



Allen-Bradley

PowerFlex[®]

**700S High Performance AC
Drives
and
700H Adjustable Frequency
AC Drives**

Frame 9 (132 -160 KW / 200-250 HP)

Hardware Service Manual

**Rockwell
Automation**

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at <http://www.ab.com/manuals/gi>) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary we use notes to make you aware of safety considerations.



WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

Important: Identifies information that is critical for successful application and understanding of the product.



ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you:

- identify a hazard
 - avoid the hazard
 - recognize the consequences
-



Shock Hazard labels may be located on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be present.



Burn Hazard labels may be located on or inside the equipment (e.g., drive or motor) to alert people that surfaces may be at dangerous temperatures.

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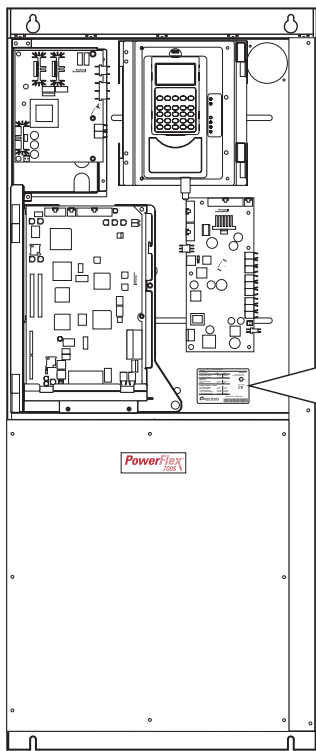
Overview

Who Should Use this Manual?

This manual is intended for qualified service personnel responsible for troubleshooting and repairing high power PowerFlex 700S and 700H AC Drives. You should have previous experience with, and basic understanding of, electrical terminology, procedures, required troubleshooting equipment, equipment protection procedures and methods, and safety precautions.

What is in this Manual

This manual contains hardware service information for Frame 9 PowerFlex 700S and 700H drives only. Verify that you are working on a Frame 9 drive by checking the data nameplate on the Control Frame. The frame number is printed just above the serial number.



Cat No. 20D J 300 N 0 NNNBNNNN

UL Open Type/IP00

	540V	650V
Normal Duty Power	160 kW	250 kW
Heavy Duty Power	132 kW	200 kW
Input: DC,		
DC Voltage Range	462 - 594	583 - 713
Amps	350	350
Output: 3 Phase, 0 - 320Hz		
AC Voltage Range	0 - 400	0 - 460
Base Hz (default)	50 Hz	60 Hz
Continuous Amps	300/245	300/245
1 Min Overload Amps	330/368	330/368
2 Sec Overload Amps	450/490	450/490

MFD. in 1989 on Nov 9

Frame #: 9

Serial Number: 2622381652

AB

Allen-Bradley

MADE IN THE USA (FAC 1B)

Series: A

Standard I/O: NONE

Original Firmware No. 2.04

C

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9D42

What is Not in this Manual

This manual does not contain in depth fault information for troubleshooting. That information is available in publications 20C-PM001, *Programming Manual - PowerFlex 700H Adjustable Frequency AC Drive*, PFLEX-IN006, *Installation Instructions - PowerFlex 700S and 700H Adjustable Frequency AC Drive* and 20D-UM001, *User Manual - PowerFlex 700S High Performance AC Drive*.

Reference Materials

Allen-Bradley publications are available on the internet at www.rockwellautomation.com/literature.

The following publications provide general drive information.

Title	Publication
Wiring and Grounding Guide, (PWM) AC Drives	DRIVES-IN001...
Safety Guidelines for the Application, Installation and Maintenance of Solid State Control	SGI-1.1
A Global Reference Guide for Reading Schematic Diagrams	0100-2.10
Guarding Against Electrostatic Damage	8000-4.5.2

The following publications provide specific PowerFlex drive information.

Title	Publication
Programming Manual - PowerFlex 700H AC Drive	20C-PM001...
User Manual - PowerFlex 700S High Performance Drive	20D-UM001...
Installation Instructions - Hi-Resolution Feedback Option Card for PowerFlex 700S Drives	20D-IN001...
Installation Instructions - Multi Device Interface Option for PowerFlex 700S Drives	20D-IN004...
Installation Instructions - Main Control Board PowerFlex 700S Drives	20D-IN005...
Installation Instructions - Control Assembly Cover for PowerFlex 700S Drives	20D-IN006...
Installation Instructions - PowerFlex 700S and 700H Drives	PFLEX-IN006...
Reference Manual - PowerFlex Adjustable Frequency Drive, (Volume 1 - 70 & 700)	PFLEX-RM001...
Reference Manual - PowerFlex Adjustable Frequency Drive, (Volume 2 - 700S)	PFLEX-RM002...

The following publications provide information that is necessary when applying the DriveLogix Controller.

Title	Publication
User Manual - DriveLogix System	20D-UM002...
Installation Instructions - DriveLogix Controller	20D-IN002...
Installation Instructions - Memory Expansion for DriveLogix Controller	20D-IN007...
ControlNet Daughtercard Installation Instructions	1788-IN002...
ControlNet Daughtercard Installation Instructions	1788-IN005...

Understanding Manual Conventions

Terms

The following words are used throughout the manual to describe an action:

Word	Meaning
Can	Possible, able to do something
Cannot	Not possible, not able to do something
May	Permitted, allowed
Must	Unavoidable, you must do this
Shall	Required and necessary
Should	Recommended
Should Not	Not recommended

Cross References

“[Figure 2.2 on page 2-6](#)” is a cross reference to figure 2.2 on page 5 of Chapter 2.

“[Figure C.1 on page C-2](#)” is a cross reference to figure C.1 on page 2 of Appendix C.

Additional Support Available on Internet

Additional troubleshooting information and software tools are available on the Allen-Bradley Drives Support Website (<http://www.ab.com/support/abdrives/>).

General Precautions

Class 1 LED Product



ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into module ports or fiber-optic cable connectors.



ATTENTION: This drive contains **ESD** (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference A-B publication 8000-4.5.2, “Guarding Against Electrostatic Damage” or any other applicable ESD protection handbook.



ATTENTION: An incorrectly applied or installed drive can result in component damage or a reduction in product life. Wiring or application errors, such as, undersizing the motor, incorrect or inadequate AC supply, or excessive ambient temperatures may result in malfunction of the system.



ATTENTION: Only **qualified personnel** familiar with high power PowerFlex 700S and 700H Drives and associated machinery should plan or implement the installation, start-up and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.



ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the DC+ & DC- terminals. The voltage must be zero.



ATTENTION: Potentially fatal voltages may result from improper usage of an oscilloscope and other test equipment. The oscilloscope chassis may be at a potentially fatal voltage if not properly grounded. If an oscilloscope is used to measure high voltage waveforms, use only a dual channel oscilloscope in the differential mode with X 100 probes. It is recommended that the oscilloscope be used in the A minus B Quasi-differential mode with the oscilloscope chassis correctly grounded to an earth ground.

Troubleshooting and Error Codes



ATTENTION: To avoid an electric shock hazard, ensure that all power to the drive has been removed before performing the following.



ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the DC+ & DC- terminals. The voltage must be zero.



ATTENTION: HOT surfaces can cause severe burns. **Do not** touch the heatsink surface during operation of the drive. After disconnecting power allow time for cooling.



ATTENTION: This drive contains **ESD** (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference A-B publication 8000-4.5.2, “Guarding Against Electrostatic Damage” or any other applicable ESD protection handbook.

Creating Fault Reports

Clear and complete fault reports are critical for analysis and repair of modules returned to the factory.

At a minimum perform, and record the following:

- Record the contents of the fault queue (faults and times of occurrence)
- Make record of any burn marks on the rectifying module, DC-capacitors, inverter bridge, charging resistors, balancing/precharging resistors, printed circuit boards, bus bars, cabling and fiber-optic cabling
- Make record of any liquid and condensation marks on printed circuit boards, components and mechanical parts
- Make record of the amount of dust and other additional particles on drive and drive components
- Make record of any mechanical damage to the drive and drive components
- Record the size and type of main fuses
- Record any other important marks and damage

Addressing 700S Hardware Faults

Fault	No.	Description	Action (if appropriate)
HiHp In PhaseLs	65	AC Input Phase Loss - AC voltage is not present on one or two input phases.	1. Check for voltage on each input phase 2. Check the status of each external input fuses
HiHp Bus Com Dly	66	Bus Communication Time Delay - the processor has not received proper periodic feedback information.	Check fiber-optic connections between the Power Interface Circuit Board and Voltage Feedback Circuit Board
HiHp Bus Link LS	67	Bus Communication Link Loss - bus communication between the Power Interface Circuit Board and Voltage Feedback Circuit Board has halted.	Check fiber-optic connections between the Power Interface Circuit Board and Voltage Feedback Circuit Board
HiHp Bus CRC Er	68	Bus Communication CRC Error - too many Cycling Ring Checksum (CRC) errors have occurred in the communication bus.	Check fiber-optic connections between the Power Interface Circuit Board and Voltage Feedback Circuit Board
HiHp Bus WtchDog	69	Bus Communication Watchdog Error - communication has halted in the communication bus, causing the watch dog timer to expire.	1. Check fiber-optic connections between the Power Interface Circuit Board and Voltage Feedback Circuit Board 2. Check connections between the Main Control Board and the Power Interface Circuit Board 3. Replace the Voltage Feedback Circuit Board 4. Replace the Power Interface Circuit Board 5. Replace the Main Control Board
HiHp Fan Fdbk Ls	70	Fan Feedback Loss - a fan feedback signal has been lost.	1. Check the main cooling fan 2. Check the Main Control Board cooling fan

Fault	No.	Description	Action (if appropriate)
HiHp Drv OvrLoad	71	Drive Overload - the circuit board on the Power Module has detected an overload.	Measure output current of the drive. If the level is ever greater than the maximum drive rated output current level reduce the load. If the levels are always well below the drive rated levels, then replace the power module
HiHp PwrBd PrcEr	72	Power Board Processor Error - a microprocessor on the Power Board has detected a communication error.	<ol style="list-style-type: none"> 1. Check fiber-optic connections between the Power Interface Circuit Board and Voltage Feedback Circuit Board 2. Check connections between the Main Control Board and the Power Interface Circuit Board 3. Replace the Voltage Feedback Circuit Board 4. Replace the Power Interface Circuit Board 5. Replace the Main Control Board
HiHp PrChrg Cntc	73	Precharge Contactor Fault - proper contactor feedback has not occurred. The precharge contactor has probably failed to pick up or the feedback signal has failed. This fault only applies to DC input drives.	<ul style="list-style-type: none"> • Check precharge circuit wiring • Check for loose connections on X50 terminal block
HiHp PwrEE Error	74	Power EEPROM Error - the rating of the drive and data in the Power EEPROM on the Power Board do not match.	Replace output power module or program a new power board
HiHP PwrBd OTemp	75	Power Board Over-Temperature - temperature of the Power Board on has exceeded 85° C.	Check the main cooling fan and fan power supply, replace if necessary

Addressing 700H Hardware Faults

Name	No.	Description	Action (if appropriate)
Power Loss	3	DC bus voltage remained below [Power Loss Volts] for longer than [Power Loss Time]. Enable/Disable with [Fault Config 1]. For more information refer to publication 20C-PM001, <i>Programming Manual - PowerFlex 700H</i> .	Monitor the incoming AC line for low voltage or line power interruption.
UnderVoltage	4	DC bus voltage fell below the minimum value of 333V for 400/480V drives and 461V for 600/ 690V drives. Enable/Disable with [Fault Config 1]. For more information refer to publication 20C-PM001, <i>Programming Manual - PowerFlex 700H</i> .	Monitor the incoming AC line for low voltage or power interruption.

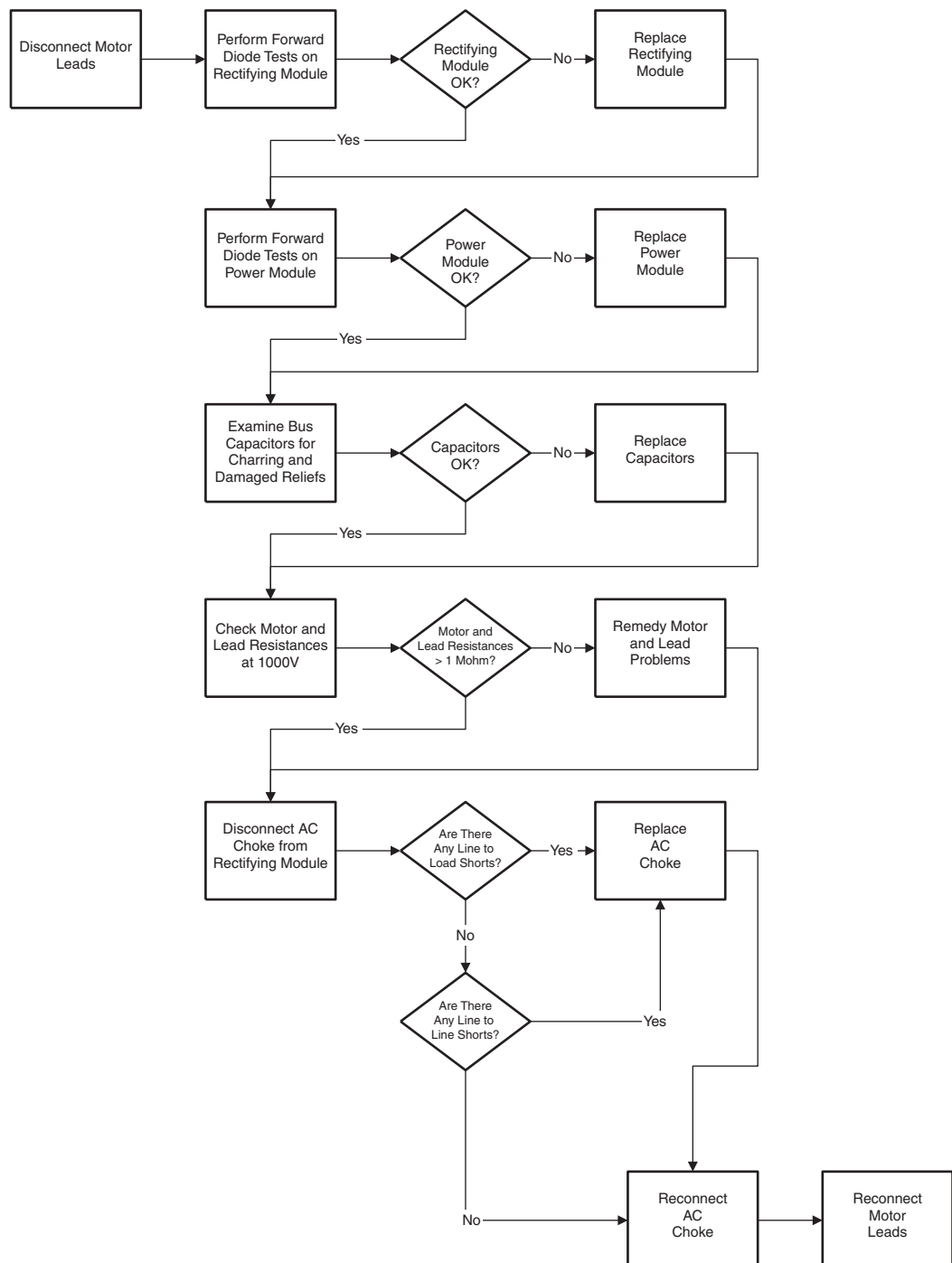
Name	No.	Description	Action (if appropriate)
OverVoltage	5	DC bus voltage exceeded maximum value.	Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time or install and external dynamic brake option.
Input Phase	10	One input line phase missing.	Check user-supplied fuses Check AC input line voltage.
OutPhasMissng	11	Zero current in one output motor phase.	Check motor wiring. Check motor for open phase.
Ground Fault	13	A current path to earth ground greater than 25% of drive rating. Ground fault level is 50% of the drive's heavy duty current rating. The current must appear for 800ms before the drive will fault.	Check the motor and external wiring to the drive output terminals for a grounded condition.
InverterFault	14	Hardware problem in the power structure.	Cycle power. Replace drive.
System Fault	16	Hardware problem exists in the power structure.	Cycle power. Replace drive.
Load Loss	46		
Power Unit	70	One or more of the output transistors were operating in the active region instead of desaturation. This can be caused by excessive transistor current or insufficient base drive voltage.	Clear fault.

Diagnostic Procedures by Symptom

The following charts list drive symptom, symptom descriptions and recommended actions.

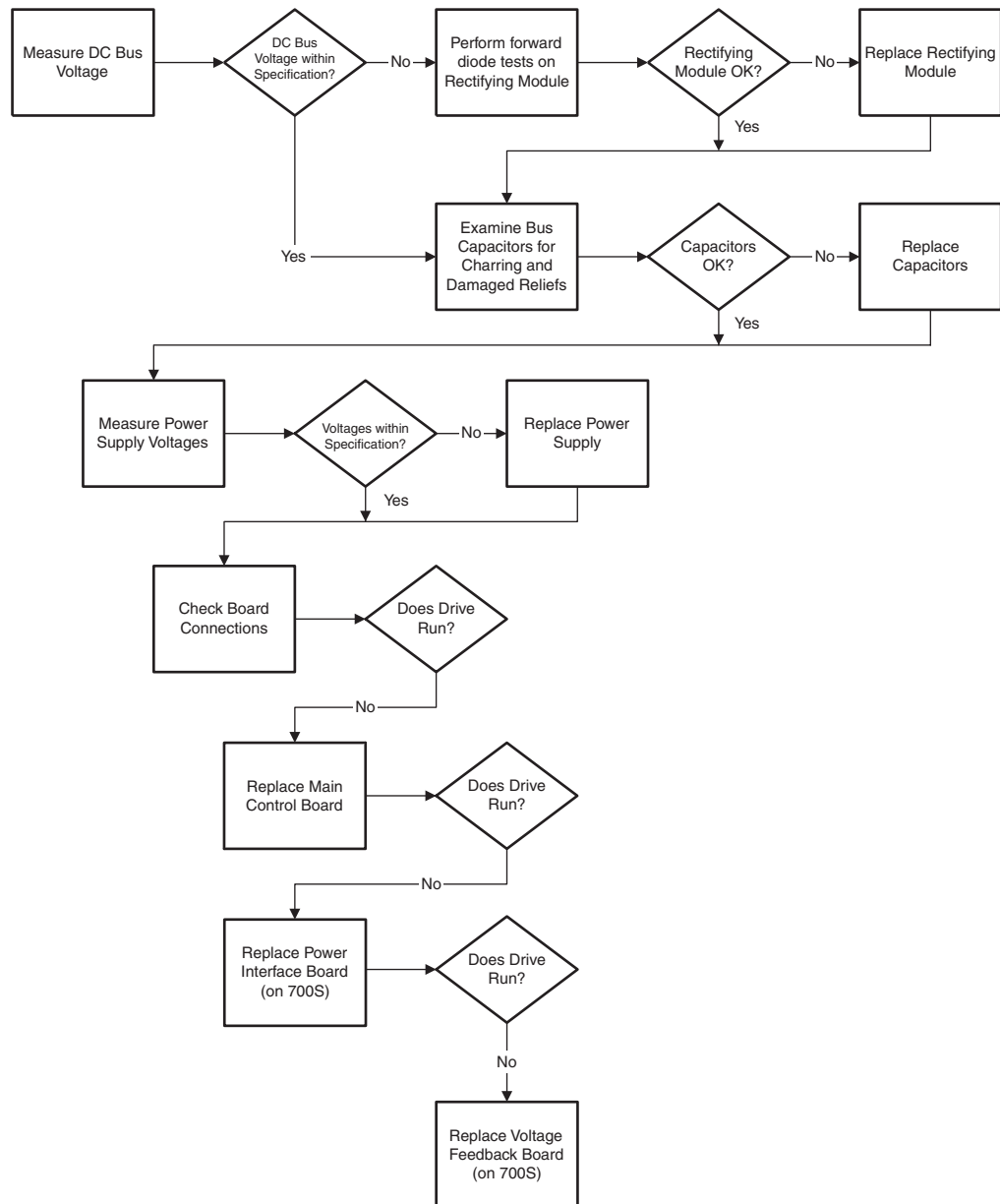
Blown Input Fuses

Use this procedure when a drive clears any of its external circuit breaker or power fuses:



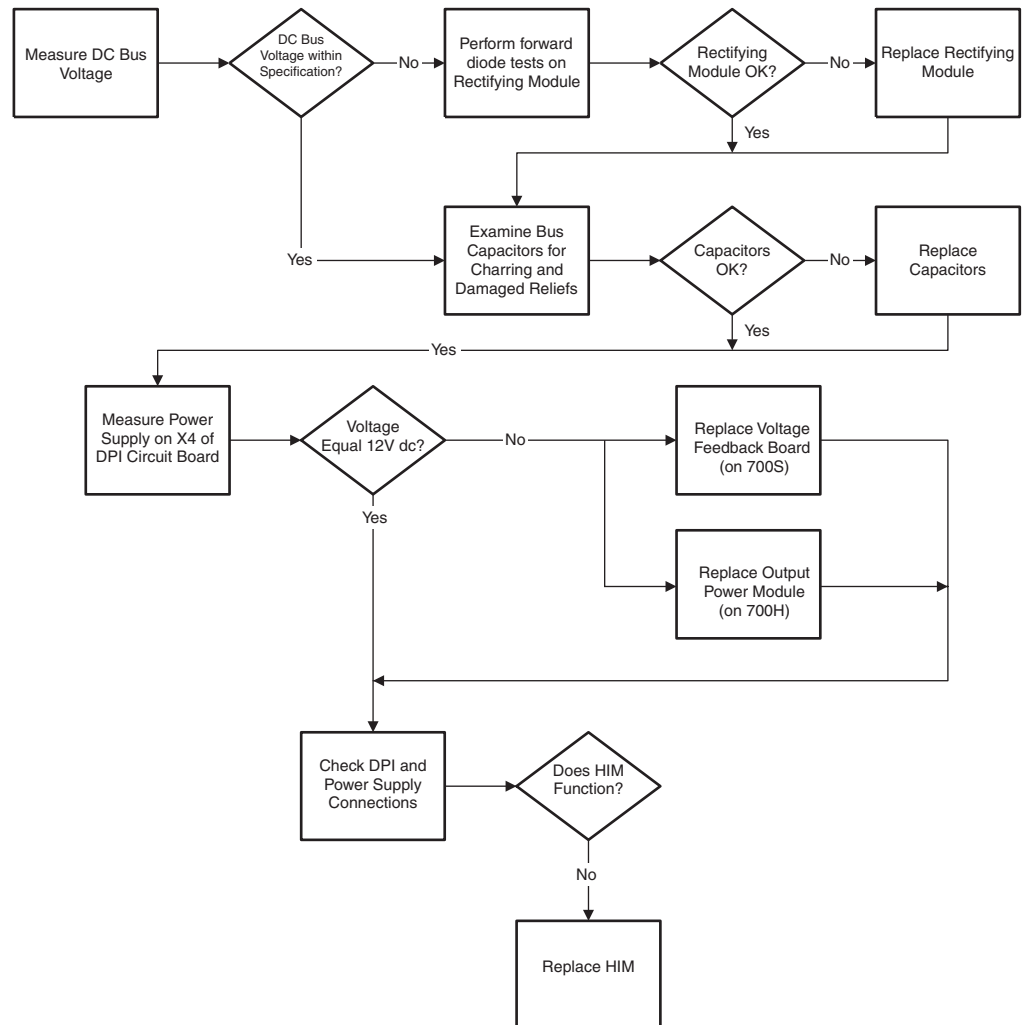
No Output Voltage

Use this procedure when there is not voltage present at the drive output terminals, even though the drive indicates the motor is running:



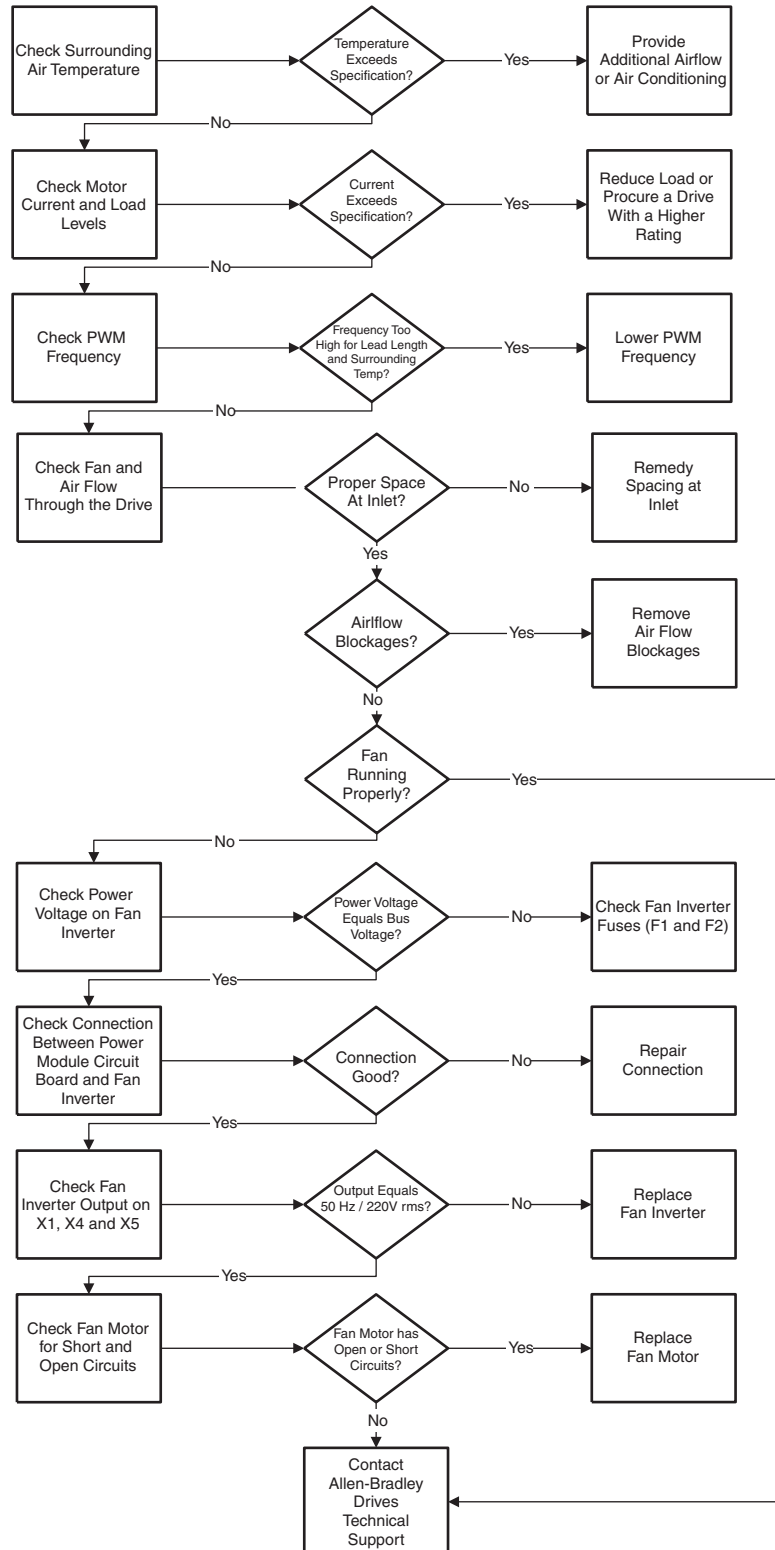
No HIM Display

Use this procedure when the HIM does not function:



Over-Temperature Faults

Use this procedure to troubleshoot drive over-temperature faults (14 - Inv Otemp Pend and 15 - Inv Otemp Trip in 700S or 8 - Heatsink OvrTemp and 9 - Trnsistr OvrTemp in 700H):



Component Test Procedures



ATTENTION: To avoid an electric shock hazard, ensure that all power to the drive has been removed before performing the following.



ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the DC+ & DC- terminals. The voltage must be zero.



ATTENTION: HOT surfaces can cause severe burns. **Do not** touch the heatsink surface during operation of the drive. After disconnecting power allow time for cooling.



ATTENTION: This drive contains **ESD** (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference A-B publication 8000-4.5.2, “Guarding Against Electrostatic Damage” or any other applicable ESD protection handbook.

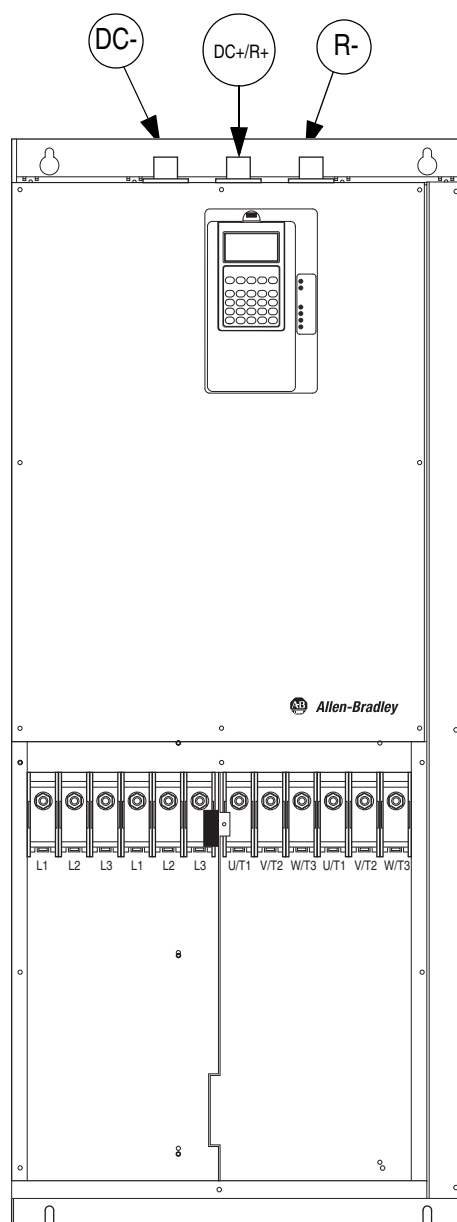
Forward Biased Diode Tests for Major Power Components

A forward biased diode test checks the semiconductor junctions between the terminals and measures the voltage drop across those junctions. To pass each test, the meter must beep once and display a voltage within the specification shown in the table. If the test finds a short, the meter will display .000 and beep continuously. If the test finds an open circuit or reversed polarity, the meter will display “.0L” (zero load).

1. Remove power from the drive
2. Check for zero volts between DC+ and DC-
3. Remove the Connection cover, while referring to [Opening Drive on page 3-4](#).
4. Disconnect the motor leads from the drive

Forward Biased Diode Tests for Rectifying Module

Figure 2.1 Measurement Points for Forward Biased Diode Tests on Major Power Components



5. Perform forward biased diode tests, using a digital multimeter, on the points listed in [Table 2.A on page 2-3](#) (on AC Three-Phase drives). **If the Rectifying Module fails any of these tests, replace it** (See [Removing the Rectifying Module on page 3-27](#)).

Table 2.A Forward Biased Diode Tests for Rectifying Module

Meter Leads		Nominal meter reading
+	-	
L1	DC-	Value should gradually rise to 1.8V
L2	DC-	
L3	DC-	
L1	DC+/R+ ⁽¹⁾	0.450V ± 0.075V
L2	DC+/R+	
L3	DC+/R+	
DC-	L1	0.335V ± 0.075V
DC-	L2	
DC-	L3	
DC+/R+ ⁽¹⁾	L1	Value should gradually rise to 1.8V
DC+/R+	L2	
DC+/R+	L3	

⁽¹⁾ If the drive does not contain the brake chopper option, the DC+/R+ terminal will be labeled DC+.

Forward Biased Diode Tests for Output Power Module

6. Perform forward biased diode tests, using a digital multimeter, on the points listed in [Table 2.B on page 2-3](#). **If the Output Power Module fails any of these tests, replace it** (See [Removing the Power Module on page 3-23](#)).

Table 2.B Forward Biased Diode Tests for Output Power Module

Meter Leads		Nominal meter reading
+	-	
T1	DC-	Value should gradually rise to 1.8V
T2	DC-	
T3	DC-	
T1	DC+/R+	0.290V ± 0.075V
T2	DC+/R+	
T3	DC+/R+	
DC-	T1	
DC-	T2	
DC-	T3	
DC+/R+	T1	Value should gradually rise to 1.8V
DC+/R+	T2	
DC+/R+	T3	

Forward Biased Diode Tests for Brake Chopper

7. Perform forward biased diode tests, using a digital multimeter, on the points listed in [Table 2.C on page 2-4](#) (on drives with Brake Choppers).
If the Brake Chopper Assembly fails any of these tests, replace it.

Table 2.C Forward Biased Diode Tests for Brake Chopper Assembly

Meter Leads		Nominal meter reading
+	-	
R-	DC-	Value should gradually rise to 1.8V
R-	DC+/R+	3.15V \pm 0.075V
DC-	R-	0.36V \pm 0.75V
DC+/R+	R-	Value should gradually rise to 1.8V

Checking Rectifying Module

1. Remove power from the drive
2. Check for zero volts between DC+ and DC-
3. Remove the Connection cover, while referring to [Opening Drive on page 3-4](#).
4. Remove the DPI/HIM Assembly, while referring to [Removing the DPI / HIM Assembly on page 3-6](#).
5. Remove the 700S Control Assembly (on a 700S drive), while referring to [Removing 700S Control Assembly on page 3-8](#).
6. Remove the 700S Voltage Feedback circuit board (on a 700S drive), while referring to [Removing the 700S Voltage Feedback Circuit Board on page 3-10](#).
7. Remove the 700S Power Interface circuit board (on a 700S drive), while referring to [Removing the 700S Power Interface Circuit Board on page 3-12](#).
8. Remove the 700H Main Control board and enclosure (on a 700H drive), while referring to [Removing the 700H Fiber Optic Adapter Board on page 3-15](#).
9. Referring to [Removing the Control Frame and Cross Plate on page 3-17](#), remove the Control Frame and Cross Plate.
10. Referring to [Removing the EMC-Protection Plate on page 3-20](#), remove the EMC-Protection Plate.
11. Visually inspect the pre-charging resistors. If pre-charging resistors are damaged:
 - A. Replace the Rectifying Module (See [Removing the Rectifying Module on page 3-27](#)).
 - B. Check capacitors, rectifiers and external connections for short-circuits. Referring to [Forward Biased Diode Tests for Output Power Module on page 2-3](#), check the Output Power Module.

Measurement of Rectifying Module

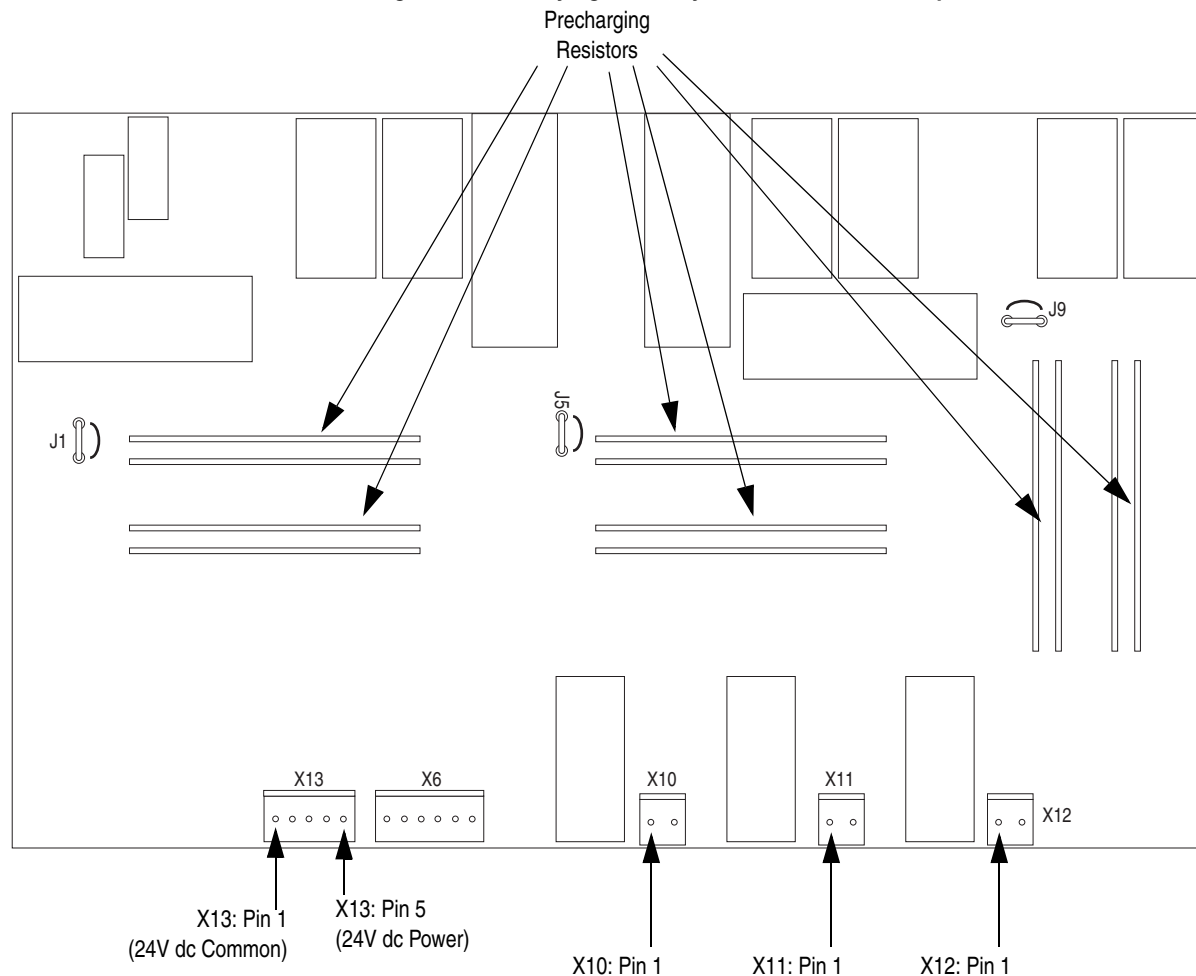
12. Disconnect connectors X13, X12, X11 and X10.
13. Perform resistance measurements, using a digital multimeter, on the points listed in [Table 2.D on page 2-5](#) (on AC Three-Phase drives). These points are on the back of the X10, X11 and X12 plugs which you have disconnected from the board. **If the Rectifying Module fails any of these tests, replace it** (See [Removing the Rectifying Module on page 3-27](#)).

Table 2.D Rectifying Module Measurements

Measurement points	Resistance
X10: red to X10: black	18Ω ± 1Ω
X11: red to X11: black	
X12: red to X12: black	

Checking the Rectifier Circuit Board

14. Connect 24V power (from the test power supply) to X13: Pin 5 and 24V Common to X13: Pin 1
15. Perform “DC Test Power Supply ON” tests in [Table 2.E on page 2-6](#).
16. De-energize test power supply. Perform “DC Test Power Supply OFF” tests in [Table 2.E on page 2-6](#).
17. If the results differ from measurements shown in [Table 2.E on page 2-6](#), replace the Rectifying Module (See [Removing the Rectifying Module on page 3-27](#)).

Figure 2.2 Rectifying board layout and measurement points**Table 2.E Rectifying Board Forward Biased Diode Test Results**

Meter Leads		DC Test Power Supply ON	DC Test Power Supply OFF
+	-		
J1	X10:PIN1	~ 0.5V	OL
J5	X11:PIN1	~ .5V	OL
J9	X12:PIN1	~ .5V	OL

Important: Power supply polarity is critical during these tests. Reversing the polarity will damage components on the circuit board.

Checking the Brake Chopper

These tests require a recommended multi-meter capable of measuring capacitance.

18. Disconnect the cable which connects the brake chopper to the Output Power Module connector X11.

19. Measure gate capacitance (gate to emitter) between the grey and white wires on the X11 plug.

20. Measure gate capacitance (gate to emitter) between the red and black wires on the X11 plug.

Important: Use correct polarity when you measure gate capacitance.

21. If measurement results are not similar to values in [Table 2.F on page 2-7](#), replace both brake chopper and rectifying module (See [Removing the Rectifying Module on page 3-27](#)).

Table 2.F Proper Brake Chopper Measurements

Meter Leads		Capacitance (+/- 20%)
+	-	
X11-grey	X11-white	50nF
X11-red	X11-black	50nF

Checking the Main Fan

1. Remove power from the drive
2. Check for zero volts between DC+ and DC-
3. Remove the Connection cover, while referring to [Opening Drive on page 3-4](#).
4. Remove the fan power supply cover, while referring to [Removing the Fan Power Supply on page 3-34](#)
5. Disconnect the fan motor from the output filter transformer (Refer to [Fan Power Supply Connections on page B-8](#)).
6. Measure the resistance of the fan windings. If the resulting measurements are not similar to those in [Table 2.G on page 2-8](#), replace the fan (See [Removing the Main Fan on page 3-32](#)).

Table 2.G Correct Fan Measurements

Connection Wires	Resistance \pm 5%
Black-Brown	62
Brown-Blue	36
Blue-Black	27

7. Disconnect capacitor from fan power supply.
8. Measure value of the start capacitor. If the resulting value does not equal 7 μ F, replace the capacitor (See [Removing the Fan Power Supply on page 3-34](#)).

Checking Capacitors

Important: This procedure requires special equipment and training. Only qualified and trained personnel should perform these procedures.

These tests require the recommended high voltage DC-power supply.

1. Test each capacitor with a DC-power supply. Recommended is to set DC power supply current limit < 50mA.
2. Connect the power supply's DC+ to the drive's DC+ terminal and the power supply's DC- to the drive's DC- terminal.
3. Set power supply voltage setting to zero.
4. Switch on the external DC power supply.
5. Slowly increase the external DC power supply output voltage to the drive's nominal DC bus voltage (1.35 x Unity)

Example: 480v AC Nominal Voltage

$$1.35 \times 480\text{v} = 648\text{v}$$

6. Monitor the current while testing.
7. Leakage current should be less than 3mA when voltage has stabilized.
8. Abort test if current leakage is significantly higher when voltage has stabilized.
9. Decrease the DC power supply output voltage to zero. Wait until DC bus voltage has decreased to zero. Switch off the external DC power supply.
10. As a precaution, use a resistor to discharge each capacitor after testing. Use a proper resistor that can handle the discharging current.
11. If any capacitor has failed. Replace all the capacitors in the same series connection (See [Removing Capacitors on page 3-38](#)).

Checking AC-Choke

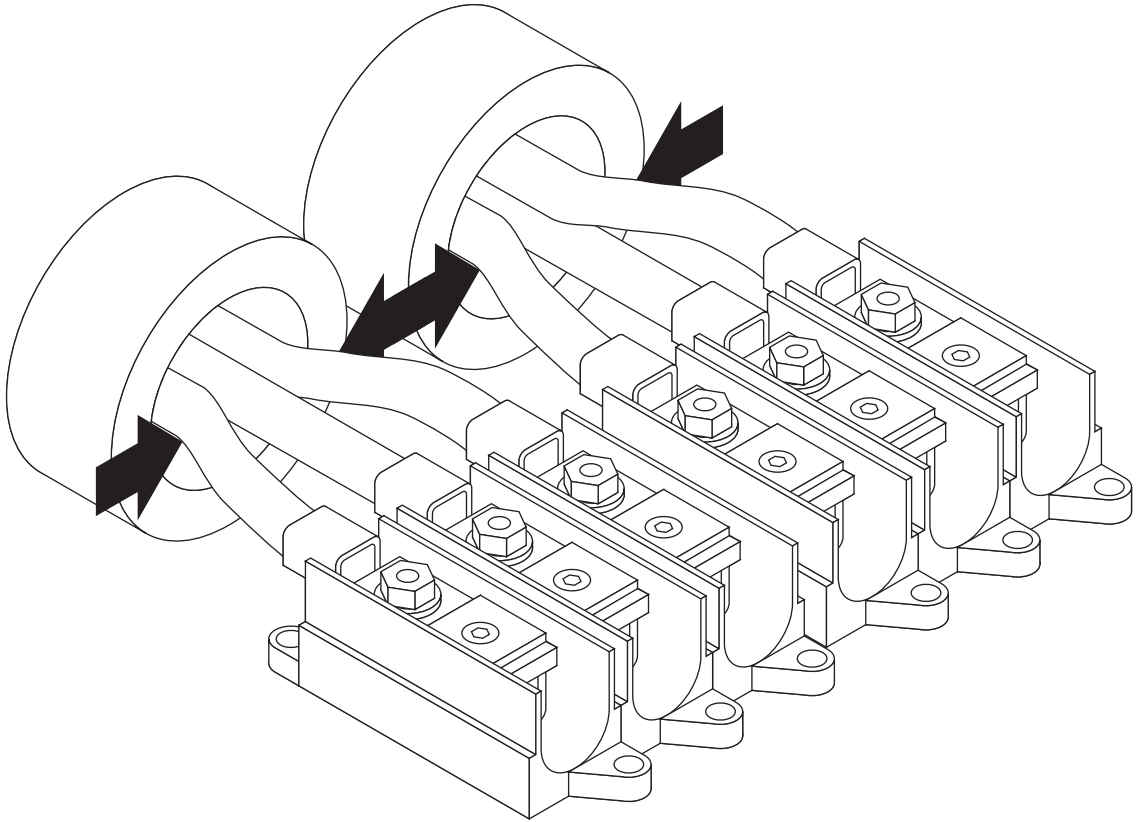
1. Visually inspect the AC-Choke for burn marks.
2. Measure the resistance between and across each phase and from each phase to ground to verify that each phase is intact and not shorted to ground.
3. If the AC-Choke fails either inspection or tests, replace it (See [Removing the AC-Choke on page 3-40](#)).

Checking Terminals

Check that cables L1 and L3 do not touch the ferrite ring.

If cables are touching the ferrite ring:

1. Loosen terminals L1 and L3.
2. Push cables L1 and L3 towards cable L2.
3. Tighten terminals, using torques specified in [Torque Specifications on page 3-1](#).



Access Procedures



ATTENTION: To avoid an electric shock hazard, ensure that all power to the drive has been removed before performing the following.



ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the DC+ & DC- terminals. The voltage must be zero.



ATTENTION: HOT surfaces can cause severe burns. **Do not** touch the heatsink surface during operation of the drive. After disconnecting power allow time for cooling.










ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into fiber-optic ports or fiber-optic cable connectors.









































ATTENTION: This drive contains **ESD** (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference A-B publication 8000-4.5.2, “Guarding Against Electrostatic Damage” or any other applicable ESD protection handbook.

Torque Specifications

The following table lists fastener torque specifications:

Item	Screw	Torque Final
Connection Cover (mounting)	 M4 x 8 Pozidrive®	3 N-m (27 lb.-in.)
Power Cover (mounting)	 MM4 x 8 Pozidrive	3 N-m (27 lb.-in.)
Conduit Cover (mounting)	 M4 x 8 Pozidrive	3 N-m (27 lb.-in.)
DPI / HIM Assembly Door	 M3 x 6 Phillips®	0.9 N-m (8 lb.-in.)
DPI / HIM Assembly (mounting)	 M3 x 6 Phillips	0.9 N-m (8 lb.-in.)
Shield for 700S Voltage Feedback Circuit Board (mounting)	 M3 x 6 Phillips	0.9 N-m (8 lb.-in.)
700S Voltage Feedback Circuit Board (mounting)	 M3 x 0.5 thread - 37 mm x 37 mm hex standoff	0.9 N-m (8 lb.-in.)

Item	Screw	Torque Final
700S Power Interface Circuit Board (mounting)	 M3 x 6 Phillips	0.9 N-m (8 lb.-in.)
700H Control Board (mounting)	 M3 x 5 Pozidrive	0.9 N-m (8 lb.-in.)
700H Control Board enclosure (mounting)	 M4 x 8 Pozidrive M4 x 40 Pozidrive	3 N-m (27 lb.-in.)
700H Fiber Optic Adapter bracket (mounting)	 M4 x 8 Pozidrive	3 N-m (27 lb.-in.)
700H Fiber Optic Adapter Board (mounting)	 M4 x 8 Pozidrive	0.9 N-m (8 lb.-in.)
Control Frame (mounting)	 M4 x 8 Pozidrive	3 N-m (27 lb.-in.)
Conduit (mounting)	 M4 x 8 Pozidrive	3 N-m (27 lb.-in.)
MOV (mounting)	 M4 x 30 Phillips	3 N-m (27 lb.-in.)
Ground Wire on Cross Plate	 M6 x 14 hexagonal screw	4 N-m (35 lb.-in.)
Cross Plate (mounting)	 M4 x 8 Pozidrive	3 N-m (27 lb.-in.)
DC+, DC- and brake cable to DC-link	 M8 nut	14 N-m (124 lb.-in.)
AC-choke (terminals) L1, L2, L3, A, B, C	 M8 x 25 hexagonal screw	17 N-m (151 lb.-in.)
IGBT (terminals)	 M8 x 20 hexagonal screw	9 N-m (80 lb.-in.)
DC+, DC-, and brake cable to top terminals	 M8 x 20 hexagonal screw	20 N-m (177 lb.-in.)
EMI Protection Plate (mounting)	 M4 x 8 Pozidrive	3 N-m (27 lb.-in.)
DC- Bus Bars to rectifier/power busbars	 M6 x 14 Pozidrive	5 N-m (44 lb.-in.)
Rectifier/Power Module (upper mounting)	 M5 x 10 Pozidrive	4 N-m (35 lb.-in.)
Rectifier/Power Module (lower mounting)	 M5 x 10 Pozidrive	4 N-m (35 lb.-in.)
Rectifier (terminals)	 M8 x 20 hexagonal screw	9 N-m (80 lb.-in.)
Fan Power Supply Plate (mounting)	 M4 x 8 Pozidrive	3 N-m (27 lb.-in.)
Fan Assembly (top mounting)	 M4 x 8 Pozidrive	3 N-m (27 lb.-in.)
Fan Assembly (bottom mounting)	 M4 x 8 Pozidrive	3 N-m (27 lb.-in.)
Fan Power Supply Capacitor Bracket (mounting)	 M4 x 8 Pozidrive	3 N-m (27 lb.-in.)
Fan Power Supply (mounting)	 M4 x 8 Pozidrive	1.8 N-m (15 lb.-in.)
Capacitor (-) Bus Bar	 M6 x 16 Pozidrive	4 N-m (35 lb.-in.)
Capacitor (+) Bus Bar	 M6 x 14 Pozidrive	4 N-m (35 lb.-in.)
Capacitor (+) Bus Bar with bush ring	 M6 x 20 Pozidrive	4 N-m (35 lb.-in.)
DC+ and DC- cables to Bus Bars	 M8 x 20 hexagonal screw	10 N-m (89 lb.-in.)

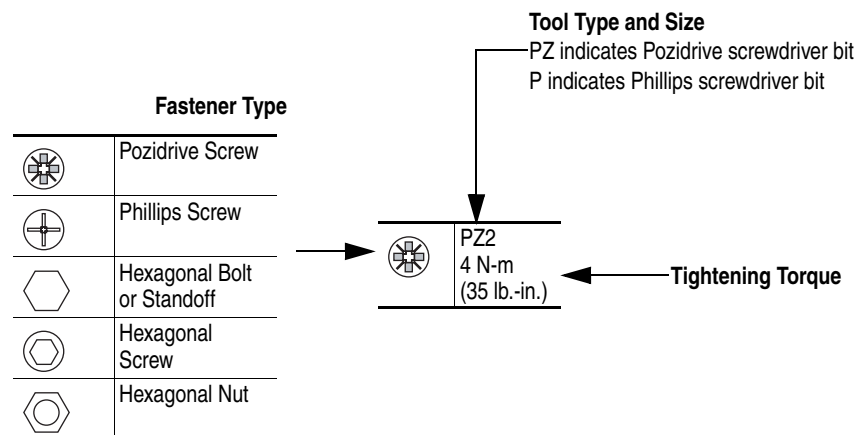
Item	Screw	Torque Final
Brake chopper (terminals)	 M5 x 12 Pozidrive	4 N-m (35 lb.-in.)
Brake chopper Bus Bar (terminal)	 M8 x 20 hexagonal screw	10 N-m (89 lb.-in.)
Rectifier (mounting)	 M6 x 20 Pozidrive	5 N-m (44 lb.-in.)
Brake chopper (mounting)	 M6 x 14 Pozidrive	5N-m (44 lb.-in.)
Rectifying board	 M4 x 8 Pozidrive	1.5 N-m (13 lb.-in.)
AC-choke (upper plate mounting)	 M8 x 8 Pozidrive	3 N-m (27 lb.-in.)
Control Bracket (mounting)	 M4 x 8 Pozidrive	3 N-m (27 lb.-in.)
AC-choke (mounting)	 M5 x 10 Pozidrive	4 N-m (35 lb.-in.)
Motor and AC Line Terminals	 M8 nut	20 N-m (177 lb.-in.)
Terminal Strip Assembly (mounting)	 M5 x 10 Pozidrive	4 N-m (35 lb.-in.)

Pozidrive® is a registered trademark of the Phillips Screw Company

Phillips® is a registered trademark of Phillips Screw Company

Understanding Torque Figures in Assembly Diagrams

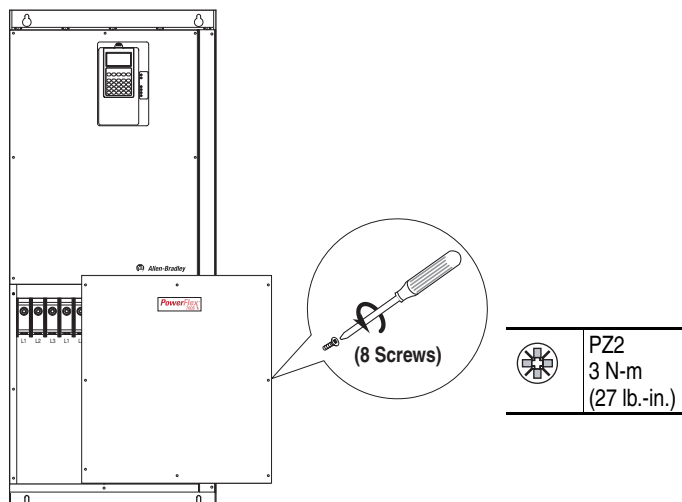
Icons and numbers in the assembly diagrams indicate how to tighten hardware:



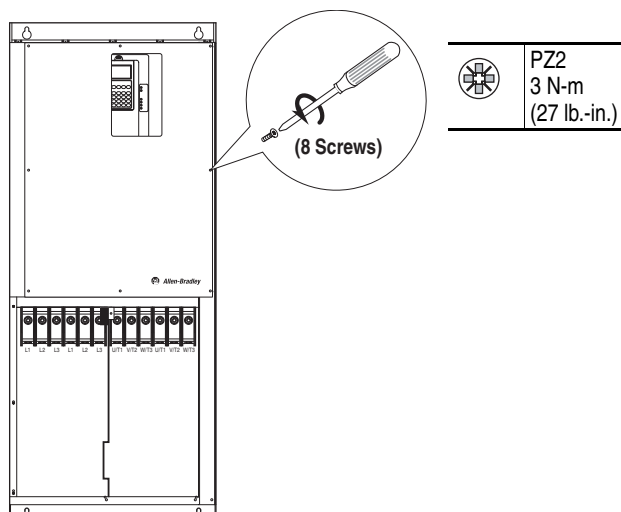
Opening Drive

Opening

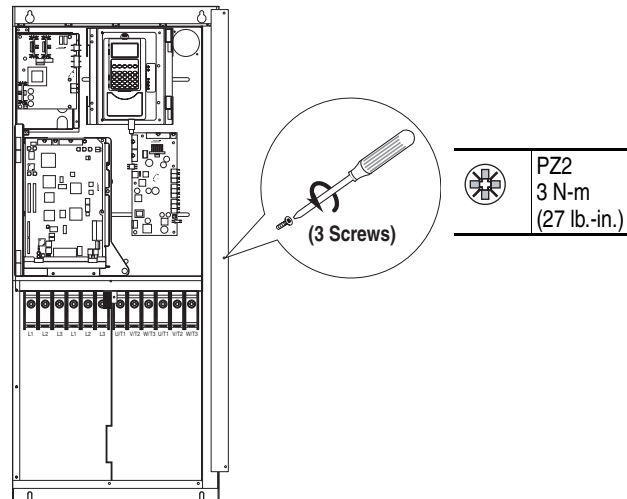
1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Remove Connection cover



4. Remove Power cover



5. Remove Conduit Cover



Closing

The covers may be replaced and removed in any order.

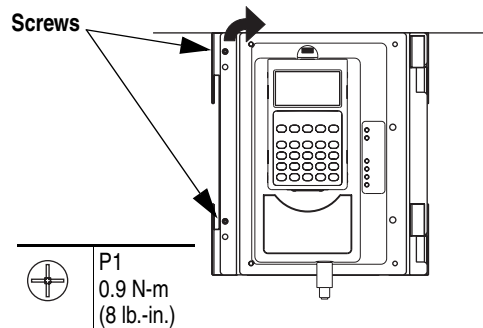
Removing the DPI / HIM Assembly

Removal

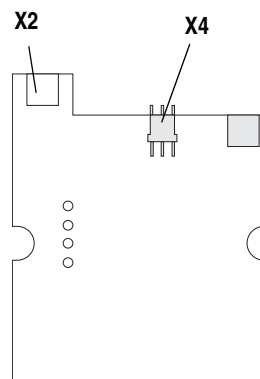
1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Referring to [Opening Drive on page 3-4](#), remove the Power Cover from the drive.

Important: Before removing connections and wires, mark the connections and wires to avoid incorrect wiring during assembly.

4. Remove two screws from front of DPI / HIM assembly.



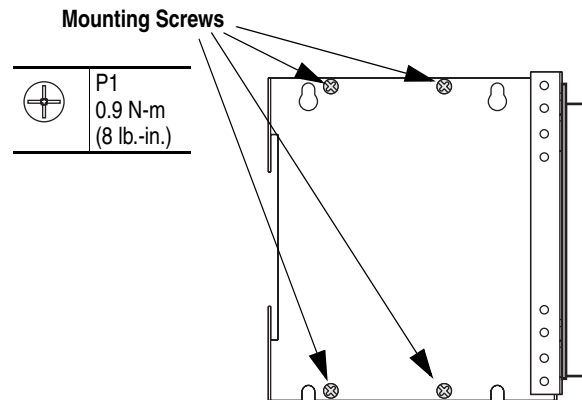
5. Open the door, which holds the DPI interface and HIM.
6. Unplug the DPI cable from X2 connector on the DPI Interface Circuit Board.



**Back View of DPI
Circuit Board which
should remain mounted
on the back of
the assembly**

7. Unplug the cable from X4 connector on the circuit board (on 700S drives only).

8. Remove four mounting screws and the assembly from the Control Frame.

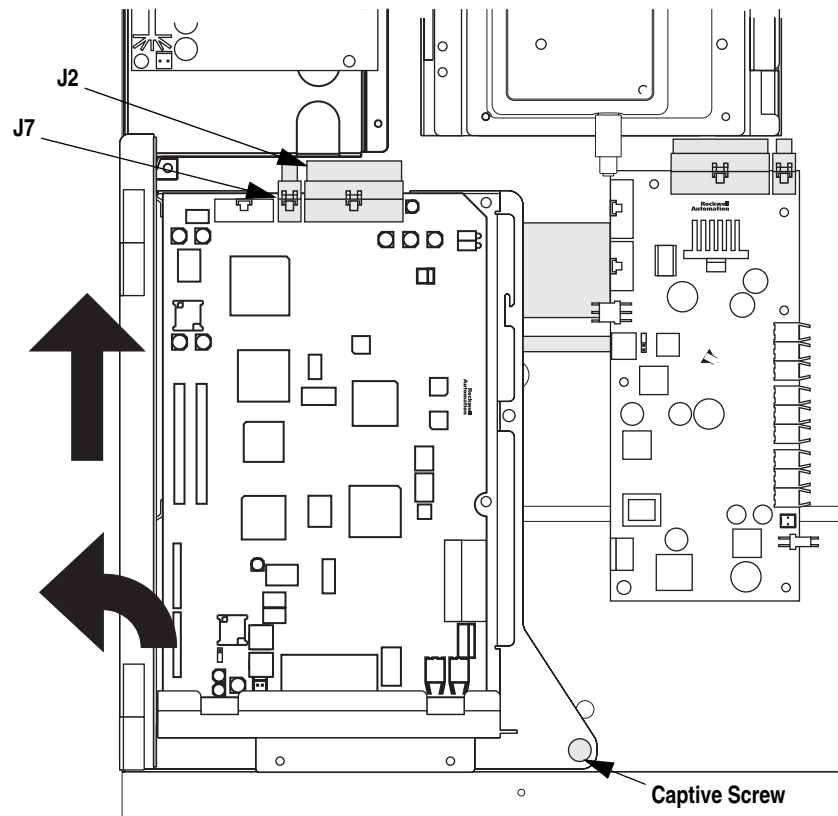


Installation

Install the DPI / HIM Assembly in reverse order of removal, while referring to [Torque Specifications on page 3-1](#).

Removing 700S Control Assembly

Removal



1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Referring to [Opening Drive on page 3-4](#), remove the Power Cover from the drive.

Important: Before removing connections and wires, mark the connections and wires to avoid incorrect wiring during assembly.

4. On the 700S control assembly, unplug I/O and SynchLink cables from the Main Control Board, unplug feedback wiring from feedback option card and unplug communication cables from DriveLogix controller.



ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into SynchLink fiber-optic ports or SynchLink fiber-optic cable connectors.

Important: Minimum inside bend radius for SynchLink fiber-optic cable is 25.4 mm (1 in.). Any bends with a shorter inside radius can

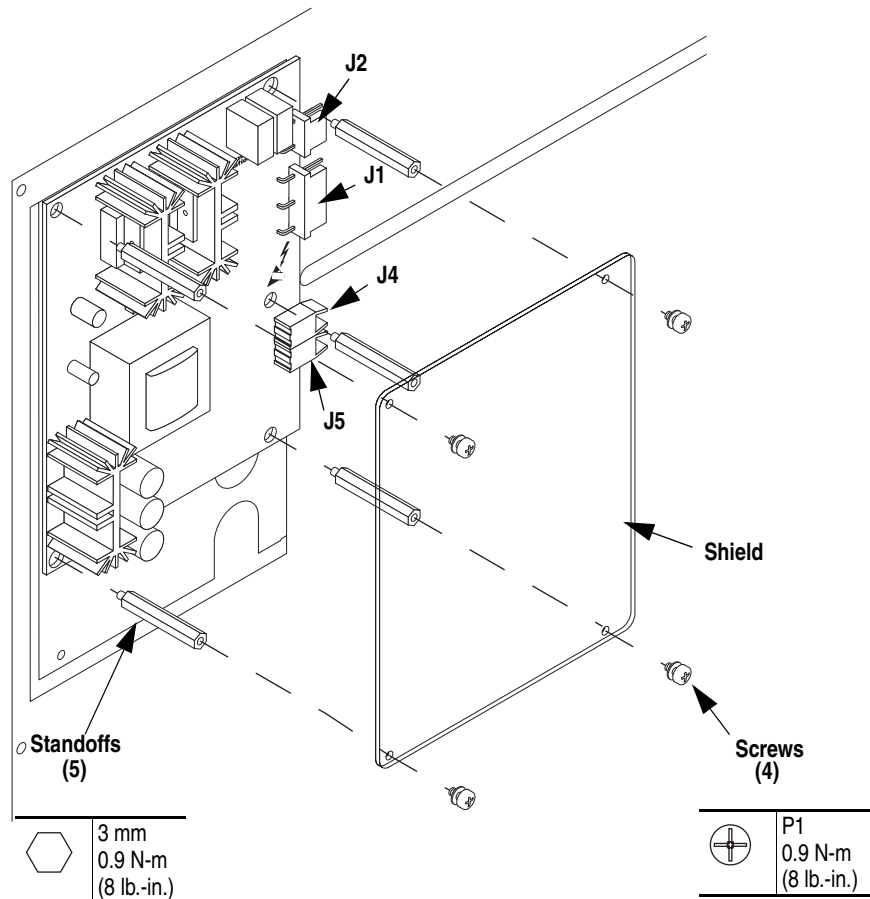
permanently damage the fiber-optic cable. Signal attenuation increases with decreased inside bend radii.

5. Unplug J2 and J7 ribbon cables from the Main Control Board.
6. Loosen captive screw.
7. Swing Control Assembly away from drive.
8. Lift Control Assembly up and off of hinge.

Installation

Install the 700S Control Assembly in reverse order of removal, while referring to [Torque Specifications on page 3-1](#).

Removing the 700S Voltage Feedback Circuit Board Removal



1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Referring to [Opening Drive on page 3-4](#), remove the Power Cover from the drive.
4. Carefully disconnect fiber-optic cables from sockets J4 and J5 of the Voltage Feedback Circuit Board, and carefully set them aside.



ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into fiber-optic ports or fiber-optic cable connectors.

Important: Minimum inside bend radius for fiber-optic cable is 25.4 mm (1 in.). Any bends with a shorter inside radius can permanently

damage the fiber-optic cable. Signal attenuation increases with decreased inside bend radii.

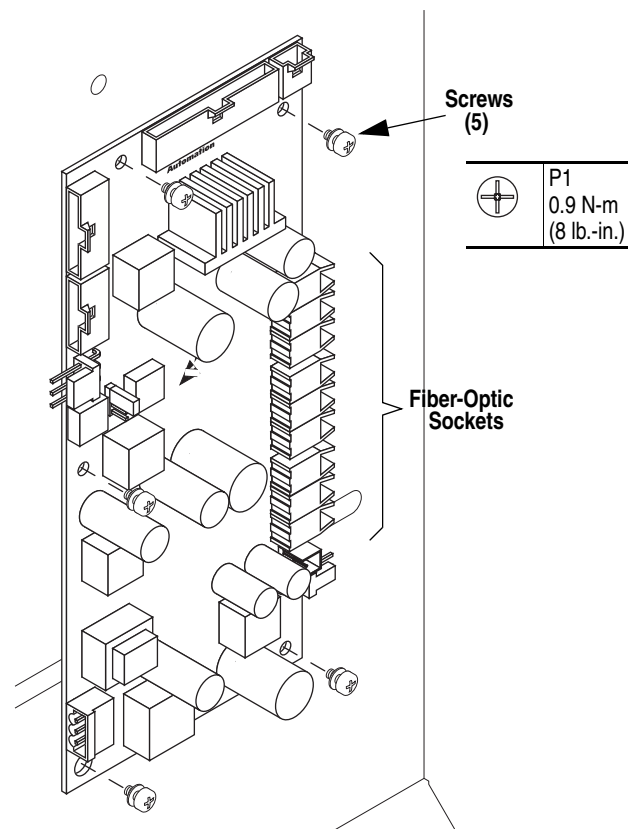
5. Disconnect feedback cables from sockets J1 and J2 of the Voltage Feedback Circuit Board.
6. Remove the four screws which secure the clear plastic shield to the standoffs and remove the shield.
7. Remove the five standoffs which support the clear plastic shield and secure the Voltage Feedback Circuit Board to its mounting plate.
8. Remove the Voltage Feedback Circuit Board from its mounting plate.

Installation

Install the Voltage Feedback Circuit Board in reverse order of removal, while referring to [Torque Specifications on page 3-1](#).

Removing the 700S Power Interface Circuit Board

Removal



1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Referring to [Opening Drive on page 3-4](#), remove the Power Cover from the drive.
4. Carefully disconnect the ribbon cables from sockets along the top side of the Power Interface Circuit Board, and carefully set them aside.
5. Carefully disconnect the fiber-optic cables from sockets along the right side of the circuit board, and carefully set them aside.



ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into fiber-optic ports or fiber-optic cable connectors.

Important: Minimum inside bend radius for fiber-optic cable is 25.4 mm (1 in.). Any bends with a shorter inside radius can permanently

damage the fiber-optic cable. Signal attenuation increases with decreased inside bend radii.

6. Disconnect other cables from sockets of the circuit board, and set them aside.
7. Remove the five screws which secure the Power Interface Circuit Board to the Control Frame.
8. Remove the circuit board from the Control Frame.

Installation

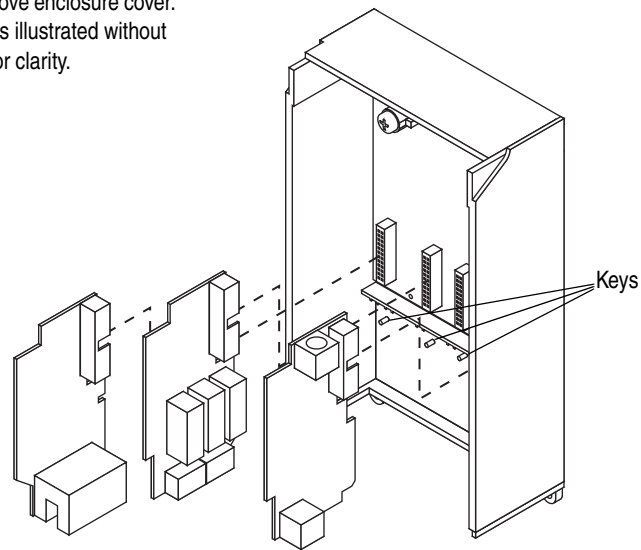
Install the 700S Power Interface Circuit Board in reverse order of removal, while referring to [Torque Specifications on page 3-1](#).

Removing the 700H I/O Boards and Control Assembly

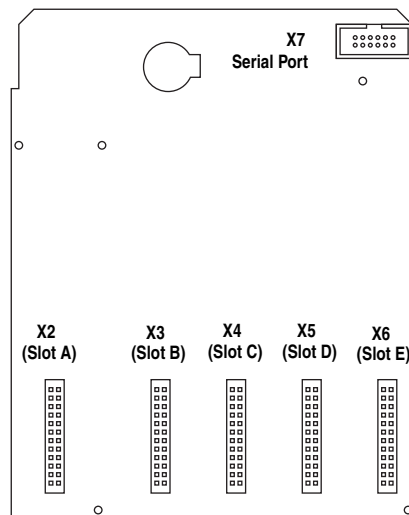
Removal

1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Referring to [Opening Drive on page 3-4](#), remove the Power Cover, Connection Cover and Conduit Cover from the drive.
4. Open the enclosure that contains the Control and I/O Boards and carefully unplug the DPI cable and any I/O cables.
5. Remove the I/O Boards from the Control Board and enclosure. Note the order of the boards and the keys which prevent placement of boards in incorrect slots.

Do not remove enclosure cover.
Enclosure is illustrated without the cover for clarity.

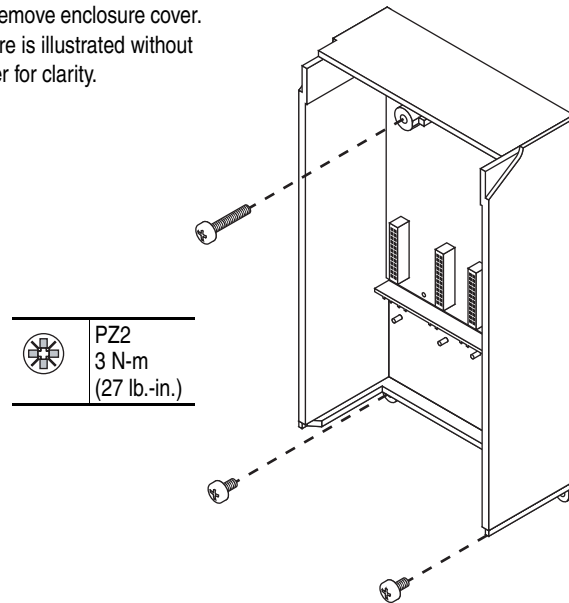


6. Unplug the serial connection from X7 of the Control Board.



7. Remove the three screws which secure the Control Assembly to the drive.

Do not remove enclosure cover.
Enclosure is illustrated without
the cover for clarity.



8. Remove the Control Assembly.

Installation

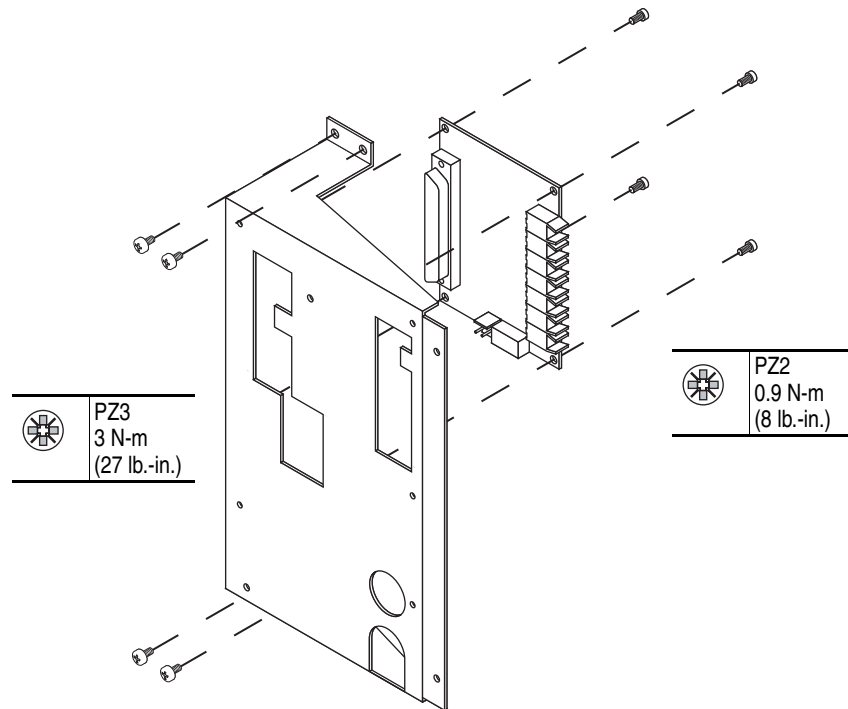
Install the 700H Control and I/O Boards in reverse order of removal, while referring to [Torque Specifications on page 3-1](#).

Removing the 700H Fiber Optic Adapter Board

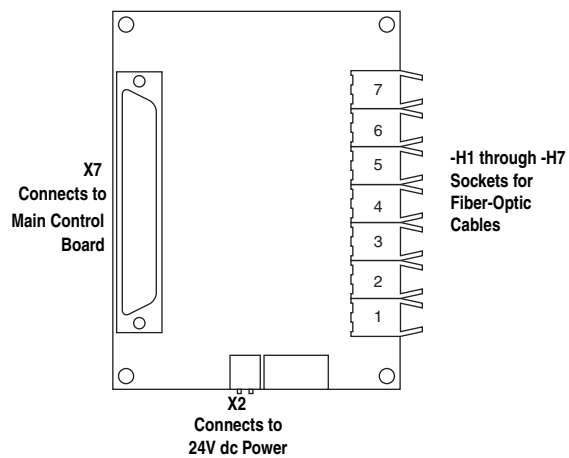
Removal

1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Referring to [Opening Drive on page 3-4](#), remove the Power Cover, Connection Cover and Conduit Cover from the drive.
4. Referring to [Removing the 700H I/O Boards and Control Assembly on page 3-14](#), remove the I/O boards and Control Assembly.
5. Remove the Control Frame while referring to [Removing the Control Frame and Cross Plate on page 3-17](#).

6. Remove the four screws which secure the Fiber Optic Adapter bracket to the drive.



7. Remove the Fiber Optic Adapter bracket.
8. Disconnect the control power cable from X2 of the Fiber Optic Adapter Board.



9. Carefully disconnect the fiber-optic cables from right side of the circuit board, and carefully set them aside.



ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into fiber-optic ports or fiber-optic cable connectors.

Important: Minimum inside bend radius for fiber-optic cable is 25.4 mm (1 in.). Any bends with a shorter inside radius can permanently damage the fiber-optic cable. Signal attenuation increases with decreased inside bend radii.

10. Remove the four screws which secure the Fiber Optic Adapter Board to the bracket.
11. Remove the Fiber Optic Adapter Board from the bracket.

Installation

Install the 700H Fiber Optic Adapter Board in reverse order of removal, while referring to [Torque Specifications on page 3-1](#).

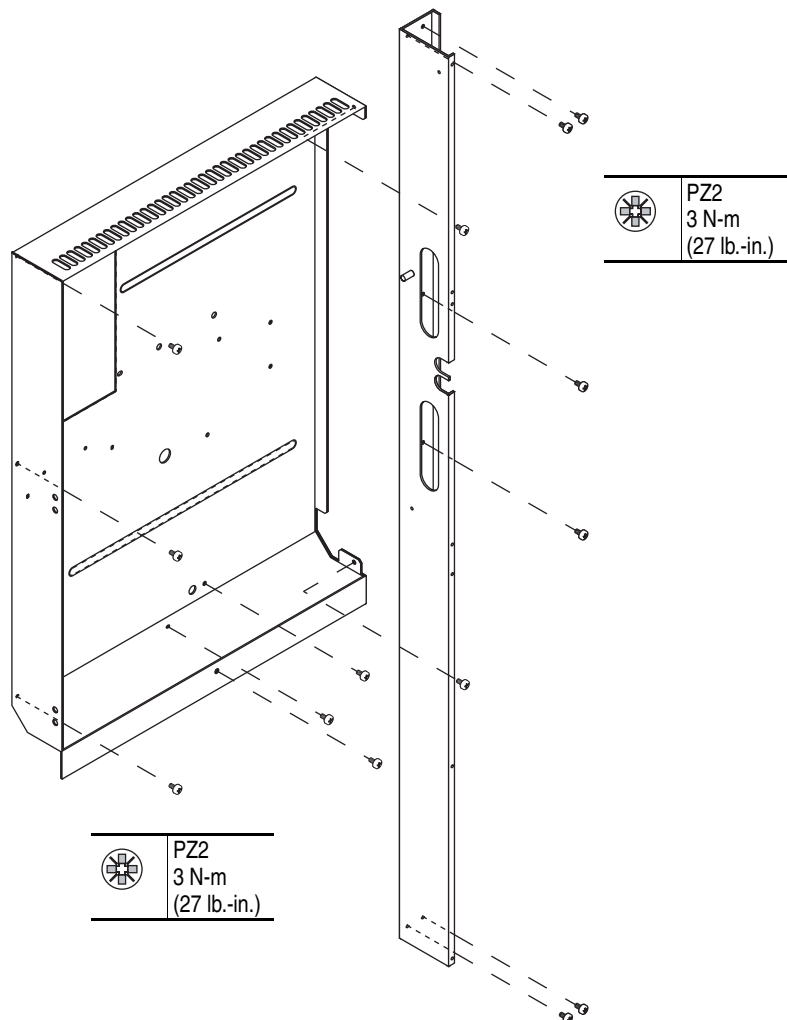
Removing the Control Frame and Cross Plate

Removal

1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Referring to [Opening Drive on page 3-4](#), remove the Power Cover, Connection Cover and Conduit Cover from the drive.
4. Referring to [Removing the DPI / HIM Assembly on page 3-6](#), remove the DPI / HIM assembly.
5. If removing a Control Frame from a DC input drive with precharge interlock, disconnect the wiring from terminal strip X50.

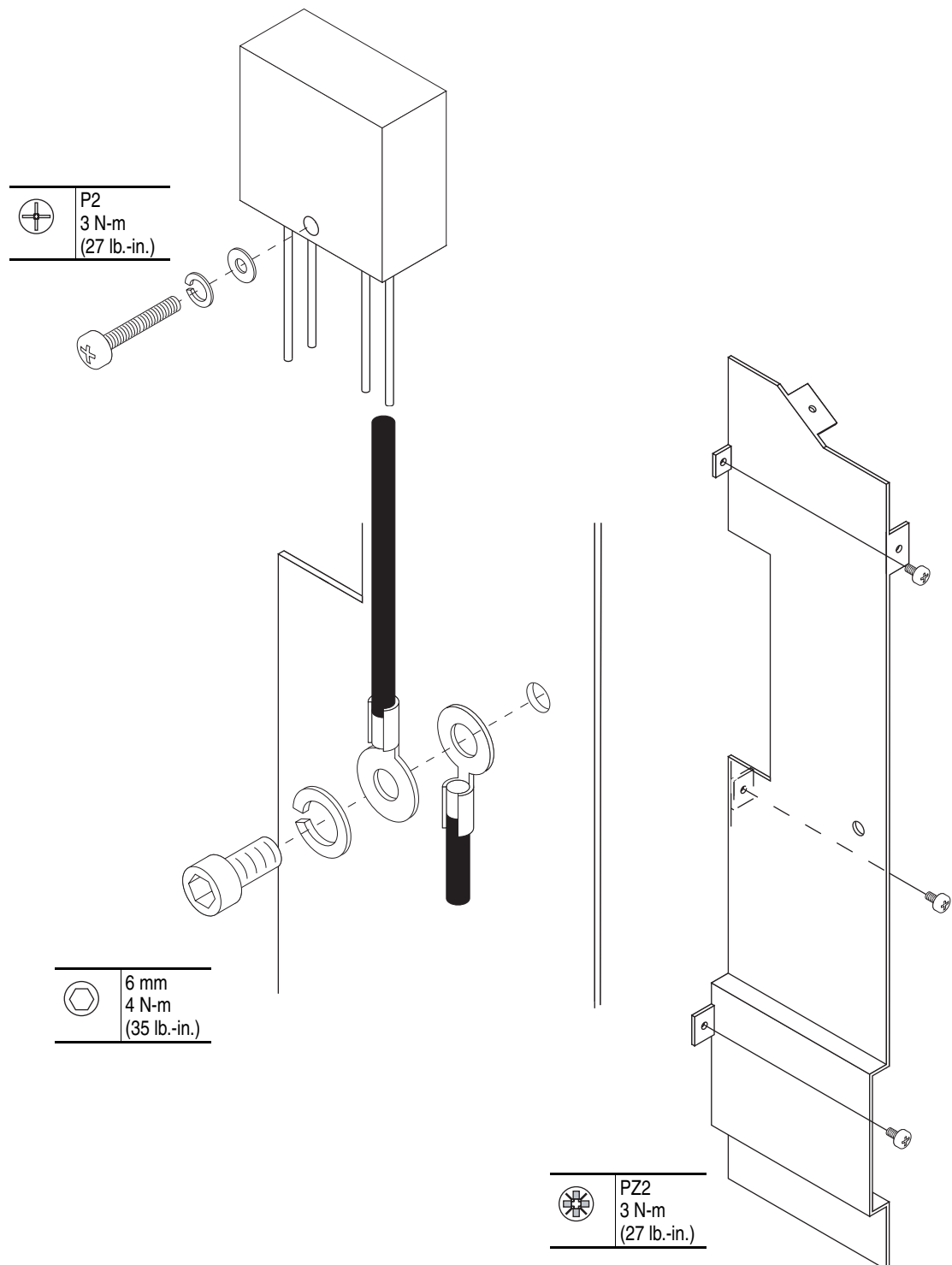
Important: Before removing connections and wires, mark the connections and wires to avoid incorrect wiring during assembly.

6. If removing a Control Frame from a 700S drive, remove the Power Interface and Voltage Feedback circuit boards (refer to [Removing the 700S Voltage Feedback Circuit Board on page 3-10](#) and [Removing the 700S Power Interface Circuit Board on page 3-12](#)).
7. If removing a Control Frame from a 700H drive, carefully disconnect the connections to the I/O boards and Control Assembly, and carefully set aside
8. Remove the DPI / HIM Assembly, while referring to [Removing the DPI / HIM Assembly on page 3-6](#).
9. Remove eight screws which secure the Control Frame to the drive.
10. Remove the six screws which secure the Conduit to the drive.



11. Remove the Conduit from the drive.
12. Remove the Control Frame from the drive while carefully routing the cables and wires through the access hole of the Control Frame.

13. Disconnect the Cross Plate Fan (if present), MOV and ground wires.



14. Remove three screws which hold Cross Plate to the drive.

15. Remove the Cross Plate.

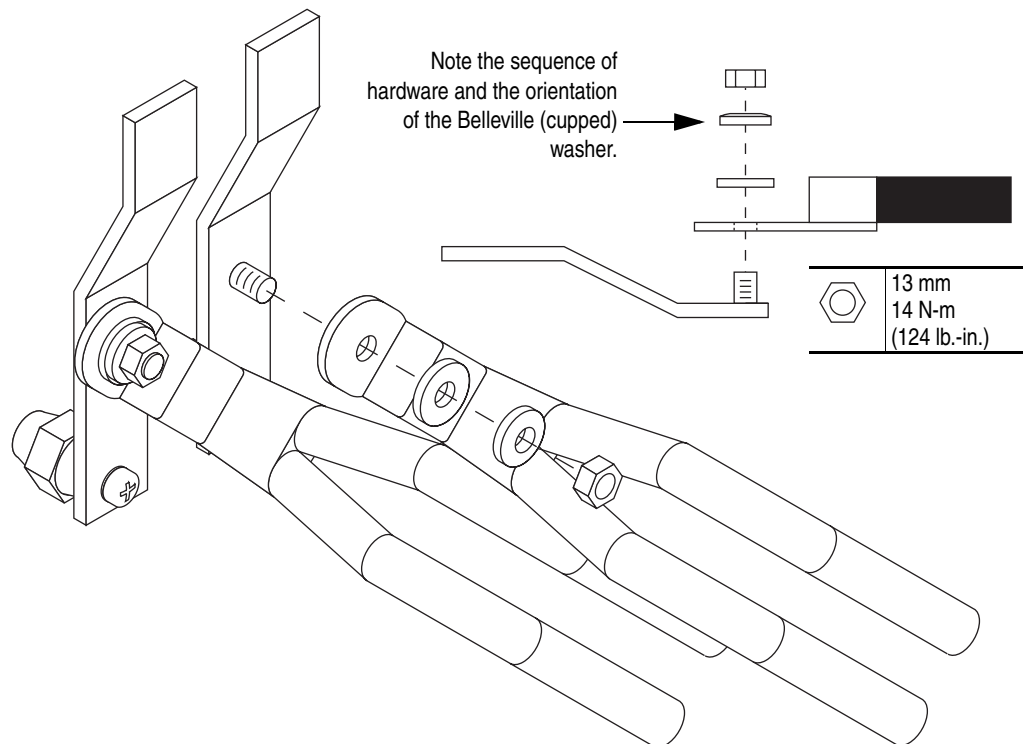
Installation

Install the Control Frame and Cross Plate in reverse order of removal, while referring to [Torque Specifications on page 3-1](#).

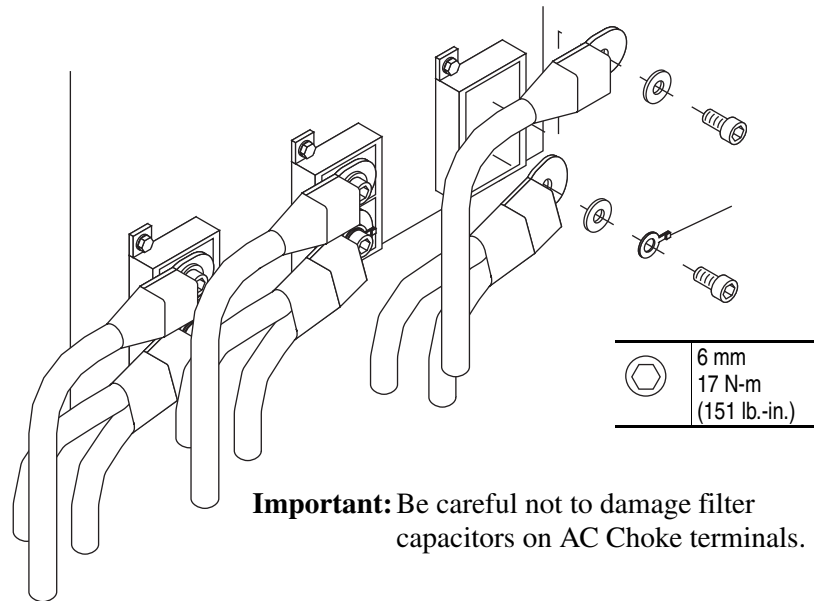
Removing the EMC-Protection Plate

Removal

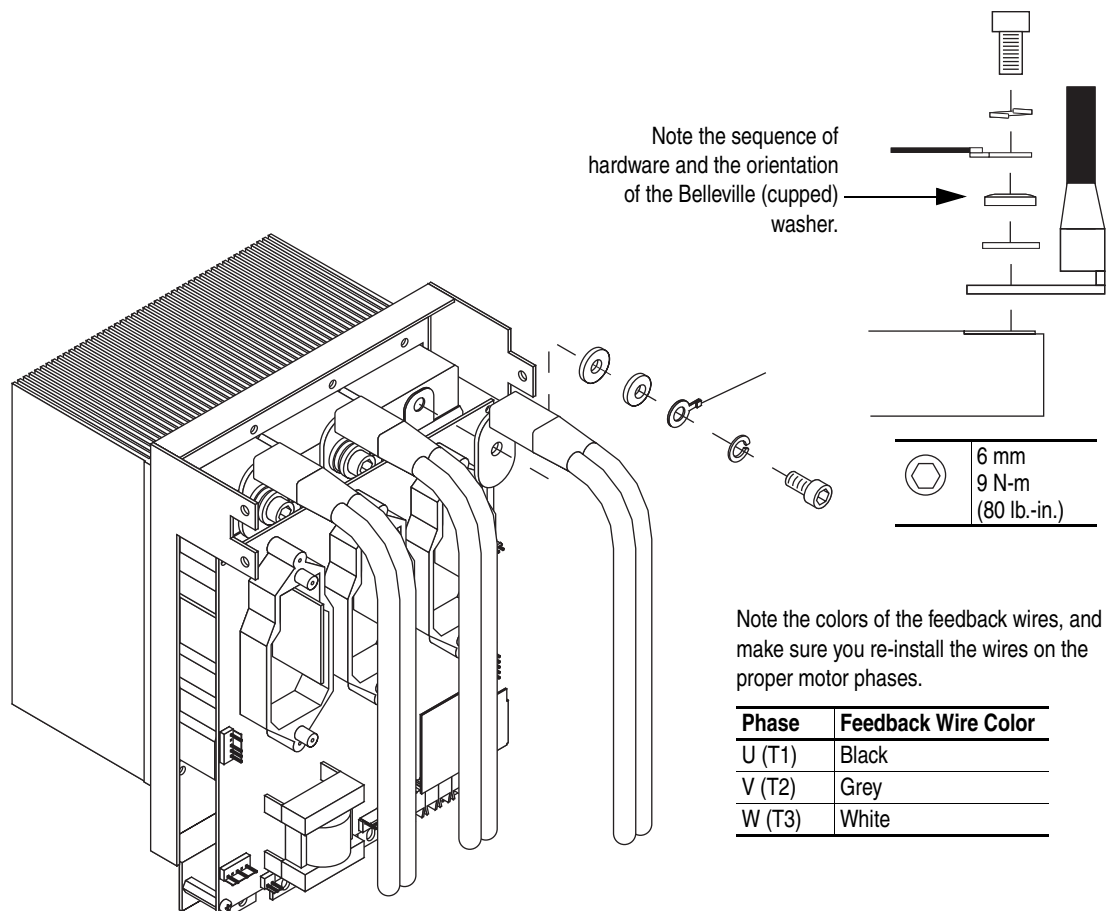
1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Referring to [Opening Drive on page 3-4](#), remove the Power Cover, Connection Cover and Conduit Cover from the drive.
4. Referring to [Removing the DPI / HIM Assembly on page 3-6](#), remove the DPI / HIM assembly.
5. Referring to [Removing the Control Frame and Cross Plate on page 3-17](#), remove the Control Frame and Cross Plate.
6. Disconnect the internal DC Bus wires from the DC Bus terminals at the top of the drive.



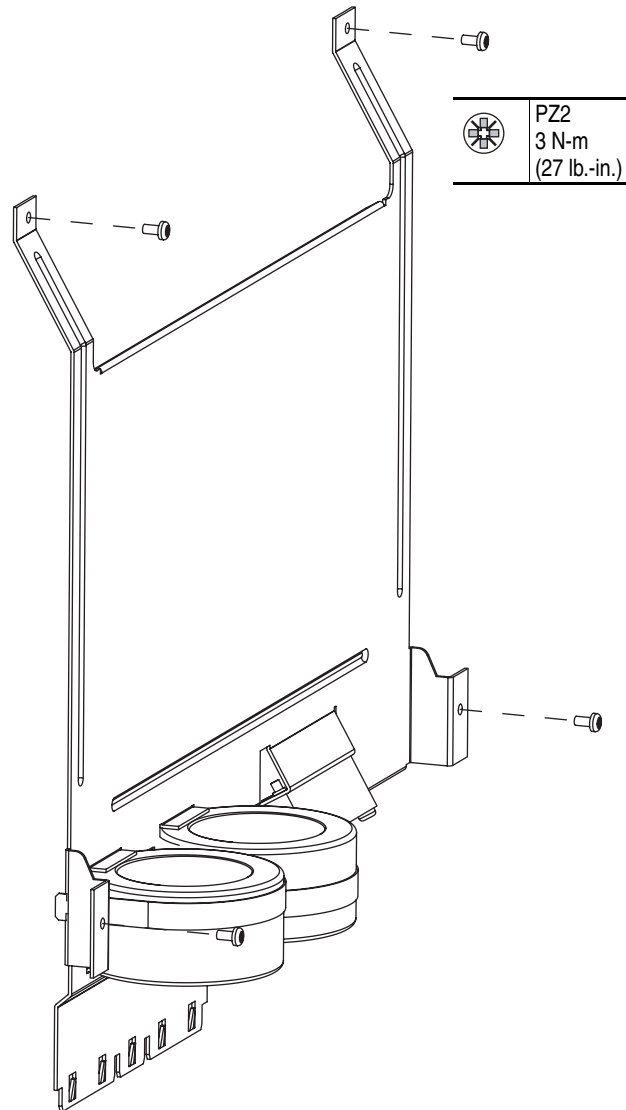
7. Disconnect the internal three-phase wiring from the AC choke (if present).



8. Disconnect the output cables from the top of the Power Module.



9. Remove four screws which secure the EMI-Protection Plate to the drive.
Also remove the two screws which secure the common mode inductors.



10. Disconnect the fan which is mounted on the EMI-Protection Plate.

11. Remove the EMI-Protection Plate.

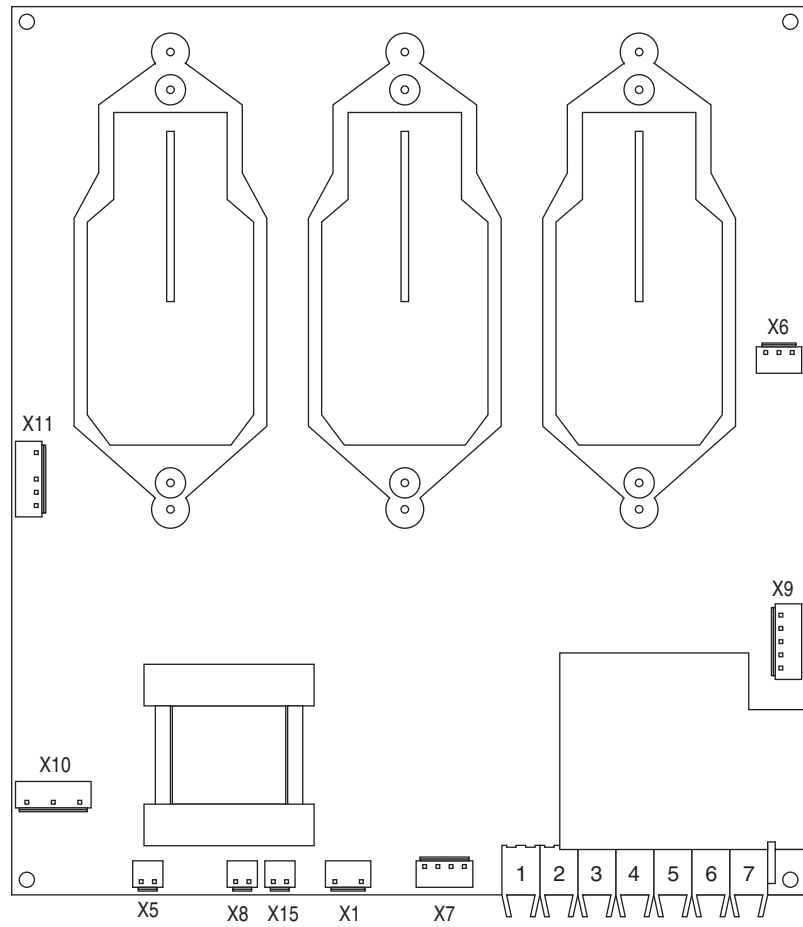
Installation

Install the EMC-Protection Plate in reverse order of removal, while referring to [Torque Specifications on page 3-1](#).

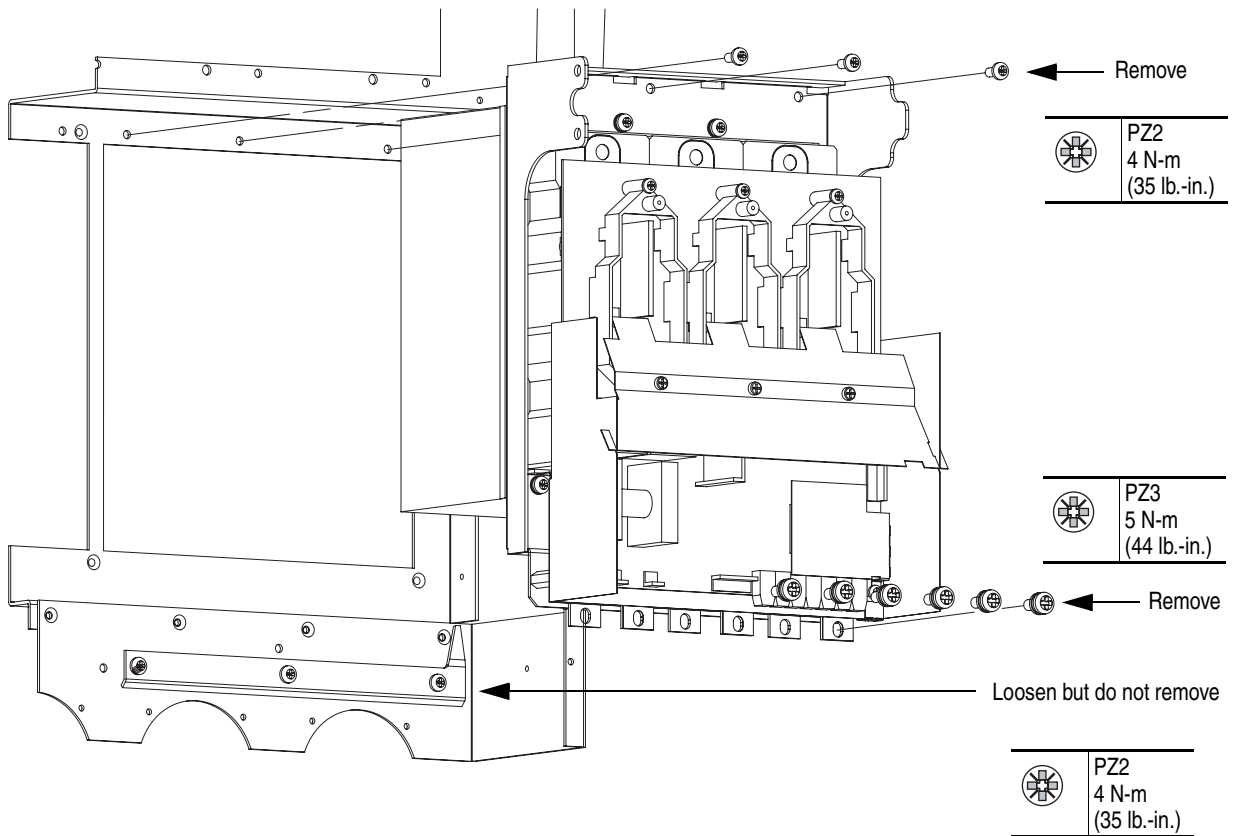
Removing the Power Module Removal

1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Referring to [Opening Drive on page 3-4](#), remove the Power Cover, Connection Cover and Conduit Cover from the drive.
4. Referring to [Removing the DPI / HIM Assembly on page 3-6](#), remove the DPI / HIM assembly.
5. Referring to [Removing the Control Frame and Cross Plate on page 3-17](#), remove the Control Frame and Cross Plate.
6. Referring to [Removing the EMC-Protection Plate on page 3-20](#), remove the EMC-Protection Plate.

7. Disconnect all of the cables from the Power Module circuit board.

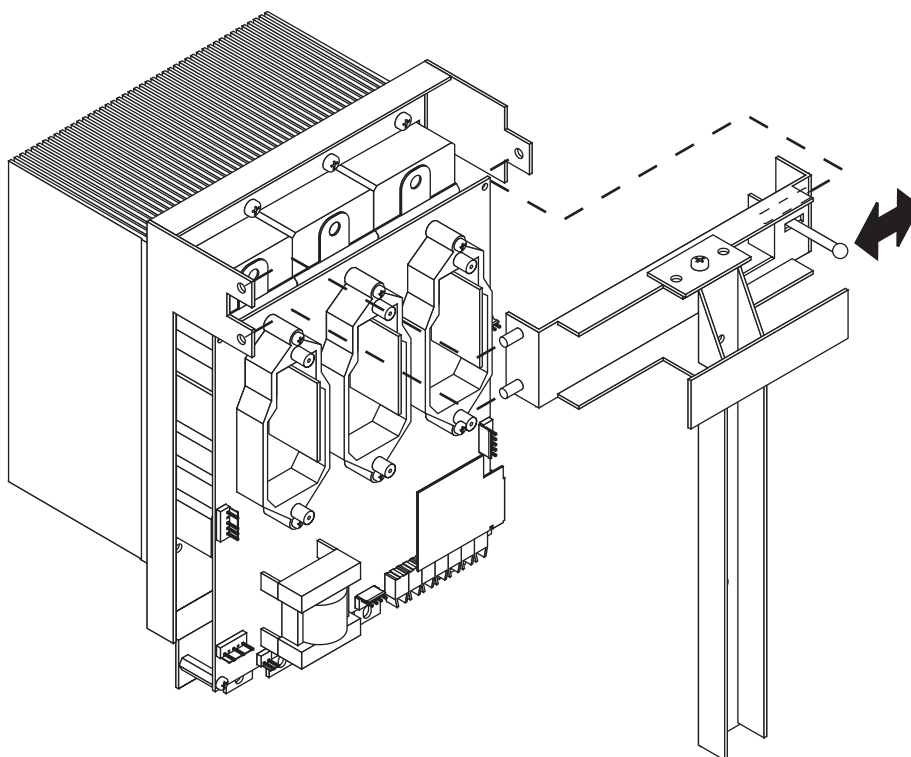


8. Remove the six screws which connect the Power Module to the DC Bus bars.



9. Remove the three fastening screws at the top of the Power Module.
10. Loosen (4-5 turns), but do not remove the three fastening screws at the bottom of the Power Module.

11. Install the RT1 tool on the Power Module and remove the module from the drive.



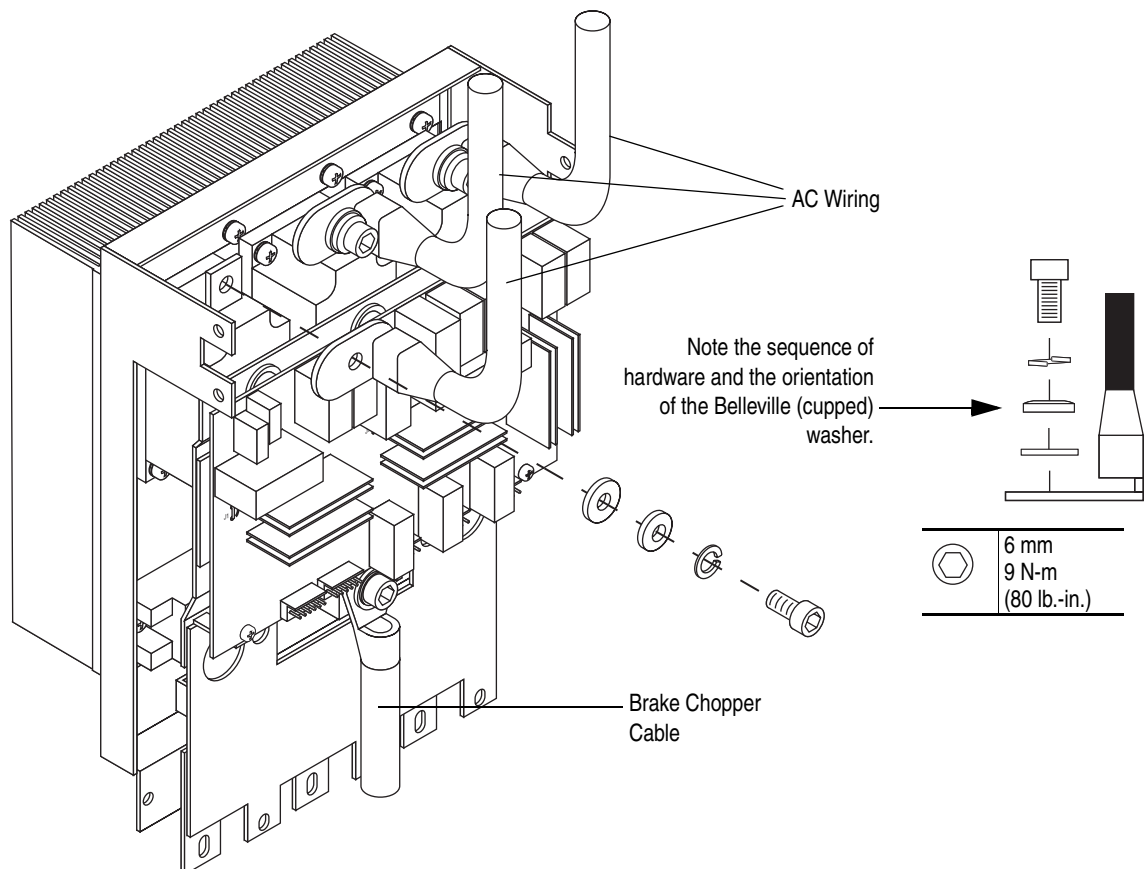
Installation

Install the Power Module in reverse order of removal, while referring to [Torque Specifications on page 3-1](#).

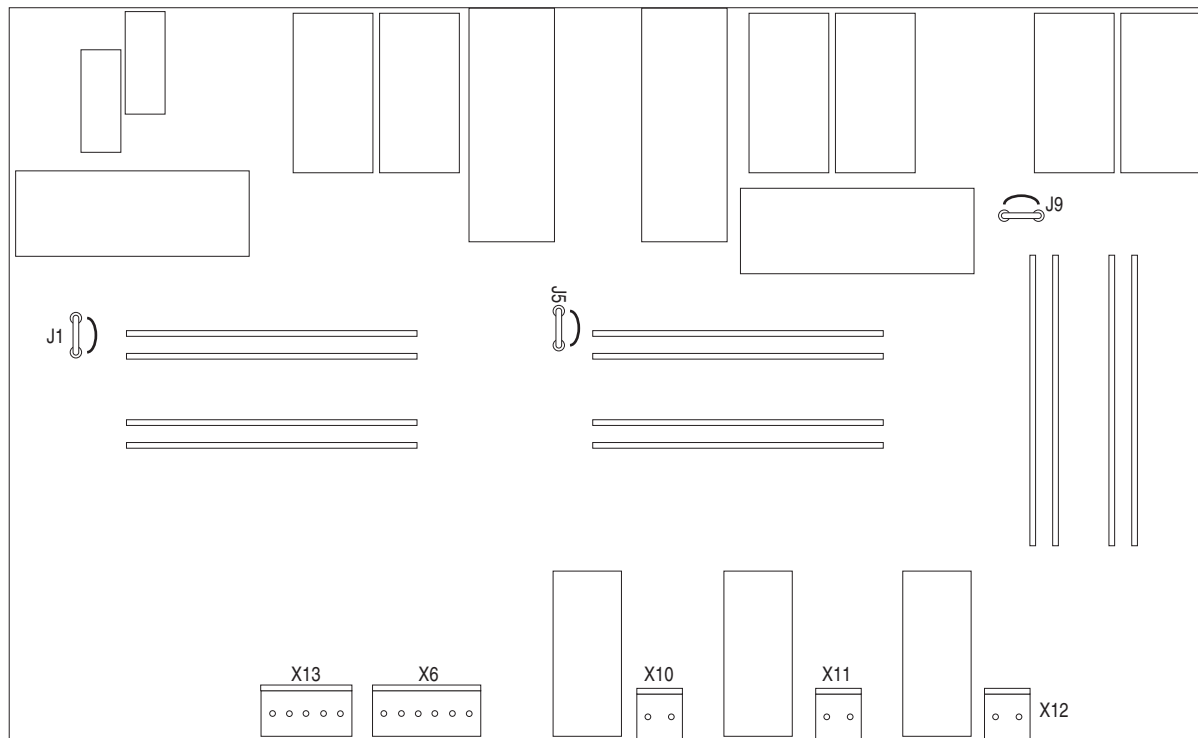
Removing the Rectifying Module

Removal

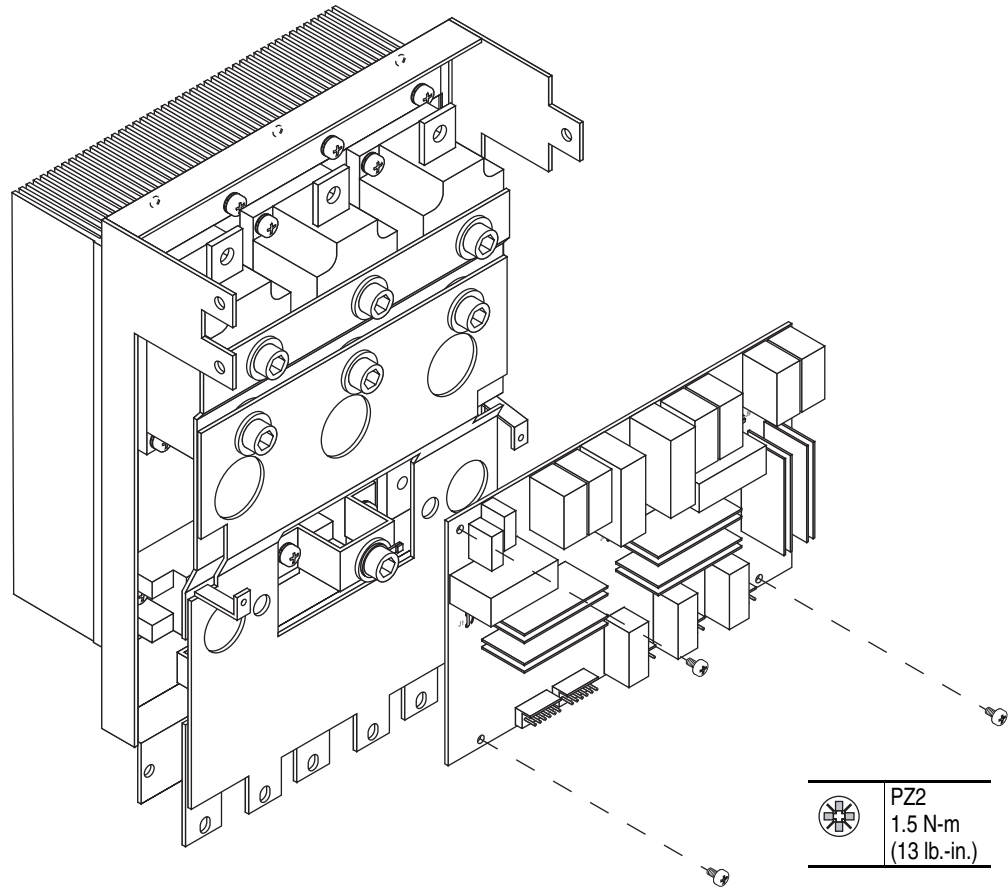
1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Referring to [Opening Drive on page 3-4](#), remove the Power Cover, Connection Cover and Conduit Cover from the drive.
4. Referring to [Removing the DPI / HIM Assembly on page 3-6](#), remove the DPI / HIM assembly.
5. Referring to [Removing the Control Frame and Cross Plate on page 3-17](#), remove the Control Frame and Cross Plate.
6. Referring to [Removing the EMC-Protection Plate on page 3-20](#), remove the EMC-Protection Plate.
7. Remove the three-phase AC wiring from the Rectifying Module. Also remove the Brake Chopper Cable, if present.



8. Disconnect the cables from connectors on the Rectifying Module circuit board.

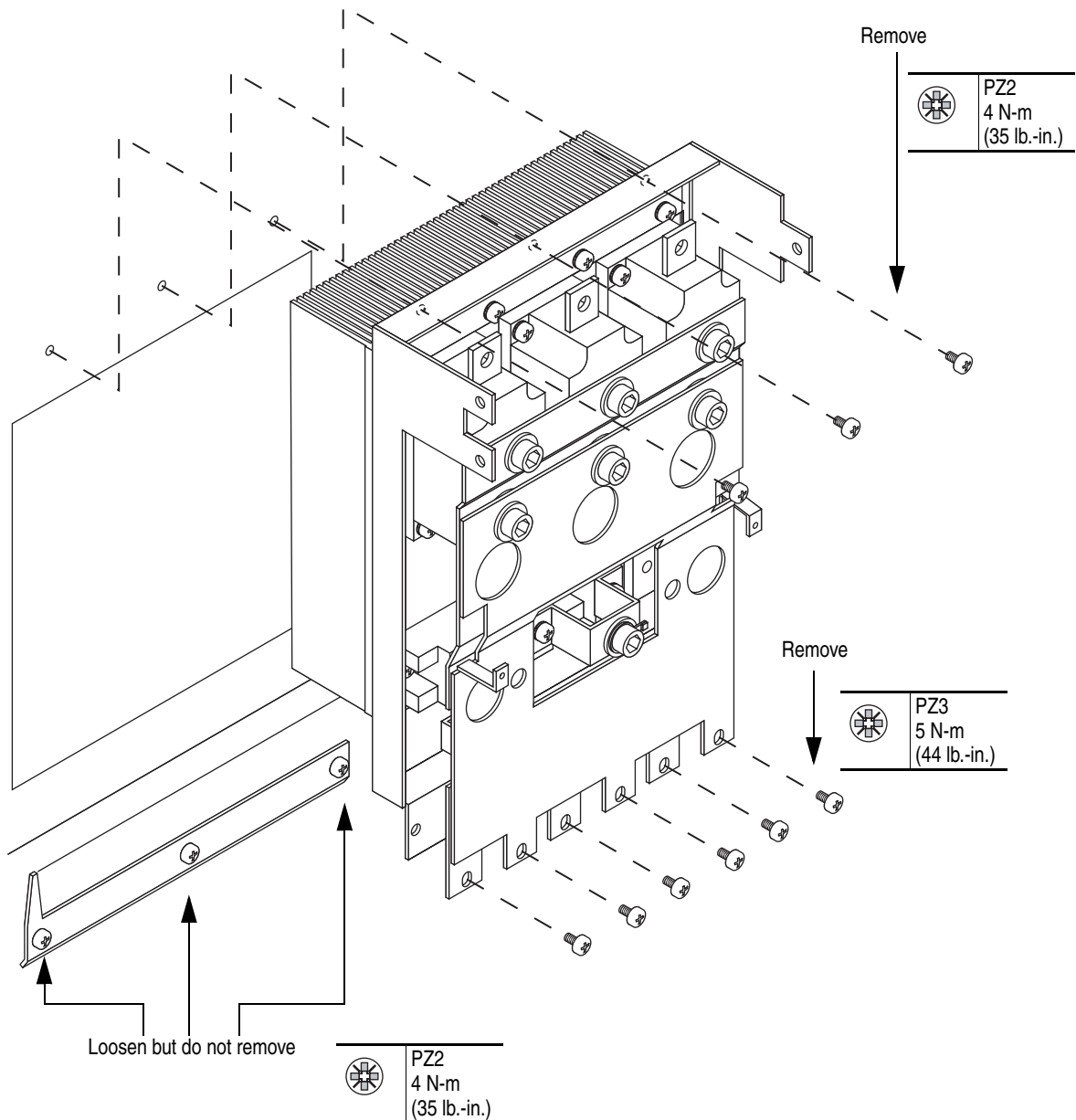


9. Remove the three screws which secure Rectifying Module circuit board to the Rectifying Module sub-assembly. Do not remove the screws at the top of the module which secure the conducting straps (that connect the circuit board to AC power from the AC Choke).



10. Remove the Rectifying Module circuit board.

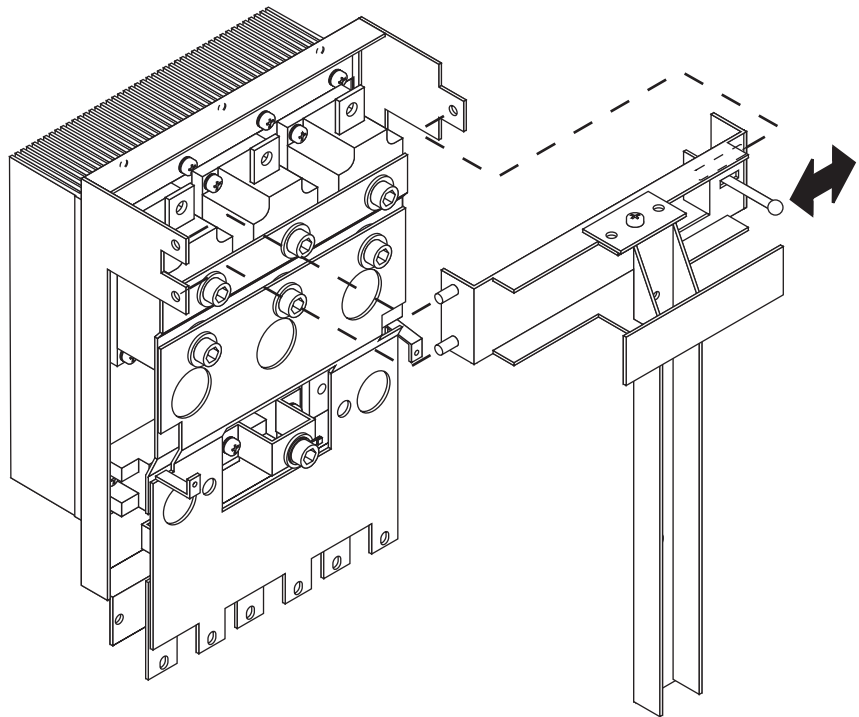
- 11.** Remove the six screws which connect the Rectifying Module to the DC Bus bars.



- 12.** Remove the three fastening screws at the top of the Rectifying Module.

- 13.** Loosen (4-5 turns), but do not remove the three fastening screws at the bottom of the Rectifying Module.

14. Install the RT1 tool on the Rectifying Module and remove the module from the drive.



Installation

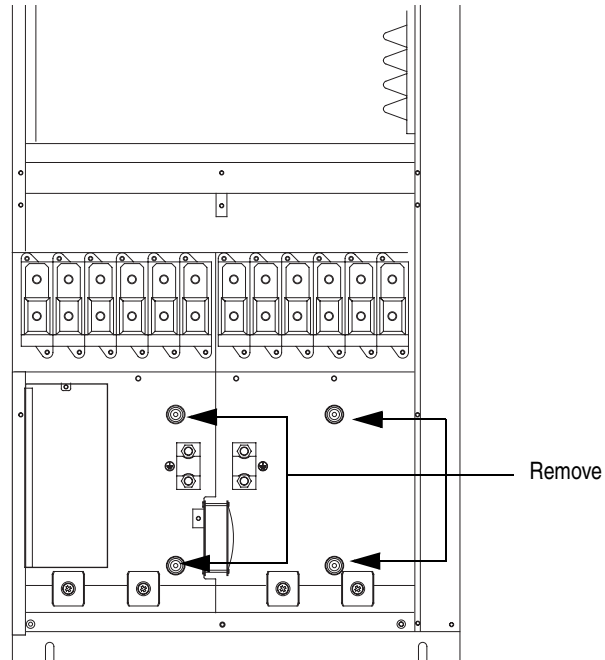
Install the Rectifying Module in reverse order of removal, while referring to [Torque Specifications on page 3-1](#).

Important: Before installing a new Rectifying Module, be sure to remove the circuit board. Mechanical interference with the RT1 tool could damage the new circuit board.

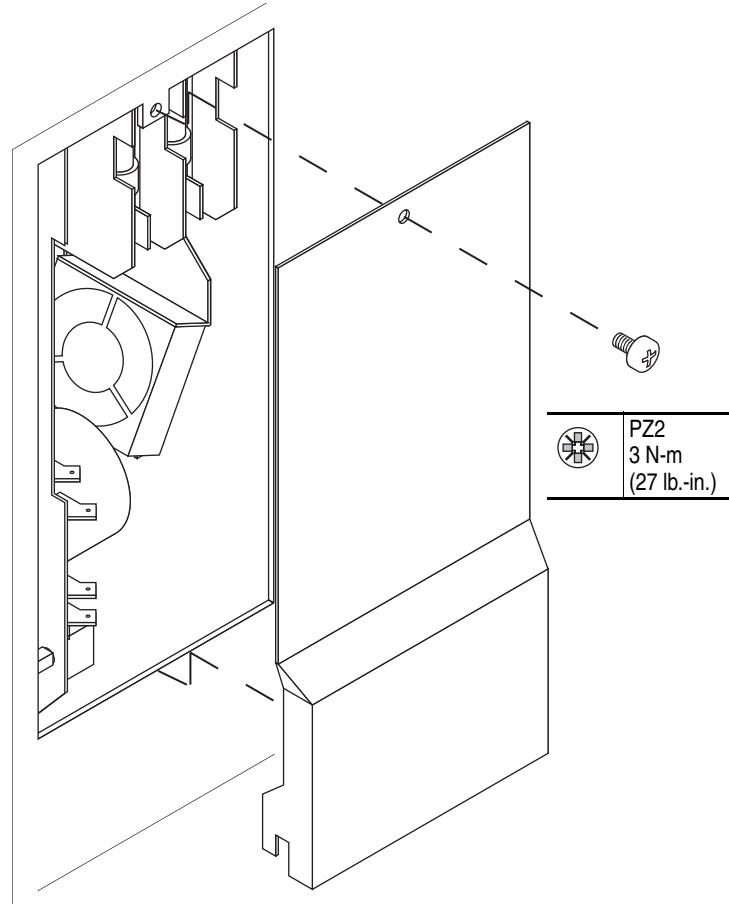
Removing the Main Fan

Removal

1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Referring to [Opening Drive on page 3-4](#), remove the Connection Cover from the drive.
4. Remove the four rubber bushings which cover the screws which mount the fan assembly



5. Remove the screw which secures the fan power supply plate. Then lift and pull the plate away from the drive.



6. Disconnect the motor lead wires including the ground wire. Refer to [Figure B.8 on page B-8](#), when reconnecting these wires.
 7. Check that the upper mounting bolts securely hold drive on the wall of the system enclosure. Remove lower mounting bolts from the bottom of the frame.
 8. Loosen, but do NOT remove, four front screws (which are accessible through the holes vacated by the rubber bushings) so that the fan assembly can easily slide off. To loosen, but not remove these front screws, turn them 12 times.
 9. Remove four screws from bottom of the frame. The fan plate should now easily slide down. If it does not, loosen the front screws another turn and attempt again. Continue loosening the screws until the fan plate slides easily from the drive.
- Important:** Do not attempt to force the fan plate from the drive. This may bend the fan.
10. Remove fan from fan plate. Refer to [Figure C.6 on page C-7](#).

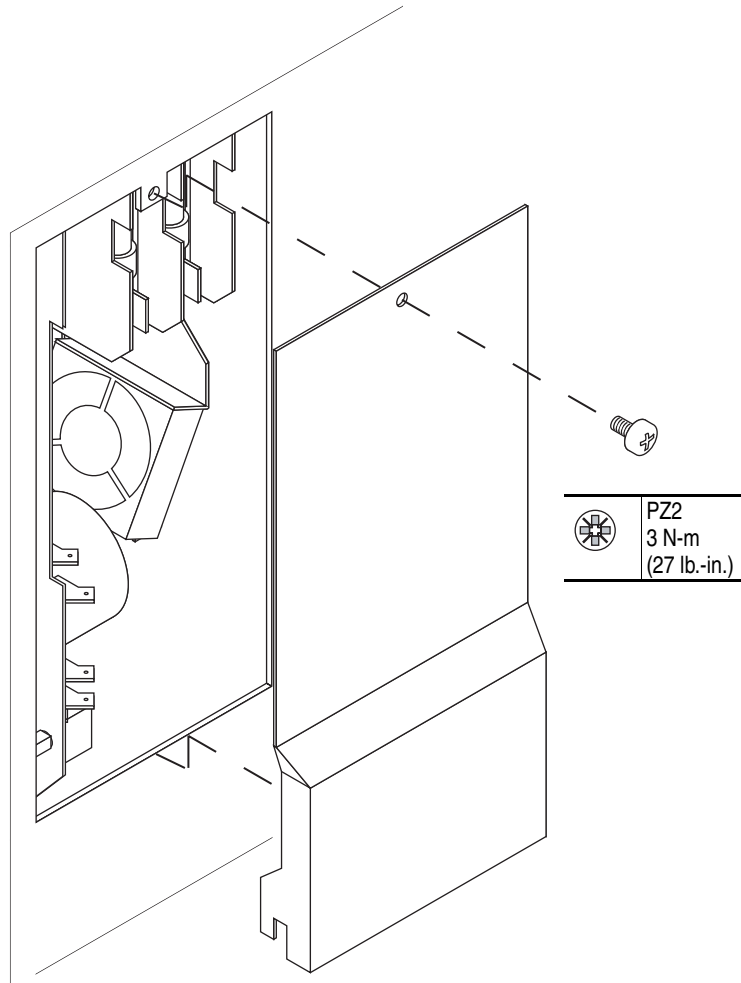
Installation

Install the fan in reverse order of removal, while referring to [Torque Specifications on page 3-1](#). Refer to [Figure B.8 on page B-8](#), when reconnecting the fan and fan power supply.

Removing the Fan Power Supply

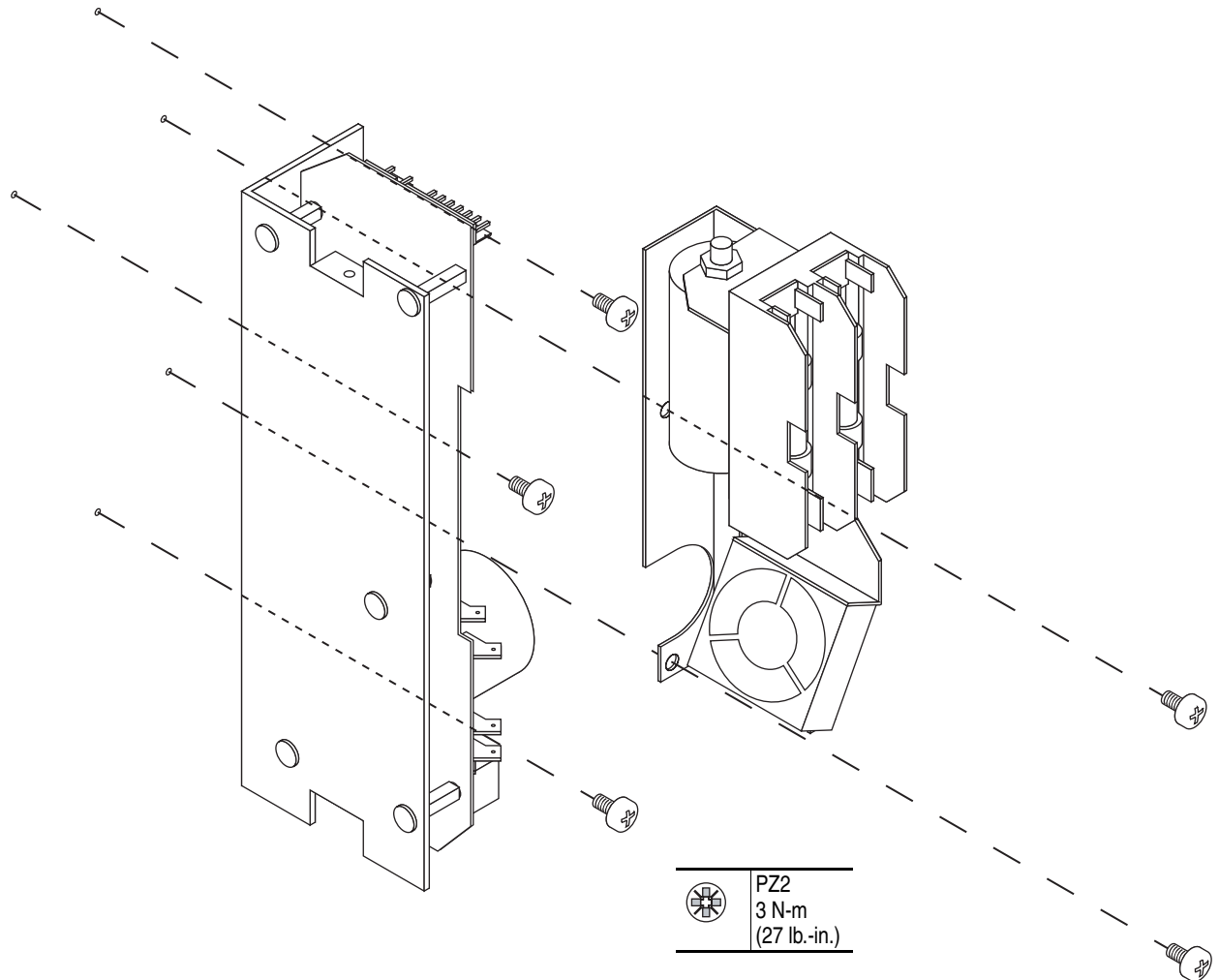
Removal

1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Referring to [Opening Drive on page 3-4](#), remove the Connection Cover from the drive.
4. Remove the screw which secures the fan power supply plate. Then lift and pull the plate away from the drive.



5. Disconnect the wires which run from the transformer to the power supply (X4 and X5 on the power supply). Refer to [Figure B.8 on page B-8](#), when reconnecting these wires.
6. On the fuseholder/capacitor bracket disconnect the capacitor from the transformer. Disconnect the power supply cooling fan and the fuses.

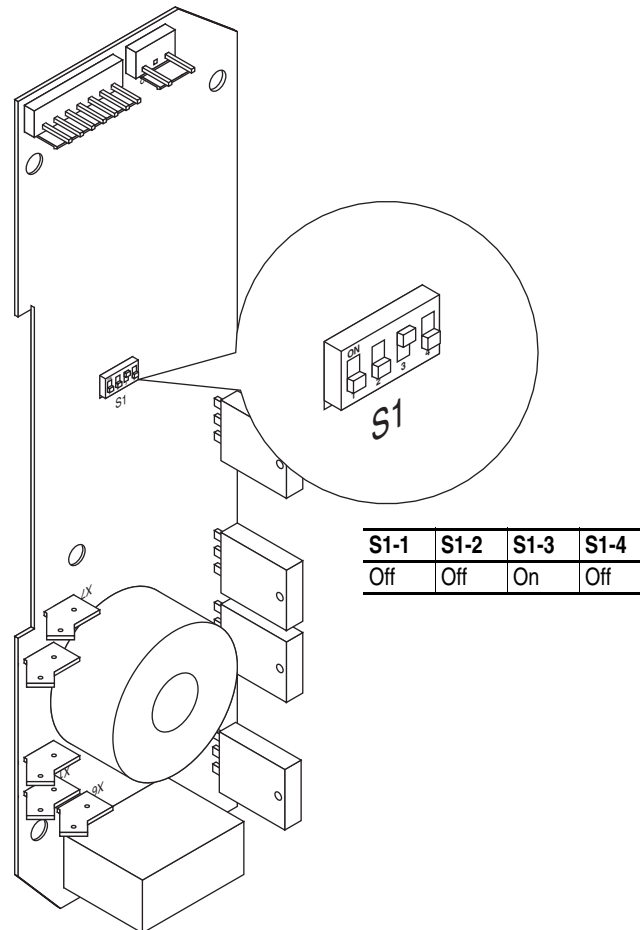
7. Remove the screws which mount the fuseholder/capacitor bracket to the drive, and remove the bracket.



8. Disconnect the remaining cable from the power supply (X8 on the power supply).
9. Remove the screws which mount the power supply to the drive, and remove the power supply.

Installation

1. Install the fan power supply and fuseholder/capacitor bracket in reverse order of removal, while referring to [Torque Specifications on page 3-1](#).
2. Verify that dip switch S1 is properly configured.



3. Install fan power supply plate.

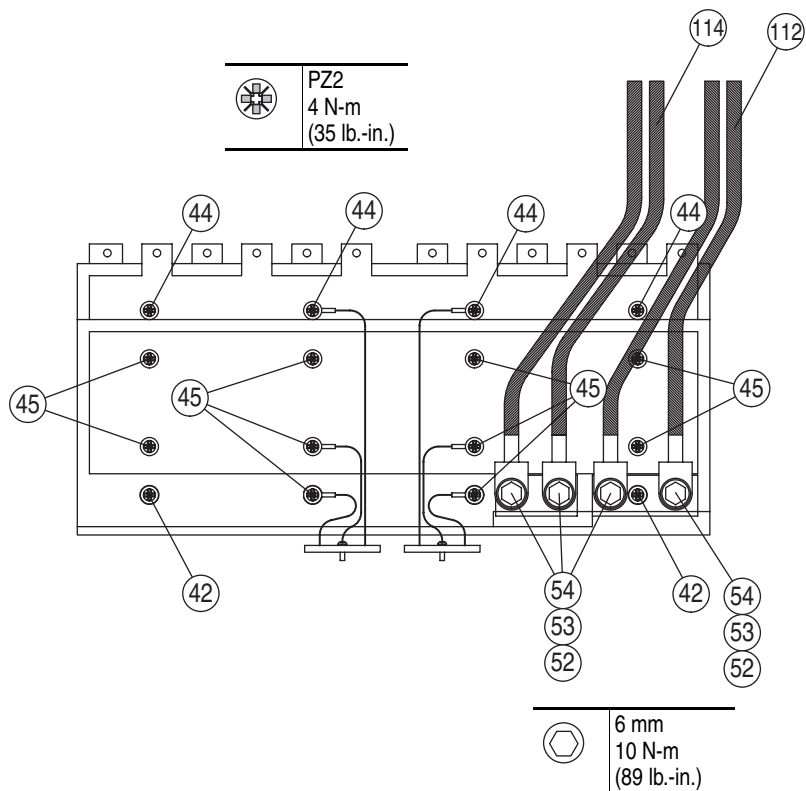
Removing Capacitors

Removal

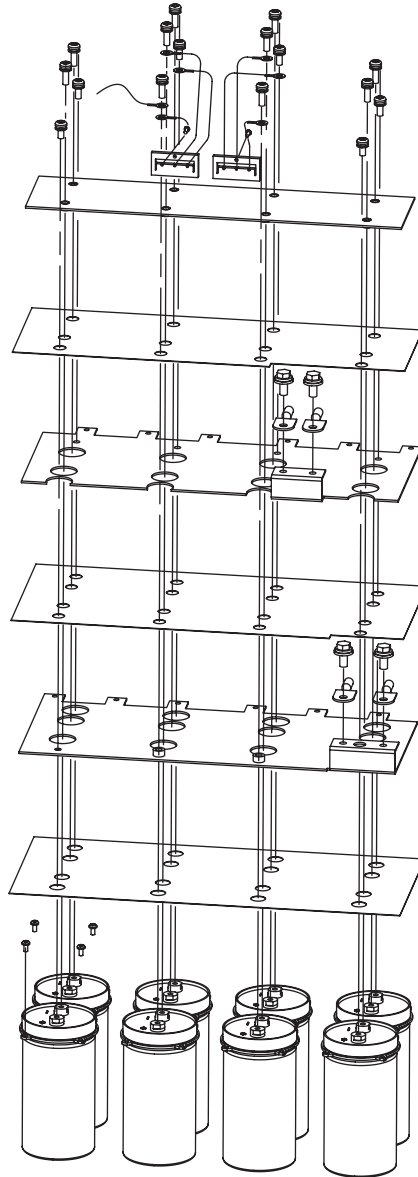
1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Referring to [Opening Drive on page 3-4](#), remove the Connection Cover from the drive.
4. Referring to [Removing the Control Frame and Cross Plate on page 3-17](#), remove the Control Frame and Cross Plate.
5. Remove terminal sub-assembly (Number 88 in [Figure C.1 on page C-2](#) or [Figure C.2 on page C-3](#))
6. Disconnect fiber-optic connectors X7, X10 and internal fan cable from power board.
7. Remove DC+ and DC- cables (Numbers 112 and 114).
8. Remove twelve (12) screws which connect the Output Power Module and Rectifying Module (if present) to the DC+ and DC- busbars.
9. Remove sixteen (16) screws (Numbers 42, 44 and 45) from capacitor terminals.

Table 3.A Capacitor Sub-assembly Hardware

Id. No.	Description
42	Screw M6 x14 Z4-1 (combination)
44	Screw M6 x16 Z4-1 (combination)
45	Screw M5x20 TX (combination)
52	Washer (straight) M8 SFS3738
53	Washer (cone) M8 DIN679
54	Screw hexagonal M8 X 20
112	Cable DC+
114	Cable DC-



10.Remove busbars and insulators.



11.Remove screws which secure capacitors to drive.

12.Remove capacitors from drive.

Installation

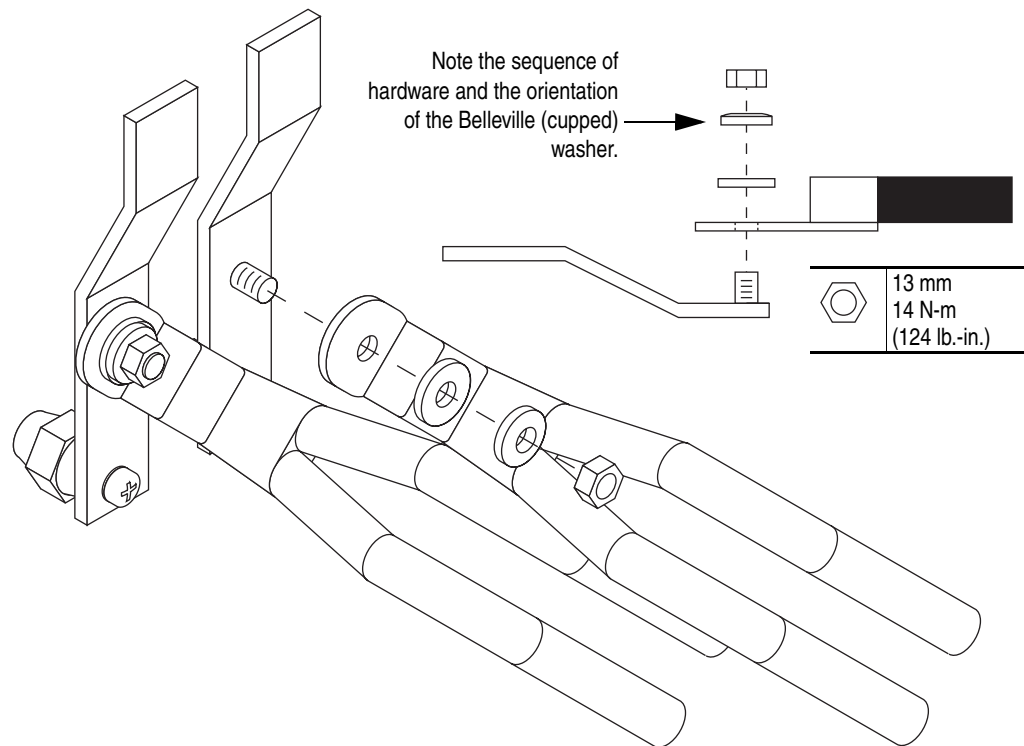
Install the capacitors in reverse order of removal, while referring to [Torque Specifications on page 3-1](#).

Important: The screws in this sub-assembly vary in length. It is critical that you use the correct screws in the correct locations. Refer to [Table 3.A on page 3-38](#).

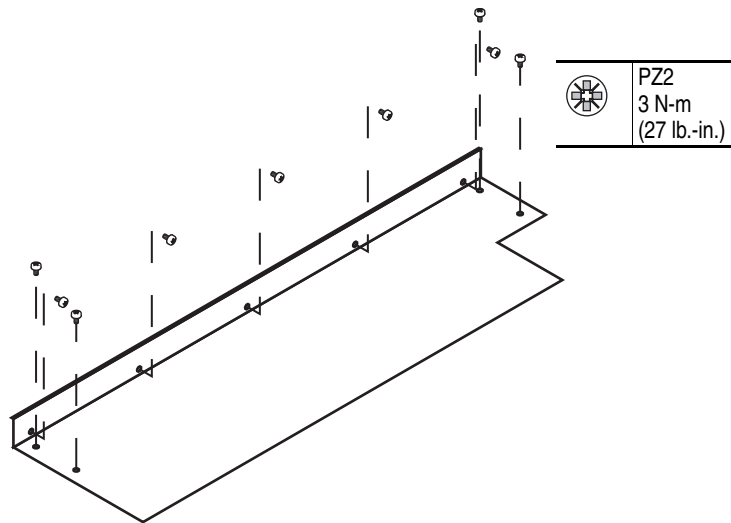
Removing the AC-Choke

Removal

1. Remove power from drive.
2. Check for zero volts between DC+ and DC-.
3. Referring to [Opening Drive on page 3-4](#), remove the Connection Cover from the drive.
4. Referring to [Removing the Control Frame and Cross Plate on page 3-17](#), remove the Control Frame and Cross Plate.
5. Disconnect the internal DC Bus wires from the DC Bus terminals at the top of the drive.

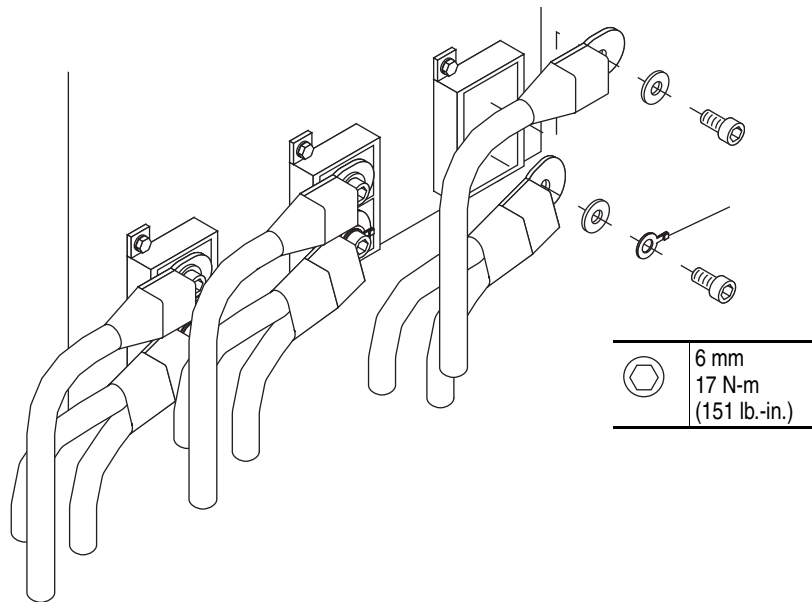


6. Remove nine (9) screws from upper plate.

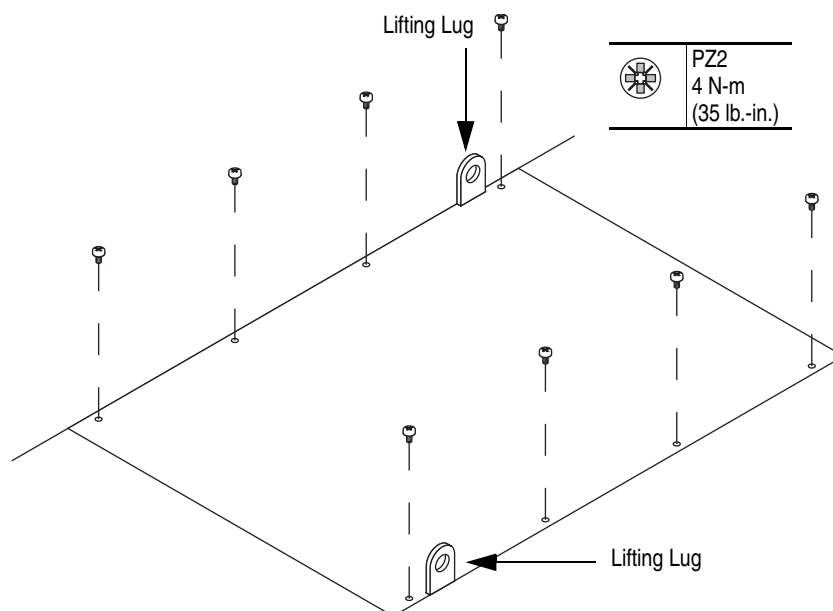


7. Remove control bracket (Number 63 in [Figure C.1 on page C-2](#) or [Figure C.2 on page C-3](#))

8. Remove all cables from AC-choke terminals.



9. Remove eight (8) fastening screws from AC-choke.



10. Remove AC-choke from drive by using lifting lugs.

Installation

Install the AC-choke in reverse order of removal, while referring to [Torque Specifications on page 3-1](#).

Start-Up After Repair



ATTENTION: Power must be applied to the drive to perform the following start-up procedure. Some of the voltages present are at incoming line potential. To avoid electric shock hazard or damage to equipment, only qualified service personnel should perform the following procedure. Thoroughly read and understand the procedure before beginning. If an event does not occur while performing this procedure, Do Not Proceed. Remove Power including user supplied control voltages. User supplied voltages may exist even when main AC power is not applied to then drive. Correct the malfunction before continuing.

Loading the 700H EEPROM

If you replace the Output Power Module or Control Board in a 700H drive, you must load information about the Power Module or Control Board into the Power EEPROM. Contact Allen-Bradley Drives Technical Support for instructions and tools for performing this operation.

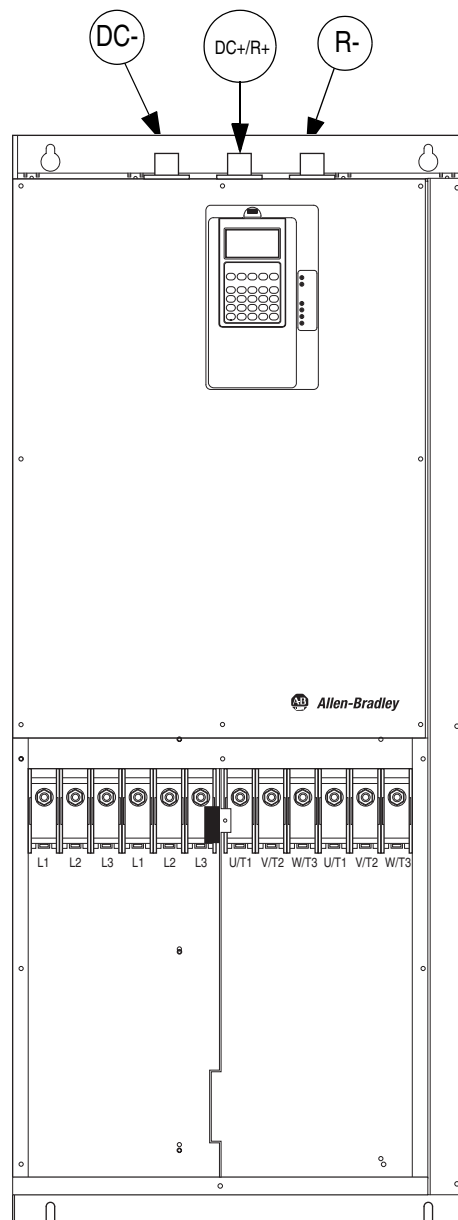
Phone	United States/ Canada	1.262.512.8176 (7 AM - 6 PM CST) 1.440.646.5800 (24 hour support)
	Outside United States/Canada	You can access the phone number for your country via the Internet: Go to http://www.ab.com Click on <i>Support</i> (http://support.rockwellautomation.com/) Under <i>Contact Customer Support</i> , click on <i>Phone Support</i>
Internet	⇒	Go to http://www.ab.com/support/abdrives/
E-mail	⇒	support@drives.ra.rockwell.com

Be prepared to furnish the following information when you contact support:

- Product Catalog Number
- Product Serial Number
- Firmware Revision Level

Before Applying Power to the Drive

1. Check for zero volts between DC+ and DC-
2. Perform forward biased diode tests, using a digital multimeter, on the



points listed in [Table 4.A on page 4-3](#) to test the Rectifying Module (on AC Three-Phase drives). A forward biased diode test checks the semiconductor junctions between the terminals and measures the voltage drop across those junctions. To pass each test, the meter must beep⁽¹⁾ once and display a voltage within the specification shown in the table. If the test finds a short, the meter will display .000 and beep continuously. If the test finds an open circuit or reversed polarity, the meter will display “.0L” (zero load). **If the Rectifying Module fails any of these tests, replace it.**

⁽¹⁾ Not all makes and models of digital multi-meters beep, consult documentation for your meter to determine how it indicates a positive result for the forward biased diode test and short circuit.

Table 4.A Forward Biased Diode Tests for Rectifying Module

Meter Leads		Nominal meter reading
+	-	
L1	DC-	Value should gradually rise to 1.8V
L2	DC-	
L3	DC-	
L1	DC+/R+	0.450V \pm 0.075V
L2	DC+/R+	
L3	DC+/R+	
DC-	L1	0.335V \pm 0.075V
DC-	L2	
DC-	L3	
DC+/R+ ⁽¹⁾	L1	Value should gradually rise to 1.8V
DC+/R+	L2	
DC+/R+	L3	

⁽¹⁾ If the drive does not contain the brake chopper option, the DC+/R+ terminal will be labeled DC+.

3. Perform forward biased diode tests, using a digital multimeter, on the points listed in [Table 4.B](#) to test the Output Power Module. **If the Output Power Module fails any of these tests, replace it.**

Table 4.B Forward Biased Diode Tests for Output Power Module

Meter Leads		Nominal meter reading
+	-	
T1	DC-	Value should gradually rise to 1.8V
T2	DC-	
T3	DC-	
T1	DC+/R+	0.290V \pm 0.075V
T2	DC+/R+	
T3	DC+/R+	
DC-	T1	
DC-	T2	
DC-	T3	
DC+/R+	T1	Value should gradually rise to 1.8V
DC+/R+	T2	
DC+/R+	T3	

4. Perform forward biased diode tests, using a digital multimeter, on the points listed in [Table 4.C](#) to test the Brake Chopper Assembly (on drives with Brake Choppers). **If the Brake Chopper Assembly fails any of these tests, replace it.**

Table 4.C Forward Biased Diode Tests for Brake Chopper Assembly

Meter Leads		Nominal meter reading
+	-	
R	DC-	Value should gradually rise to 1.8V
R	DC+/R+	3.15V \pm 0.075V
DC-	R	3.60V \pm 0.75V
DC+/R+	R	Value should gradually rise to 1.8V




Testing with the External DC Power Supply Without Load (Optional)

This is a low current - low risk test for the Output Power Module and drive Control board. It requires the recommended high voltage DC-power supply.

1. Verify that the external DC power supply is de-energized
2. Connect the power supply's DC+ to the drive's DC+ terminal and the power supply's DC- to the drive's DC- terminal.
3. Set power supply voltage setting to zero.
4. Switch on the external DC power supply.
5. Slowly increase the external DC power supply output voltage to the drive's nominal DC bus voltage (1.35 x Unity)




Example: 480v AC Nominal Voltage

$$\frac{3 \bullet \sqrt{2}}{\Pi} \bullet V = 1.35 \times 480V = 648V$$

-
6. Measure the DC bus voltage and verify that the value is reflected in:
 - parameter 306 [DC Bus Voltage] (700S)
 - parameter 012 [DC Bus Voltage] (700H)
 7. Make configuration changes which allow the HIM to issue start and speed commands.
 8. Make configuration changes which allow operation without an encoder and motor.
 9. Start the drive, by pressing .
 10. Increase the speed command from zero to base speed, by pressing  (the up button).
 11. Stop the drive, by pressing  (the stop button).
 12. Return the configurations to suit the application.
 13. Decrease the DC power supply output voltage to zero. Wait until DC bus voltage has decreased to zero. Switch off the external DC power supply.








Testing Without a Motor

This test allows you to measure several operating parameters and diagnose problems without connecting the motor.

1. Verify that input power wiring and grounding is connected.
1. Verify that the motor cables are disconnected.
2. Energize the drive.
3. Make configuration changes which allow the HIM to issue start and speed commands.
4. Make configuration changes which allow operation without an encoder and motor.
5. Start the drive, by pressing .
6. Increase the speed command from zero to base speed, by pressing  (the up button).
7. Measure the output voltage on each phase and verify that it is balanced. If it is unbalanced troubleshoot the drive.
8. Stop the drive, by pressing  (the stop button).
9. Return the configurations to suit the application.

Performing the Power Circuit Diagnostic Test on a 700S

The Power Circuit Diagnostic Test, on the 700S, allow you to diagnose problems in the drive's power structure without applying large amounts of power.

1. Verify that input power wiring and grounding is connected.
2. Verify that the motor cables are connected.
3. Energize the drive.
4. From the Monitor menu on the HIM press  (the escape button) to navigate to the Main menu.
5. Use  (the down button) to move the cursor to the Start-Up selection, and  to select Start-Up. Then press  again to verify your intention to continue with the Start-Up menu.
6. Use  (the down button) to move the cursor to Power Circuit Diagnostics (Pwr Circuit Diag), and  to select Power Circuit Diagnostics.
7. Press  to begin the Power Circuit Diagnostic routine. Follow indications and instructions on the HIM.

Testing With the Motor

This test allows you to measure several operating parameters and diagnose problems without connecting the motor to its mechanical load.

1. Verify that input power wiring and grounding is connected.
2. Verify that the motor cables are connected.
3. Verify that the motor load is disconnected.
4. Energize the drive.
5. Start the drive and increase the speed from zero to base speed.
6. Measure drive output current and verify that the value is reflected in:
 - parameter 308 [Output Current] (700S)
 - parameter 003 [Output Current] (700H)
7. Stop the drive.

Service Tools and Equipment

Software Tools

DriveTools 2000, Drive Executive, Drive Explorer and Drive Observer are software tools for uploading, downloading and monitoring system parameters

Service tools

Service of the PowerFlex frequency converter requires certain kinds of tools, devices and test equipment. Basic tools, devices and test equipment have to meet requirements of professional services. The tools have to be in good condition and have to fit how and where they are going to be used.

This list of basic service tools which will cover needs of tools for repair and maintenance measurements.

Item	Description	Details
1	Oscilloscope	Portable, digitizing, dual channel scope, with isolation
2	Current clamp	1000A(ac, rms), signal output
3	Soldering station	Soldering / de soldering
4	Adjustable power supply	0...1300Vdc, 1A, adjustable current limit. Efore LPS 750-HV or equivalent.
5	Adjustable power supply	0...690Vac (+10%), 10A, three phase, galvanic isolation
6	Multi meter	Digital multi meter, capable of ac and dc voltage, continuity, resistance, capacitance measurements, and forward diode bias tests. Fluke model 87 III or equivalent.
7	Insulation tester	1000Vdc
8	Torque wrench	1...12Nm
9	Torque wrench	6...50Nm
10	box wrench	7mm, 8mm, 10mm, 13mm, 17mm, 19mm, 22mm
11	socket extension	230mm
12	Wrench	7mm, 8mm, 10mm, 13mm, 17mm, 19mm, 22mm
13	Wire cutter	
14	Nose pliers	
15	Crimping tools	For cable terminals 1,5...240
16	Angle wrench	
17	Screw driver	
18	*Flat nose	7*2(mm)
19	*Pozidrive	1, 2, 3
20	*Phillips	1, 2, 3
21	*Torx	25
22	Hexagonal wrench	4, 5, 6
23	ESD-protected place of work	Working surface, Floor covering, seat and earthings
24	ESD-protective clothing	Wrist wrap, shoes, overall clothing (coat)
25	Power supply (service)	Capacity of three phase service 400/500/690Vac, 250A

Item	Description	Details
26	CK-2	Cable kit of DC power supply for PowerFlex frame 9 units
27	RT-1	Module replacement tool for PowerFlex frame 9 units
28	Fiber-optic repair kit	

Schematics

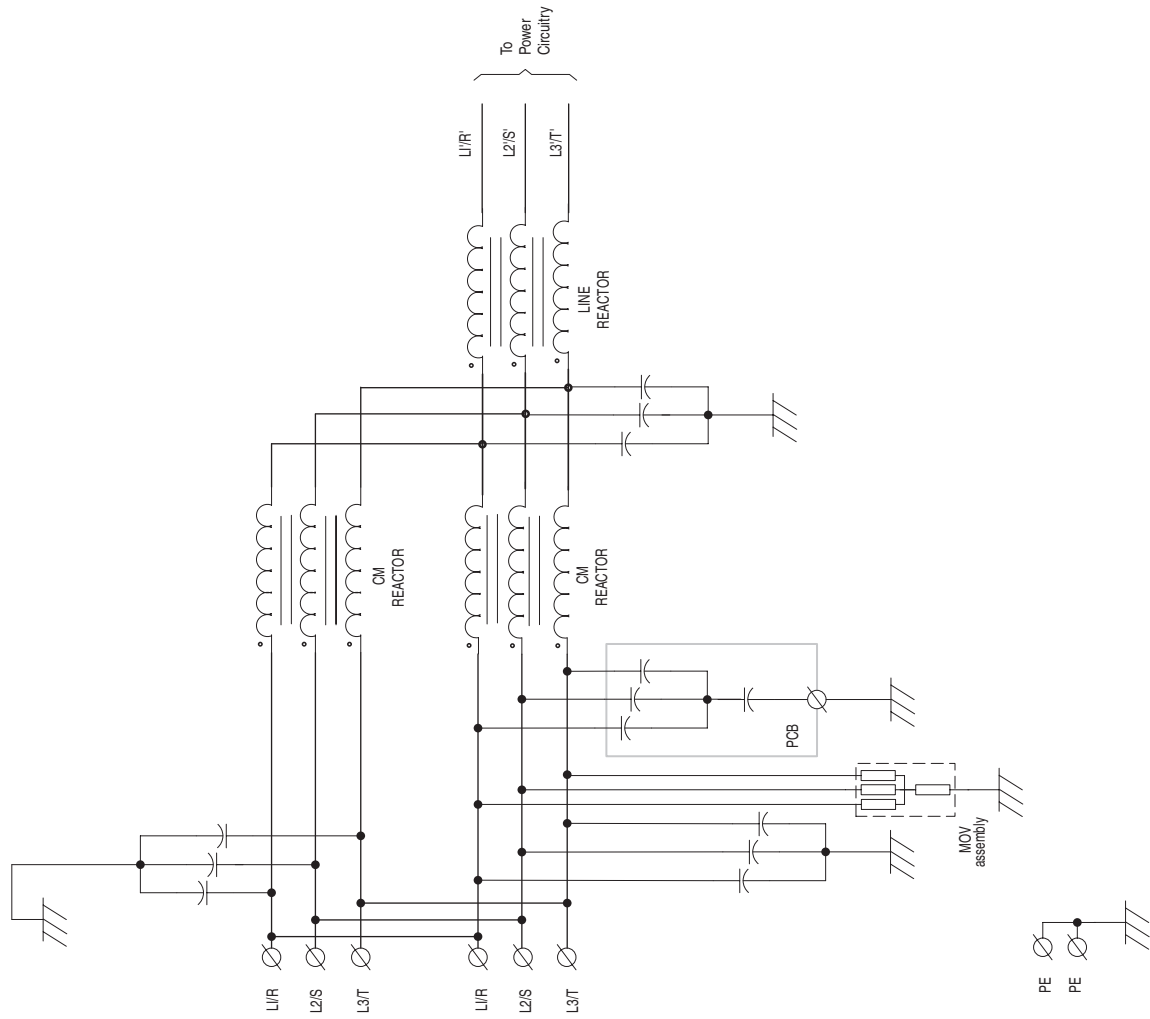


Figure B.1 Input Conditioning Circuitry for Drives with AC Input

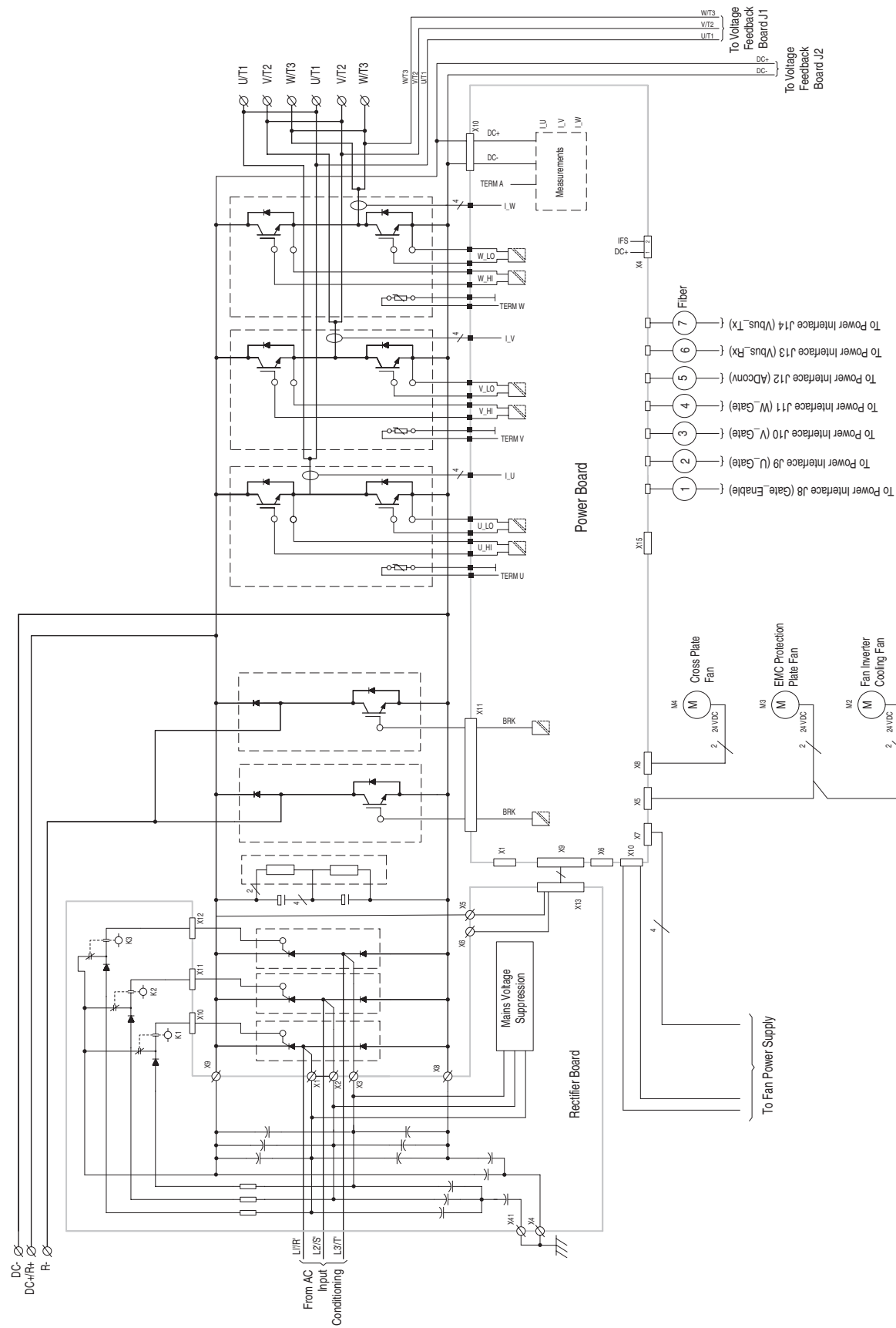


Figure B.2 Power Circuitry for 700S Drives with AC Input

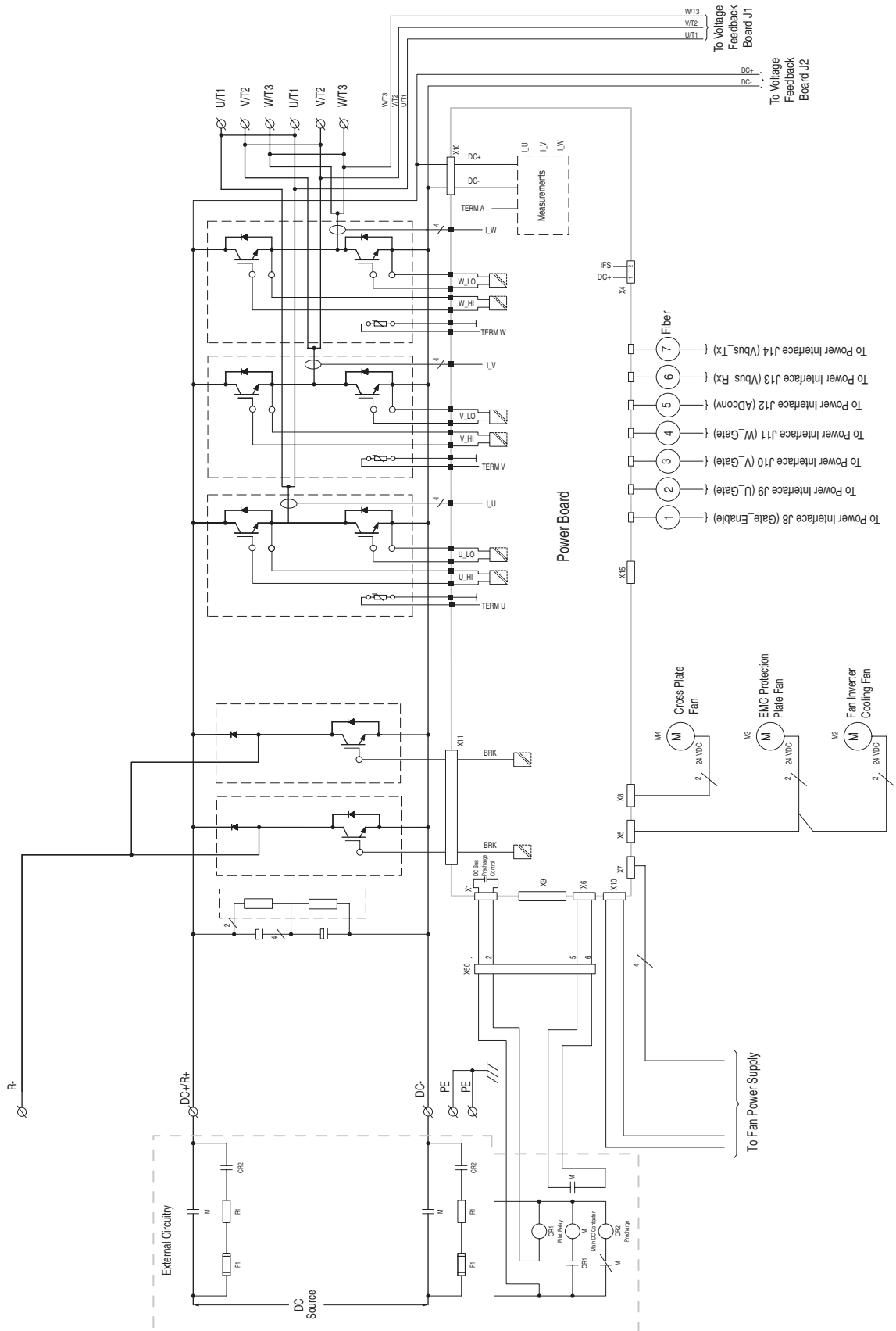


Figure B.3 Power Circuitry for 700S Drives with DC Input

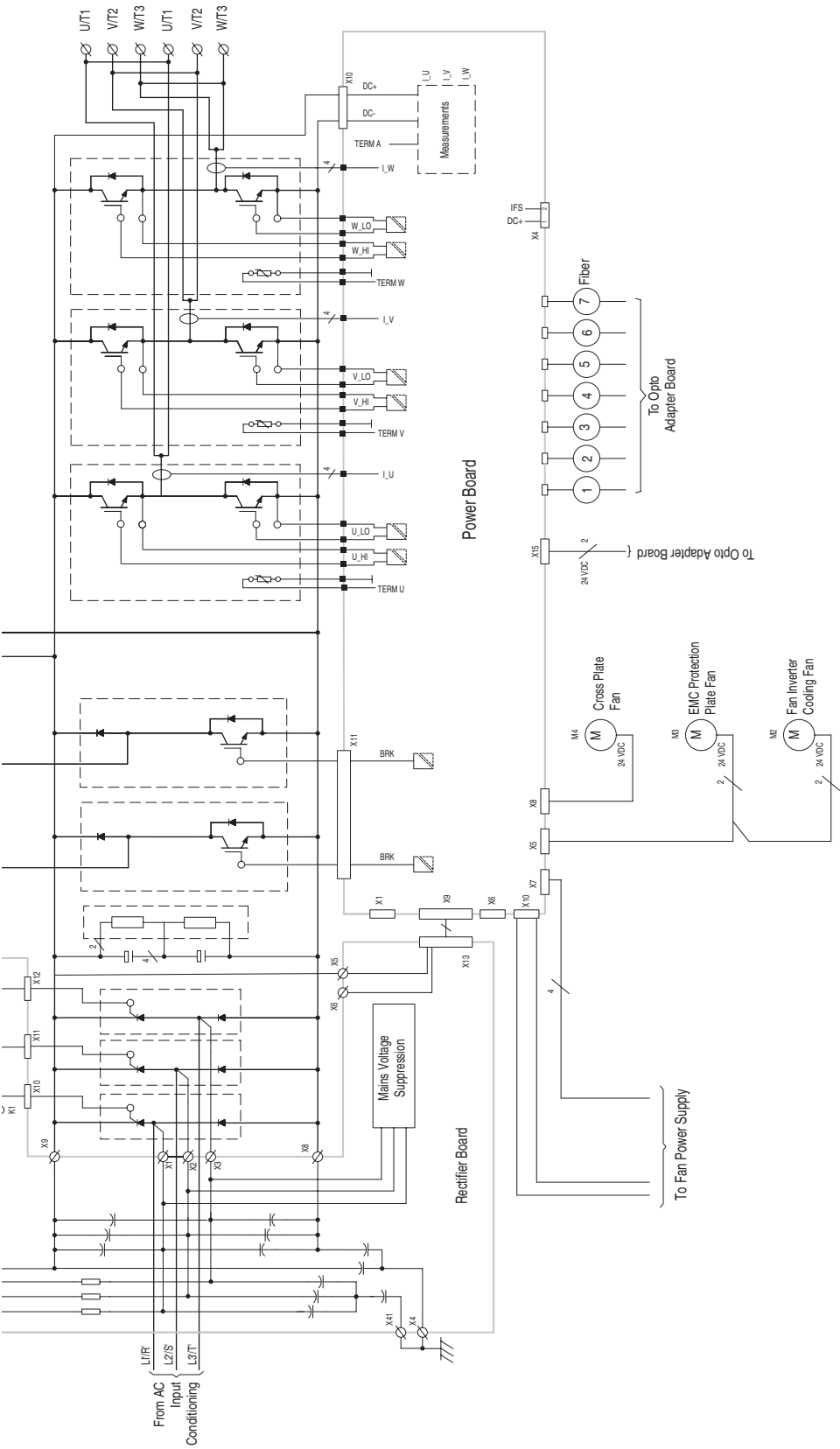


Figure B.4 Power Circuitry for 700H Drives with AC Input

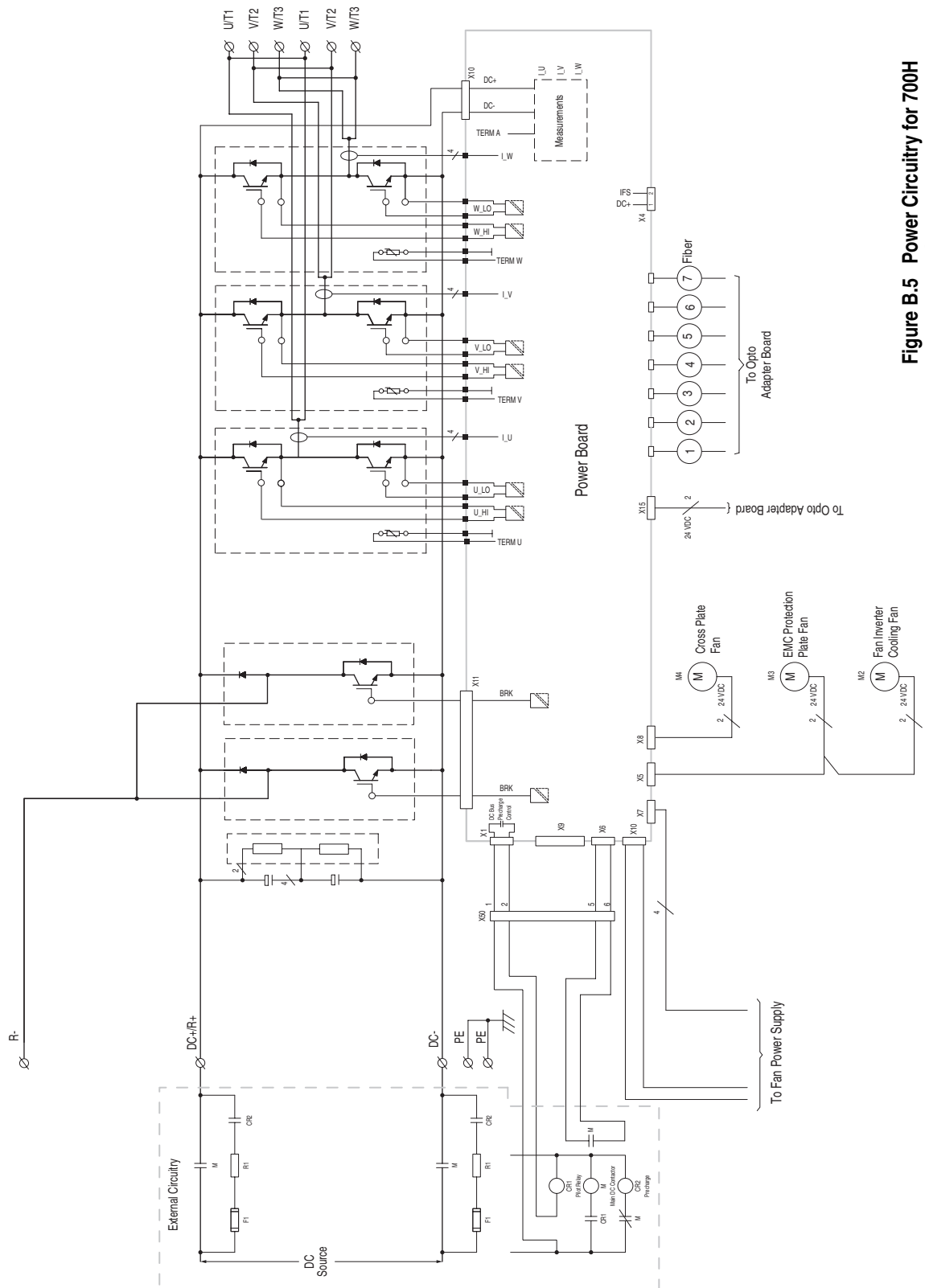


Figure B.5 Power Circuitry for 700H Drives with DC Input

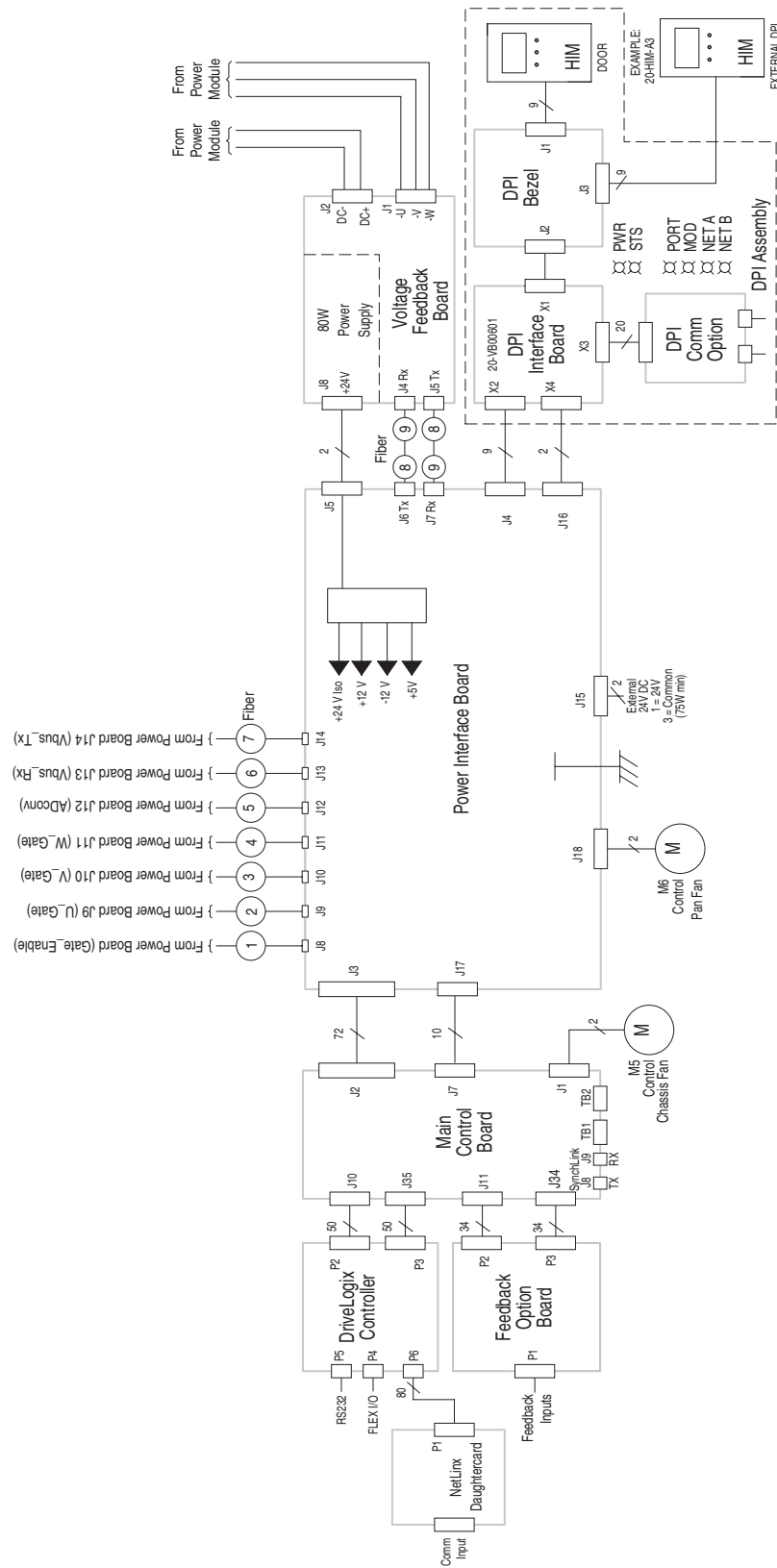


Figure B.6 Circuit Board Connections for 700S Drives

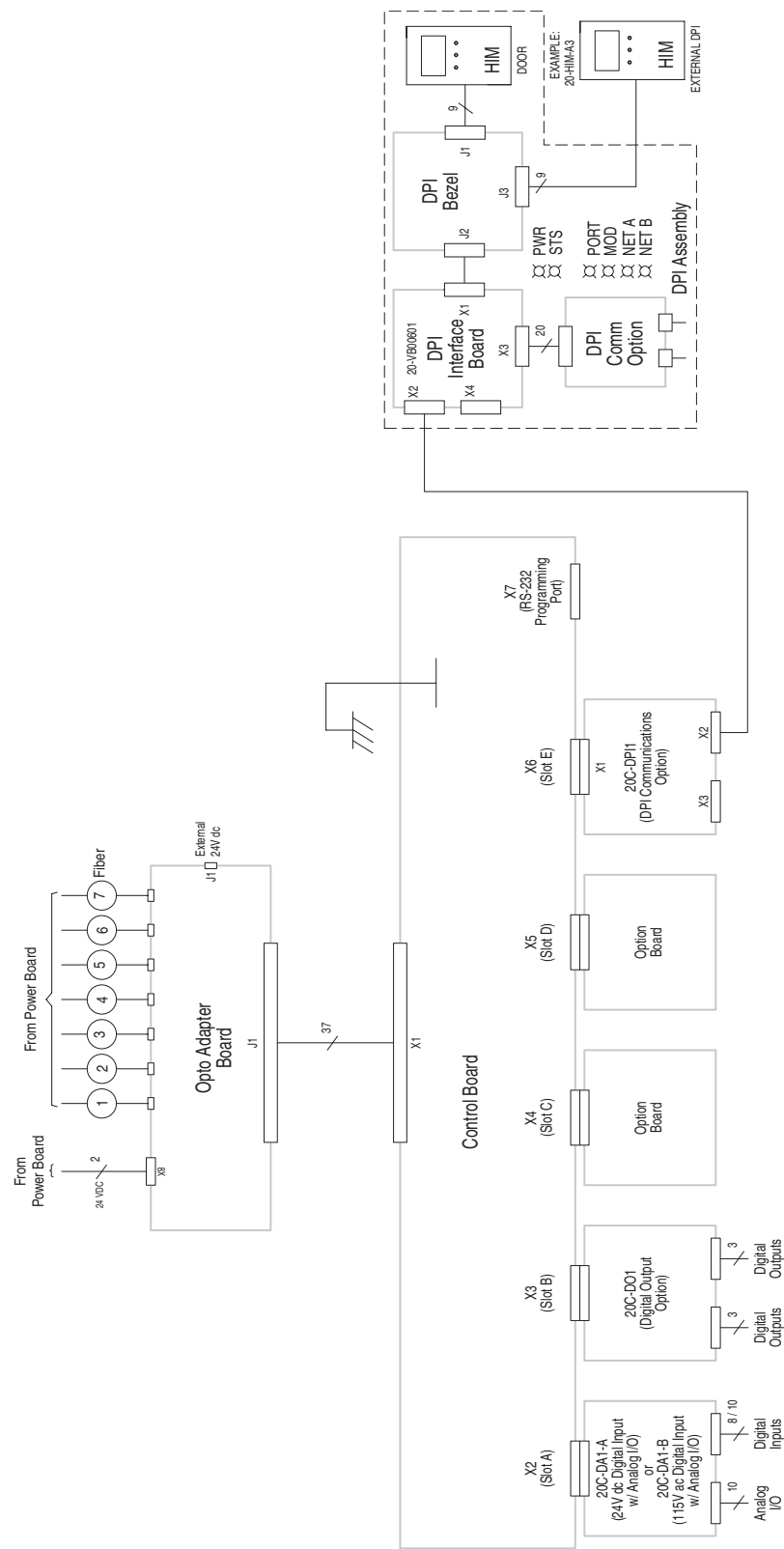


Figure B.7 Circuit Board Connections for 700H Drives

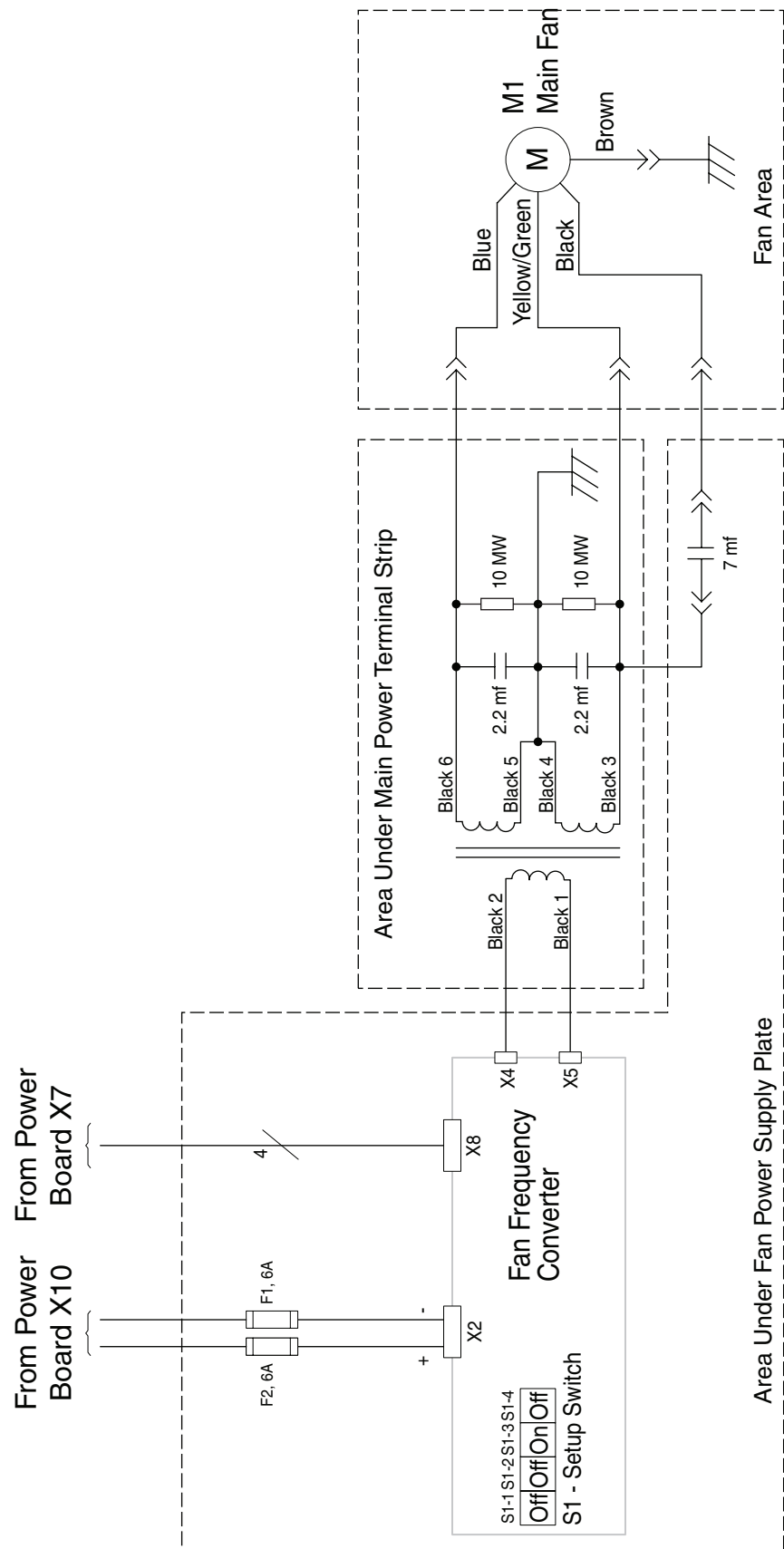


Figure B.8 Fan Power Supply Connections

Disassembly / Assembly Diagrams

Diagrams on the following pages illustrate disassembly and assembly of the drive and its sub-systems.

Figure C.1 700S 261A / 300A Mechanical Construction

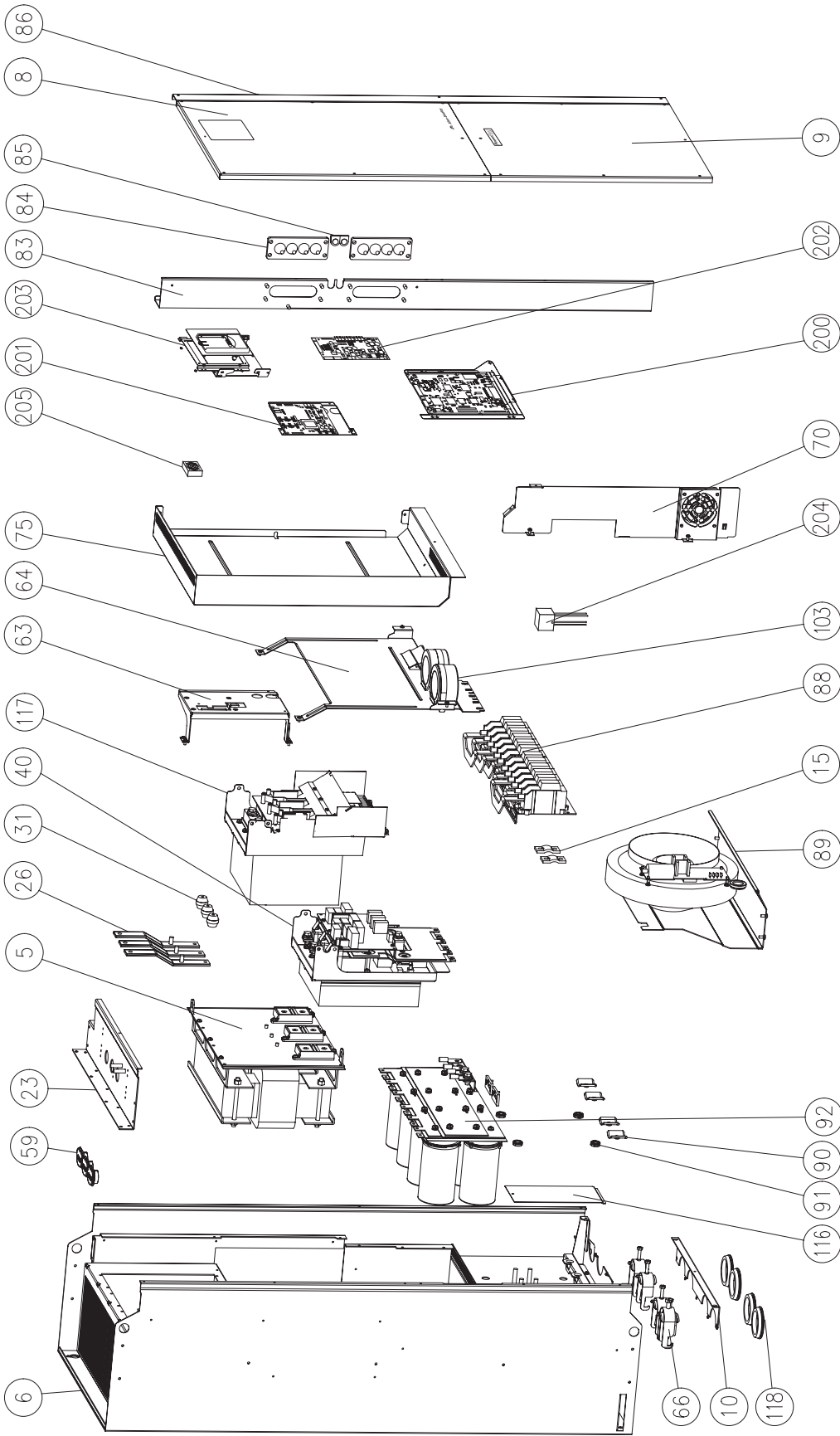


Figure C.2 700H 261A / 300A Mechanical Construction

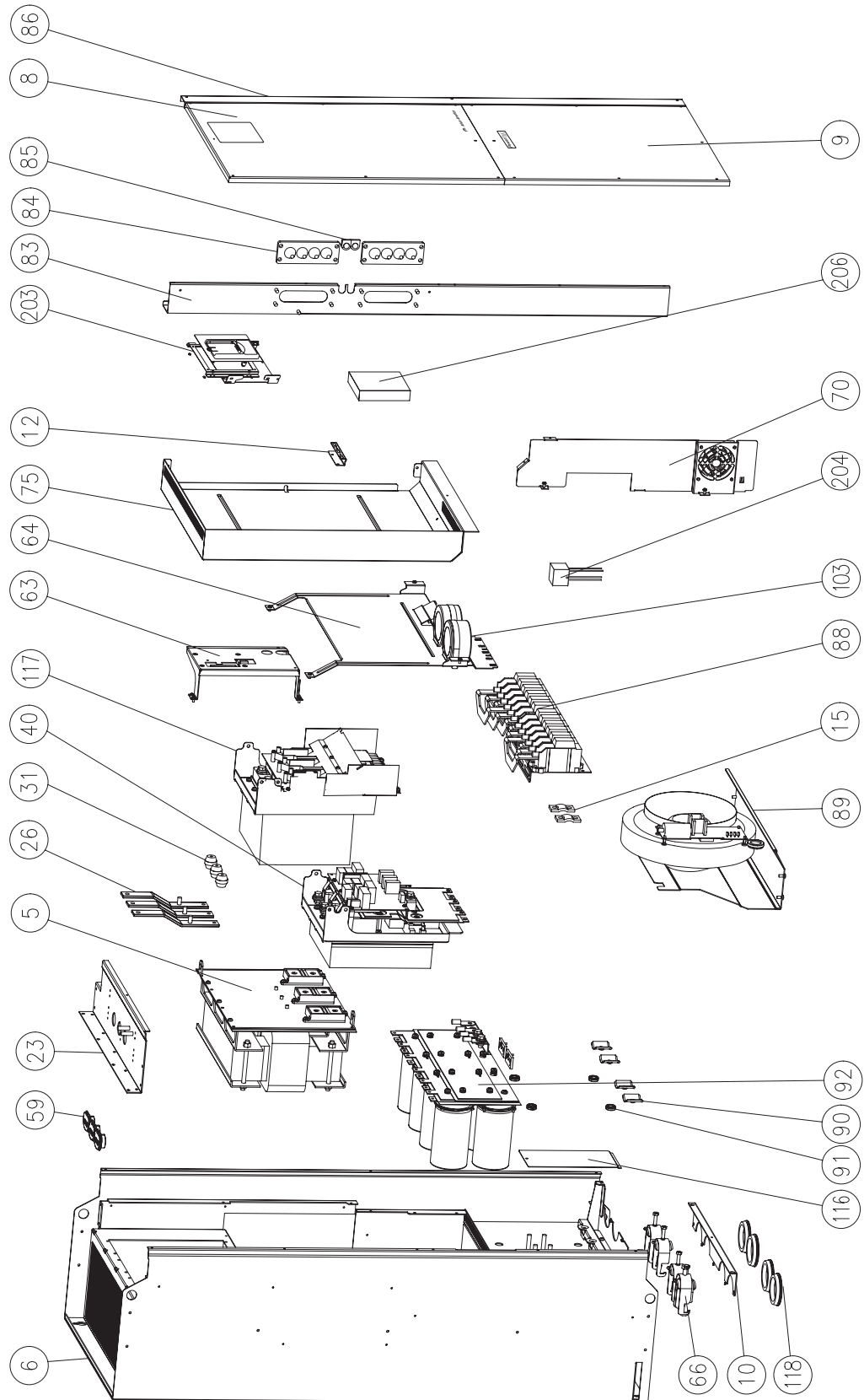


Figure C.3 Cross Plate (terminals) and Internal Fan

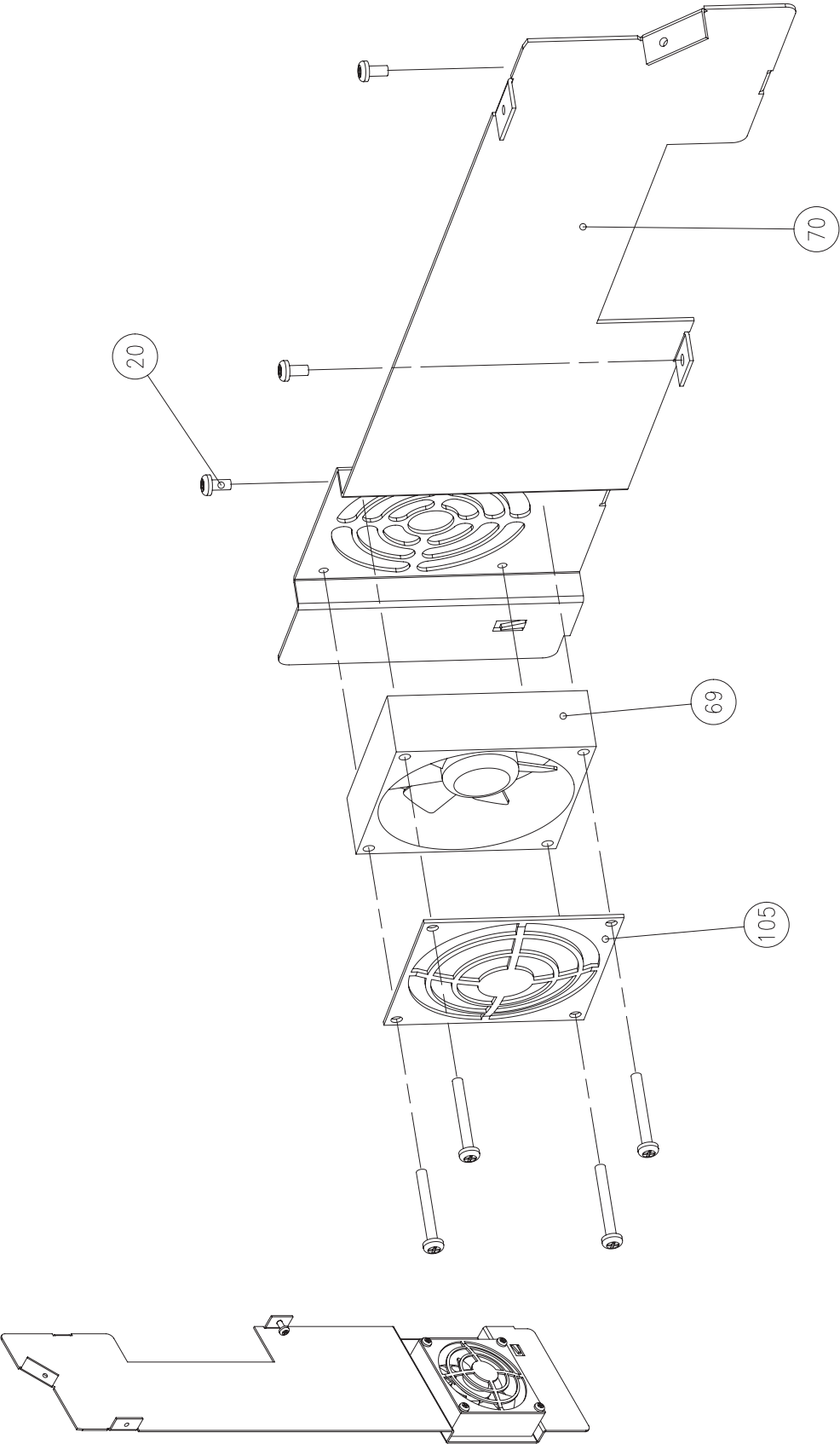


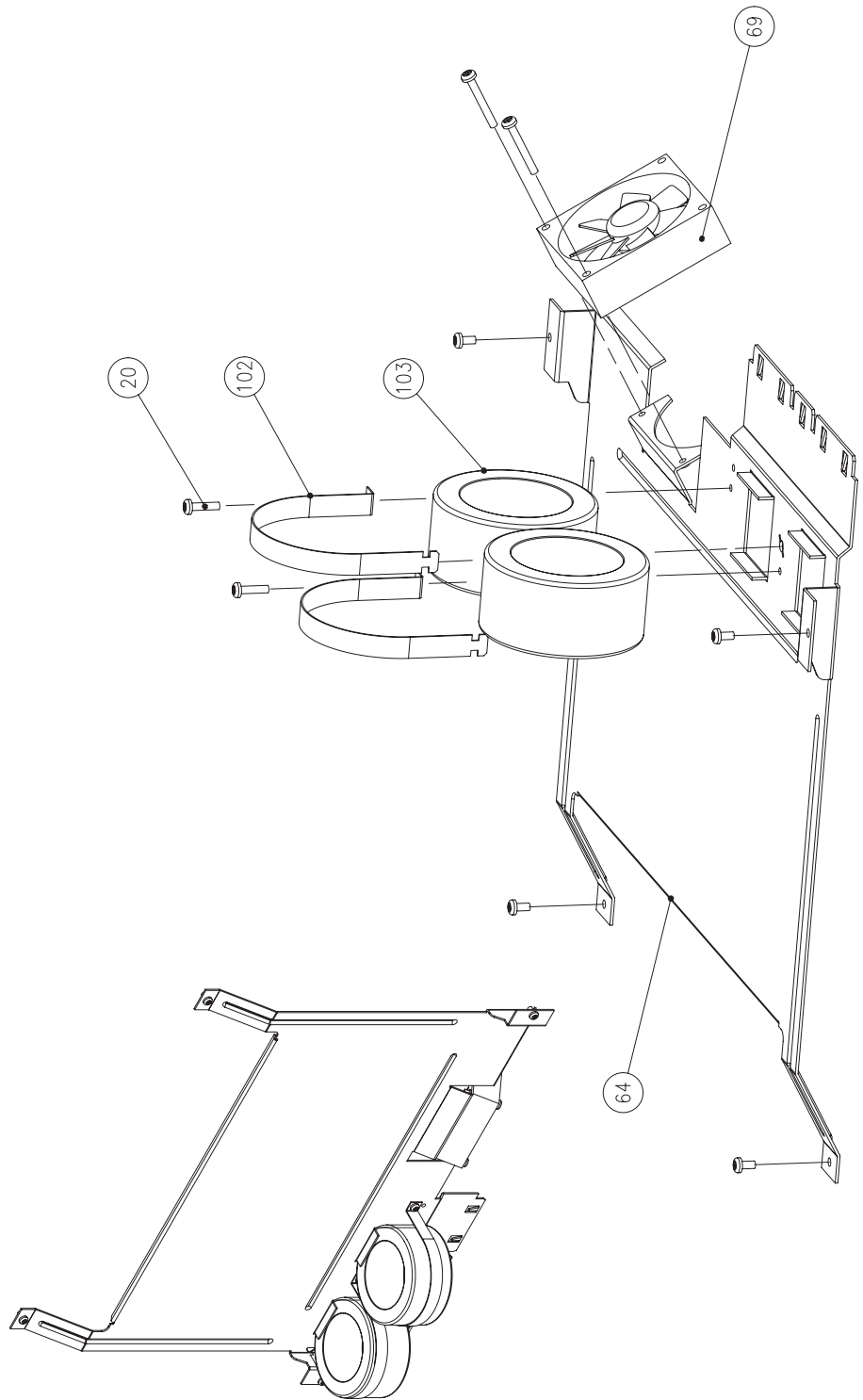
Figure C.4 EMC-Protection Plate

Figure C.5 Capacitor Sub-Assembly

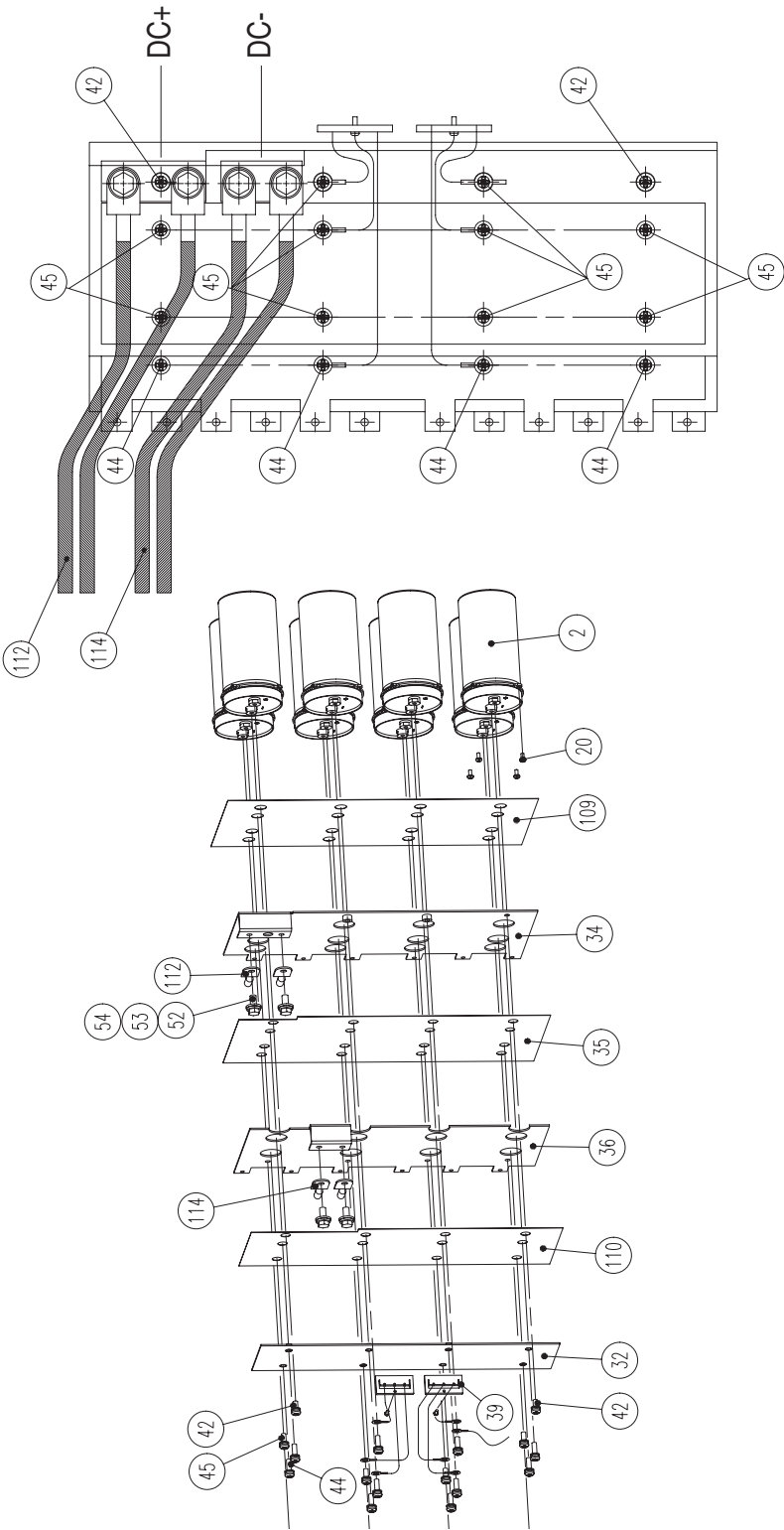


Figure C.6 Fan Sub-Assembly

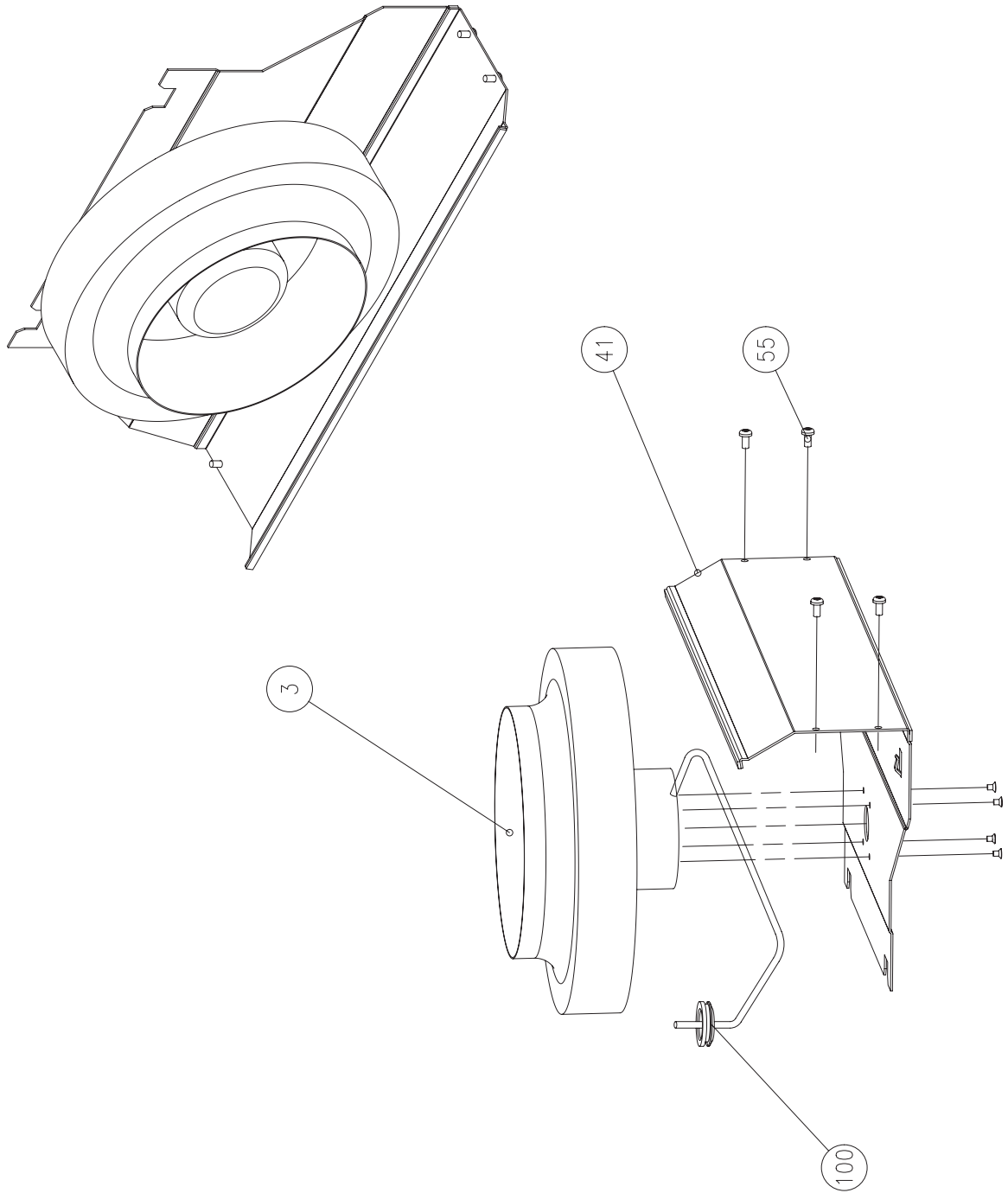


Figure C.7 Control Bracket

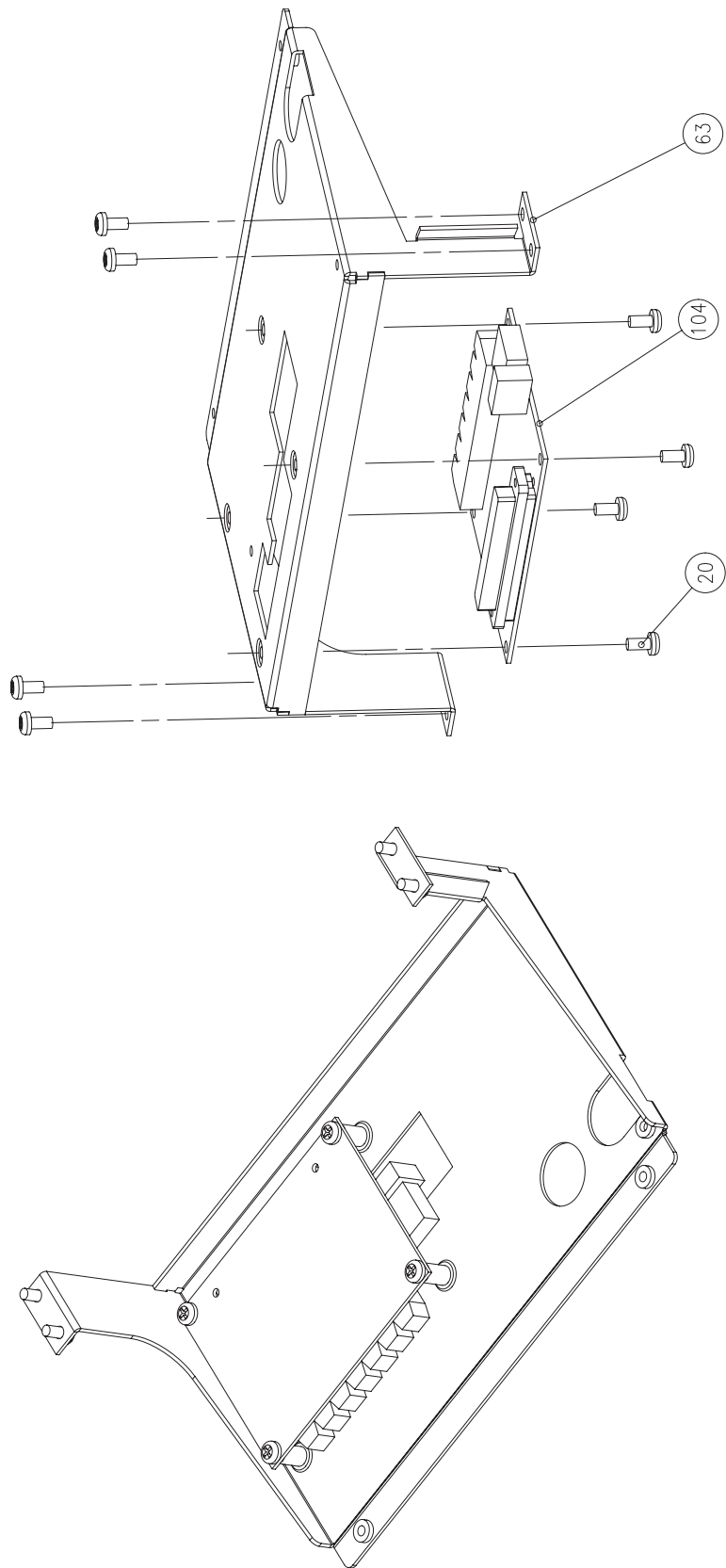


Figure C.8 Rectifying Module

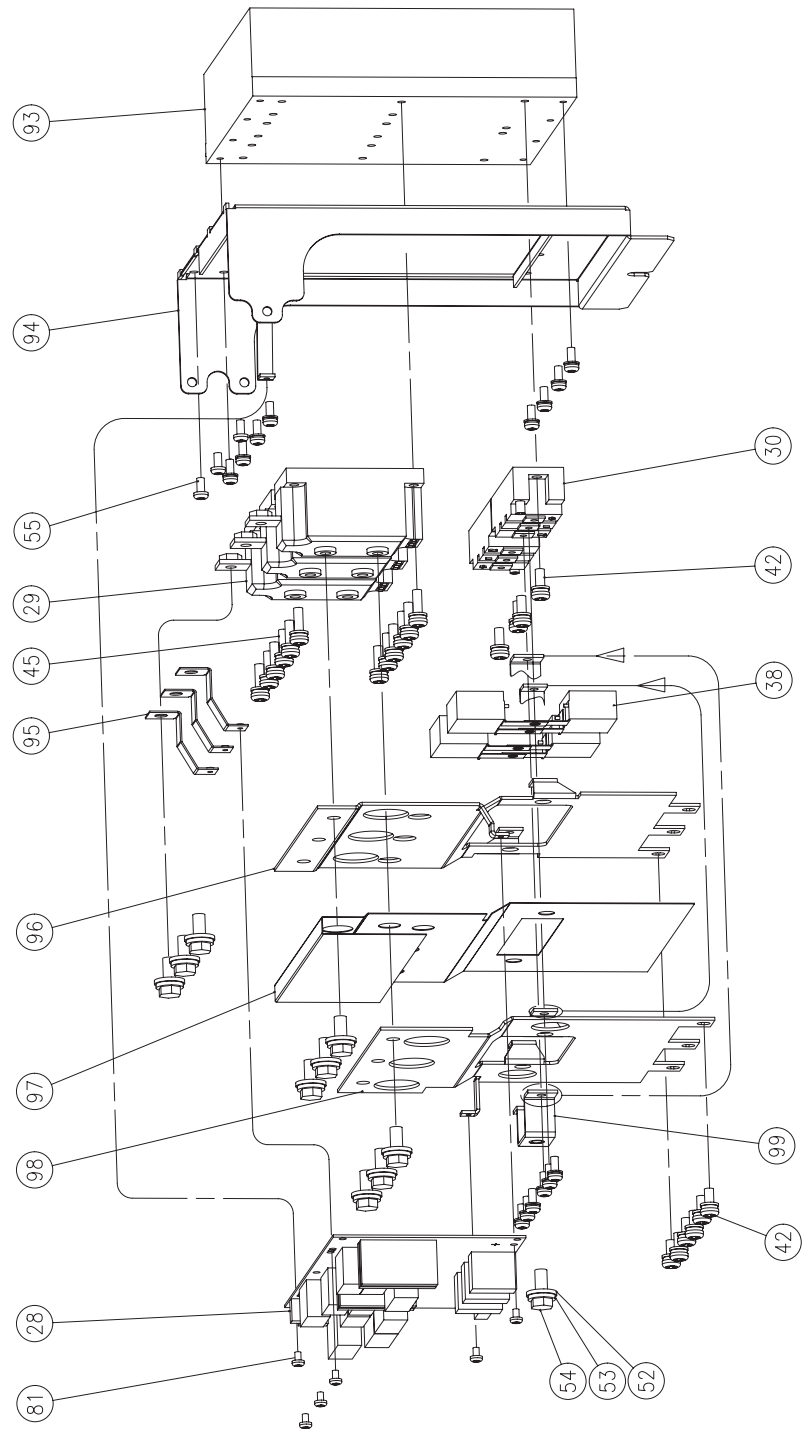
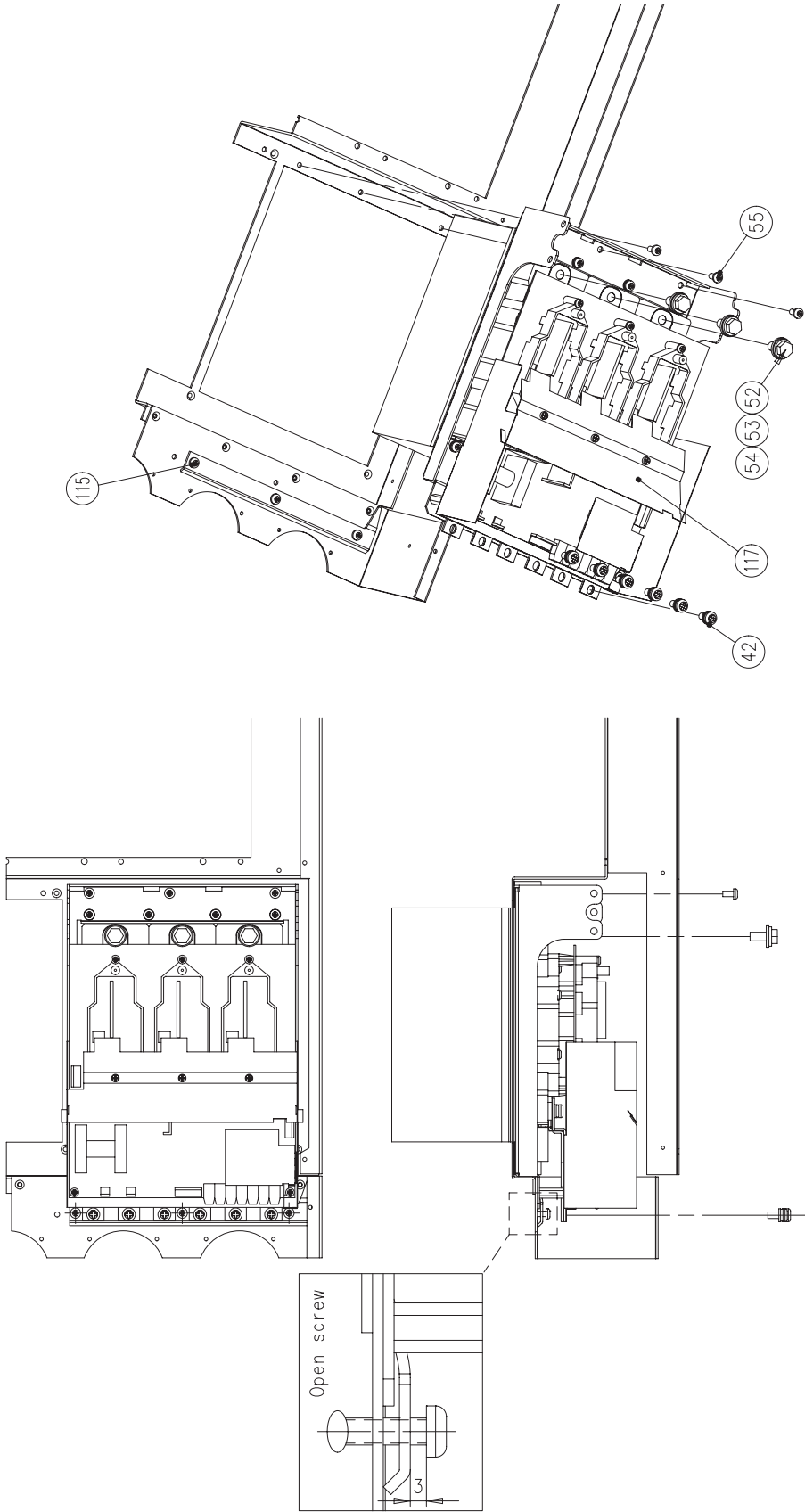


Figure C.9 Power Module



Key to ID Numbers

The following table describes the parts identified by balloons in the mechanical drawings:

Id. No.	Description	Shown in...
2	DC Bus Capacitor ELKO 3300uF 420V	Figure C.5
3	Fan 230W	Figure C.6
5	AC-choke/filter 310A	Figure C.1 , Figure C.2
6	Frame	Figure C.1 , Figure C.2
8	Cover (power)	Figure C.1 , Figure C.2
9	Cover (connection)	Figure C.1 , Figure C.2
10	Bushing plate	Figure C.1 , Figure C.2
12	Earthing plate	Figure C.2
15	Earthing cover 3	Figure C.1 , Figure C.2
20	Screw M4 x 8	Figure C.3
23	Upper plate	Figure C.1 , Figure C.2
26	Busbar DC- and brake	Figure C.1 , Figure C.2
28	Rectifying board	Figure C.8
29	Diode mod SKKH 330/16	Figure C.8
30	IGBT/Diode SKM 195GAL123D (brake)	Figure C.8
31	Stand-off insulator M6*25 (brake)	Figure C.1 , Figure C.2
32	Busbar DC connection	Figure C.5
34	Busbar DC+	Figure C.5
35	Insulator DC+/-	Figure C.5
36	Busbar DC-	Figure C.5
38	Capacitor 220nF/1250V 500V 6mm	Figure C.8
39	Discharging resistor 2x8k	Figure C.6
40	Rectifying module sub-as.	Figure C.1 , Figure C.2
40	Rectifying module sub-as. (brake)	Figure C.1 , Figure C.2
41	Fan plate	Figure C.6
42	Screw M6 x14 Z4-1 (combination)	Figure C.5 , Figure C.8 , Figure C.9
44	Screw M6 x16 Z4-1 (combination)	Figure C.5
45	Screw M5x20 TX (combination)	Figure C.5 , Figure C.8
52	Washer (straight) M8 SFS3738	Figure C.5 , Figure C.8 , Figure C.9
53	Washer (cone) M8 DIN679	Figure C.5 , Figure C.8 , Figure C.9
54	Screw hexagonal M8 X 20	Figure C.5 , Figure C.8 , Figure C.9
55	Screw M4 x 8	Figure C.6
59	Bushing rubber GD21	Figure C.1 , Figure C.2

Id. No.	Description	Shown in...
63	Control bracket	Figure C.1 , Figure C.2 , Figure C.7
64	EMC-protection plate (power)	Figure C.1 , Figure C.2 , Figure C.4
66	Cable lug KP40	Figure C.1 , Figure C.2
68	Fan power supply	
69	Internal fan	Figure C.3 , Figure C.4
70	Cross plate (terminals)	Figure C.1 , Figure C.2 , Figure C.3
75	Control frame	Figure C.1 , Figure C.2
81	Screw M4 x 8	Figure C.8
83	Control cable conduit	Figure C.1 , Figure C.2
84	Plate gasket 52486	Figure C.1 , Figure C.2
85	Bushing rubber 52515	Figure C.1 , Figure C.2
86	Cover (control cable conduit)	Figure C.1 , Figure C.2
88	Terminal sub-assembly H	Figure C.1 , Figure C.2
88	Terminal sub-assembly T/L	Figure C.1 , Figure C.2
89	Fan sub-assembly	Figure C.1 , Figure C.2
90	Stop plate 34	Figure C.1 , Figure C.2
91	Bushing rubber GD9	Figure C.1 , Figure C.2
92	Capacitor sub-Assembly	Figure C.1 , Figure C.2
93	Heat sink (rectifying module)	Figure C.8
94	Frame (heat sink, rectifier)	Figure C.8
95	Busbar rectifying board	Figure C.8
96	Busbar rectifier +	Figure C.8
97	Insulator, rectifier	Figure C.8
98	Busbar rectifier -	Figure C.8
99	Busbar brake	Figure C.8
100	Bushing rubber GD16	Figure C.6
102	Clamp for ferrite ring	Figure C.4
103	Ferrite ring packet	Figure C.1 , Figure C.2 , Figure C.4
104	VaconBus adapter	Figure C.7
105	Finger proof shield	Figure C.3
109	Insulator capacitor	Figure C.5
110	Insulator DC-/connection	Figure C.5

Id. No.	Description	Shown in...
112	Cable DC+	Figure C.5
114	Cable DC-	Figure C.5
115	Screw M5 x 10	Figure C.9
116	Fan power supply cover	Figure C.1 , Figure C.2
117	Power module sub-as. 261A	Figure C.1 , Figure C.2 , Figure C.9
117	Power module sub-as. 300A	Figure C.1 , Figure C.2 , Figure C.9
118	Bushing rubber GD48	Figure C.1 , Figure C.2
200	700S Control Assembly	Figure C.1 ,
201	700S Voltage Feedback Circuit Board	Figure C.1 ,
202	700S Power Interface Circuit Board	Figure C.1 ,
203	DPI / HIM Assembly	Figure C.1 , Figure C.2
204	MOV	Figure C.1 , Figure C.2
205	Fan (Control frame)	Figure C.1
206	700H Control Assembly	Figure C.2

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Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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