)

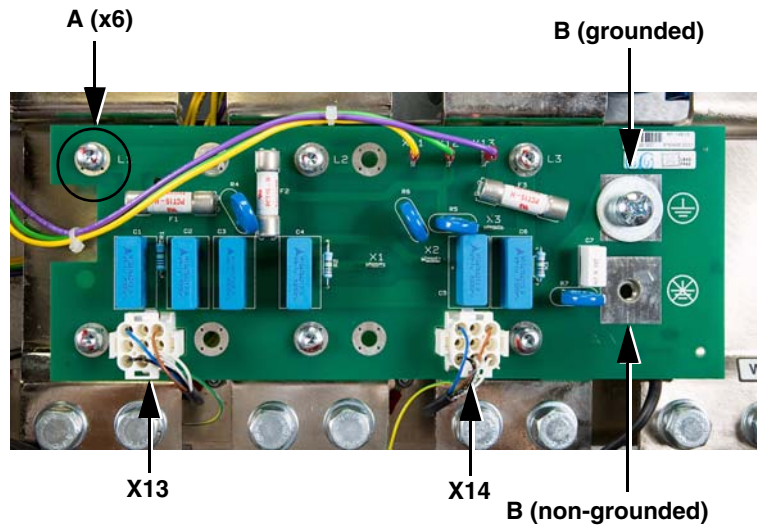
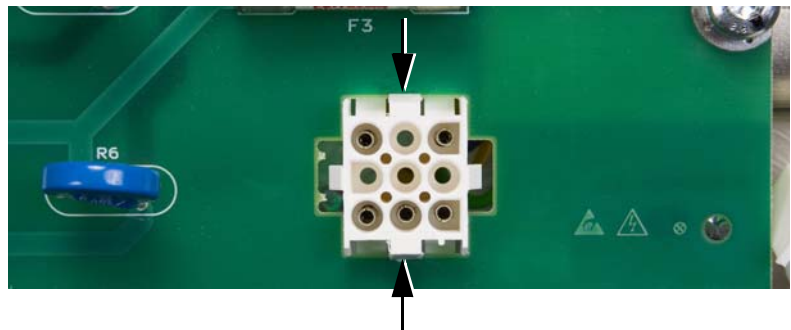


Figure 100: Fan Connector Detail



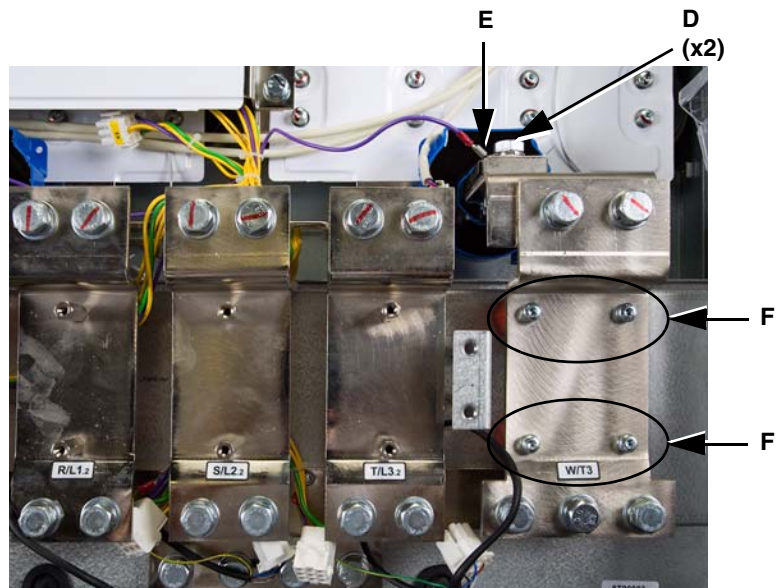
Remove the W/T3 Bus Bar

2. Remove the W/T3 bus bar as follows.
  - Using an 18 mm socket wrench, remove two bolts and washers (D, Figure 101) securing the output from the phase-W DC bus plate to the W/T3 bus bar.

**NOTE:** An output sensor plate (E, Figure 101) with a violet lead is under the front bolt. Remove the sensor plate.

- Using a T-30 Torx driver, remove four screws and washers (F, Figure 101) securing the W/T3 bus bar to the insulators on the bottom terminal bracket and remove the bus bar.

Figure 101: W/T3 Bus Bar

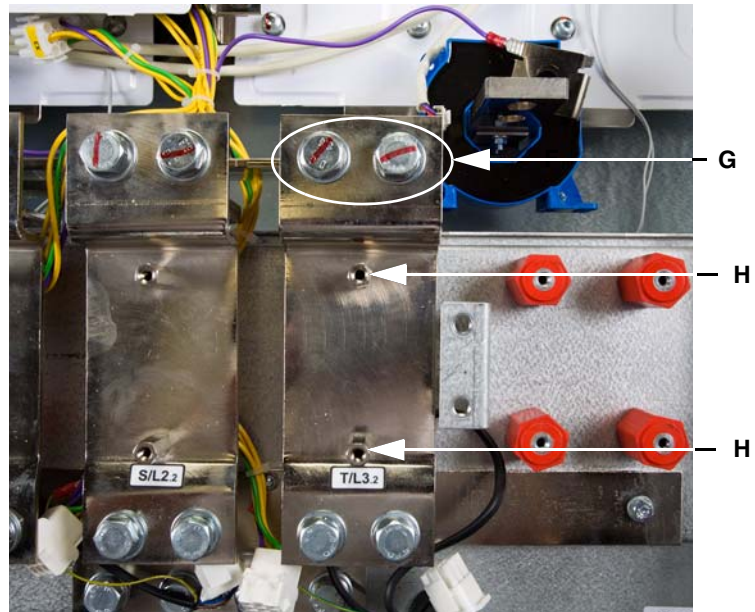




Remove the T/L3.2 Bus Bar

3. Remove the T/L3.2 bus bar as follows.
  - Using an 18 mm socket wrench, remove two bolts and washers (**G**, Figure 102) securing the L3.2 input bus bar to the T/L3.2 bus bar.
  - Using a 10 mm socket wrench, remove two standoffs (**H**, Figure 102) securing the TL3.2 bus bar to the red insulators on the bottom terminal bracket and remove bus bar.

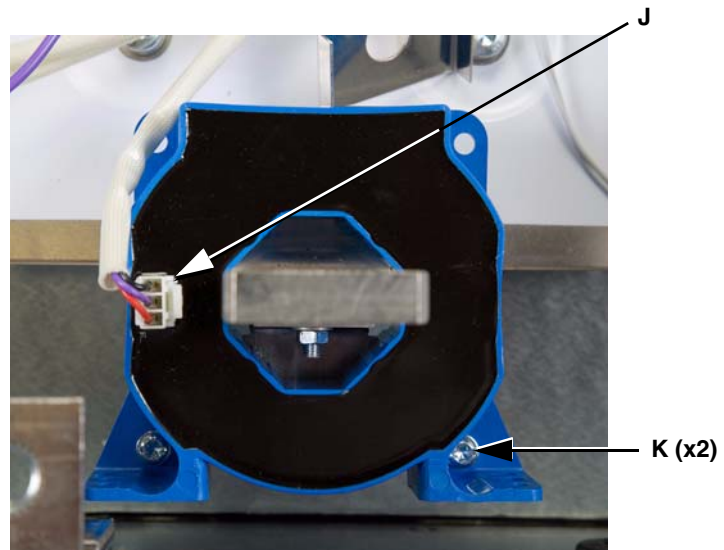
Figure 102: T/L3.2 Bus Bar



Replace the Phase-W Motor Current Sensor

4. Replace the phase-W motor current sensor as follows.
  - Unplug the connection (J, Figure 103) from the phase-W motor current sensor.
  - Using a T-20 Torx driver, remove two screws (K, Figure 103) securing the motor current sensor to the brace on the phase-W bus plate.
  - Install the new motor current sensor on the brace and secure it with the two T-20 screws (K, Figure 103). Tighten the screws to 1.2 N•m (10.6 lb-in).
  - Plug the connector (J, Figure 103) into the new motor current sensor.

**Figure 103: Phase-W Motor Current Sensor**



**NEXT STEP:** If you are only replacing the phase-W motor current sensor, skip to Step 10 on page 107 to replace the T/L3.2 bus bar and other removed equipment.

If you are also replacing the phase-V motor current sensor, continue with “Replacing the Phase-V Motor Current Sensor” on page 98.

## Replacing the Phase-V Motor Current Sensor

1. Remove filter board 2 (the right board) as follows.
  - Using a T-30 Torx driver, remove six screws (**A**, Figure 104) securing the filter board to input bus bars R/L1.2, S/L2.2, and T/L3.2.

**NOTE:** Note whether the grounding screw (**B**) is installed in the grounded or non-grounded position for reinstallation. Figure 104 shows the screw in the grounded position.

- Using a size 3 Phillips driver, remove the grounding screw and washer (**B**, Figure 104) securing the filter board to the drive frame.
- Unplug fan connections X13 and X14 (Figure 104) from the filter board.
- Gently press in on the tabs at the top and bottom of the fan connectors and push them down through the cutouts in the filter board. See Figure 105.
- Move the filter board under the terminals and out of the way.

Figure 104: Filter Board 2 (Right Board)

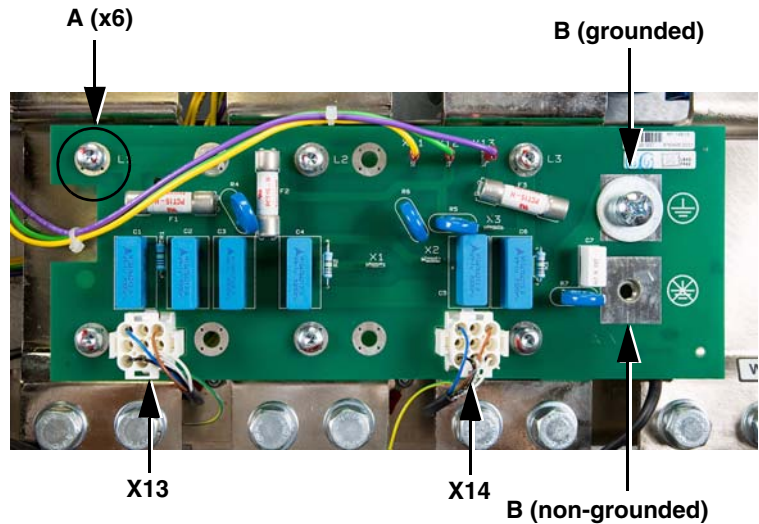
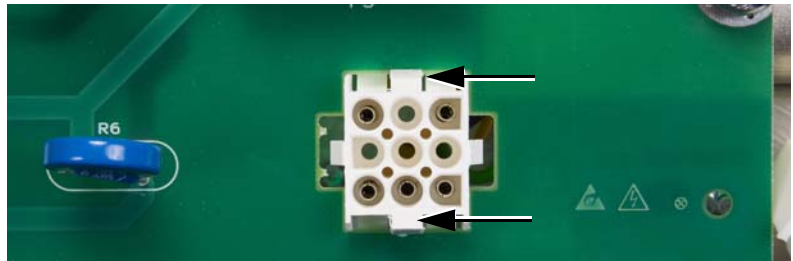


Figure 105: Fan Connector Detail



Remove the V/T2 Bus Bar

2. Remove the V/T2 bus bar as follows. See Figure 106.
  - Using an 18 mm socket wrench, remove two bolts and washers (D, Figure 106) securing the output from the phase-V DC bus plate to the V/T2 bus bar.

**NOTE:** An output sensor plate (E, Figure 106) with a green lead is under the front bolt. Remove the sensor plate.

- Using a T-30 Torx driver, remove two screws (F, Figure 106) securing the insulator plate to the V/T2 bus bar and remove the plate.
- Using a T-30 Torx driver, remove two screws and washers (G, Figure 107) securing the V/T2 bus bar to the insulators on the bottom terminal bracket and remove the bus bar.

Figure 106: V/T2 Bus Bar

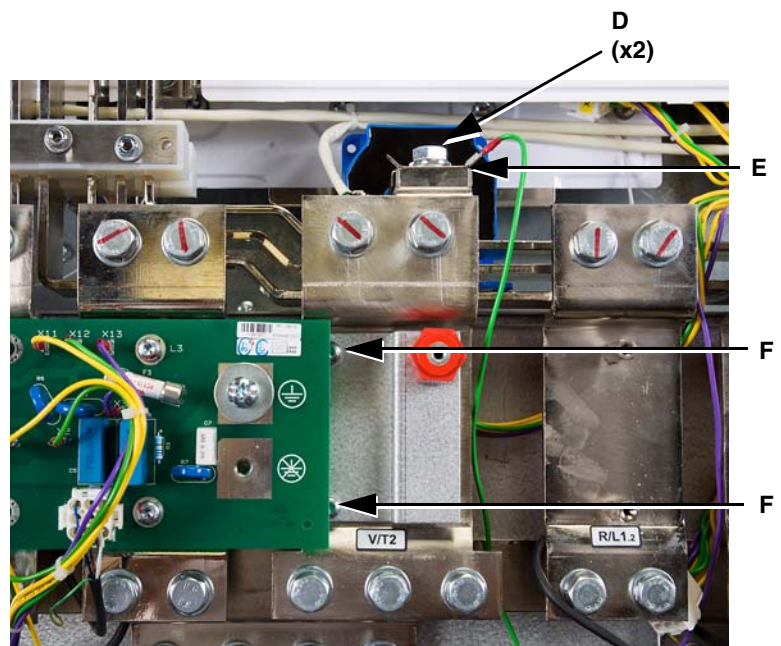
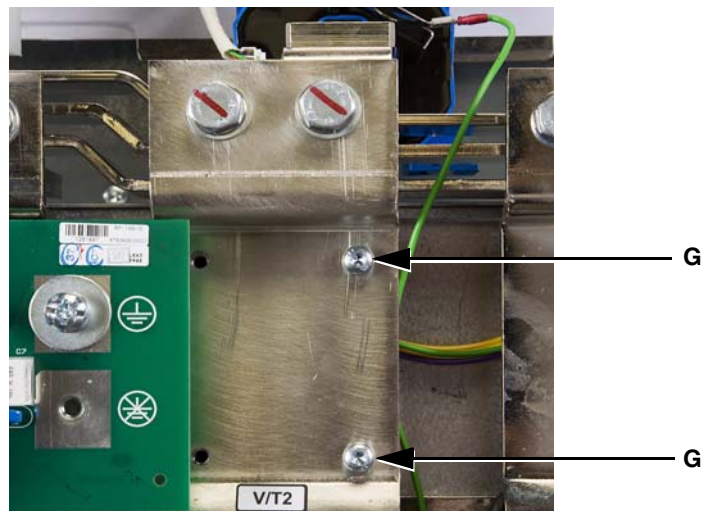


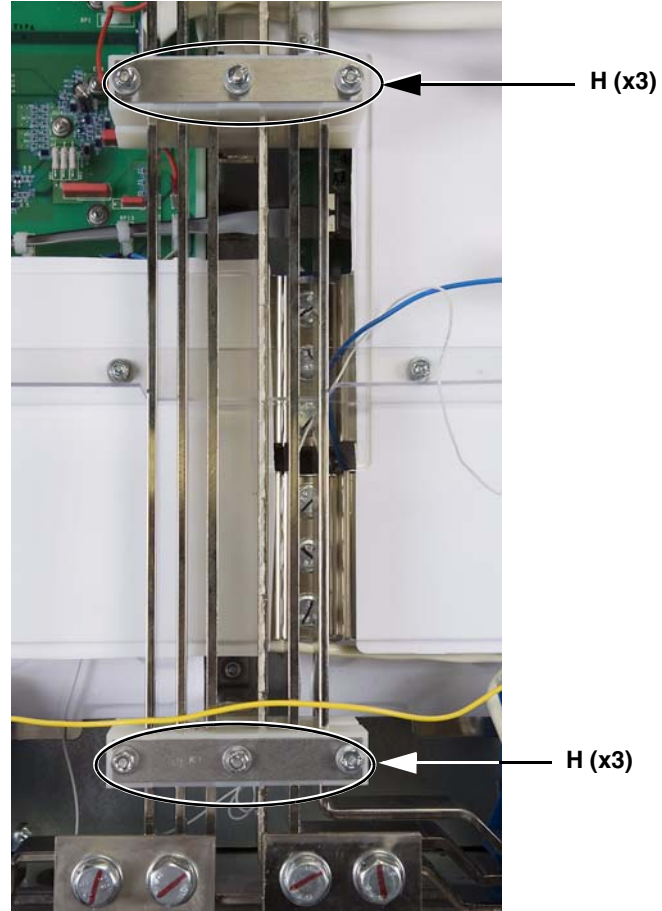
Figure 107: V/T2 Bus Bar



Remove the Input Bus Bar Brackets

- Using a 10 mm socket wrench, remove six nuts (**H**, Figure 108) securing the top half of the input bus bar brackets to the bottom half, and remove the top part of the brackets.

**Figure 108: Input Bus Bar Brackets (Top)**





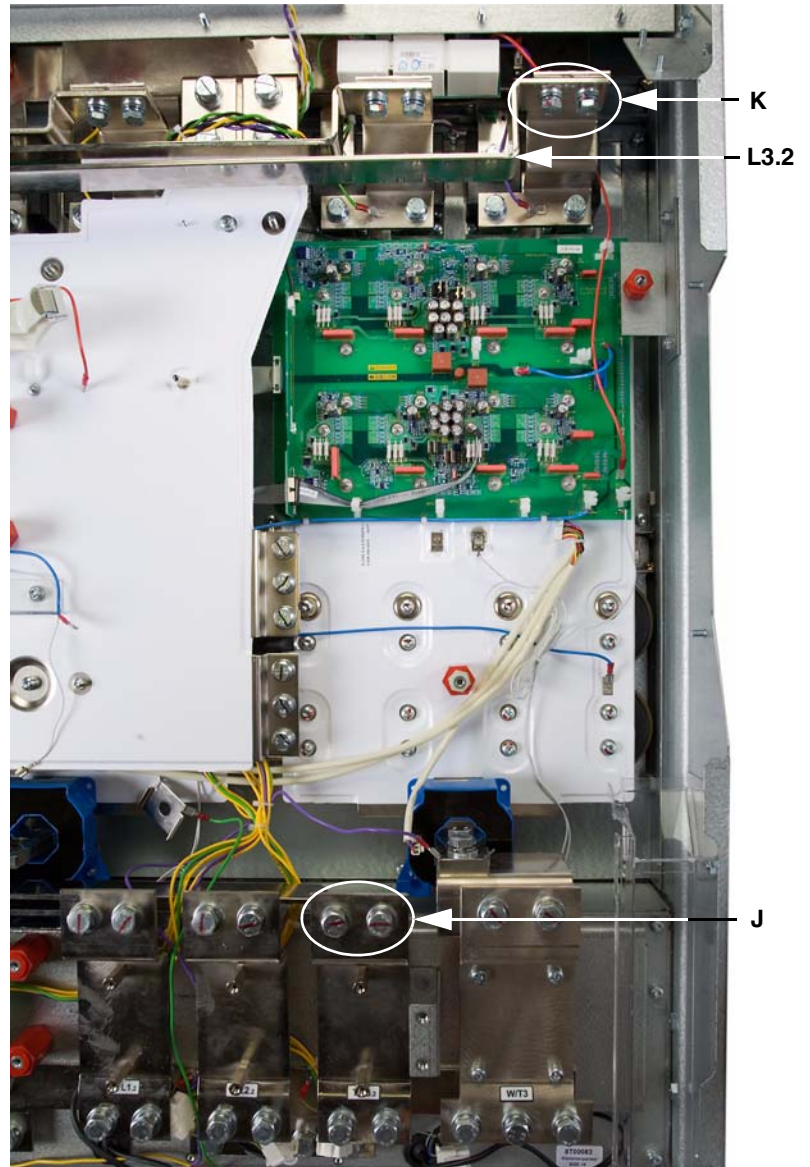
Remove the L3.2 Input Bus Bar

4. Remove the L3.2 input bus bar as follows.
  - Using an 18 mm socket wrench, remove two bolts and washers (**J**, Figure 109) securing the bottom of the L3.2 input bus bar to the T/L3.2 bus bar.
  - Using a 16 mm socket wrench, remove two bolts (**K**, Figure 109) securing the top of the L3.2 input bus bar to the L3.2 rectifier and remove the bus bar.

**Table 25: L3.2 Input Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
<b>J</b>	(2) 18-mm bolts and washers	45	398
<b>K</b>	(2) 16-mm bolts	27	239

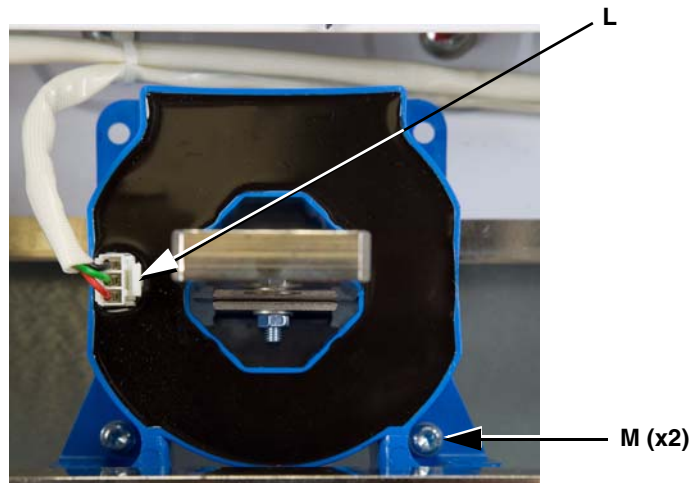
**Figure 109: L3.2 Input Bus Bar**



Replace the Phase-V Motor Current Sensor

5. Replace the phase-V motor current sensor as follows.
  - Unplug the connection (**L**, Figure 110) from the phase-V motor current sensor.
  - Using a T-20 Torx driver, remove two screws (**M**, Figure 110) securing the motor current sensor to the brace on the phase-V bus plate.
  - Install the new motor current sensor on the brace and secure it with two T-20 screws (**M**, Figure 110). Tighten the screws to 1.2 N•m (10.6 lb-in).
  - Plug the connector (**L**, Figure 110) into the new motor current sensor.

**Figure 110: Phase-V Motor Current Sensor**



Replace the L3.2 Input Bus Bar

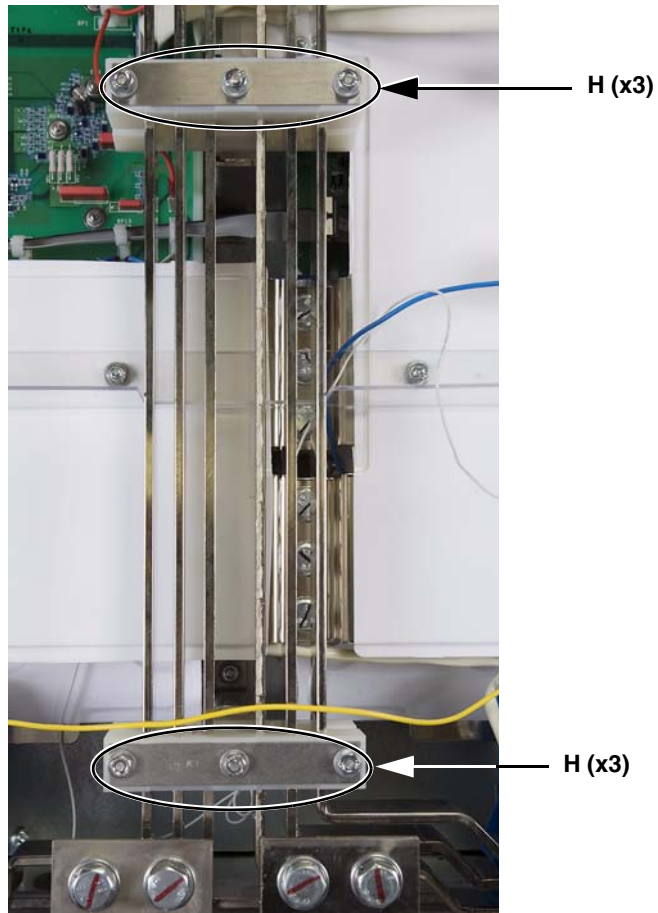
6. Replace the L3.2 input bus bar as follows.
  - Position the bus bar in the drive as shown in Figure 109 on page 101.
  - Using an 16 mm socket wrench, secure the top of the bus bar to the rectifier line input (**K**, Figure 109) with two bolts.
  - Using an 18 mm socket wrench, secure the bottom of the bus bar to the T/L3.2 bus bar with two bolts and washers (**J**, Figure 109).
  - Tighten the hardware to the torque values specified in Table 25 on page 101.

Replace the Input Bus Bar Brackets (Top)

- Using a 10 mm socket wrench, secure the top half of the input bus bar brackets to the bottom half with six nuts (**H**). See Figure 111. Tighten the nuts to 5.5 N•m (48.7 lb-in).

Before installing the brackets, ensure that they have no tears or cracks. If the brackets are damaged, install a new piece from the plastic kit. See page 23.

Figure 111: Input Bus Bar Brackets (Top)



Replace the V/T2 Bus Bar

**Table 26: V/T2 Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
D	(2) 18-mm bolts and washers	45	398
F	(2) T-30 screws	5.5	48.7
G	(2) T-30 screws and washers	5.5	48.7

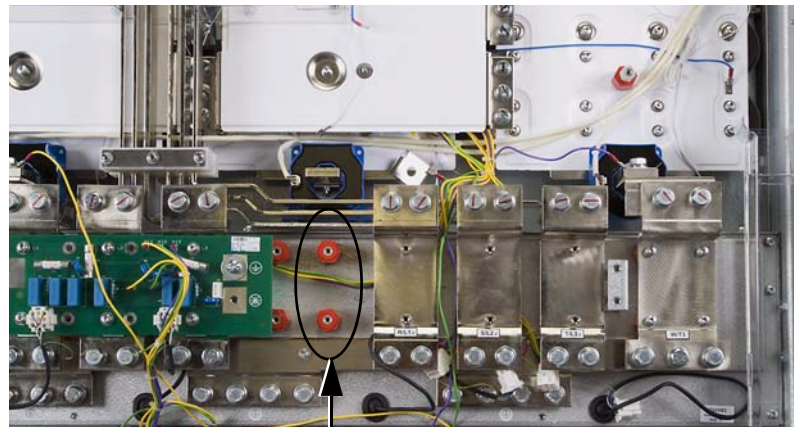
8. Replace the V/T2 bus bar as follows.

- Position the V/T2 bus bar over the insulators on the bottom terminal bracket as shown in Figures 112 and 113.
- Using a T-30 Torx driver, secure the bus bar to the insulators on the bottom terminal bracket with two screws and washers (G, Figure 113).
- Using a T-30 Torx driver, secure the insulator plate to the V/T2 bus bar with two screws (F, Figure 114 on page 105).
- Using an 18 mm socket wrench, secure the V/T2 bus bar to the output on the phase-V DC bus plate with two bolts and washers (D, Figure 114 on page 105).

**NOTE:** Replace the output sensor plate (E, Figure 114 on page 105) under the front bolt.

- Tighten the hardware to the torque values specified in Table 26.

**Figure 112: Bottom Terminal Bracket**



V/T2 bus bar  
 mounting holes

**Figure 113: V/T2 Bus Bar**

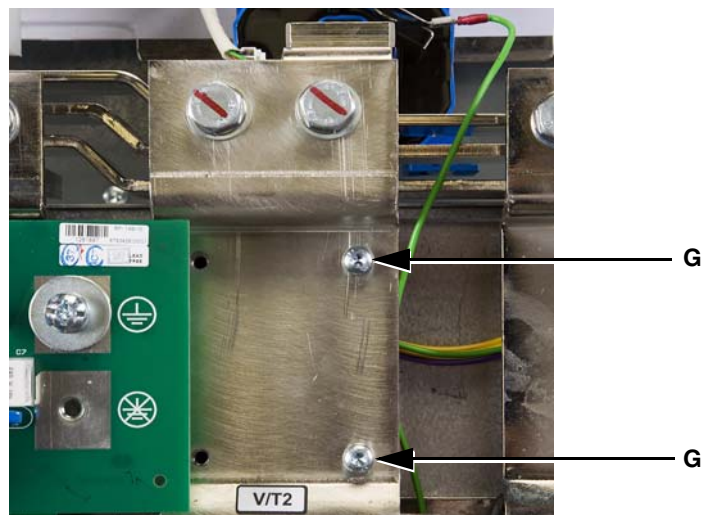
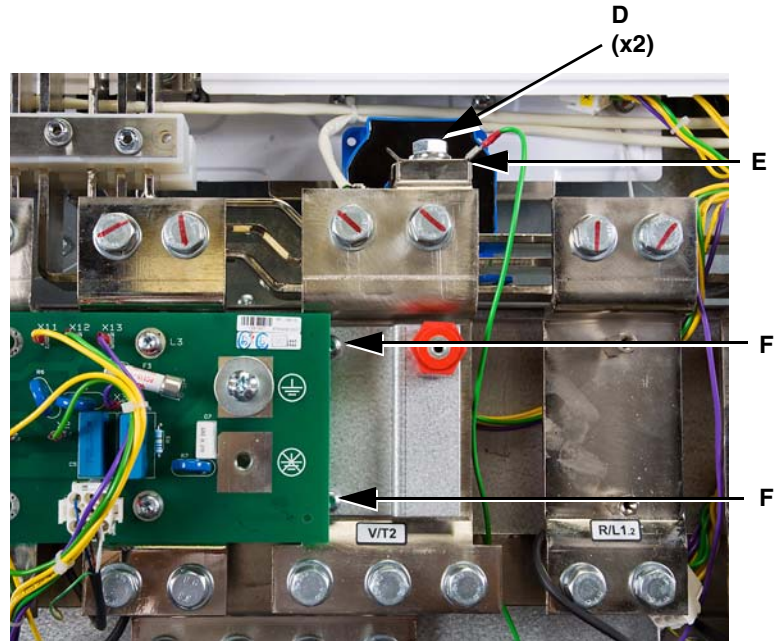




Figure 114: V/T2 Bus Bar

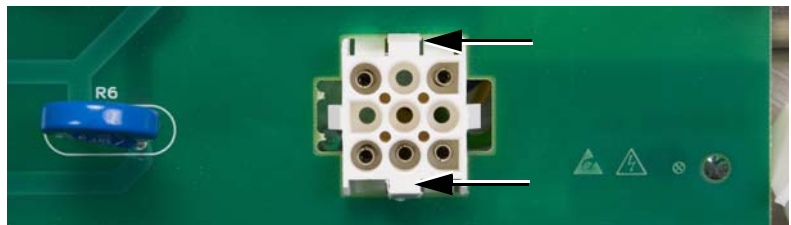


Replace Filter Board 2 (Right Board)

9. Replace filter board 2 as follows.

- Gently press the top and bottom tabs on the fan connectors and push them up through the cutouts on the filter board. See Figure 115.

Figure 115: Fan Connector Detail



- Position the filter board over the standoffs on input bus bars R/L1.2, S/L2.2, and T/L3.2. See Figure 116.

Figure 116: R/L1.2, S/L2.2, T/L3.2 Bus Bars





- Using a T-30 Torx driver, secure the filter board to the input bus bars with six screws (**A**, Figure 117).

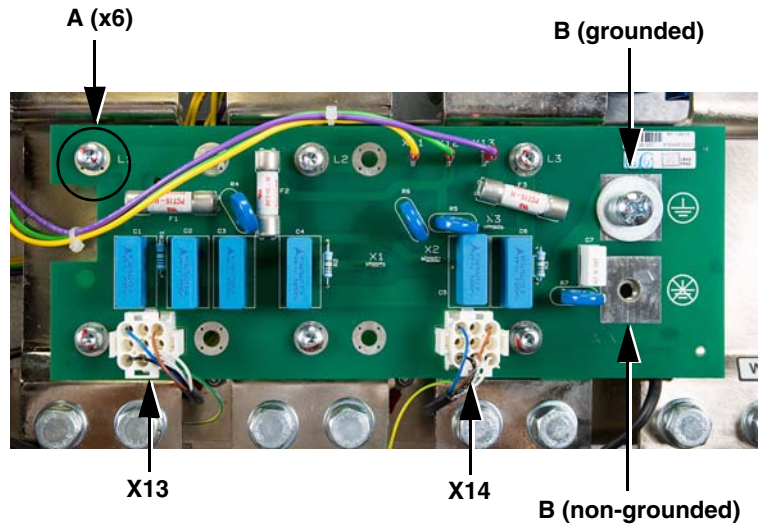
**NOTE:** Be sure to install the grounding screw and washer (**B**) in the original position. Figure 117 shows the screw in the grounded position.

- Using a size 3 Phillips driver, install the grounding screw and washer (**B**, Figure 117).
- Tighten the hardware to the torque values specified in Table 27.
- Connect the two 9-pin fan connectors at terminals X13 and X14. See Figure 117.

**Figure 117: Filter Board 2 (Right Board)**

**Table 27: Filter Board 2 Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
<b>A</b>	(6) T-30 screws	5.5	48.7
<b>B</b>	(1) Size 3 Phillips screw and washer	5.5	48.7



**NEXT STEP:** If you only replaced the phase-V motor current sensor, skip to “Reassemble the Drive” on page 113.

Replace the T/L3.2 Bus Bar

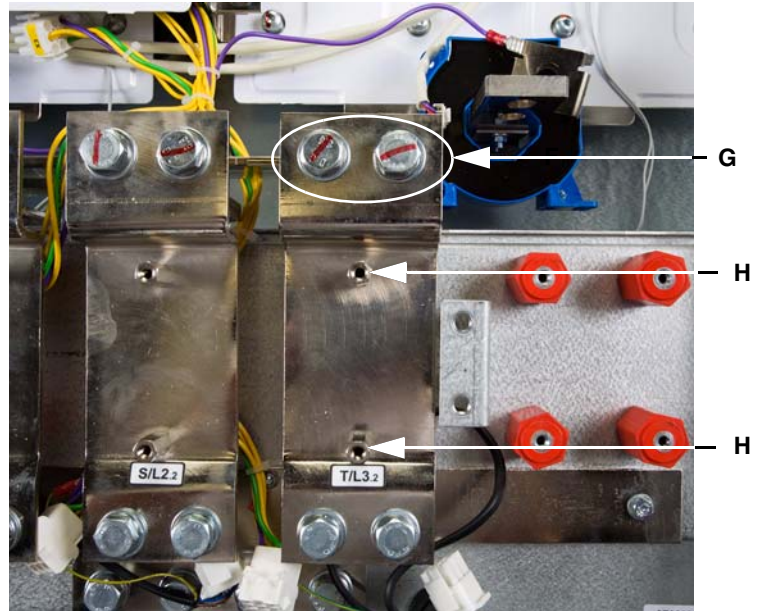
**Table 28: T/L3.2 Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
G	(2) 18-mm bolts and washers	45	398
H	(2) 10-mm standoffs	5.5	48.7

10. Replace the T/L3.2 bus bar as follows.

- Position the T/L3.2 bus bar in the drive as shown in Figure 118.
- Using an 18 mm socket wrench, secure the L3.2 input bus bar to the T/L3.2 bus bar with two bolts and washers (G, Figure 118).
- Using a 10 mm socket wrench, secure the T/L3.2 bus bar to the red insulators on the bottom terminal bracket with two standoffs (H, Figure 118).
- Tighten the hardware to the torque values specified in Table 28.

**Figure 118: T/L3.2 Bus Bar**



Replace the W/T3 Bus Bar

**Table 29: W/T3 Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
D	(2) 18-mm bolts and washers	45	398
F	(4) T-30 screws and washers	5.5	48.7

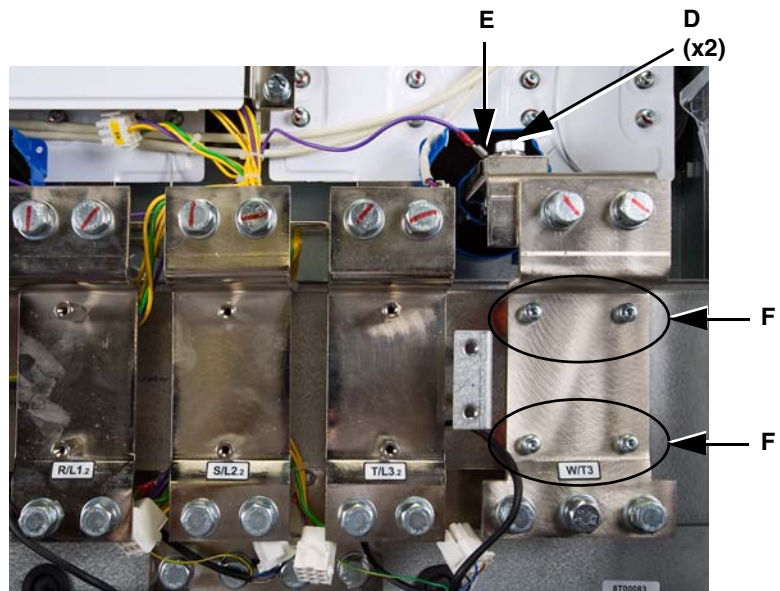
11. Replace the W/T3 bus bar as follows.

- Using a T-30 Torx driver, secure the W/T3 bus bar to the insulators on the bottom terminal bracket with four screws and washers (F, Figure 119).
- Using an 18 mm socket wrench, secure the W/T3 bus bar to the output on the phase-W DC bus plate with two bolts and washers (D, Figure 119).

**NOTE:** Replace the output sensor plate (E, Figure 119) under the front bolt.

- Tighten the hardware to the torque values specified in Table 29.

**Figure 119: W/T3 Bus Bar**

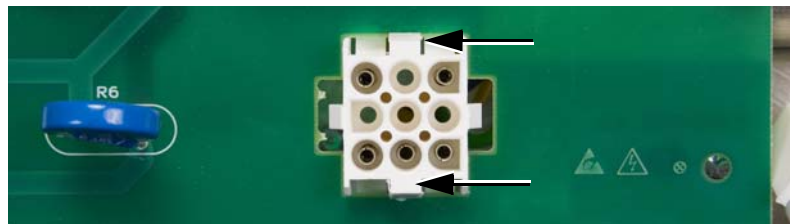


Replace Filter Board 2 (Right Board)

12. Replace filter board 2 as follows.

- Gently press the top and bottom tabs on the fan connectors and push them up through the cutouts on the filter board. See Figure 120.

**Figure 120: Fan Connector Detail**



- Position the filter board over the standoffs on input bus bars R/L1.2, S/L2.2, and T/L3.2. See Figure 119.
- Using a T-30 Torx driver, secure the filter board to the input bus bars with six screws (A, Figure 121 on page 109).

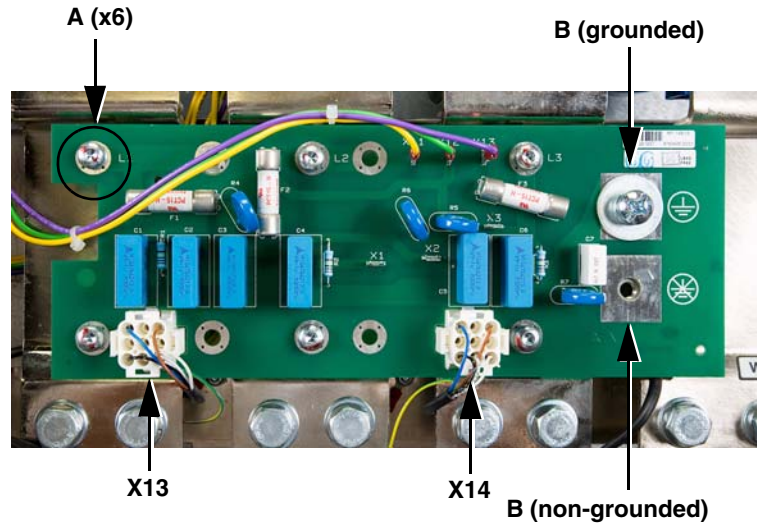
**NOTE:** Be sure to install the grounding screw and washer (**B**) in the original position. Figure 121 shows the screw in the grounded position.

- Using a size 3 Phillips driver, install the grounding screw and washer (**B**, Figure 121).
- Tighten the hardware to the torque values specified in Table 30.
- Connect the two 9-pin fan connectors at terminals X13 and X14. See Figure 121.

**Figure 121: Filter Board 2 (Right Board)**

**Table 30: Filter Board 2 Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
<b>A</b>	(6) T-30 screws	5.5	48.7
<b>B</b>	(1) Size 3 Phillips screw and washer	5.5	48.7



**NEXT STEP:** If you only replaced the phase-W motor current sensor, skip to “Reassemble the Drive” on page 113.

Replace the L1.1 Input Bus Bar and R/L1.1 Bus Bar

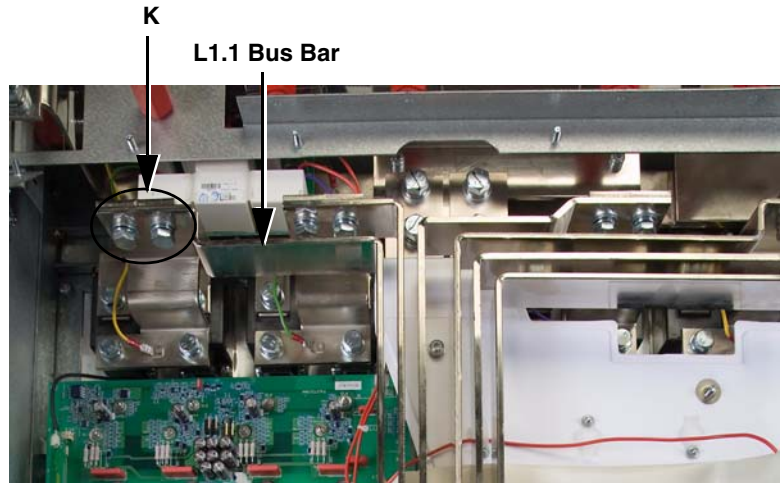
**Table 31: L1.1 and R/L1.1 Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
G	(2) 18-mm bolts and washers	45	398
H	(2) 10-mm standoffs	5.5	48.7
K	(2) 16-mm bolts	27	239

13. Replace the L1.1 input bus bar as follows.

- Position the L1.1 input bus bar in the drive as shown in Figure 122.
- Using a 16 mm socket wrench, secure the top of the bus bar to the L1.1 rectifier with two bolts (K, Figure 122).

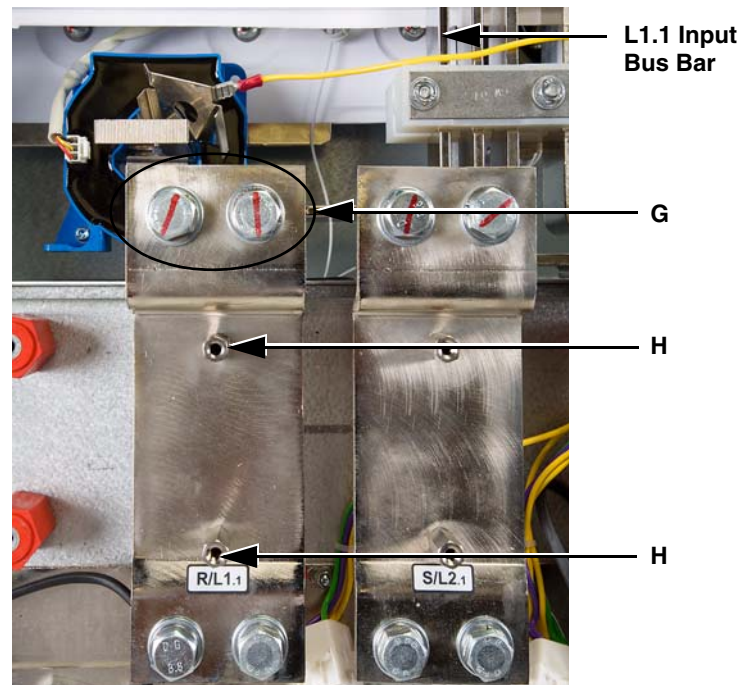
**Figure 122: L1.1 Input Bus Bar**



14. Replace the R/L1.1 bus bar as follows.

- Using a 10 mm socket wrench, secure the R/L1.1 bus bar to the red insulators on the bottom terminal bracket with two standoffs (H, Figure 123).
- Using an 18 mm socket wrench, secure the bottom of the L1.1 input bus bar to the R/L1.1 bus bar with two bolts and washers (G, Figure 123).
- Tighten the hardware to the torque values specified in Table 31.

**Figure 123: R/L1.1 Bus Bar**



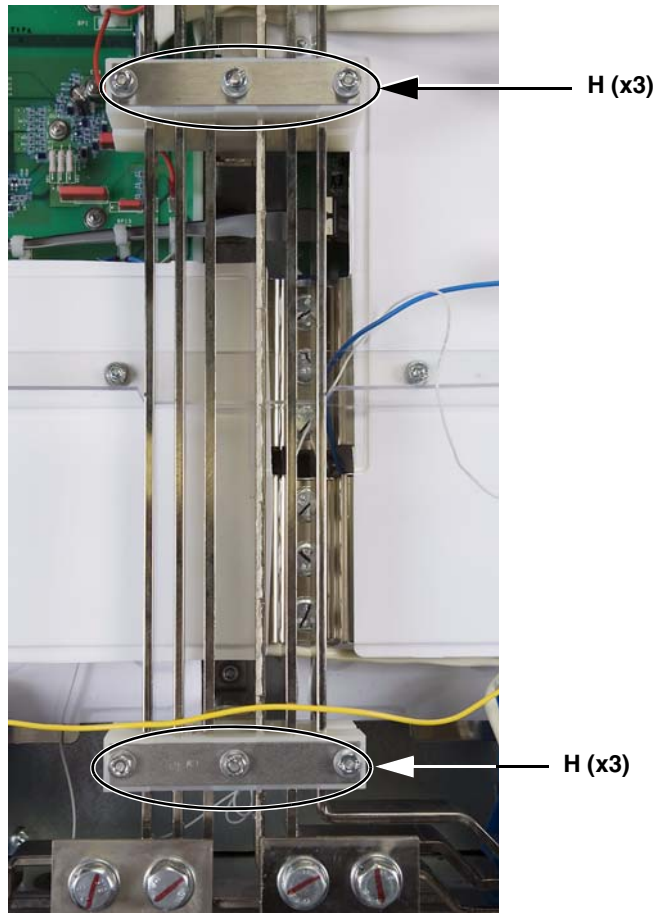


Replace the Input Bus Bar Brackets (Top)

- Using a 10 mm socket wrench, secure the top half of the input bus bar brackets to the bottom half with six nuts (**H**). See Figure 124. Tighten the nuts to 5.5 N•m (48.7 lb-in).

Before installing the brackets, ensure that they have no tears or cracks. If the brackets are damaged, install a new piece from the plastic kit. See page 23.

Figure 124: Input Bus Bar Brackets (Top)



Replace the U/T1 Bus Bar

**Table 32: U/T1 Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
C	(2) 18-mm bolts and washers	45	398
F	(4) T-30 screws and washers	5.5	48.7

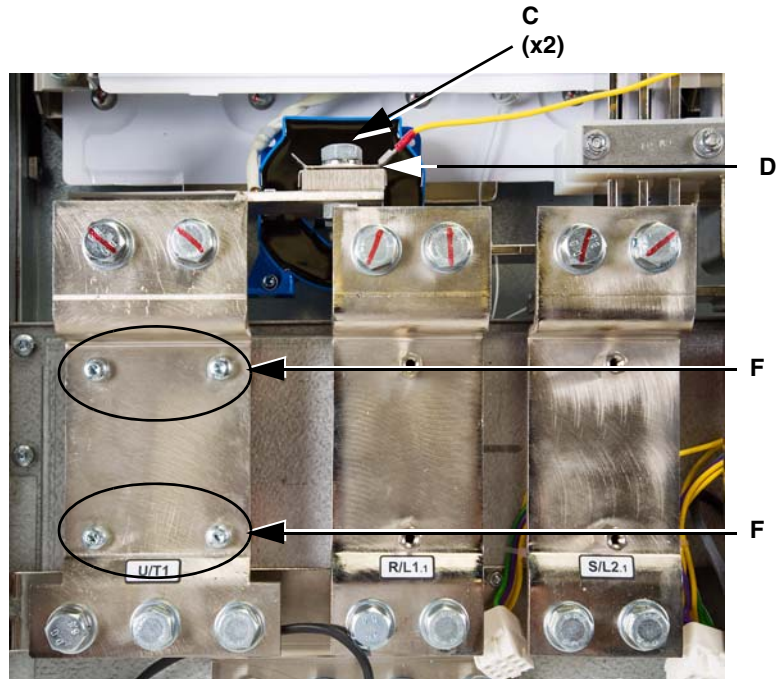
16. Replace the U/T1 bus bar as follows.

- Using a T-30 Torx driver, secure the U/T1 bus bar to the insulators on the bottom terminal bracket with four screws (F, Figure 125).
- Using an 18 mm socket wrench, secure the output from the U-phase DC bus plate to the U/T1 bus bar with two bolts and washers (C, Figure 125).

**NOTE:** Replace the output sensor plate (D, Figure 125) under the front bolt.

- Tighten the hardware to the torque values specified in Table 32.

**Figure 125: U/T1 Bus Bar**

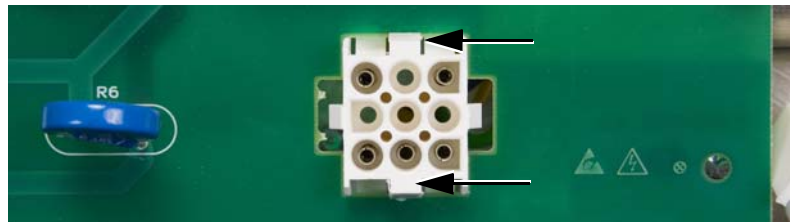


Replace Filter Board 1

17. Replace filter board 1 as follows.

- Gently press the top and bottom tabs on the fan connectors and push them up through the cutouts on the filter board. See Figure 126.

**Figure 126: Fan Connector Detail**



- Position the filter board over the standoffs on input bus bars R/L1.1, S/L2.1, and T/L3.1.
- Using a T-30 Torx driver, secure the filter board to the input bus bars with six screws (A, Figure 127 on page 113).

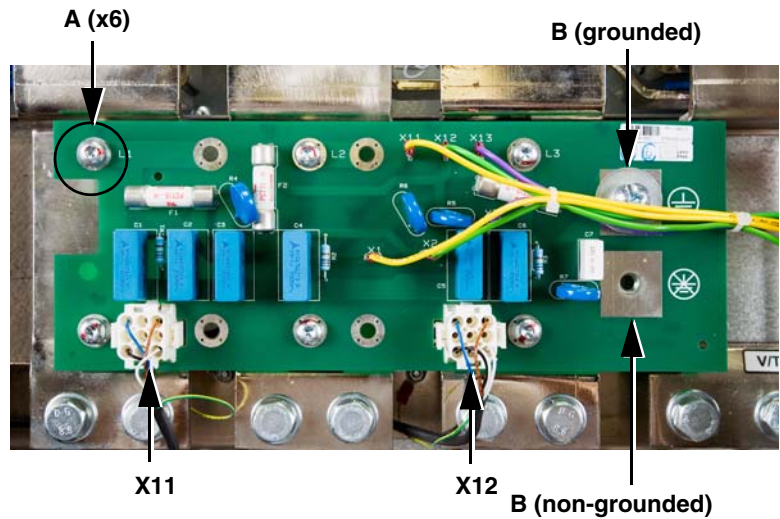
**NOTE:** Be sure to install the grounding screw and washer (**B**) in the original position. Figure 127 shows the screw in the grounded position.

- Using a size 3 Phillips driver, install the grounding screw and washer (**B**, Figure 127).
- Tighten the hardware to the torque values specified in Table 33.
- Connect the two 9-pin fan connectors at terminals X11 and X12. See Figure 127.

**Figure 127: Filter Board 1 (Left Board)**

**Table 33: Filter Board 1 Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
<b>A</b>	(6) T-30 screws	5.5	48.7
<b>B</b>	(1) Size 3 Phillips screw and washer	5.5	48.7



**Reassemble the Drive**

If you are only replacing the motor current sensors, perform Steps 14–24 of “Reassembly Steps for Level 2 Parts” beginning on page 141 to replace the following parts:

- |  |  |
|--|--|
| <input type="checkbox"/> Fan bracket                   | <input type="checkbox"/> Soft charge board connections |
| <input type="checkbox"/> BU (+) bus bar                | <input type="checkbox"/> Control module assembly       |
| <input type="checkbox"/> Middle crossbrace             | <input type="checkbox"/> EMC tray                      |
| <input type="checkbox"/> Power board assembly          | <input type="checkbox"/> Power terminal shields        |
| <input type="checkbox"/> Fan control board connections | <input type="checkbox"/> Front cover                   |
| <input type="checkbox"/> Power board connections       |  |

## Replacing the Gate Driver Boards VX5A1204

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

Before performing the steps in this procedure, perform Steps 1–21 of “Disassembly Steps for Accessing Level 2 Parts” beginning on page 44 to remove the following parts from the drive:

- |  |   |
|--|---|
| <input type="checkbox"/> Front cover                   | <input type="checkbox"/> Middle crossbrace        |
| <input type="checkbox"/> Power terminal shields        | <input type="checkbox"/> BU (+) bus bar           |
| <input type="checkbox"/> EMC tray                      | <input type="checkbox"/> Fan bracket              |
| <input type="checkbox"/> Control module assembly       | <input type="checkbox"/> Input bus bar brackets   |
| <input type="checkbox"/> Soft charge board connections | <input type="checkbox"/> Input bus bars           |
| <input type="checkbox"/> Power board connections       | <input type="checkbox"/> Top phase-U DC bus plate |
| <input type="checkbox"/> Fan control board connections | <input type="checkbox"/> Top DC bus plate         |
| <input type="checkbox"/> Power board assembly          |   |

## Remove the Gate Driver Board

1. Remove the gate driver board that you are replacing as follows.
  - Remove the connections from the gate driver board. See Table 34.

**NOTE:** Clip the tie wraps to remove the connection at terminal X51 of gate driver board V.

- Using a 7 mm socket wrench, remove 24 nuts securing the gate driver board to the power IGBT modules and the DC bus plate and remove the board from the drive. See Figure 129 on page 116.

**Table 34: Gate Driver Board Wiring<sup>1</sup>**

Wire No. <sup>2</sup>	Terminal No.	Description	To:
<b>Gate Driver Board U (Left)</b>			
E144	X4	2-pin, black	Temperature sensor U
E138	X32	18-pin, gray	GDB <sup>3</sup> V, X31
E129	X51	1-pin, blue	UD0 (neutral) on DC bus plate
E127	X52	1-pin, blue	GDB V, X51
E126	X61	1-pin, red	SB <sup>4</sup> 1, X10
E139	X62	1-pin, white	Bleeder resistor 1
E100	X82	14-pin, white	GDB V, X81 and PB <sup>5</sup> , X8
<b>Gate Driver Board V (Center)</b>			
E128	X4	2-pin, black	Temperature sensor V
E138	X31	18-pin, gray	GDB <sup>3</sup> U, X32
E146	X32	18-pin, gray	GDB W, X31
E127	X51	1-pin, blue	GDB U, X52
E123	X52	1-pin, blue	GDB W, X51
E100	X81	14-pin, white	GDB U, X82 and PB <sup>5</sup> , X8
E102	X82	14-pin, white	GDB W, X81
<b>Gate Driver Board W (Right)</b>			
E145	X4	2-pin, black	Temperature sensor W
E146	X31	18-pin, gray	GDB <sup>3</sup> V, X32
E142	X32	18-pin, gray	PB <sup>5</sup> , X3
E123	X51	1-pin, blue	GDB V, X52
E102	X81	14-pin, white	GDB V, X82
E132	X53	1-pin, blue	Insulator near MCB <sup>6</sup>
E164	X62	1-pin, white	Bleeder resistor 3
E160	X61	1-pin, red	SB <sup>4</sup> 2, X10

<sup>1</sup> Terminals X4 and X32 are connected to a daughter board on the gate driver board assembly.

<sup>2</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

<sup>3</sup> GDB: Gate driver board

<sup>4</sup> SB: SCR snubber board

<sup>5</sup> PB: Power board

<sup>6</sup> MCB: Motor control board



Figure 128: Gate Driver Boards

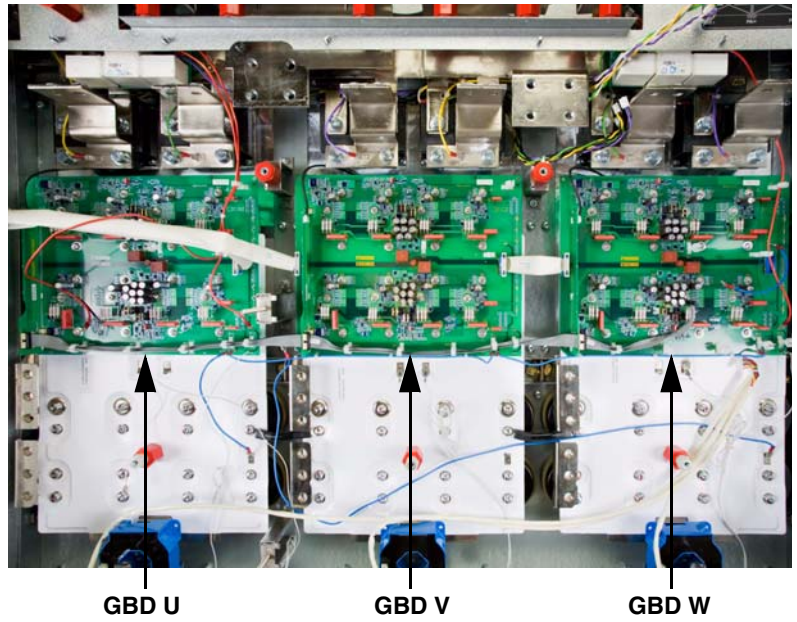
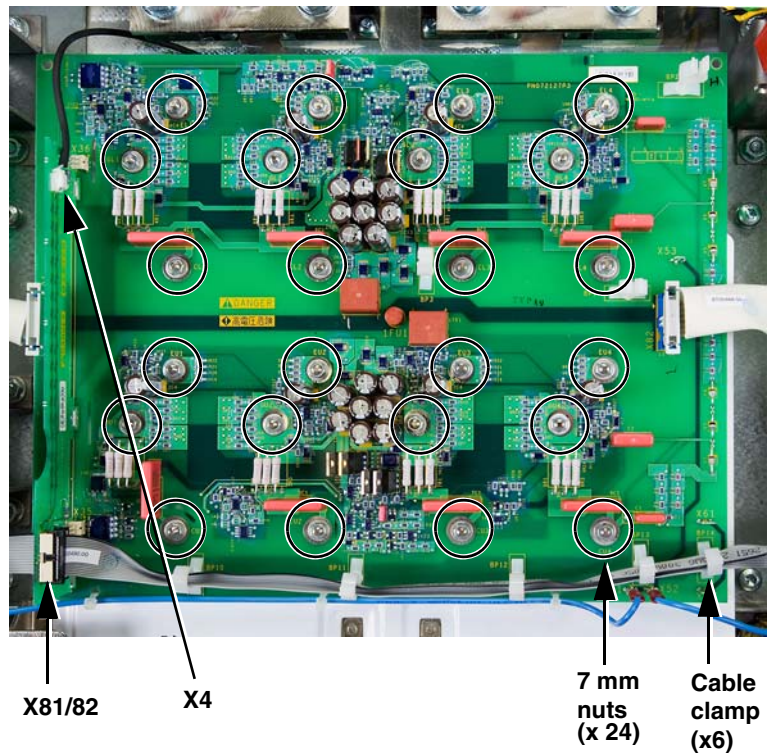


Figure 129: Gate Driver Board Detail, Phase V Shown



### Install the New Gate Driver Board

2. Transfer the six plastic cable clamps (see Figure 129 on page 116) from the old gate driver board onto the new one as follows.
  - To remove a clamp, pinch the clamp on the bottom side of the board and push it up through the mounting hole.
  - Snap the cable clamps into the mounting holes on the new board.
3. Seat the gate driver board on the DC bus plate standoffs.
4. Using a 7 mm socket wrench, secure the board with 24 nuts. See Figure 129 on page 116. Tighten the nuts to 1.2 N•m (10.6 lb-in).
5. Replace the gate driver board wiring. See Table 34 on page 115 for the connections.

### Reassemble the Drive

If you are only replacing a gate driver board, perform Steps 3–24 of “Reassembly Steps for Level 2 Parts” beginning on page 141 to replace the following parts:

- |  |  |
|--|--|
| <input type="checkbox"/> Top DC bus plate                | <input type="checkbox"/> Power board assembly          |
| <input type="checkbox"/> Top phase-U DC bus plate        | <input type="checkbox"/> Fan control board connections |
| <input type="checkbox"/> Input bus bar brackets (bottom) | <input type="checkbox"/> Power board connections       |
| <input type="checkbox"/> Input bus bars                  | <input type="checkbox"/> Soft charge board connections |
| <input type="checkbox"/> Input bus bar brackets (top)    | <input type="checkbox"/> Control module assembly       |
| <input type="checkbox"/> Fan bracket                     | <input type="checkbox"/> EMC tray                      |
| <input type="checkbox"/> BU (+) bus bar                  | <input type="checkbox"/> Power terminal shields        |
| <input type="checkbox"/> Middle crossbrace               | <input type="checkbox"/> Front cover                   |

## Replacing the Temperature Sensors, VZ3G1104

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

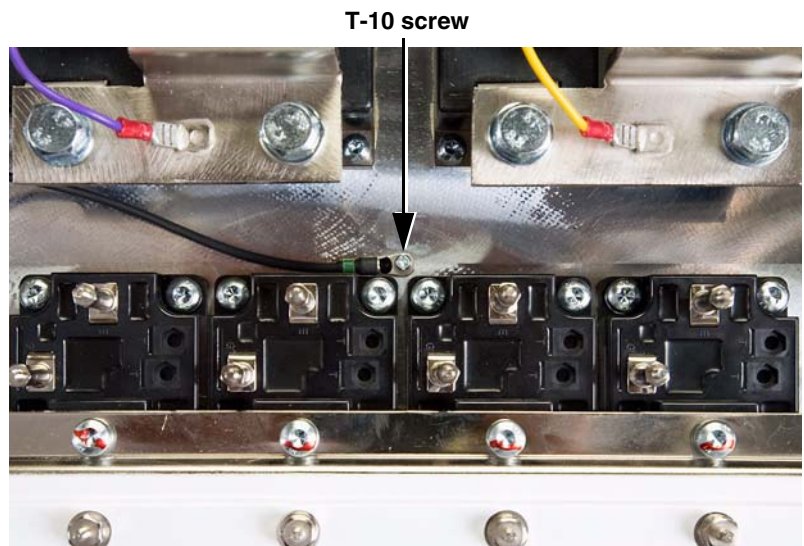
There is one temperature sensor for each phase in the drive. The sensors are located under the gate driver boards on the DC bus plate.

Before performing the steps in this procedure, perform Steps 1–22 of “Disassembly Steps for Accessing Level 2 Parts” beginning on page 44 to remove the following parts from the drive:

- |  |   |
|--|---|
| <input type="checkbox"/> Front cover                   | <input type="checkbox"/> Middle crossbrace        |
| <input type="checkbox"/> Power terminal shields        | <input type="checkbox"/> BU (+) bus bar           |
| <input type="checkbox"/> EMC tray                      | <input type="checkbox"/> Fan bracket              |
| <input type="checkbox"/> Control module assembly       | <input type="checkbox"/> Input bus bar brackets   |
| <input type="checkbox"/> Soft charge board connections | <input type="checkbox"/> Input bus bars           |
| <input type="checkbox"/> Power board connections       | <input type="checkbox"/> Top phase-U DC bus plate |
| <input type="checkbox"/> Fan control board connections | <input type="checkbox"/> Top DC bus plate         |
| <input type="checkbox"/> Power board assembly          | <input type="checkbox"/> Gate driver boards       |

1. Using a T-10 Torx driver, remove one screw securing the temperature sensor to the DC bus plate. See Figure 130.
2. Replace the temperature sensor and secure it with the T-10 screw. Tighten the screw to 0.4–0.6 N•m (3.5–5.3 lb-in).

**Figure 130: Temperature Sensor**



## Reassemble the Drive

If you are only replacing a temperature sensor, perform Steps 2–24 of “Reassembly Steps for Level 2 Parts” beginning on page 141 to replace the following parts:

- Gate driver boards
- Top DC bus plate
- Top phase-U DC bus plate
- Input bus bar brackets (bottom)
- Input bus bars
- Input bus bar brackets (top)
- Fan bracket
- BU (+) bus bar
- Middle crossbrace
- Power board assembly
- Fan control board connections
- Power board connections
- Soft charge board connections
- Control module assembly
- EMC tray
- Power terminal shields
- Front cover

## Replacing the Power IGBT Modules VZ3IM1604M1271

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

Before performing the steps in this procedure, perform Steps 1–23 of “Disassembly Steps for Accessing Level 2 Parts” beginning on page 44 to remove the following parts from the drive:

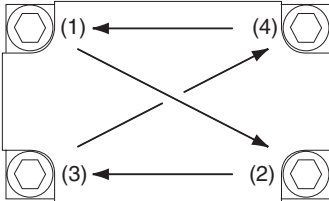
- |  |   |
|--|---|
| <input type="checkbox"/> Front cover                   | <input type="checkbox"/> BU (+) bus bar           |
| <input type="checkbox"/> Power terminal shields        | <input type="checkbox"/> Fan bracket              |
| <input type="checkbox"/> EMC tray                      | <input type="checkbox"/> Input bus bar brackets   |
| <input type="checkbox"/> Control module assembly       | <input type="checkbox"/> Input bus bars           |
| <input type="checkbox"/> Soft charge board connections | <input type="checkbox"/> Top phase-U DC bus plate |
| <input type="checkbox"/> Power board connections       | <input type="checkbox"/> Top DC bus plate         |
| <input type="checkbox"/> Fan control board connections | <input type="checkbox"/> Gate driver boards       |
| <input type="checkbox"/> Power board assembly          | <input type="checkbox"/> Bottom DC bus plate      |
| <input type="checkbox"/> Middle crossbrace             |   |

You must replace the power IGBT modules in sets of four as follows. See Figure 132 on page 121.

- Replace modules 1, 2, 3, and 4 together.
- Replace modules 5, 6, 7, and 8 together.



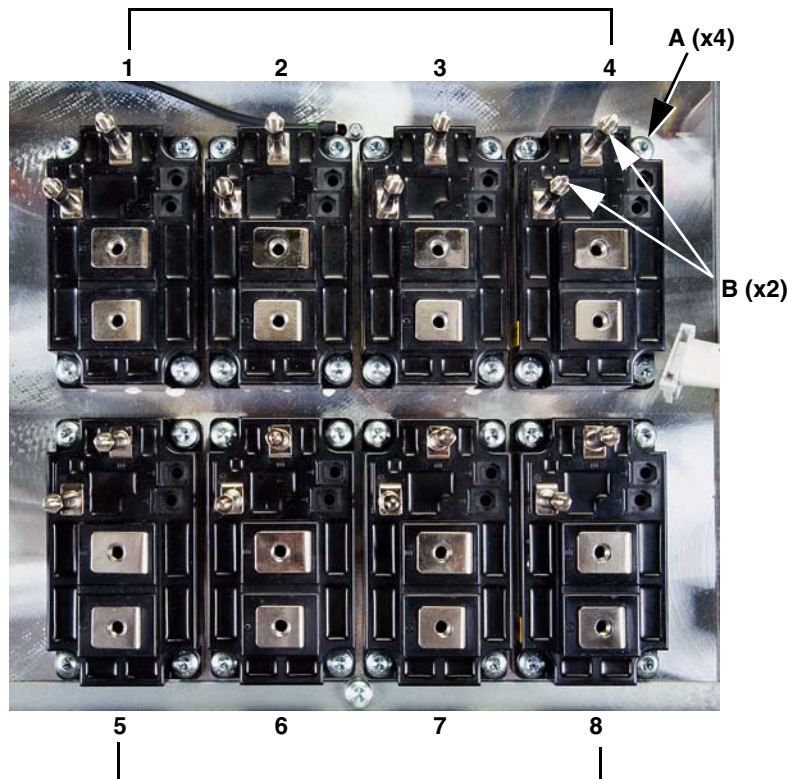
Figure 131: Torque Sequence



1. Using a T-30 Torx driver, remove four screws (**A**, Figure 132) securing the module to the heatsink and remove the module from the drive.
2. Using a 7 mm socket wrench, remove two standoffs (**B**, Figure 132) from the old IGBT module, and install them on terminals E and G of the new module. Tighten the standoffs to 1.2 N•m (10.6 lb-in).
3. Clean the portion of the heatsink that makes contact with the power IGBT module.
4. Evenly coat the bottom of the new power IGBT module with a thin layer of thermal compound, included in the kit, and position the module on the heatsink.
5. Using a T-30 Torx driver, secure the module to the heatsink with four screws (**A**, Figure 132). Initially tighten the screws, in the sequence shown in Figure 131, to 0.7–1.0 N•m (6.2–8.9 lb-in), and then to a final torque of 3.3–4.4 N•m (29.2–38.9 lb-in).

**NEXT STEP:** If you are also replacing the capacitors, skip to “Replacing the Capacitors VY1ADC1112” beginning on page 123. If you are only replacing the power IGBT modules, continue with “Reassemble the Drive” on page 122.

Figure 132: Power IGBT Modules, Phase V Shown



## Reassemble the Drive

If you are only replacing the power IGBT modules, perform Steps 1–24 of “Reassembly Steps for Level 2 Parts” beginning on page 141 to replace the following parts:

- Bottom DC bus plate
- Gate driver boards
- Top DC bus plate
- Top phase-U DC bus plate
- Input bus bar brackets (bottom)
- Input bus bars
- Input bus bar brackets (top)
- Fan bracket
- BU (+) bus bar
- Middle crossbrace
- Power board assembly
- Fan control board connections
- Power board connections
- Soft charge board connections
- Control module assembly
- EMC tray
- Power terminal shields
- Front cover

## Replacing the Capacitors VY1ADC1112

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

This kit contains six capacitors. If a capacitor has shorted, you must replace **all** of the capacitors in the drive.

Before performing the steps in this procedure, perform Steps 1–23 of “Disassembly Steps for Accessing Level 2 Parts” beginning on page 44 to remove the following parts from the drive:

- |  |   |
|--|---|
| <input type="checkbox"/> Front cover                   | <input type="checkbox"/> BU (+) bus bar           |
| <input type="checkbox"/> Power terminal shields        | <input type="checkbox"/> Fan bracket              |
| <input type="checkbox"/> EMC tray                      | <input type="checkbox"/> Input bus bar brackets   |
| <input type="checkbox"/> Control module assembly       | <input type="checkbox"/> Input bus bars           |
| <input type="checkbox"/> Soft charge board connections | <input type="checkbox"/> Top phase-U DC bus plate |
| <input type="checkbox"/> Power board connections       | <input type="checkbox"/> Top DC bus plate         |
| <input type="checkbox"/> Fan control board connections | <input type="checkbox"/> Gate driver boards       |
| <input type="checkbox"/> Power board assembly          | <input type="checkbox"/> Bottom DC bus plate      |
| <input type="checkbox"/> Middle crossbrace             |   |

1. Replace a capacitor as follows. See Figure 133.

- Unlock the capacitor by turning it counterclockwise, and remove it from the drive.
- Install the new capacitor and lock it into place.

**NOTE:** Ensure that the positive terminal (+) is oriented toward the top of the drive and negative terminal (-) toward the bottom.

**Figure 133: Capacitors, Phase V Shown**



## Reassemble the Drive

If you are only replacing the capacitors, perform Steps 1–24 of “Reassembly Steps for Level 2 Parts” beginning on page 141 to replace the following parts:

- Bottom DC bus plate
- Gate driver boards
- Top DC bus plate
- Top phase-U DC bus plate
- Input bus bar brackets (bottom)
- Input bus bars
- Input bus bar brackets (top)
- Fan bracket
- BU (+) bus bar
- Middle crossbrace
- Power board assembly
- Fan control board connections
- Power board connections
- Soft charge board connections
- Control module assembly
- EMC tray
- Power terminal shields
- Front cover

## Replacing the SCR Modules and Diode Modules (VZ3TM1600M1671 and VZ3DM1600M1671)

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

### **⚠ DANGER**

#### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- When the controller is damaged, voltage may remain on certain energy storage capacitors after de-energization of the controller and discharge of the main capacitor bank.
- Before working on or near assemblies containing energy storage capacitors, verify that the capacitor voltages are less than 42 Vdc.
- The following assemblies have energy-storing capacitors:
  - SCR snubber board. See Figures 139 and 140 on page 128.
- Always check for the presence of voltage using a voltmeter set to the 1000 Vdc scale. When voltage is present, allow the voltmeter to discharge the capacitor’s stored charge. Refer to “Discharging Stored Energy in Capacitors” on page 12.

**Failure to follow these instructions will result in death or serious injury.**

Before performing the steps in this procedure, perform Steps 1–21 of “Disassembly Steps for Accessing Level 2 Parts” beginning on page 44 to remove the following parts from the drive:

- |  |   |
|--|---|
| <input type="checkbox"/> Front cover                   | <input type="checkbox"/> Middle crossbrace        |
| <input type="checkbox"/> Power terminal shields        | <input type="checkbox"/> BU (+) bus bar           |
| <input type="checkbox"/> EMC tray                      | <input type="checkbox"/> Fan bracket              |
| <input type="checkbox"/> Control module assembly       | <input type="checkbox"/> Input bus bar brackets   |
| <input type="checkbox"/> Soft charge board connections | <input type="checkbox"/> Input bus bars           |
| <input type="checkbox"/> Power board connections       | <input type="checkbox"/> Top phase-U DC bus plate |
| <input type="checkbox"/> Fan control board connections | <input type="checkbox"/> Top DC bus plate         |
| <input type="checkbox"/> Power board assembly          |   |



### Remove the Top Terminal Bracket

1. Remove the top terminal bracket as follows.
  - Using a T-30 right-angle Torx driver, remove six screws (A, Figures 134 and 135) securing the PO.1, PA/+, PC/-, and PO.2 bus bars to the red insulators on the terminal bracket.
  - Using a T-30 Torx driver, remove five screws (B, Figure 136) securing the terminal bracket to the drive frame and remove the terminal bracket from the drive.
  - Using an 18 mm socket wrench, remove ten bolts (C, Figure 137 on page 127) from the PO.1, PA/+, PC/-, and PO.2 bus bars.

Figure 134: Top Terminal Bracket Bus Bar Connections

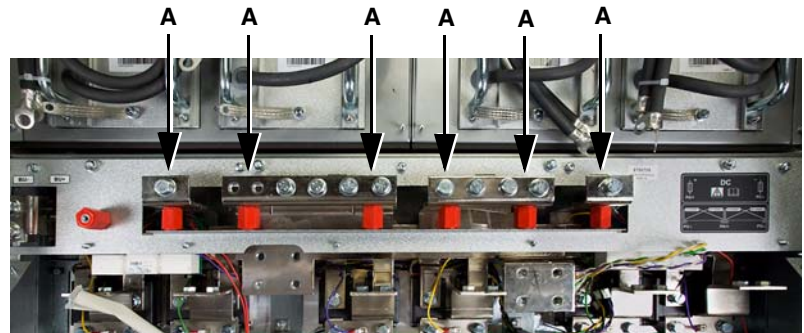


Figure 135: Bus Bar Connection Detail



Figure 136: Top Terminal Bracket Mounting Hardware

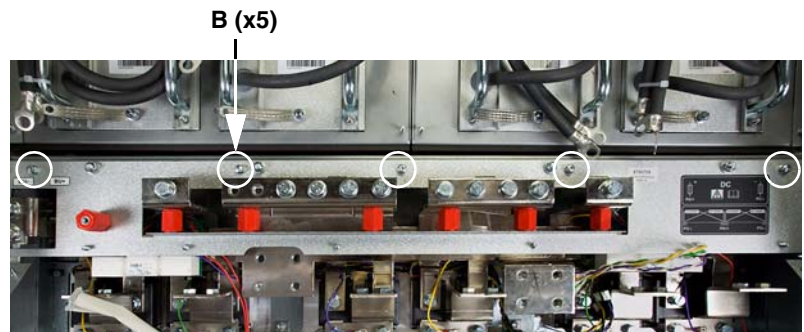
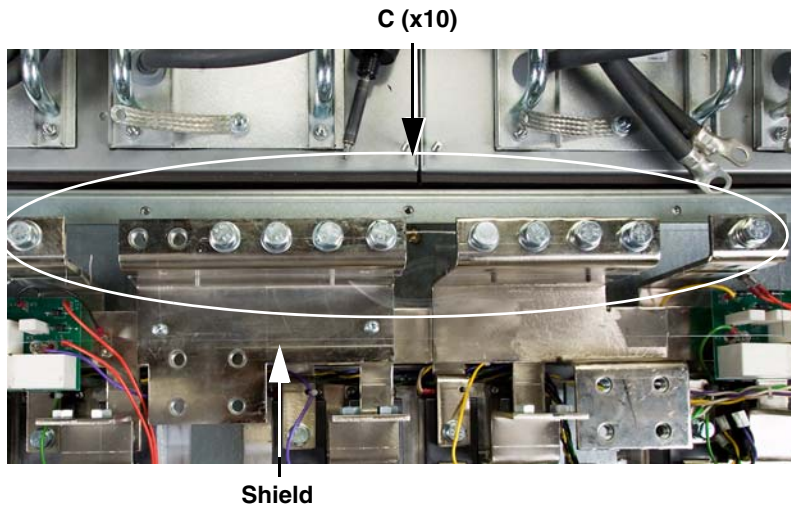


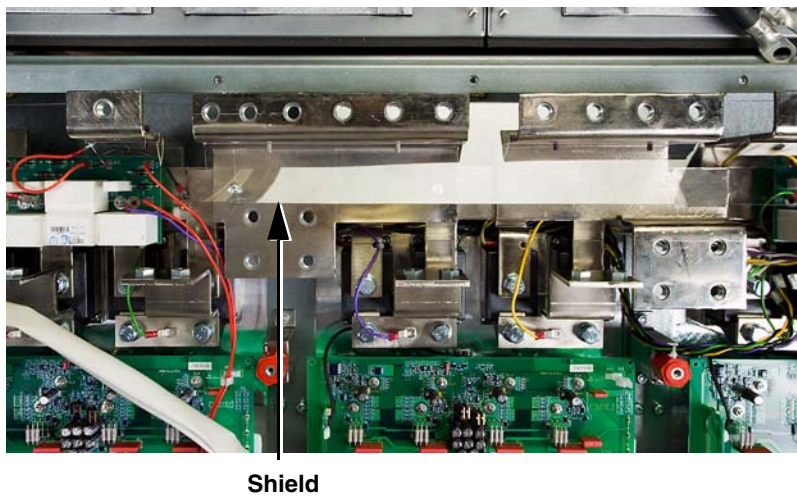
Figure 137: Bus Bar Connections



**Remove the Rectifier Shield**

2. Remove the plastic rectifier shield from the bus bars. See Figure 138.

Figure 138: Rectifier Shield



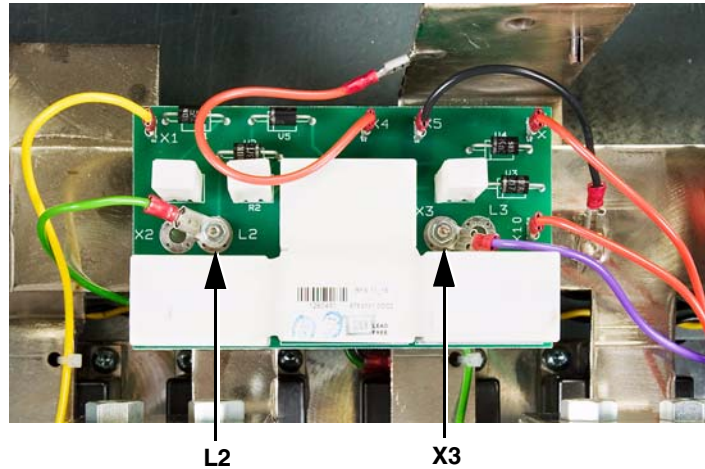
**Remove the SCR Snubber Boards**

3. Remove SCR snubber board 1 (left board) from the drive as follows.
  - Using needle-nose pliers, carefully remove the connections from SCR snubber board 1 (left board) terminals X1, X4, X5, X10, and X11. See Table 35 and Figure 139 for the connection locations.
  - Using a 7 mm socket wrench, remove two nuts securing the snubber board to the insulators on the PC/- bus and remove the wires from terminals L2 and X3. See Figure 139.
  - Remove the board from the drive.

**Table 35: SCR Snubber Board Wiring**

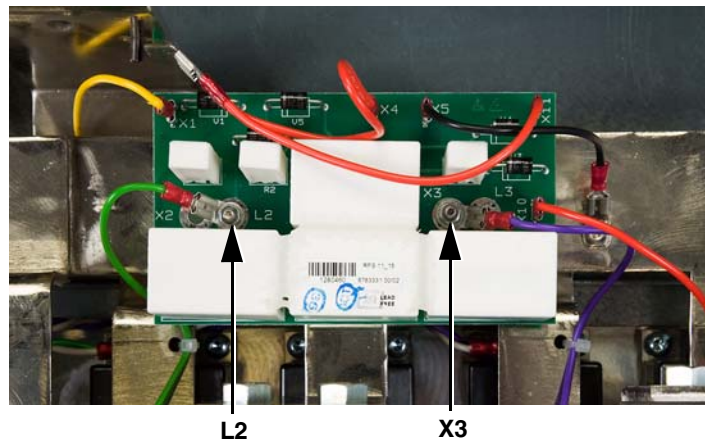
Wire No. <sup>1</sup>	Terminal No.	Description	To:
<b>SCR Snubber Board 1 (Left Board)</b>			
E131	X1	Yellow, 1-pin	L1.1 rectifier
E130	X4	Red, 1-pin	PO.1 rectifier bus bar
E133	X5	Black, 1-pin	PC/- rectifier bus bar
E126	X10	Red, 0.25 in., 1-pin	GDB <sup>2</sup> U X61
E126	X11	Red, 0.19 in., 1-pin	PB <sup>3</sup> RFS31-X11
E167	L2	Green, 1-pin	L2.1 Line input bar
E168	X3	Violet, 1-pin	L3.1 Line input bar
<b>SCR Snubber Board 2 (Right Board)</b>			
E157	X1	Yellow, 1-pin	L1.2 rectifier
E158	X4	Red, 1-pin	PO.2 rectifier bus bar
E159	X5	Black, 1-pin	PC/- rectifier bus bar
E1160	X10	Red, 0.25 in., 1-pin	GDB <sup>4</sup> W X61
E158	X11	Red, 0.19 in., 1-pin	PO.2 rectifier bus bar
E169	L2	Green, 1-pin	L2.2 line input bar
E170	X3	Violet, 1-pin	L3.2 Line input bar

**Figure 139: SCR Snubber Board 1**



4. Remove SCR snubber board 2 (right board) from the drive as follows.
  - Using needle-nose pliers, carefully remove the connections from SCR snubber board 2 (right board) terminals X1, X4, X5, X10, and X11. See Table 35 and Figure 140 for the connection locations.
  - Using a 7 mm socket wrench, remove two nuts securing the snubber board to the insulators on the PC/- bus and remove the wires from terminals L2 and X3. See Figure 140.
  - Remove the board from the drive.

**Figure 140: SCR Snubber Board 2**



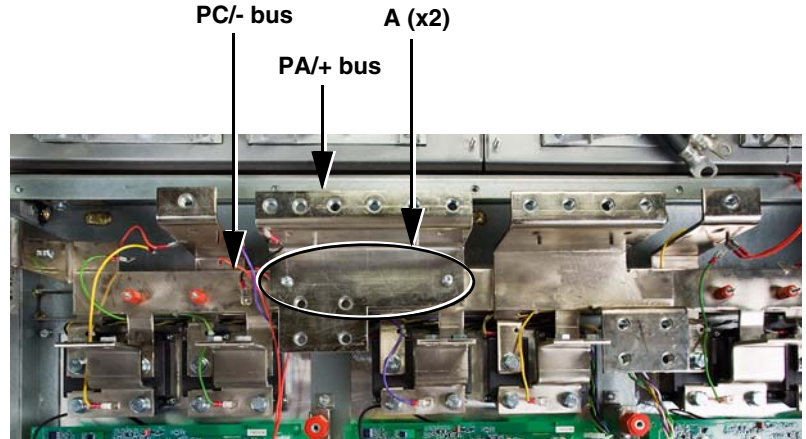
<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.  
<sup>2</sup> GDB: Gate driver board  
<sup>3</sup> PB: Power board  
<sup>4</sup> GDB: Gate driver board



### Remove the SCR Bus Work

- Using a T-30 Torx driver, remove two screws (A, Figure 141) securing the PA/+ bus bar to the red insulators on the PC/- bus and remove the PA/+ bus bar.

Figure 141: PA/+ Bus Connections



- Remove the six leads (B, Figures 142 and 143) from the six rectifier bus bars.
- Using a 16 mm socket wrench, remove twelve bolts (C, Figures 142 and 143) securing the rectifier bus bars to the SCR and diode modules (two bolts per rectifier bus bar).

Figure 142: Rectifier Bus Bars

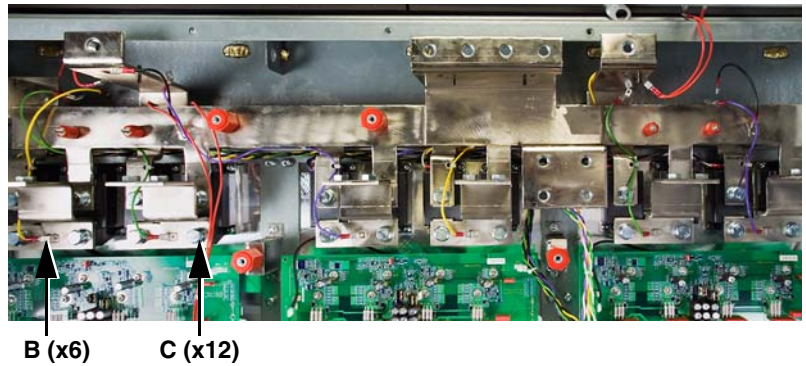
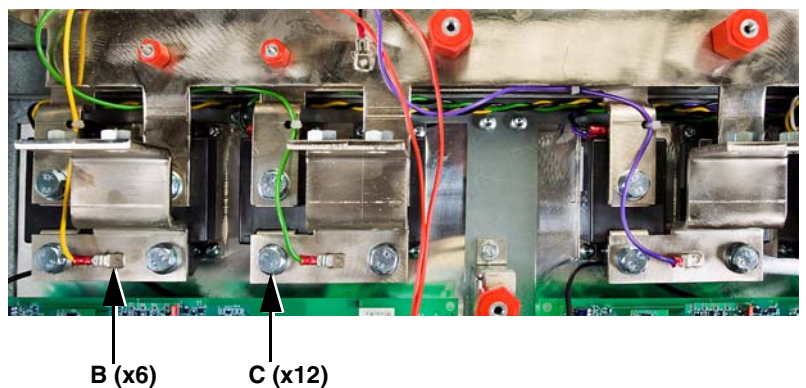
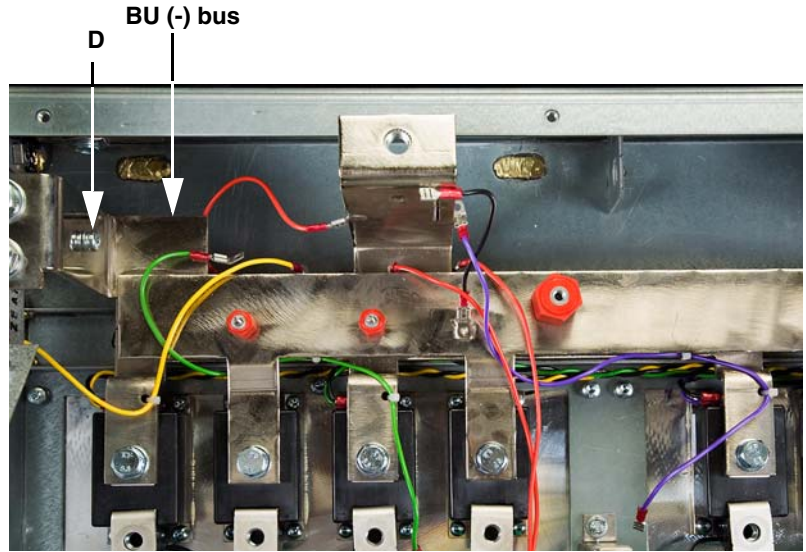


Figure 143: Rectifier Bus Bars, Detail



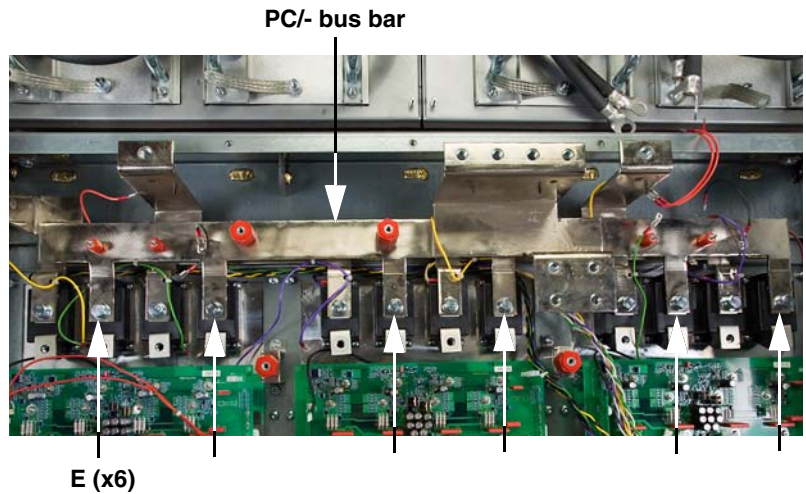
- Using a T-30 Torx driver, remove one screw (**D**, Figure 144) securing the BU (-) bus to the red insulator on the drive frame.

**Figure 144: BU (-) Bus Bar**



- Using a 16 mm socket wrench, remove six bolts (**E**, Figure 145) securing the PC/- bus bar to the diode modules and remove the bus bar.

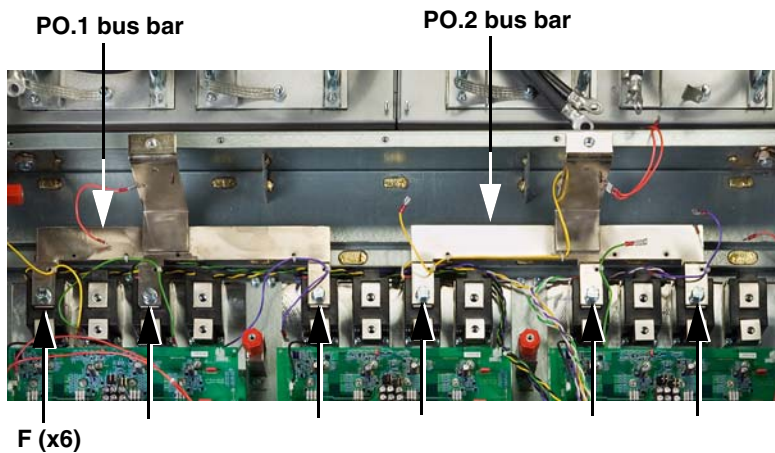
**Figure 145: PC/- Bus Bar**





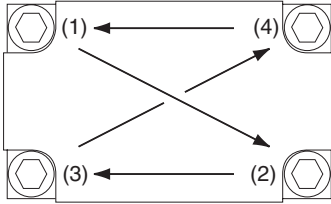
- Using a 16 mm socket wrench, remove six bolts (F, Figure 146) securing the PO.1 and PO.2 bus bars to SCR modules 1.1, 2.1, 3.1, 1.2, 2.2, and 3.2. Remove the bus bars.

Figure 146: PO.1 and PO.2 Bus Bars



**Replace the SCR or Diode Module**

**Figure 147: Torque Sequence**



**Table 36: SCR Module Wiring**

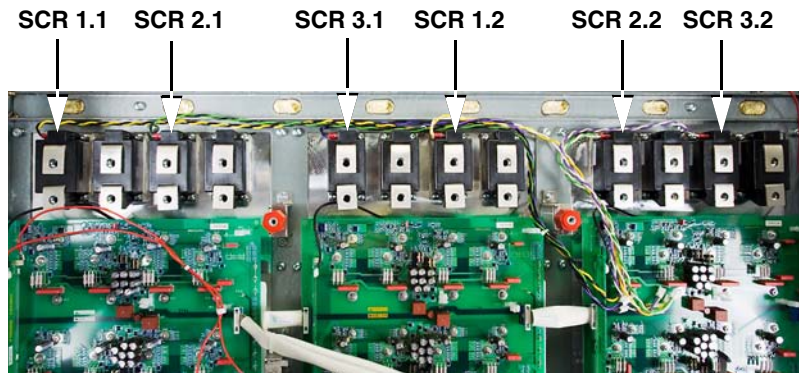
SCR Module No.	Wire Color
1.1	Yellow/black
2.1	Green/black
3.1	Violet/black
1.2	Yellow/white
2.2	Green/white
3.2	Violet/white

11. Replace an SCR module or diode module as follows.

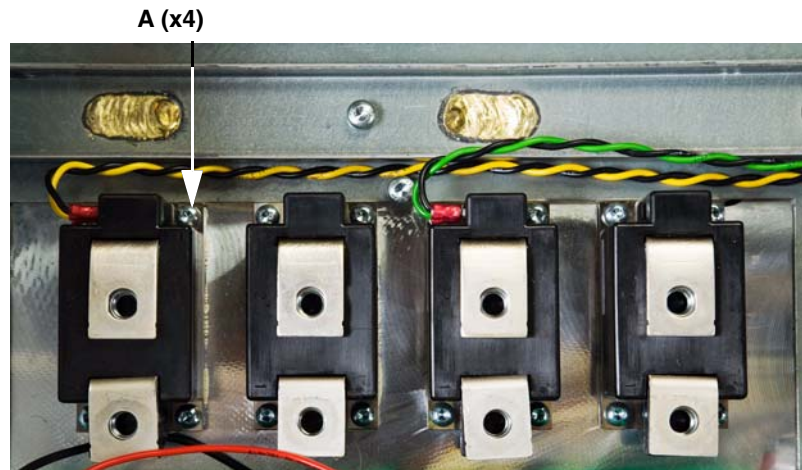
- If you are replacing an SCR module, remove the connections from terminals 4 (black wire) and 5 (color wire). See Figure 149.
- Using a T-20 Torx driver, remove four screws (**A**) securing the SCR or diode module to the heatsink and remove the module from the drive. See Figure 149.
- Clean the portion of the heatsink that makes contact with the SCR or diode module.
- Evenly coat the bottom of the new module with a thin layer of thermal compound included in the kit.
- Position the new SCR or diode module on the heatsink under the input bus bar.
- Using a T-20 Torx driver, secure the module with four screws (**A**). See Figure 149. Initially tighten the screws, in the sequence shown in Figure 147, to 0.7–1.0 N•m (6.2–8.9 lb-in), and then to a final torque of 3.3–4.4 N•m (29.2–38.9 lb-in).
- If you are replacing an SCR module, replace the connections to terminals 4 and 5. See Figure 149.

**NOTE:** Note the cable positions. See Table 36 for SCR module wiring.

**Figure 148: SCR Module Positions**



**Figure 149: SCR and Diode Modules**



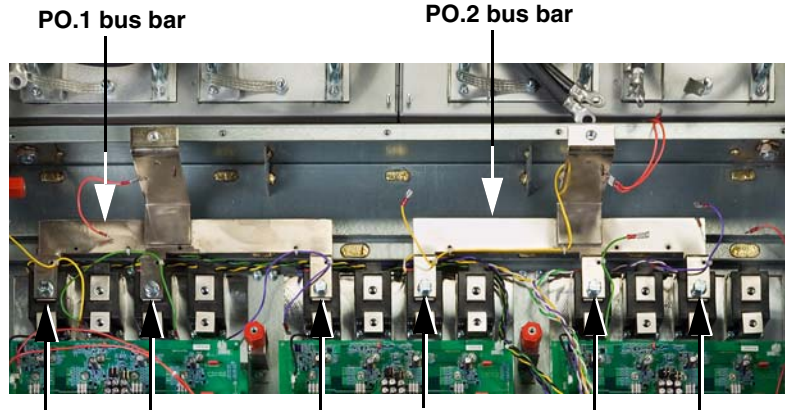
**Reinstall the SCR Buswork**

**Table 37: SCR Buswork Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
C	(12) 16-mm bolts	13.5	119.5
D	(1) T-30 screw	5.5	48.7
E	(6) 16-mm bolts	13.5	119.5
F	(6) 16-mm bolts	13.5	119.5

12. Using a 16 mm socket wrench, secure the PO.1 and PO.2 bus bars to the SCR modules with six bolts (F, Figure 150). Tighten the bolts to the torque values specified in Table 37.

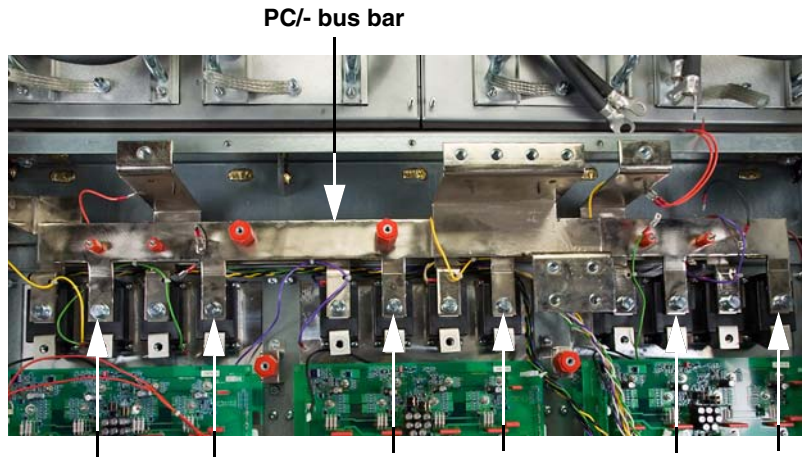
**Figure 150: PO.1 and PO.2 Bus Bars**



**F (x6)**

13. Using a 16 mm socket wrench, secure the PC/- bus bar to the diode modules with six bolts (E, Figure 151). Tighten the bolts to the torque values specified in Table 37.

**Figure 151: PC/- Bus Bar**

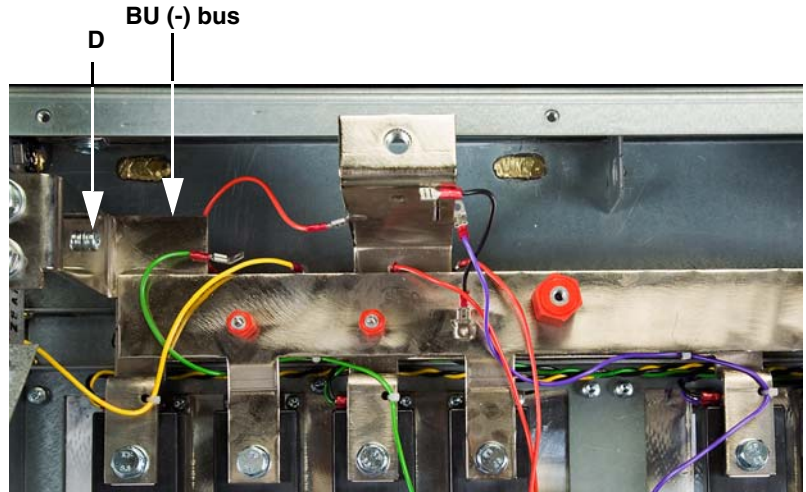


**E (x6)**



14. Using a T-30 Torx driver, secure the BU (-) bus to the red insulator on the drive frame with one screw (D, Figure 152). Tighten the screw to the torque values specified in Table 37 on page 133.

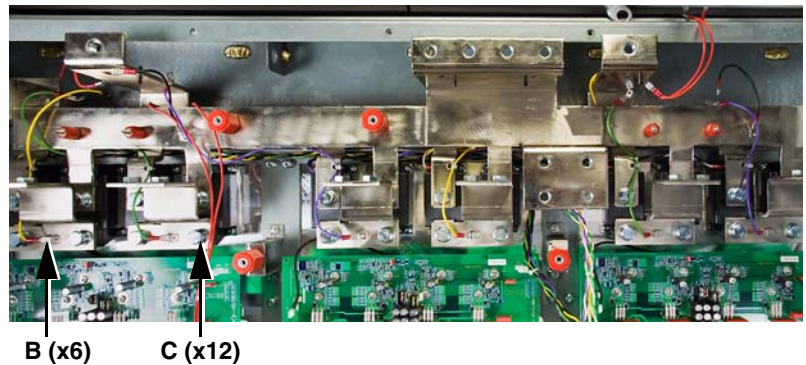
**Figure 152: BU (-) Bus Bar**



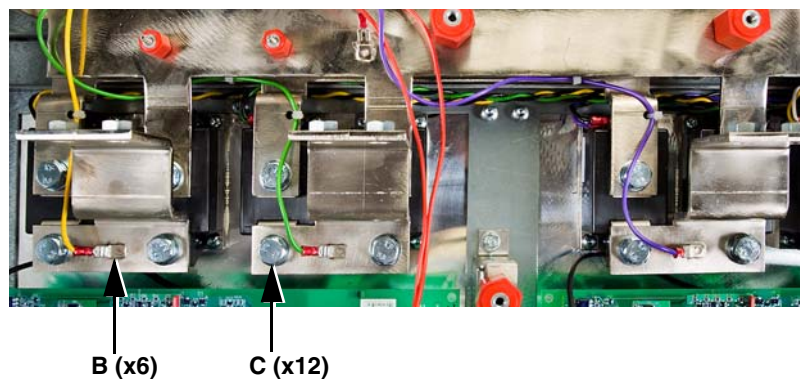
15. Using a 16 mm socket wrench, secure the six rectifier bus bars to terminal 1 of each SCR/diode module pair with twelve bolts—two bolts per rectifier bus bar (C, Figures 153 and 154). Tighten the bolts to the torque values specified in Table 37 on page 133.

16. Replace six leads (B, Figures 153 and 154) on the rectifier bus bars.

**Figure 153: Rectifier Bus Bars**

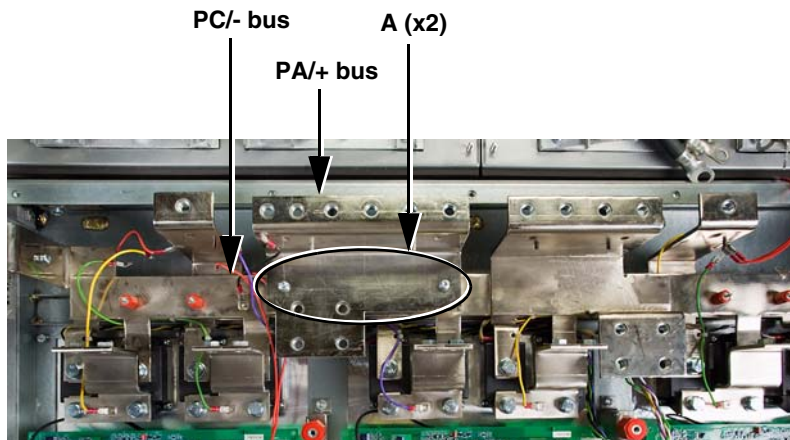


**Figure 154: Rectifier Bus Bars, Detail**



- Using a T-30 Torx driver, secure the PA/+ bus bar to the red insulators on the PC/- bus with two screws (A, Figure 155). Tighten the bolts to 5.5 N•m (48.7 lb-in).

**Figure 155: PA/+ Bus Connections**





**Replace the SCR Snubber Boards**

**Table 38: SCR Snubber Board 1 Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
E131	X1	Yellow, 1-pin	L1.1 rectifier
E130	X4	Red, 1-pin	PO.1 rectifier bus bar
E133	X5	Black, 1-pin	PC/- rectifier bus bar
E126	X10	Red, 0.25 in., 1-pin	GDB <sup>2</sup> U X61
E126	X11	Red, 0.19 in., 1-pin	PB <sup>3</sup> RFS31-X11
E167	L2	Green, 1-pin	L2.1 Line input bar
E168	X3	Violet, 1-pin	L3.1 Line input bar

<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

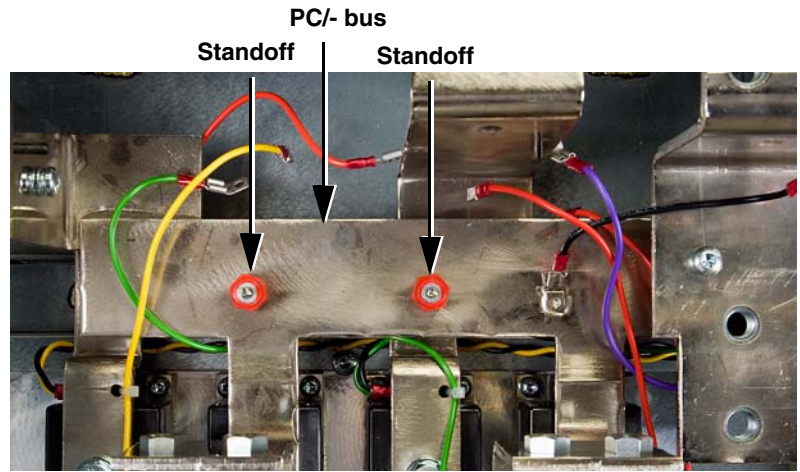
<sup>2</sup> GDB: Gate driver board

<sup>3</sup> PB: Power board

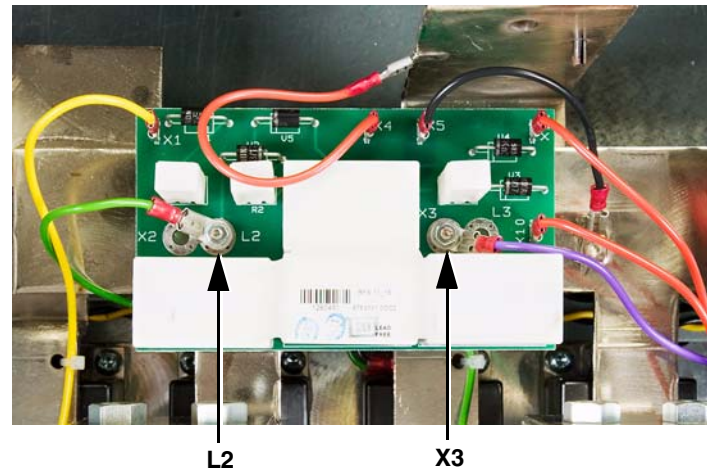
18. Replace SCR snubber board 1 (left board) as follows.

- Seat the SCR snubber board on the PC/- bus standoffs. See Figure 156.
- Replace the wires at terminals L2 and X3. Using a 7 mm socket wrench, secure the wires and the snubber board to the PC/- bus with two bolts. See Figure 157. Tighten the bolts to 1.2 N•m (10.6 lb-in).
- Replace the connections on SCR snubber board terminals X1, X4, X5, X10, and X11. See Table 38 and Figure 157 for the terminal locations.

**Figure 156: PC/- Bus**



**Figure 157: SCR Snubber Board 1**



**Table 39: SCR Snubber Board 2 Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
E157	X1	Yellow, 1-pin	L1.2 rectifier
E158	X4	Red, 1-pin	PO.2 rectifier bus bar
E159	X5	Black, 1-pin	PC/- rectifier bus bar
E160	X10	Red, 0.25 in., 1-pin	GDB <sup>2</sup> W X61
E158	X11	Red, 0.19 in., 1-pin	PO.2 rectifier bus bar
E169	L2	Green, 1-pin	L2.2 line input bar
E170	X3	Violet, 1-pin	L3.2 Line input bar

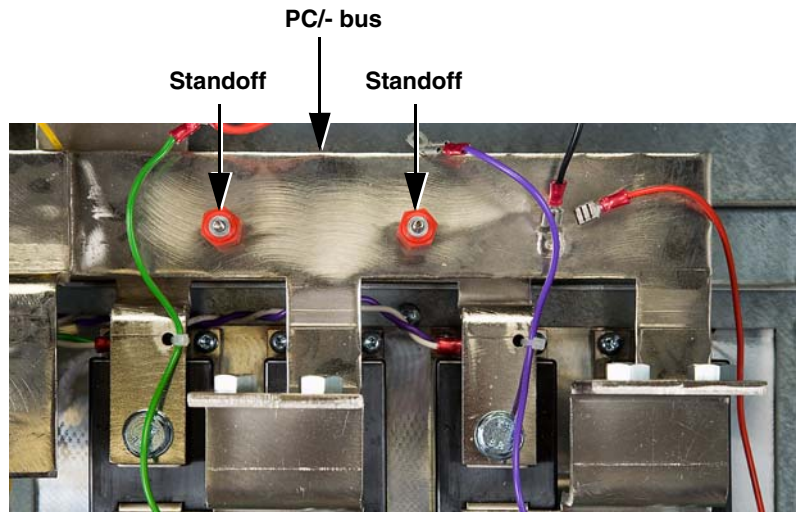
<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

<sup>2</sup> GDB: Gate driver board

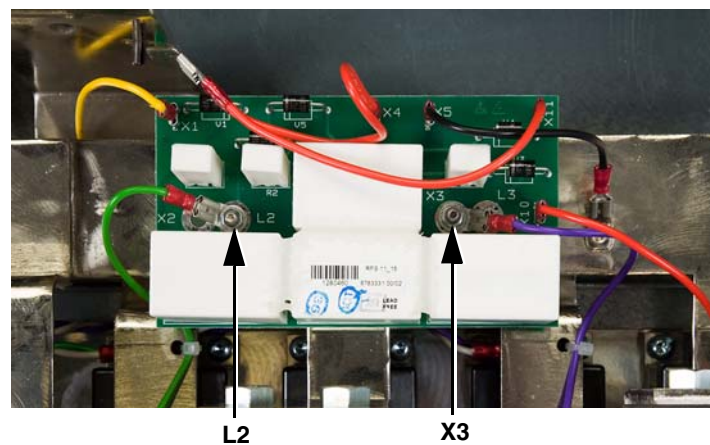
19. Replace SCR snubber board 2 (left board) as follows.

- Seat the SCR snubber board on the PC/- bus standoffs. See Figure 158.
- Replace the wires at terminals L2 and X3. Using a 7 mm socket wrench, secure the wires and the snubber board to the PC/- bus with two bolts. See Figure 159. Tighten the bolts to 1.2 N•m (10.6 lb-in).
- Replace the connections on SCR snubber board terminals X1, X4, X5, X10, and X11. See Table 39 and Figure 159 for the terminal locations.

**Figure 158: PC/- Bus**



**Figure 159: SCR Snubber Board 2**



## Replace the Rectifier Shield

20. Replace the plastic rectifier shield over the bus bars. See Figure 160. If the rectifier shield is cracked, broken, or damaged, replace it with a piece from the plastic kit. See “Replacing the Plastic Parts Kit VY1A1407” on page 23.

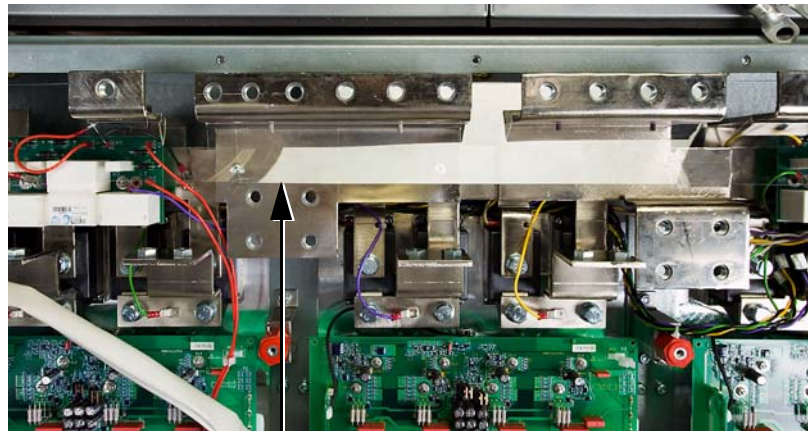
**⚠ DANGER**

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Install the rectifier shield as shown in Figure 160.
- Before installing the shield, ensure that it has no tears or cracks. If the shield is damaged, install a new piece from the plastic kit. See page 23.
- Do not install a damaged shield.

**Failure to follow these instructions will result in death or serious injury.**

Figure 160: Rectifier Shield



Shield



**Replace the Top Terminal Bracket**

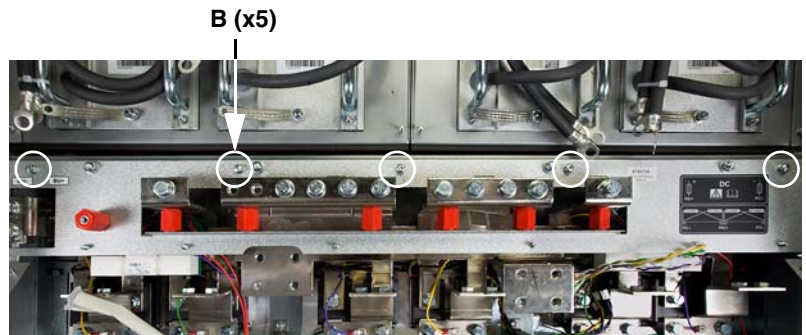
**Table 40: Top Terminal Bracket and Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
A	(6) T-30 screws	5.5	48.7
B	(5) T-30 screws	5.5	48.7
C	(10) 18-mm bolts	45	398

21. Replace the top terminal bracket as follows.

- Using a T-30 Torx driver, secure the terminal bracket to the drive frame with five screws (**B**, Figure 161). Tighten the screws to the torque values specified in Table 40.
- Using a T-30 right-angle Torx driver, secure the PO.1, PA/+, PC/-, and PO.2 bus bars to the red insulators on the terminal bracket with six screws (**A**, Figures 162 and 163). Tighten the screws to the torque values specified in Table 40.
- Using an 18 mm socket wrench, replace ten bolts (**C**, Figure 164 on page 140) in the PO.1, PA/+, PC/-, and PO.2 bus bars. Tighten the bolts to the torque values specified in Table 40.

**Figure 161: Top Terminal Bracket Mounting Hardware**



**Figure 162: Top Terminal Bracket Bus Bar Connections**



**Figure 163: Bus Bar Connection Detail**

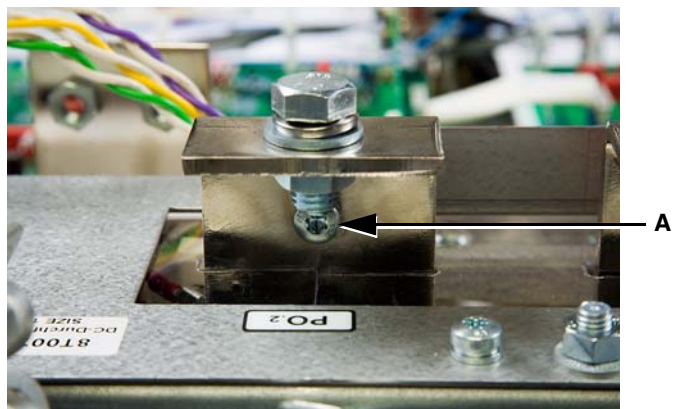
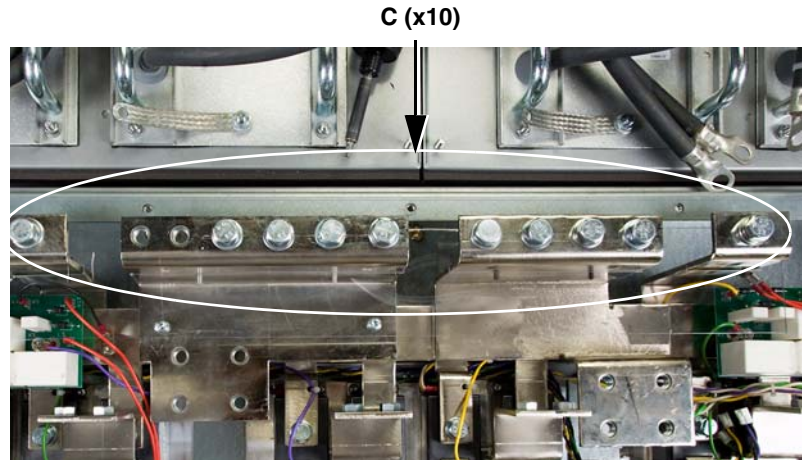


Figure 164: Bus Bar Connections



### Reassemble the Drive

If you are only replacing the SCR modules or the diode modules, perform Steps 3–24 of “Reassembly Steps for Level 2 Parts” beginning on page 141 to replace the following parts:

- |  |  |
|--|--|
| <input type="checkbox"/> Top DC bus plate                | <input type="checkbox"/> Power board assembly          |
| <input type="checkbox"/> Top phase-U DC bus plate        | <input type="checkbox"/> Fan control board connections |
| <input type="checkbox"/> Input bus bar brackets (bottom) | <input type="checkbox"/> Power board connections       |
| <input type="checkbox"/> Input bus bars                  | <input type="checkbox"/> Soft charge board connections |
| <input type="checkbox"/> Input bus bar brackets (top)    | <input type="checkbox"/> Control module assembly       |
| <input type="checkbox"/> Fan bracket                     | <input type="checkbox"/> EMC tray                      |
| <input type="checkbox"/> BU (+) bus bar                  | <input type="checkbox"/> Power terminal shields        |
| <input type="checkbox"/> Middle crossbrace               | <input type="checkbox"/> Front cover                   |



## Reassembly Steps for Level 2 Parts

**IMPORTANT:** Label and retain all removed hardware and cables for use in reassembly.

**⚠ DANGER**

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Read and understand the precautions in “Before You Begin” starting on page 5 before performing this procedure.
- Before working on this equipment, turn off all power supplying it and perform the DC bus voltage measurement procedure on page 11.

**Failure to follow these instructions will result in death or serious injury.**

This section contains instructions for replacing the following parts in the drive:

- |  |  |
|--|--|
| <input type="checkbox"/> Bottom DC bus plate             | <input type="checkbox"/> Middle crossbrace             |
| <input type="checkbox"/> Gate driver boards              | <input type="checkbox"/> Power board assembly          |
| <input type="checkbox"/> Top DC bus plate                | <input type="checkbox"/> Fan control board connections |
| <input type="checkbox"/> Top phase-U DC bus plate        | <input type="checkbox"/> Power board connections       |
| <input type="checkbox"/> Input bus bar brackets (bottom) | <input type="checkbox"/> Soft charge board connections |
| <input type="checkbox"/> Input bus bars                  | <input type="checkbox"/> Control module assembly       |
| <input type="checkbox"/> Input bus bar brackets (top)    | <input type="checkbox"/> EMC tray                      |
| <input type="checkbox"/> Fan bracket                     | <input type="checkbox"/> Power terminal shields        |
| <input type="checkbox"/> BU (+) bus bar                  | <input type="checkbox"/> Front cover                   |

You must perform some or all of the procedures in this section after replacing the spare parts identified in Table 41. Consult Table 41 for the reassembly steps that must be performed for the corresponding spare parts.

**Table 41: Reassembly Steps**

If you replaced:	Perform reassembly steps:
Power board VX5A1HC5063	Steps 21–24
Brake board VZ3F1113	Steps 21–24
Power board assembly shields (Plastic Parts Kit VY1A1407)	Steps 17–24
Motor current sensors VY1A1109	Steps 14–24
Gate driver boards VX5A1204	Steps 3–24
SCR modules VZ3TM1600M1671	Steps 3–24
Diode modules VZ3DM1600M1671	
Temperature sensors VZ3G1104	Steps 2–24
Power IGBT modules VZ3IM1604M1271	Steps 1–24
Capacitors VY1ADC1112	

**Replace the Bottom DC Bus Plate(s)**

1. Replace the Bottom DC bus plate as follows.
  - Position the DC bus plate in the drive as illustrated in Figure 165.
  - Using a T-30 Torx driver, secure the DC bus plate to terminal E on the IGBT modules (C, Figure 165) with four screws.
  - Replace the jumpers between the DC bus plates (E, Figure 165). Using a T-30 Torx driver, secure the jumpers and bus plate to the capacitors with sixteen 14 mm screws (D, Figure 165).
  - Using a T-30 Torx driver, secure the DC bus plate to terminal E on the IGBT modules with four 20 mm screws (F, Figure 165).
  - Using a 10 mm socket wrench, install four short (6 mm) standoffs (G, Figure 165) and four long (11 mm) standoffs (H, Figure 165).
  - If you are replacing the phase-V DC bus plate, connect two bleeder resistor wires, E161 and E162 (J, Figure 165). If you are replacing the phase-W DC bus plate, connect one bleeder resistor, wire E163. The phase-U DC bus plate does not have bleeder resistor connections.
  - If you are replacing the phase-U or W DC bus plates, using an 18 mm socket wrench, secure the DC bus plate to the associated output bus bar with two bolts and washers (B, Figures 166 and 167). If you are replacing the phase-U DC bus plate, this step is not necessary.
  - Connect the wire to the motor current sensor in the phase (A, Figures 166 and 167).
  - Tighten the hardware to the torque values specified in Table 42.

**Figure 165: DC Bus Plate (Phase V Shown)**

**Table 42: Bottom DC Bus Plate Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
B	(2) 18-mm bolts and washers	45	398
C	(4) Short T-30 screws (14 mm length)	5.5	48.7
D	(16) Short T-30 screws (14 mm length)	3.3	29.2
F	(4) Long T-30 screws (20 mm length)	5.5	48.7
G	(4) Short 10-mm standoffs (6 mm length)	5.5	48.7
H	(4) Long 10-mm standoffs (11 mm length)	5.5	48.7

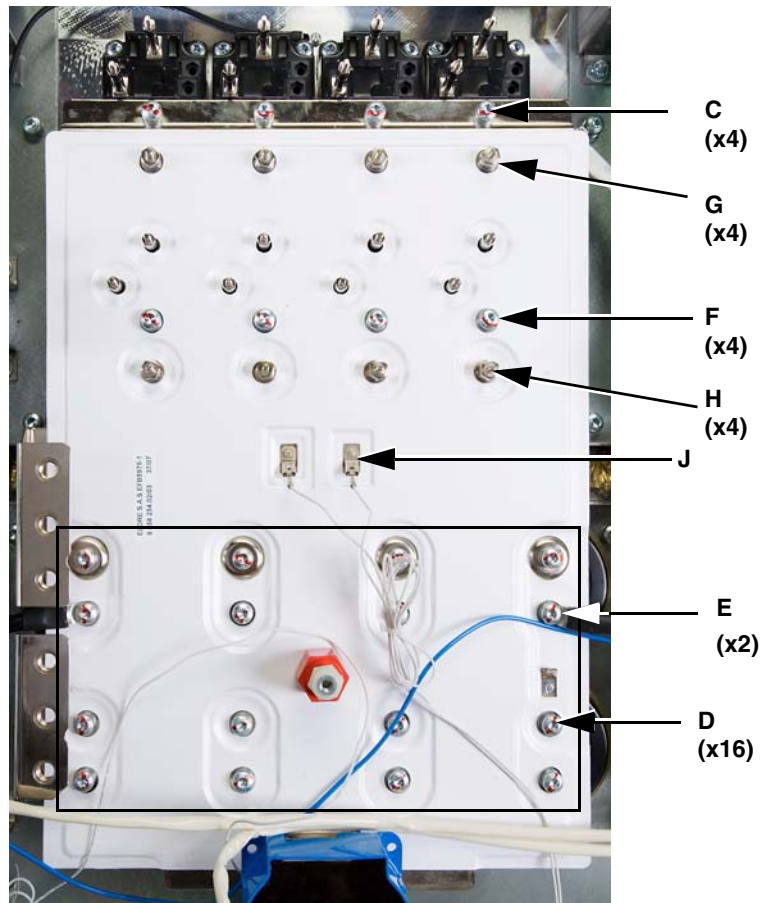


Figure 166: DC Bus Plates, Phase V Shown

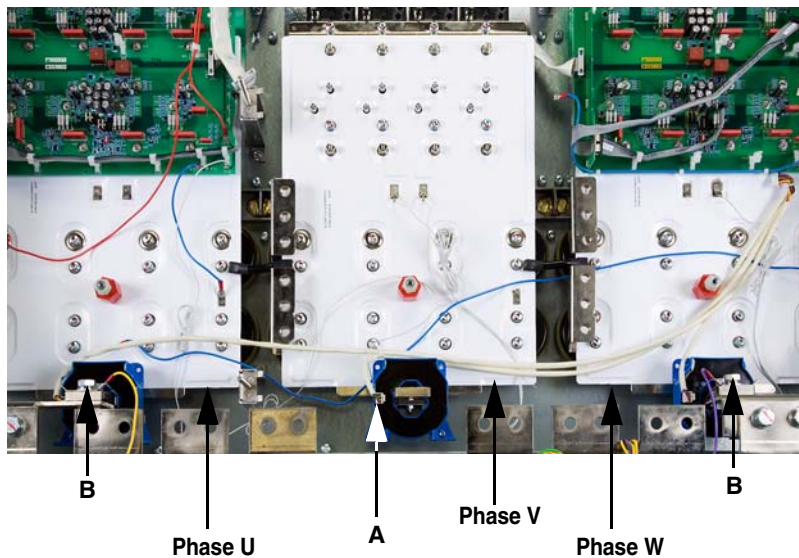
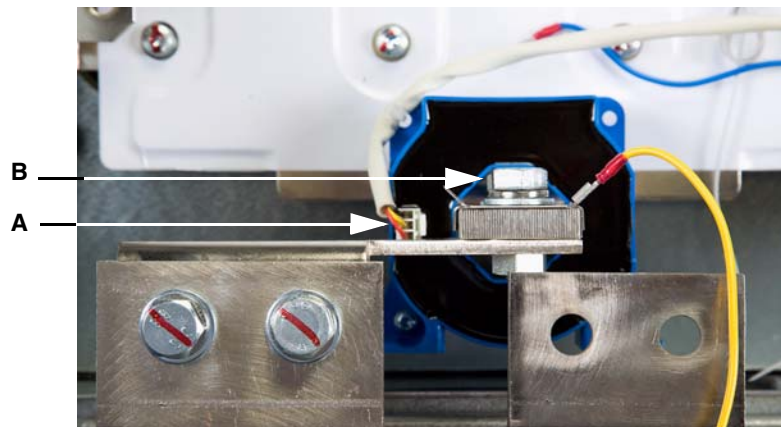


Figure 167: DC Bus Plate and Motor Current Sensor Detail



## Replace the Gate Driver Boards

2. Replace the gate driver board(s) as follows.

- Using a 7 mm socket wrench, secure the gate driver board(s) to the power IGBT modules and the DC bus plate with 24 nuts each. See Figure 169 on page 145. Tighten the nuts to 1.2 N•m (10.6 lb-in).
- Replace the gate driver board connections. See Table 43.

**Table 43: Gate Driver Board Wiring<sup>1</sup>**

Wire No. <sup>2</sup>	Terminal No.	Description	To:
<b>Gate Driver Board U (Left)</b>			
E144	X4	2-pin, black	Temperature sensor U
E138	X32	18-pin, gray	GDB <sup>3</sup> V, X31
E129	X51	1-pin, blue	UD0 (neutral) on DC bus plate
E127	X52	1-pin, blue	GDB V, X51
E126	X61	1-pin, red	SB <sup>4</sup> 1, X10
E139	X62	1-pin, white	Bleeder resistor 1
E100	X82	14-pin, white	GDB V, X81 and PB <sup>5</sup> , X8
<b>Gate Driver Board V (Center)</b>			
E128	X4	2-pin, black	Temperature sensor V
E138	X31	18-pin, gray	GDB <sup>3</sup> U, X32
E146	X32	18-pin, gray	GDB W, X31
E127	X51	1-pin, blue	GDB U, X52
E123	X52	1-pin, blue	GDB W, X51
E100	X81	14-pin, white	GDB U, X82 and PB <sup>5</sup> , X8
E102	X82	14-pin, white	GDB W, X81
<b>Gate Driver Board W (Right)</b>			
E145	X4	2-pin, black	Temperature sensor W
E146	X31	18-pin, gray	GDB <sup>3</sup> V, X32
E142	X32	18-pin, gray	PB <sup>5</sup> , X3
E123	X51	1-pin, blue	GDB V, X52
E102	X81	14-pin, white	GDB V, X82
E132	X53	1-pin, blue	Insulator near MCB <sup>6</sup>
E164	X62	1-pin, white	Bleeder resistor 3
E160	X61	1-pin, red	SB <sup>4</sup> 2, X10

<sup>1</sup> Terminals X4 and X32 are connected to a daughter board on the gate driver board assembly.

<sup>2</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

<sup>3</sup> GDB: Gate driver board

<sup>4</sup> SB: SCR snubber board

<sup>5</sup> PB: Power board

<sup>6</sup> MCB: Motor control board

Figure 168: Gate Driver Boards

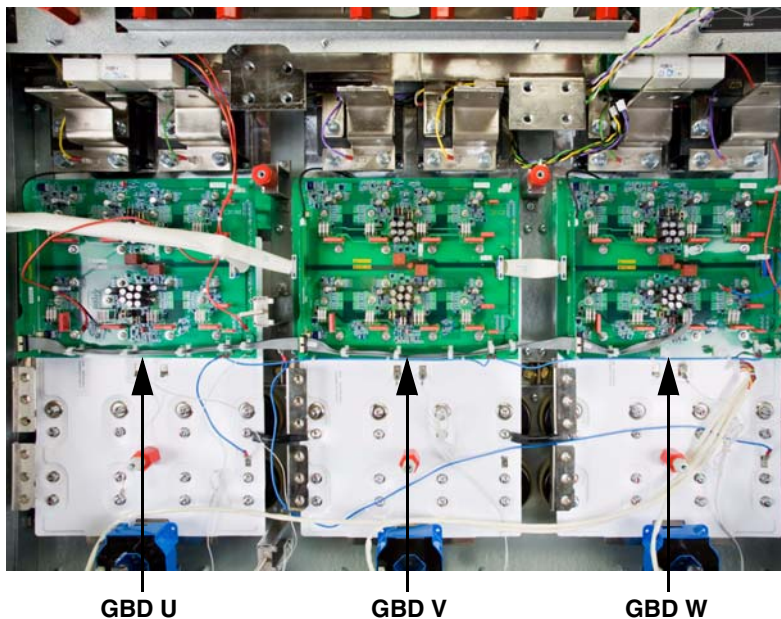
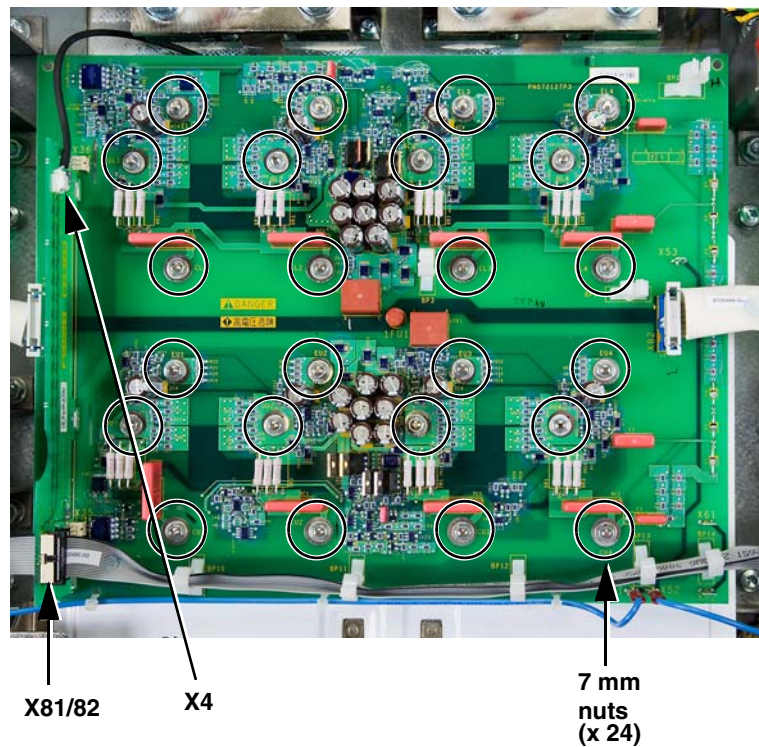


Figure 169: Gate Driver Board Detail, Phase V Shown





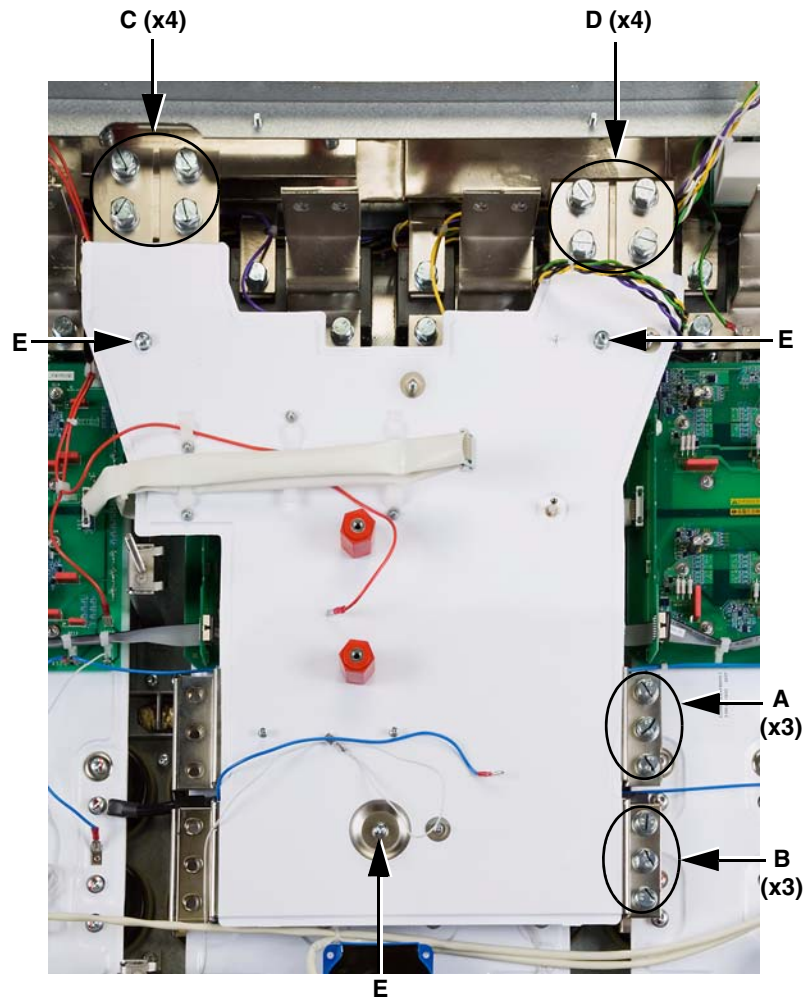
**Replace the Top DC Bus plate**

3. Replace the top DC bus plate as follows. See Figure 170.
  - Position the bus plate in the drive as illustrated in Figure 170.
  - Using an 18 mm socket wrench, secure the bus plate to the positive (+) rectifier bus with four bolts (**C**).
  - Using an 18 mm socket wrench, secure the bus plate to the negative (-) rectifier bus with four bolts (**D**).
  - Using a T-30 Torx driver, secure the bus plate to the red insulators on the heatsink and the phase-V bus plate with three screws (**E**).
  - Using a 16 mm socket wrench, secure the bus plate to the positive (+) phase-W DC bus with three bolts (**A**).
  - Using a 16 mm socket wrench, secure the bus plate to the negative (-) phase-W DC bus with three bolts (**B**).
  - Tighten the hardware to the torque values specified in Table 44.

**Figure 170: Top DC Bus Plate**

**Table 44: Top DC Bus Plate Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
<b>A</b>	(3) 16-mm bolts	27	239
<b>B</b>	(3) 16-mm bolts	27	239
<b>C</b>	(4) 18-mm bolts	45	398
<b>D</b>	(4) 18-mm bolts	45	398
<b>E</b>	(3) T-30 screws	5.5	48.7



**Replace the Top Phase-U DC Bus Plate**

**⚠ DANGER**

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Install the bus plate shield as shown in Figure 171.
- Before installing the shield, ensure that it has no tears or cracks. If the shield is damaged, install a new piece from the plastic kit. See page 23.
- Do not install a damaged shield.

**Failure to follow these instructions will result in death or serious injury.**

4. Replace the top phase-U DC bus plate as follows. See Figure 171.
  - Position the bus plate in the drive as illustrated in Figure 171.
  - Using a 16 mm socket wrench, secure the bus plate to the positive (+) bus with six bolts (**B**).
  - Using a 16 mm socket wrench, secure the bus plate to the negative (-) bus with six bolts (**C**).
  - Using a T-30 Torx driver, secure the bus plate to the insulator on the top DC bus plate with one screw (**D**).
  - Using a 10 mm socket wrench, secure the plastic shield to the bus plate with four screws (**A**).

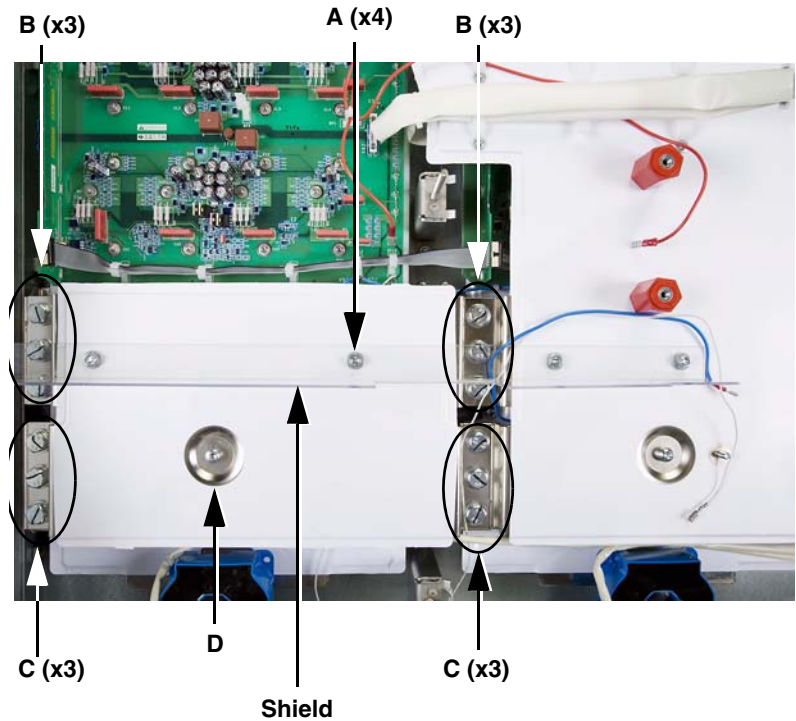
If the shield is torn, cracked, or damaged, replace it with a new piece from the plastic parts kit. See “Replacing the Plastic Parts Kit VY1A1407” beginning on page 23.

  - Tighten the hardware to the torque values specified in Table 45.

**Figure 171: Phase-U DC Bus Plate**

**Table 45: Top Phase-U DC Bus Plate Hardware Torque Values**

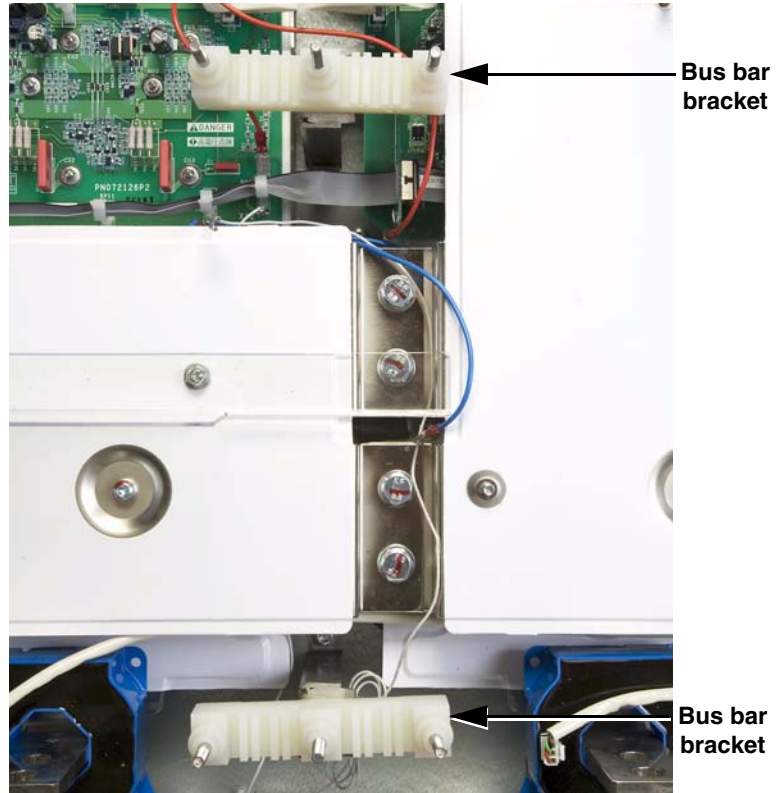
Item	Description	Torque Range	
		N•m	lb-in
<b>A</b>	(4) 10-mm screws	5.5	48.7
<b>B</b>	(6) 16-mm bolts	27	239
<b>C</b>	(6) 16-mm bolts	27	239
<b>D</b>	(1) T-30 screw	5.5	48.7



**Replace the Input Bus Bar Brackets (Bottom)**

5. Install the bottom half of the input bus bar brackets on the mounting posts on the drive frame.  
Before installing the brackets, ensure that they have no tears or cracks. If the brackets are damaged, install a new piece from the plastic kit. See page 23.

**Figure 172: Input Bus Bar Brackets, Bottom**



### Replace the Input Bus Bars

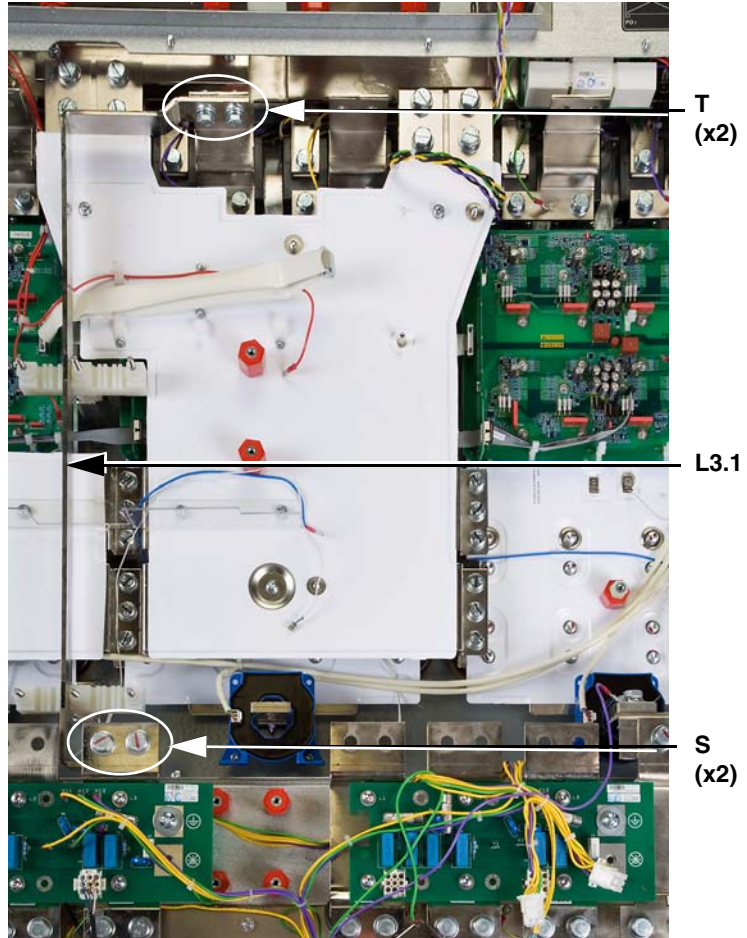
**NOTE:** L1.1, L2.1, and L3.1 are associated with input rectifier 1. L1.2, L2.2, and L3.2 are associated with input rectifier 2.

6. Replace the L3.1 input bus bar as follows. See Figure 173.
  - Position the bus bar in the drive as shown in Figure 173.
  - Using a 16 mm socket wrench, secure the top of the bus bar to the L3.1 rectifier with two bolts (**T**, Figure 173).
  - Using an 18 mm socket wrench, secure the bottom of the bus bar to the T/L3.1 bus bar with two bolts and washers (**S**, Figure 173).
  - Tighten the hardware to the torque values specified in Table 46.

**Figure 173: L3.1 Input Bus Bar**

**Table 46: L3.1 Input Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
<b>T</b>	(2) 16-mm bolts	27	239
<b>S</b>	(2) 18-mm bolts and washers	45	398



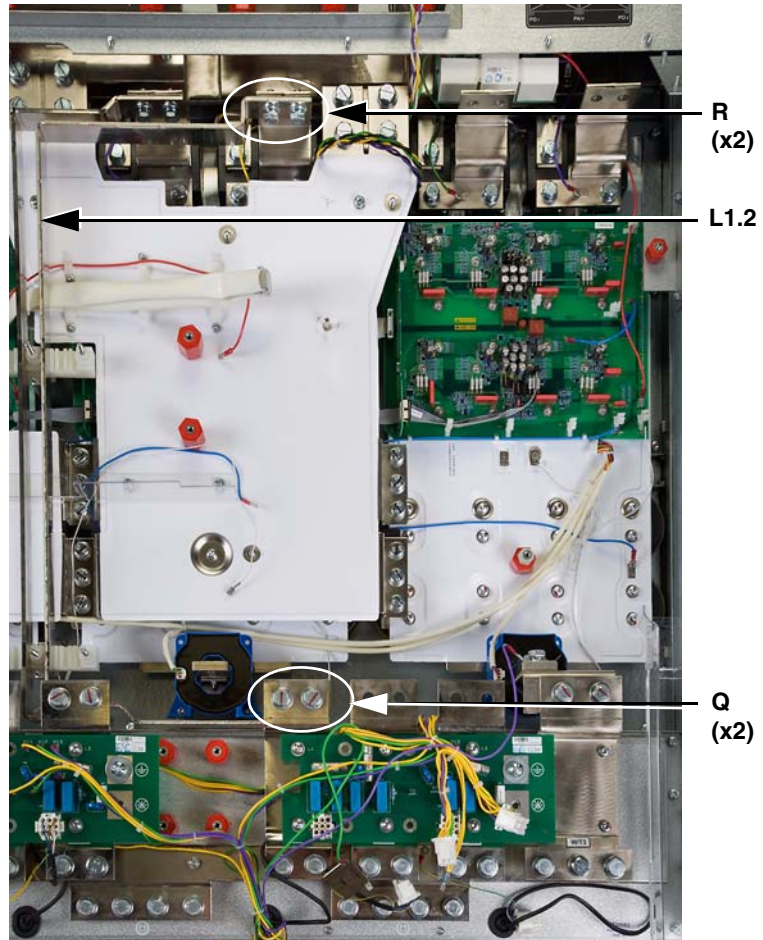


7. Replace the L1.2 input bus bar as follows. See Figure 174.
  - Position the bus bar in the drive as shown in Figure 174.
  - Using a 16 mm socket wrench, secure the top of the bus bar to the L1.2 rectifier with two bolts (**R**, Figure 174).
  - Using an 18 mm socket wrench, secure the bottom of the bus bar to the R/L1.2 bus bar with two bolts and washers (**Q**, Figure 174).
  - Tighten the hardware to the torque values specified in Table 47.

**Figure 174: L1.2 Input Bus Bar**

**Table 47: L1.2 Input Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
<b>R</b>	(2) 16-mm bolts	27	239
<b>Q</b>	(2) 18-mm bolts and washers	45	398



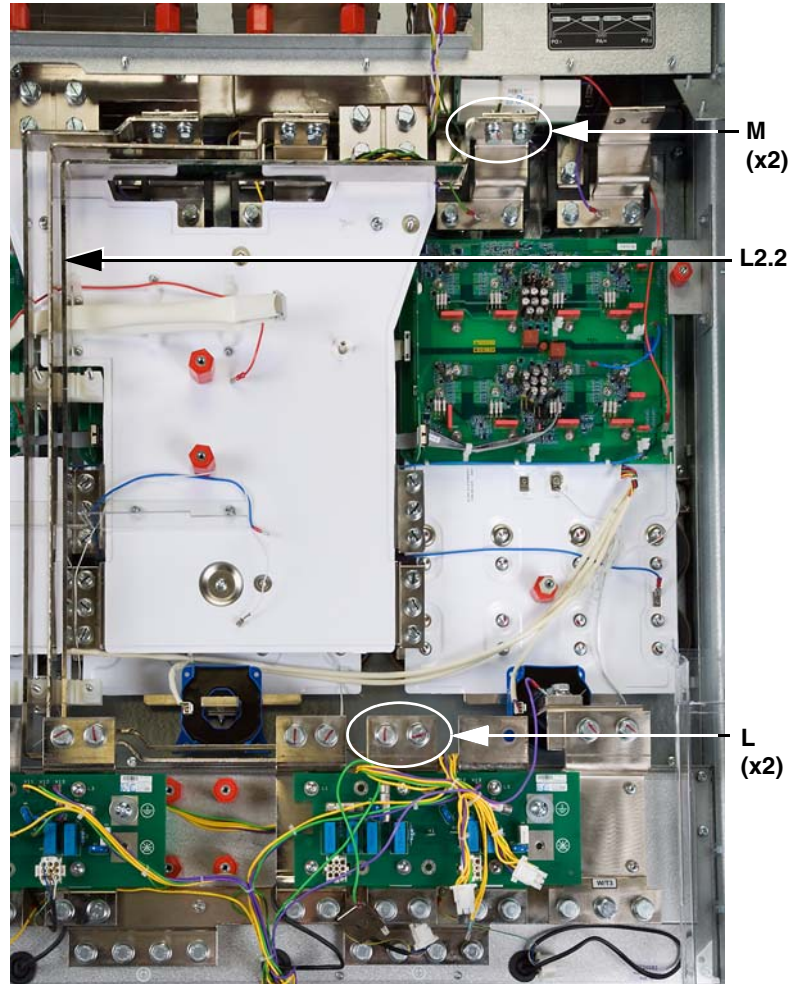


8. Replace the L2.2 input bus bar as follows. See Figure 175.
  - Position the bus bar in the drive as shown in Figure 175.
  - Using a 16 mm socket wrench, secure the top of the bus bar to the L2.2 rectifier with two bolts (M, Figure 175).
  - Using an 18 mm socket wrench, secure the bottom of the bus bar to the S/L2.2 bus bar with two bolts and washers (L, Figure 175).
  - Tighten the hardware to the torque values specified in Table 48.

Figure 175: L2.2 Input Bus Bar

Table 48: L2.2 Input Bus Bar Hardware Torque Values

Item	Description	Torque Range	
		N•m	lb-in
M	(2) 16-mm bolts	27	239
L	(2) 18-mm bolts and washers	45	398



9. Replace the L3.2 input bus bar as follows. See Figure 176.
  - Position the bus bar in the drive as shown in Figure 176.
  - Using a 16 mm socket wrench, secure the top of the bus bar to the L3.2 rectifier with two bolts (**G**, Figure 176).
  - Using an 18 mm socket wrench, secure the bottom of the bus bar to the T/L3.2 bus bar with two bolts and washers (**F**, Figure 176).
  - Tighten the hardware to the torque values specified in Table 49.

**Figure 176: L3.2 Input Bus Bar**

**Table 49: L3.2 Input Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
<b>G</b>	(2) 16-mm bolts	27	239
<b>F</b>	(2) 18-mm bolts and washers	45	398



10. Replace the V/T2 bus bar as follows.

- Using a T-30 Torx driver, secure the V/T2 bus bar to the insulators on the bottom terminal bracket with two screws and washers (J, Figure 177).
- Using an 18 mm socket wrench, secure the output from the phase-V DC bus plate to the V/T2 bus bar with two bolts and washers (F, Figure 178).

**NOTE:** Replace the sensor plate (G, Figures 177 and 178) under the front bolt.

- Using a T-30 Torx driver, secure the insulator plate to the V/T2 bus bar two screws (H, Figure 178).
- Tighten the hardware to the torque values specified in Table 50.

Figure 177: V/T2 Bus Bar

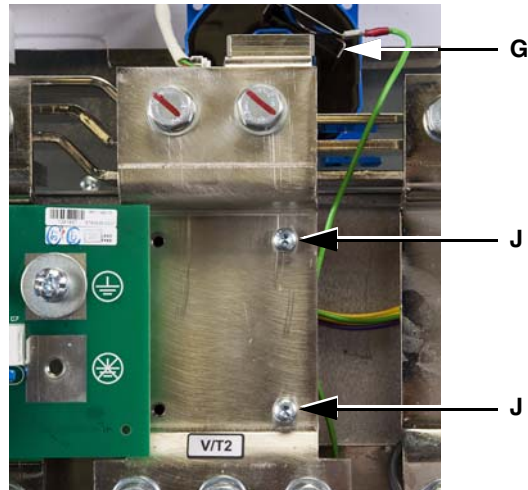
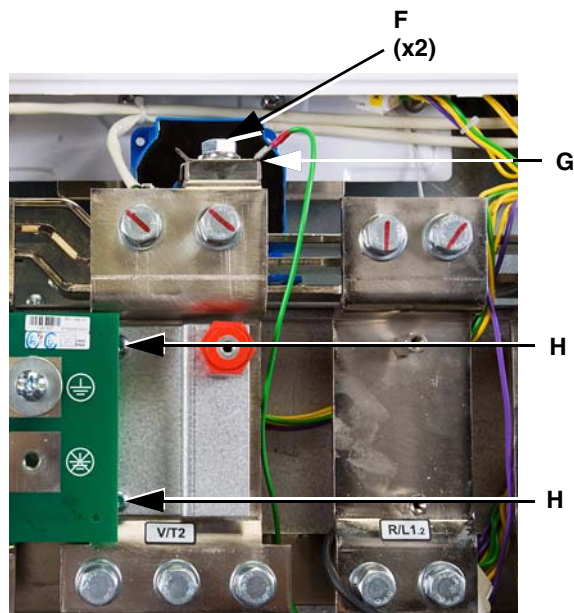


Table 50: V/T2 Bus Bar Hardware Torque Values

Item	Description	Torque Range	
		N•m	lb-in
F	(2) 18-mm bolts and washers	45	398
H	(2) T-30 screws	5.5	48.7
J	(2) T-30 screws and washers	5.5	48.7

Figure 178: V/T2 Bus Bar



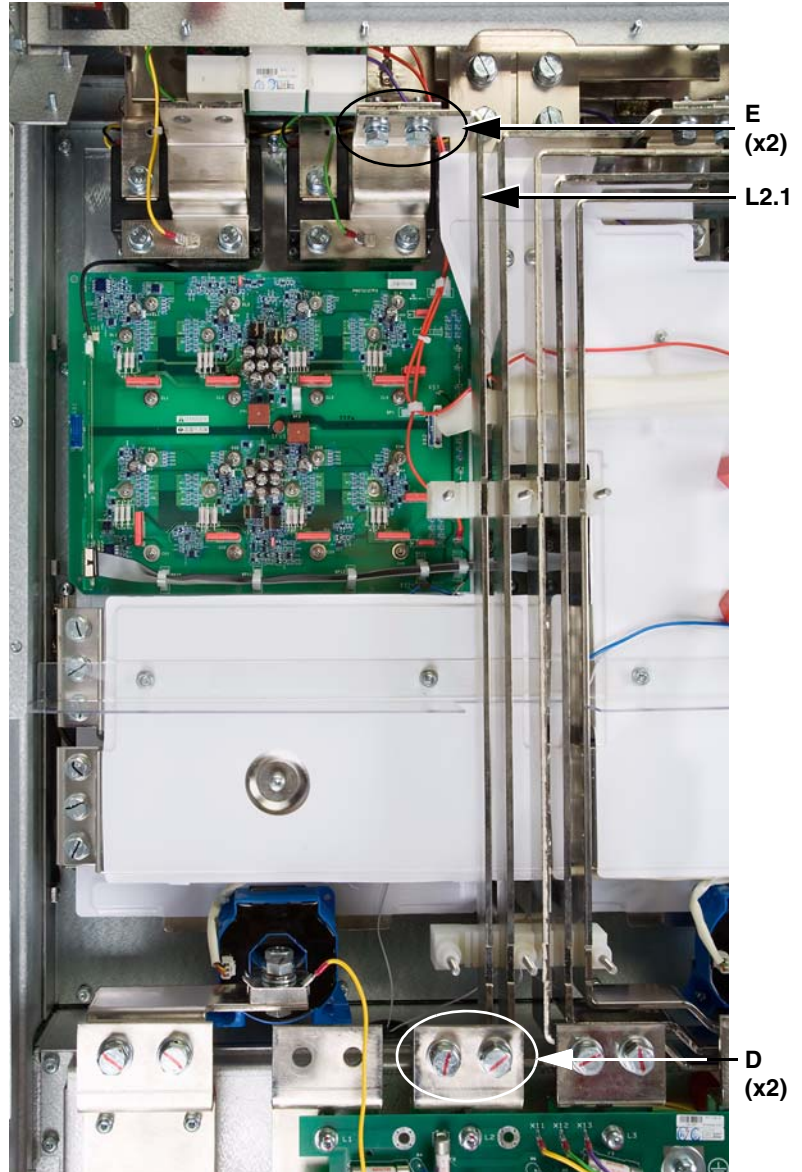


11. Replace the L2.1 input bus bar as follows. See Figure 179.
  - Position the bus bar in the drive as shown in Figure 179.
  - Using a 16 mm socket wrench, secure the top of the bus bar to the L2.1 rectifier with two bolts (E, Figure 179).
  - Using an 18 mm socket wrench, secure the bottom of the bus bar to the S/L2.1 bus bar with two bolts and washers (D, Figure 179).
  - Tighten the hardware to the torque values specified in Table 51.

**Figure 179: L2.1 Input Bus Bar**

**Table 51: L2.1 Input Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
E	(2) 16-mm bolts	27	239
D	(2) 18-mm bolts and washers	45	398

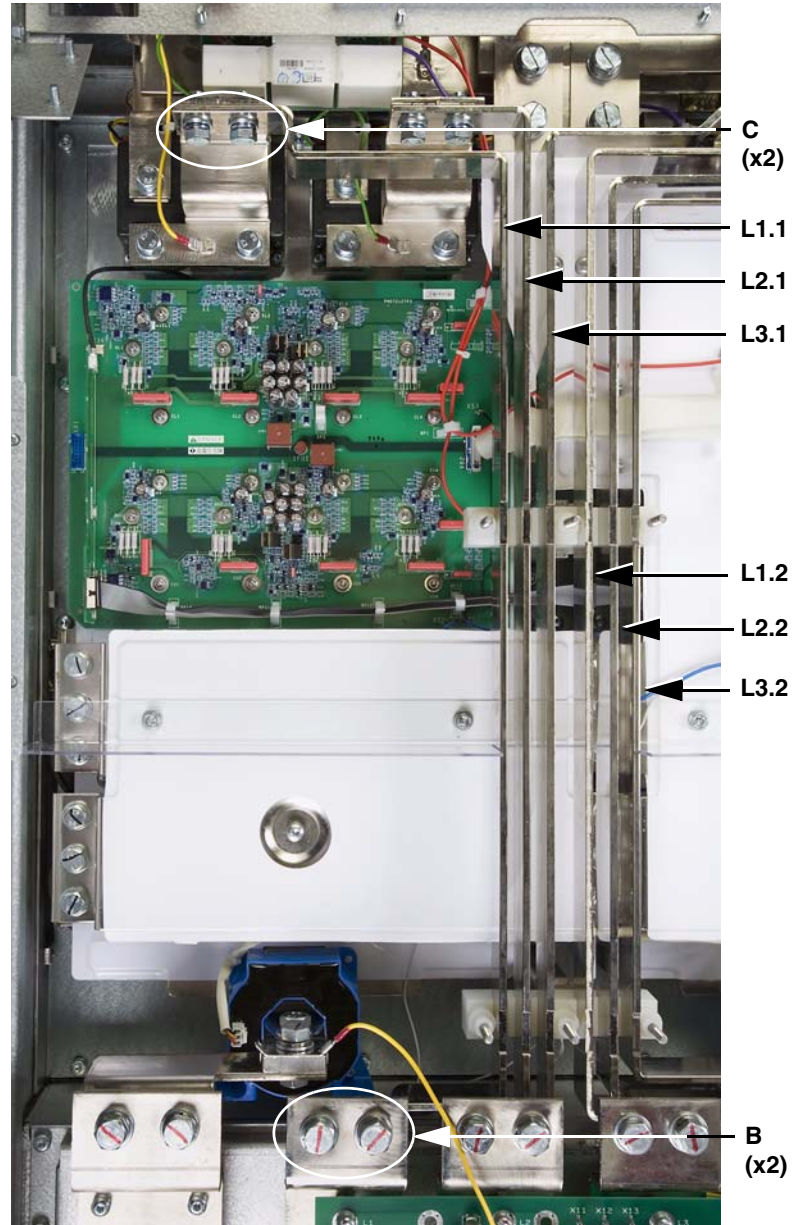


12. Replace the L1.1 input bus bar as follows. See Figure 180.
  - Position the bus bar in the drive as shown in Figure 180.
  - Using a 16 mm socket wrench, secure the top of the bus bar to the L1.1 rectifier with two bolts (**C**, Figure 180).
  - Using an 18 mm socket wrench, secure the bottom of the bus bar to the R/L1.1 bus bar with two bolts and washers (**B**, Figure 180).
  - Tighten the hardware to the torque values specified in Table 52.

**Figure 180: L1.1 Input Bus Bar**

**Table 52: L1.1 Input Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
<b>C</b>	(2) 16-mm bolts	28	247.8
<b>B</b>	(2) 18-mm bolts and washers	45	398



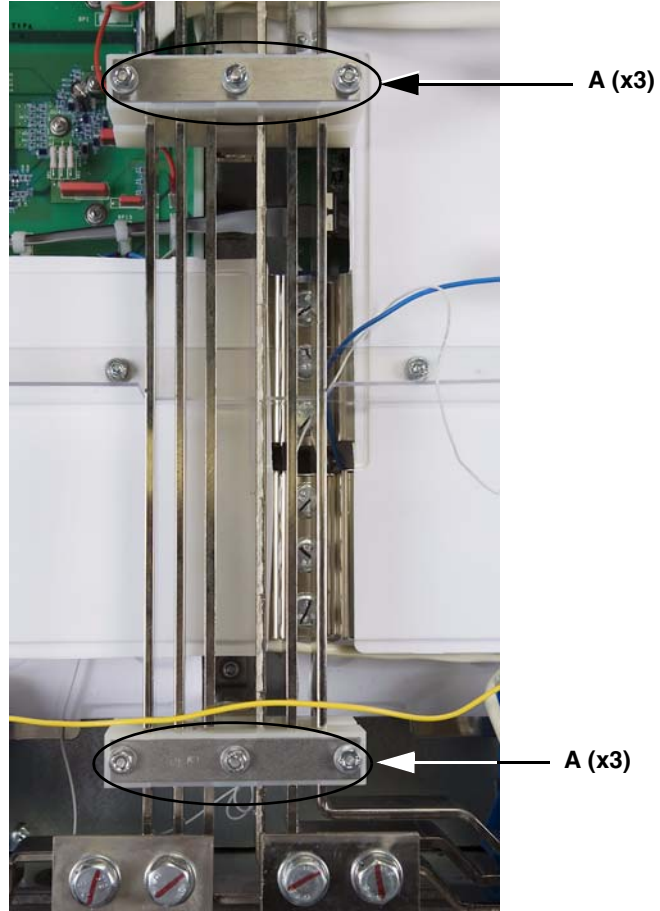


**Replace the Input Bus Bar Brackets (Top)**

13. Using a 10 mm socket wrench, secure the top half of the input bus bar brackets to the bottom half with six nuts (A). See Figure 181. Tighten the nuts to 5.5 N•m (48.7 lb-in).

Before installing the brackets, ensure that they have no tears or cracks. If the brackets are damaged, install a new piece from the plastic kit. See page 23.

**Figure 181: Input Bus Bar Brackets (Top)**



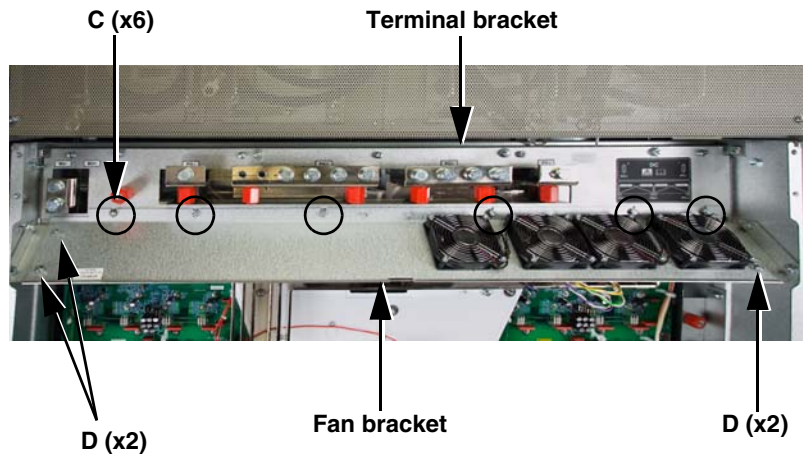
### Replace the Fan Bracket

**Table 53: Fan Bracket and BU (+) Bus Bar Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
A	(2) 18-mm bolts and washers	45	398
B	(1) T-30 screw	5.5	48.7
C	(6) 10-mm nuts	5.5	48.7
D	(4) 10-mm nuts	5.5	48.7

14. Using a 10 mm socket wrench, secure the fan bracket to the top terminal bracket (C) and the drive frame (D) with ten nuts. See Figure 182. Tighten the nuts to the torque values specified in Table 53.

**Figure 182: Fan Bracket**

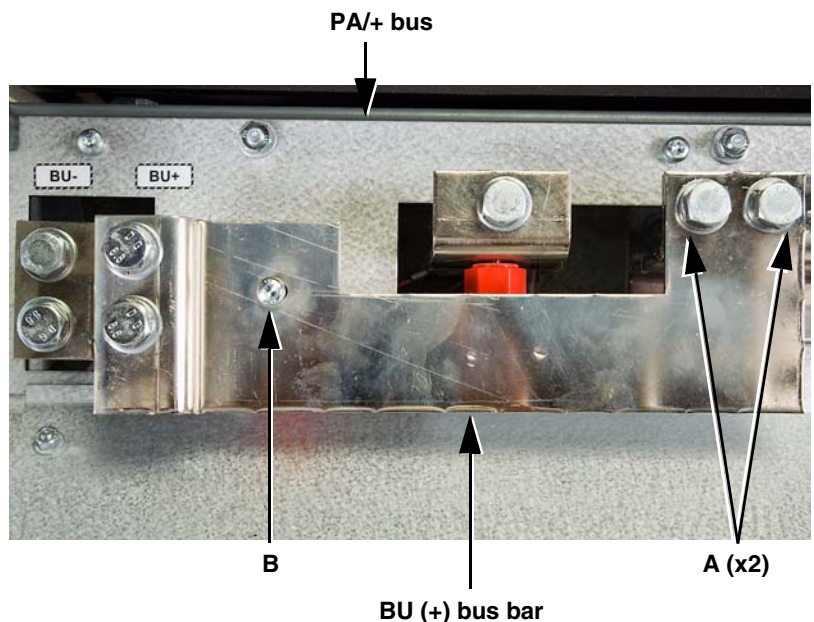


### Replace the BU (+) Bus Bar

15. Replace the BU (+) bus bar as follows. See Figure 183.

- Using an 18 mm socket wrench, secure the BU (+) bus bar to the PA/+ bus with two bolts and washers (A).
- Using a T-30 Torx driver, secure the BU (+) bus bar to the red insulator on the top terminal bracket with one screw (B).
- Tighten the hardware to the torque values specified in Table 53.

**Figure 183: BU (+) Bus Bar**



### Replace the Middle Crossbrace

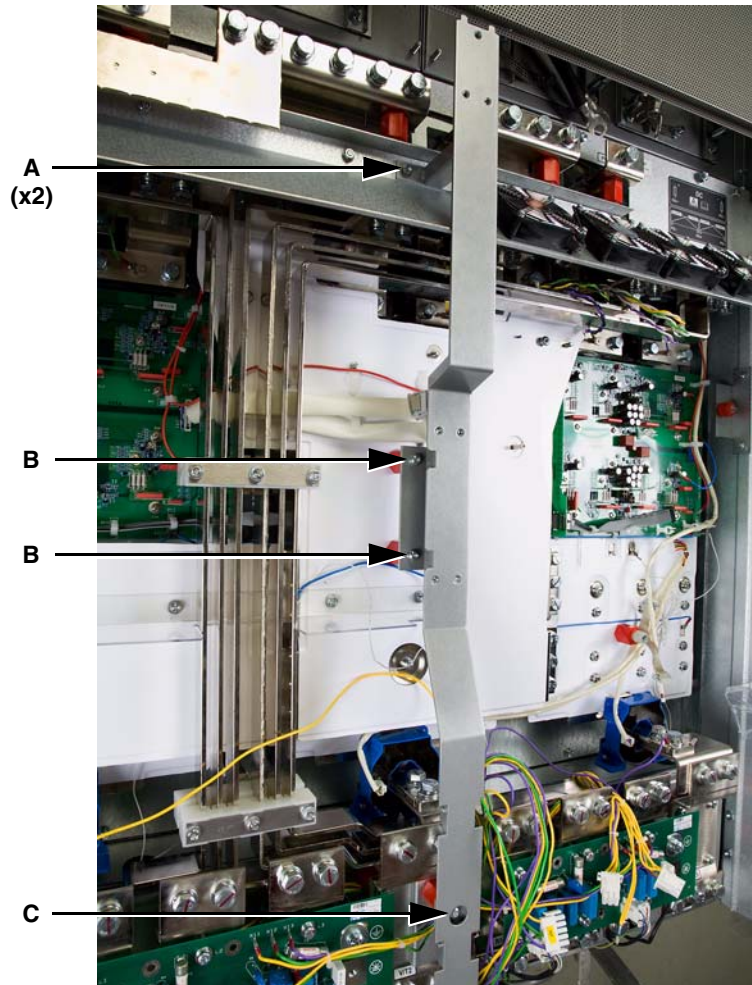
**Table 54: Crossbrace Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
<b>A</b>	(2) 10 mm nuts	5.5	48.7
<b>B</b>	(2) T-30 screws	5.5	48.7
<b>C</b>	(1) T-30 screw	5.5	48.7

16. Replace the middle crossbrace as follows. See Figure 184.

- Using a 10 mm socket wrench, secure the crossbrace to the fan bracket with two nuts (**A**).
- Using a T-30 Torx driver, secure the crossbrace to the top DC bus plate with two screws (**B**).
- Using a T-30 Torx driver, secure the crossbrace to the red insulator on the V/T2 bus with one screw (**C**).
- Tighten the hardware to the torque values specified in Table 54.

**Figure 184: Middle Crossbrace**



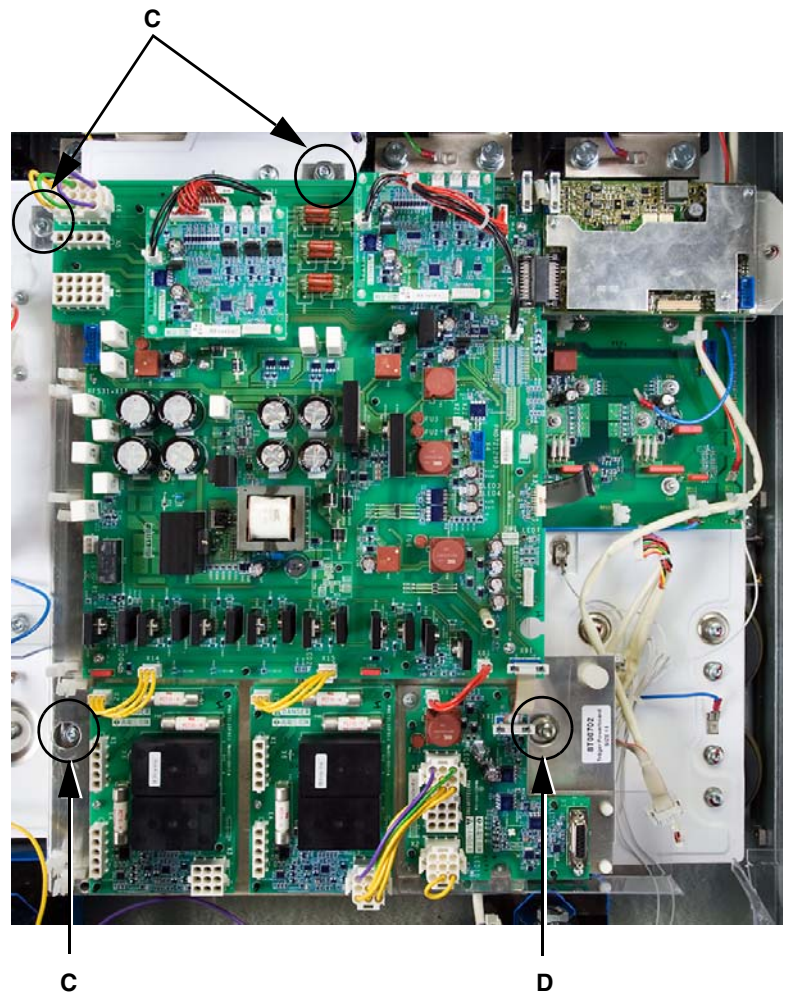
## Replace the Power Board Assembly

**NOTE:** The power board assembly consists of the power board, the motor control board, fan control boards 1 and 2, and the brake board.

17. Replace the power board assembly as follows.

- Position the assembly in the drive as shown in Figure 185.
- Using a T-30 Torx driver, secure the power board assembly to the phase-W DC bus plate with one screw and washer (**D**, Figure 185).
- Using a 10 mm socket wrench, secure the power board assembly to the bus plate assembly with three nuts (**C**, Figure 185).

**Figure 185: Power Board Assembly**



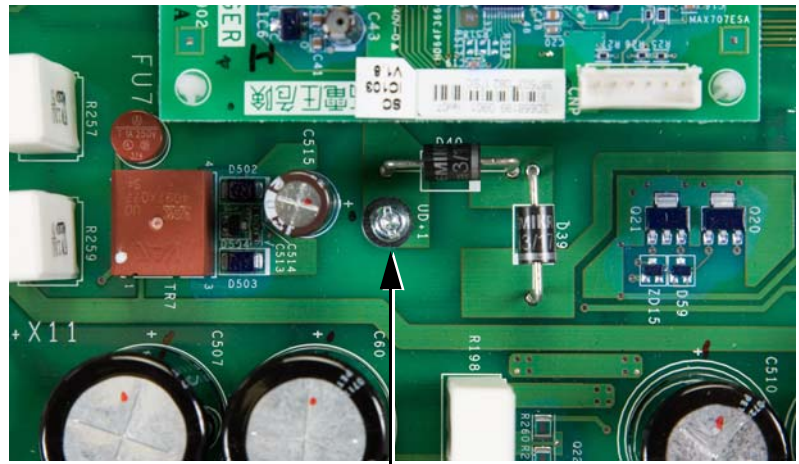


- Using a T-10 Torx driver, replace one screw (**B**, Figure 186) in power board terminal UD+1.
- Using a 21 mm socket wrench, replace the red insulator (**A**) on the assembly plate. See Figure 187.
- Connect wire E132 to the lug on the insulator. See Figure 187. The wire originates from terminal X53 on gate driver board W.
- Tighten the hardware to the torque values specified in Table 55.

**Figure 186: Power Board, Terminal UD+1**

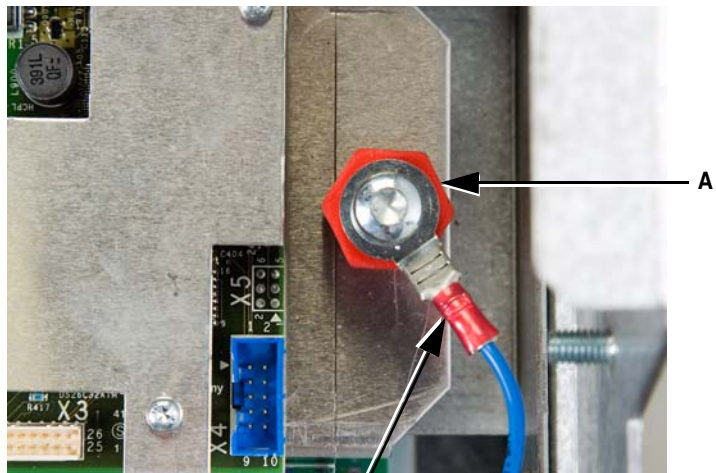
**Table 55: Power Board Assy Hardware Torque Values**

Item	Description	Torque Range	
		N•m	lb-in
<b>A</b>	(1) 21-mm insulator	5.5	48.7
<b>B</b>	(1) T-10 screw	0.8	7.1
<b>C</b>	(3) 10-mm nuts	5.5	48.7
<b>D</b>	(1) T-30 screw and washer	5.5	48.7



**B (UD+1)**

**Figure 187: Wire E132 Connection**



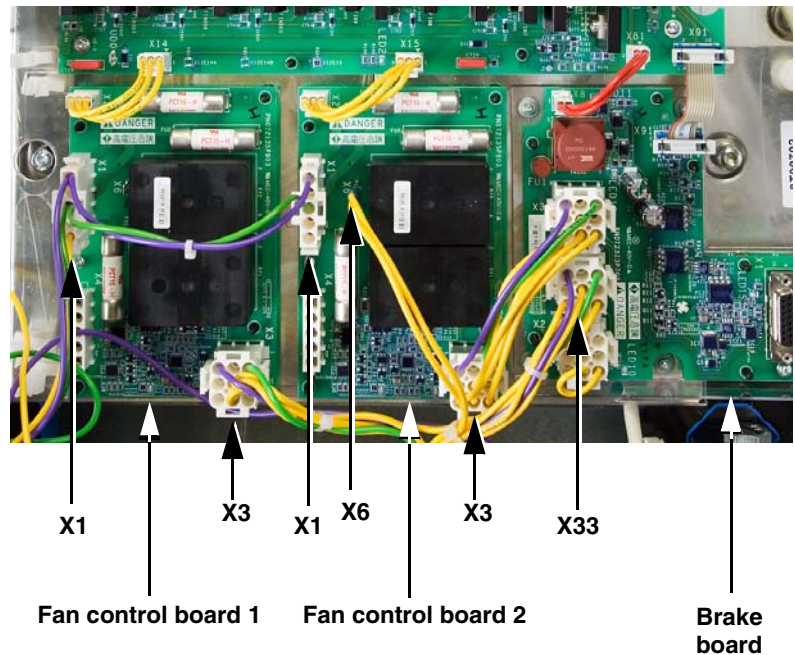
**Wire E132**



## Replace the Fan Control Board Connections

18. Replace the following connections. See Figure 188 for terminal locations.
- Replace the connections on terminal X1 of fan control boards 1 and 2.
  - Replace the connection on terminal X3 of fan control board 1.
  - Replace the connection on terminal X33 of the brake board.
  - Replace the connection on terminal X6 of fan control board 2.

**Figure 188: Fan Control Board and Brake Board Connections**



**Replace the Power Board Connections**

**Table 56: Power Board Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
E103	X11	9-pin, multi color	Motor current sensors
E136	UD0	1-pin, blue	Phase-W DC bus plate
E126	RFS 31+ X11	1-pin, red	SB <sup>2</sup> 1 X11
E141	UD -R1	1-pin, white	Bleeder resistor 1
E142	X3	18-pin, gray	GDB <sup>3</sup> W X32
E112	X4	10-pin, gray	Control module
E150	X5	5-pin, yellow/green/violet	Output bus bars T1, T2, T3
E120	X7	15-pin, yellow/green/violet	FB <sup>4</sup> 1 & 2 X11, X12, X13
E100	X8	14-pin, white	GDB U X82
E106	X21	2-pin, red/black	Internal fan
E106	X22	2-pin, red/black	Internal fan

<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

<sup>2</sup> SB: SCR Snubber board

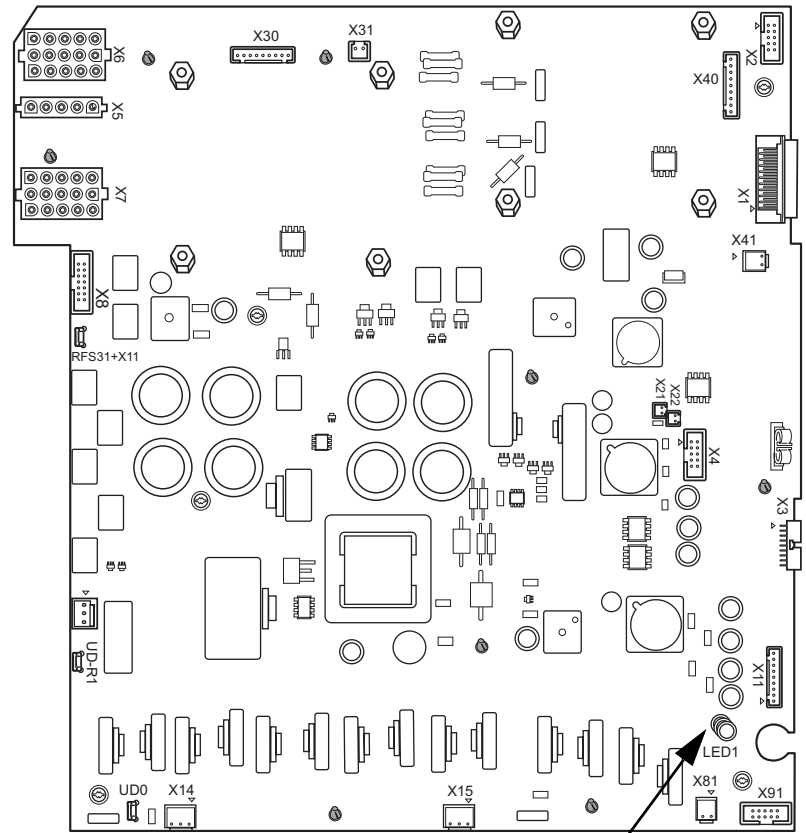
<sup>3</sup> GDB: Gate driver board

<sup>4</sup> FB: Filter board

**NOTE:** Take care not to damage the LED (see Figure 189) when removing, handling, or installing the power board.

19. Replace the power board connections listed in Table 56. See Figure 189 for the connection locations.

**Figure 189: Power Board Connections**



**FRAGILE**  
 (LED with sleeving)

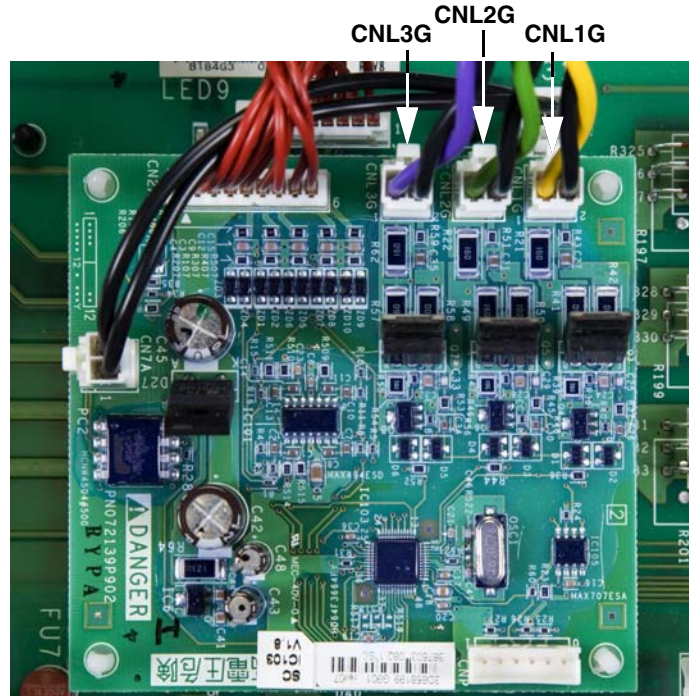
**Replace the Soft Charge Board Connections**

20. Replace connections CNL1G, CNL2G, and CNL3G on soft charge boards 1 and 2. See Figure 190 for terminal locations.

**Figure 190: Soft Charge Board: Board 1 (Left) Shown**

**Table 57: Soft Charge Board Wiring**

Wire No. <sup>1</sup>	Terminal No.	Description	To:
<b>Soft Charge Board 1 (Left Board)</b>			
E110	CN2A	9-pin, red	PB <sup>2</sup> X30 (9-pin)
E109	CNL3G	2-pin, violet/black	SCR <sup>3</sup> L3.1 Terms. 4 & 5
E108	CNL2G	2-pin, green/black	SCR L2.1 Terms. 4 & 5
E107	CNL1G	2-pin, yellow/black	SCR L1.1 Terms. 4 & 5
E111	CN7A	2-pin, black	PB X31
—	CNP	Not used	—
<b>Soft Charge Board 2 (Right Board)</b>			
E156	CN2A	9-pin, red	PB <sup>2</sup> X40 (9-pin)
E152	CNL3G	2-pin, violet/white	SCR <sup>3</sup> L3.2 Terms. 4 & 5
E153	CNL2G	2-pin, green/white	SCR L2.2 Terms. 4 & 5
E154	CNL1G	2-pin, yellow/white	SCR L1.2 Terms. 4 & 5
E155	CN7A	2-pin, black	PB <sup>2</sup> X41
—	CNP	Not used	—



<sup>1</sup> See the schematic on page 170 for complete drive wiring. Wire numbers are given for cross referencing the wires with the wiring table and the schematic. The numbers do not appear on the wires.

<sup>2</sup> PB: Power board

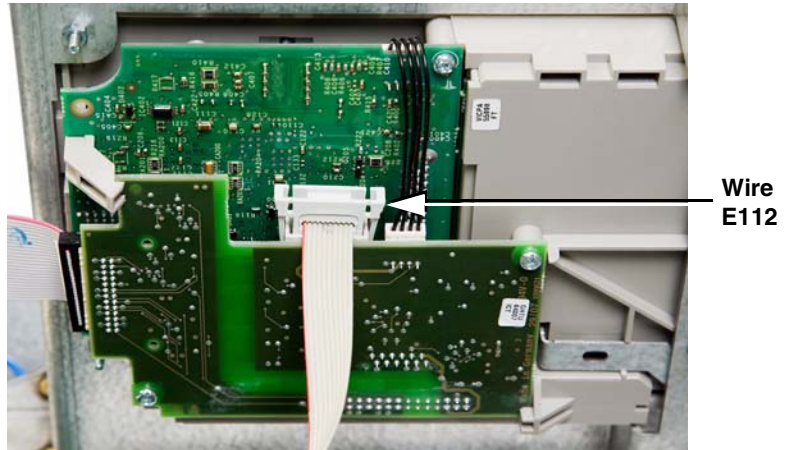
<sup>3</sup> SCR: Silicon controlled rectifier. L1.1, L2.1, and L3.1 are associated with input rectifier 1; L1.2, L2.2, and L3.2 are associated with input rectifier 2.

### Replace the Control Module Assembly

21. Replace the control module assembly as follows.

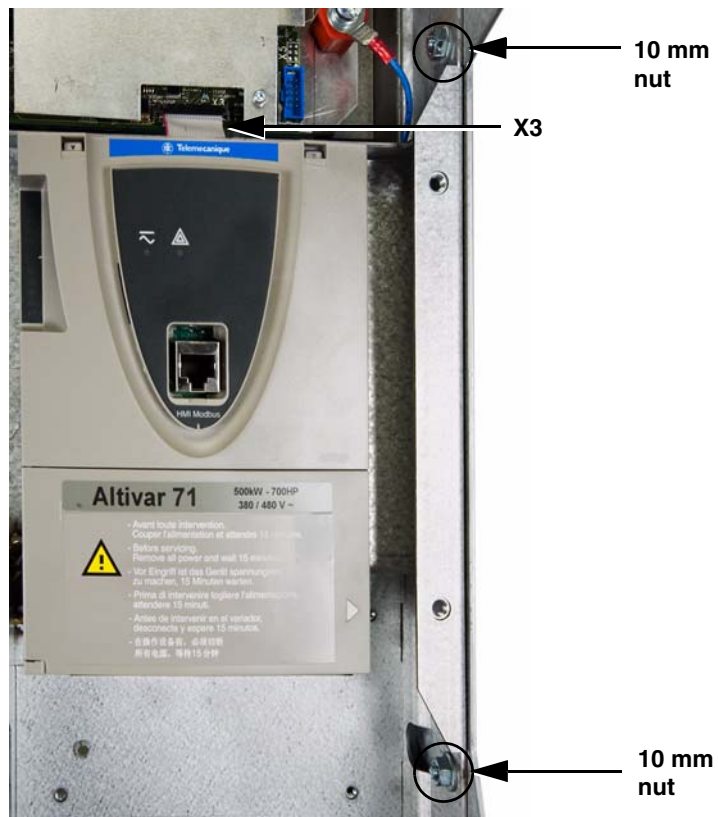
- Connect the ribbon cable (wire **E112**, Figure 191) from power board terminal X4 to the back of the control module assembly.

**Figure 191: Control Module Assembly Back**



- Using a 10 mm socket wrench, secure the control module assembly to the drive frame with two nuts (Figure 192). Tighten the nuts to 5.5 N•m (48.7 lb-in).

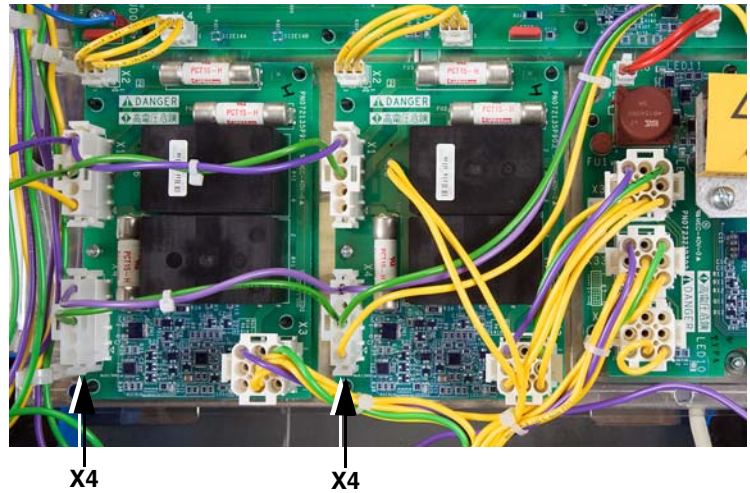
**Figure 192: Control Module Assembly, Front**





- Install the 26-pin ribbon cable from the control module assembly to motor control board terminal X3. See Figure 192 on page 164.
- Install the 5-pin connectors at terminal X4 of fan control boards 1 and 2. See Figure 193.

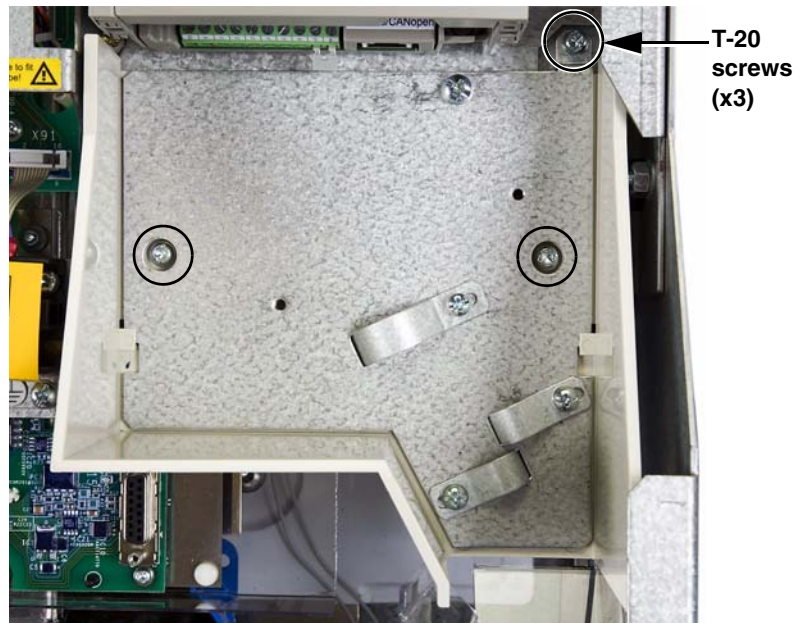
**Figure 193: Fan Control Boards 1 and 2, Terminal X4**



### Replace the EMC Tray

22. Using a T-20 Torx driver, secure the EMC tray to the control module plate with three screws. See Figure 194. Tighten the screws to 1.1–1.7 N•m (9.7–15.0 lb-in).

**Figure 194: EMC Tray**



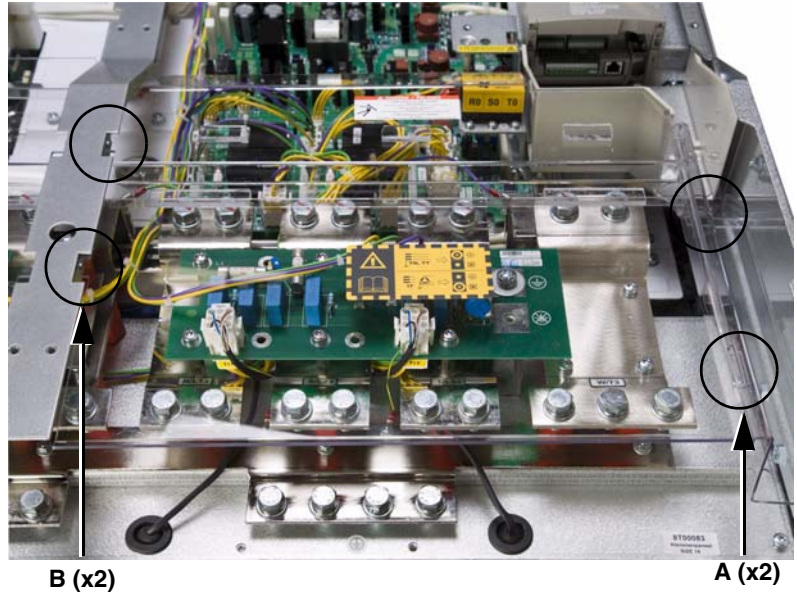


### Replace the Power Terminal Shields

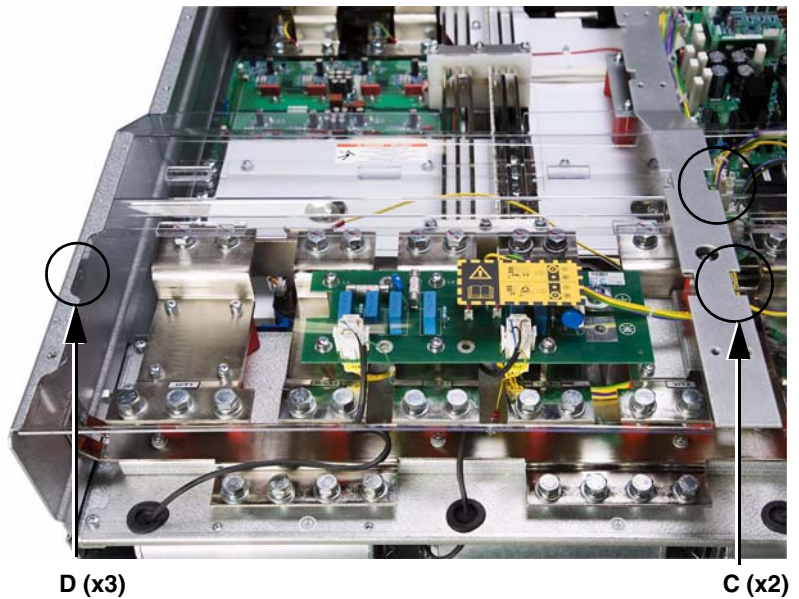
23. Replace the power terminal shields as follows:

- The right terminal shield has two tabs (A) on the right side that fit into slots on the conduit tray, and two tabs (B) on the left side that fit into slots on the middle crossbrace. See Figure 195.
- The left terminal shield has two tabs on the right (C) that fit into retaining slots in the middle crossbrace and two mounting holes (D) on the left that fit over posts on the side panel of the drive. See Figure 196.

**Figure 195: Right Terminal Shield**



**Figure 196: Left Terminal Shield**



### Replace the Front Cover

24. Replace the front cover. Using a size 2 Phillips driver, secure the front cover with 17 screws. See Figure 7 on page 20. Tighten the screws to 5.5 N•m (48.7 lb-in).

# Wiring

**NOTE:** See page 169 for the notes to the table.

**Table 58: Wiring Table**

Wire No. <sup>1</sup>	Description	From:		To:	
		Component	Terminal No.	Component	Terminal No.
E100	14-pin, white	PB	<b>X8</b>	GDB U	<b>X82</b>
	14-pin, white	GDB U	<b>X82</b>	GDB V	X81
E102	14-pin, white	GDB V	<b>X82</b>	GDB W	<b>X81</b>
E103	9-pin, multi color	PB	<b>X11</b>	Motor current sensors	
E105	3-pin, yellow	PB	<b>X14</b>	FCB <sup>2</sup> 1	<b>X2</b>
E106	2-pin, red/black	PB	<b>X21</b>	Internal fan	—
	2-pin, red/black	PB	<b>X22</b>	Internal fan	—
E107	2-pin, yellow/black	SCB 1	<b>CNL1G</b>	SCR <sup>3</sup> L1.1	<b>4 &amp; 5</b>
E108	2-pin, green/black	SCB 1	<b>CNL2G</b>	SCR L2.1	<b>4 &amp; 5</b>
E109	2-pin, violet/black	SCB 1	<b>CNL3G</b>	SCR L3.1	<b>4 &amp; 5</b>
E110	9-pin, red	PB	<b>X30</b>	SCB <sup>4</sup> 1	<b>CN2A</b>
E111	2-pin, black	PB	<b>X31</b>	SCB 1	<b>CN7A</b>
E112	10-pin, gray	PB	<b>X4</b>	Control module	—
E114	9-pin, yellow/green/violet	FCB 1	<b>X3</b>	FB	<b>X11, X12, X13</b>
				FCB 2	<b>X6</b>
				BB	<b>X33</b>
E115	9-pin, black sleeve	FB 1	<b>X11</b>	Heatsink fan 1	—
E120	15-pin, yellow/green/violet	PB	<b>X7</b>	FB <sup>5</sup> 2	<b>X11, X12, X13</b>
	5-pin, yellow/green/violet	FCB 2	<b>X1</b>	FCB 1	<b>X1</b>
				FB 1	<b>X1, X2, X3</b>
E123	1-pin, blue	GDB V	<b>X52</b>	GDB W	<b>X51</b>
E124	5-pin, 2-wire, yellow/green/violet	FCB 1	<b>X4</b>	FCB 2, TB1	<b>X4</b>
E125	9-pin, black sleeve	FB 1	<b>X12</b>	Heatsink fan 2	—
E126	1-pin, red	PB	<b>RFS 31+X11</b>	SB <sup>6</sup> 1	<b>X11</b>
E126	1-pin, red	SB 1	<b>X10</b>	GDB U	<b>X61</b>
E127	1-pin, blue	GDB U	<b>X52</b>	GDB V	<b>X51</b>
E128	2-pin, black	GDB V	<b>X4</b>	Temp sensor V	—
E129	1-pin, blue	GDB U	<b>X51</b>	DC bus plate neutral	<b>UD0</b>
E130	1-pin, red	SB 1	<b>X4</b>	PO.1 bus bar	—
E131	1-pin, yellow	SB 1	<b>X1</b>	L1.1 rectifier	—
E132	1-pin, blue	GDB W	<b>X53</b>	Insulator near MCB <sup>7</sup>	—
E133	1-pin, black	SB 1	<b>X5</b>	PC/- bus bar	—

**Table 58: Wiring Table** (continued)

Wire No. <sup>1</sup>	Description	From:		To:	
		Component	Terminal No.	Component	Terminal No.
E136	1-pin, blue	PB	<b>UD0</b>	Phase-W DC bus plate	—
E138	18-pin, gray	GDB U	<b>X32</b>	GDB V	<b>X31</b>
E139	1-pin, white	GDB U	<b>X62</b>	Bleeder resistor 1	—
E141	1-pin, white	PB	<b>UD -R1</b>	Bleeder resistor 1	—
E142	18-pin, gray	PB	<b>X3</b>	GDB <sup>8</sup> W	<b>X32</b>
E144	2-pin, black	GDB U	<b>X4</b>	Temp sensor U	—
E145	2-pin, black	GDB W	<b>X4</b>	Temp sensor W	—
E146	18-pin, gray	GDB V	<b>X32</b>	GDB W	<b>X31</b>
E147	3-pin, yellow	PB	<b>X15</b>	FCB 2	<b>X2</b>
E148	2-pin, red	PB	<b>X81</b>	BB <sup>9</sup>	<b>X8</b>
E149	10-pin, gray	PB	<b>X91</b>	BB	<b>X91</b>
E150	5-pin, yellow/ green/violet	PB	<b>X5</b>	Output bus bars T1, T2, T3	—
E151	9-pin, yellow/ green/violet	FCB 2	<b>X3</b>	BB	<b>X3</b>
E152	2-pin, violet/white	SCB 2	<b>CNL3G</b>	SCR L3.2	<b>4 &amp; 5</b>
E153	2-pin, green/white	SCB 2	<b>CNL2G</b>	SCR L2.2	<b>4 &amp; 5</b>
E154	2-pin, yellow/white	SCB 2	<b>CNL1G</b>	SCR L1.2	<b>4 &amp; 5</b>
E155	2-pin, black	PB	<b>X41</b>	SCB2	<b>CN7A</b>
E156	9-pin, red	PB	<b>X40</b>	SCB2	<b>CN2A</b>
E157	1-pin, yellow	SB <sup>6</sup> 2	<b>X1</b>	Phase L1.2 rectifier	
E158	1-pin, red	SB 2	<b>X4</b>	PO.2 bus bar and SB2 X11	—
E159	1-pin, black	SB 2	<b>X5</b>	PC/- rectifier bus bar	—
E160	1-pin, red	SB 2	<b>X10</b>	GDB W	<b>X61</b>
E161	1-pin, white	GDB V	<b>UD+</b>	Bleeder Resistor 2	—
E162	1-pin, white	GDB V	<b>UD-</b>	Bleeder Resistor 2	—
E163	1-pin, white	GDB W	<b>UD-</b>	Bleeder Resistor 3	—
E164	1-pin, white	GDB W	<b>X62</b>	Bleeder Resistor 3	—
E165	9-pin, black sleeve	FB 2	<b>X13</b>	Heatsink fan 3	—
E166	9-pin, black sleeve	FB 2	<b>X14</b>	Heatsink fan 4	—
E167	1-pin, green	SB 1	<b>L2</b>	Phase L2.1 input bar	—
E168	1-pin, violet	SB 1	<b>X3</b>	Phase L3.1 input bar	—
E169	1-pin, green	SB 2	<b>L2</b>	Phase L2.2 input bar	—
E170	1-pin, violet	SB 2	<b>X3</b>	Phase L3.2 input bar	—

**Table 58: Wiring Table** *(continued)*

Wire No. <sup>1</sup>	Description	From:		To:	
		Component	Terminal No.	Component	Terminal No.
—	15-pin, yellow/ green/violet	PB	X6	—	—
—	10-pin, white	PB	X2	MCB <sup>10</sup>	X2

<sup>1</sup> Wire numbers are given for cross referencing the wires with the schematic on page 170. The numbers do not appear on the wires.

<sup>2</sup> FCB: Fan control board

<sup>3</sup> SCR: Silicon controlled rectifier

<sup>4</sup> SCB: Soft charge board

<sup>5</sup> FB: Filter board

<sup>6</sup> SB: SCR snubber board

<sup>7</sup> MCB: Motor control board

<sup>8</sup> GDB: Gate driver board

<sup>9</sup> BB: Brake board

<sup>10</sup> MCB: Motor control board











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8001 Knightdale Blvd.  
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