# PowerFlex 6000T Drives Hardware Service Manual

Bulletin Number 6000T

Allen-Bradley
by ROCKWELL AUTOMATION

Troubleshooting Guide

Original Instructions

# Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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.

**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 a hazard, and recognize the consequence.

**IMPORTANT** Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.

**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

## Preface



## Chapter 1

### Before You Begin Tests, Maintenance, or Repairs



## Chapter 2

### Preventative and Predictive Maintenance

## Power Cell Cabinet

### Chapter 6



## Inspect Connections

### Chapter 7



### Index

# Notes:

## About This Publication

This manual provides a recommended preventative maintenance schedule, major component test, and hardware replacement procedures for PowerFlex® 6000T medium voltage drives.

## Download Firmware, AOP, EDS, and Other Files

Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes from the Product Compatibility and Download Center at rok.auto/pcdc.

## Who Should Use This Manual

This manual is intended for use by personnel familiar with operating medium voltage and solid-state variable speed drive equipment. The manual contains material that enables operation and regular maintenance of the drive system.

## What Is Not in This Manual

This manual provides information specific to maintaining the PowerFlex 6000T medium voltage variable-frequency drive. It excludes topics such as:

- Dimensional drawings (DD) and electrical drawings (ED) that are generated for each customer's order
- Spare parts lists compiled for each customer's order
- Drive-specific technical specifications

For additional product detail or information relating to PowerFlex 6000T drives, see the publications that are listed in Additional Resources on page 9.

## Required Supplemental Information

Review the project-specific dimensional drawings (DDs) and electrical drawings (EDs) to better understand the specific drive system cabinet orientation and wiring requirements before performing any mechanical or electrical work. Contact the local Rockwell Automation office to obtain digital copies, if necessary.

## General Precautions

**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 Allen-Bradley 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 personnel familiar with the PowerFlex 6000T Adjustable Speed Drive (ASD) and associated machinery should plan or implement the installation, startup, and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

**ATTENTION:** Only qualified personnel with the correct PPE (Personal Protective Equipment) should service the equipment. Be sure to follow the safety procedures and local regulations to disconnect the high voltage. After waiting for 15 minutes, open the cabinet door and verify the absence of medium voltage on the input, output, and power cell terminals with a high-voltage detector that is properly rated for the line and motor voltages. All status indicator lights on the power cells must be off and the drive be grounded with portable grounding cables on the input and output before servicing. Failure to follow the safety procedures can result in severe injury or death.

## Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

| Topic | Page |
|---|---|
| Updated Inrush current spec in Table 1 - Line-to-Ground Short-circuit Specification | 13 |
| Updated Periodic Preventative Maintenance Schedule | 19 |
| Updated section Regular Maintenance Intervals | 21 |
| Added topic Replacement Schedule to Chapter 2 | 26…31 |
| Updated topic Final Report | 32 |
| Added topic Predictive Maintenance to Chapter 2 | 33…35 |
| Updated section Replace Top Mounted Cooling Fans | 41…44 |
| Added topic Replace Sensors to Chapter 3 | 45…46 |
| Added topic Control Pod Overview to Chapter 4 | 50 |
| Updated drawing of MCB for step 7 of topic Main Control Board Replacement | 54 |
| Added sections Set Jumpers on MCB and Set IP Address to topic Main Control Board Replacement | 56 |
| Added section Set Jumpers on PIOB to topic Power I/O Board Replacement | 60 |
| Added topic I/O Option Card Settings to Chapter 4 | 63 |
| Added section Replace Upper Control Pod Fan Assembly to topic Control Pod Fan Assembly Replacement | 63 |

## Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

| Resource | Description |
|---|---|
| PowerFlex 6000T Drives Shipping and Handling Manual, publication 6000-PC100 | Provides instructions for shipping and handling PowerFlex 6000T drives and related equipment. |
| PowerFlex 6000T Drives Installation Instructions, publication 6000-IN100 | Provides instructions for installing PowerFlex 6000T drives and related equipment. |
| PowerFlex 6000T Drives Programming Manual, publication 6000-PM100 | Provides detailed information on drive features, programming parameters, and troubleshooting faults and alarms. |
| Enhanced HIM Integrated Touch Screen Display, publication EHIM-QS001 | Provides detailed information on the integrated touch screen display and how to use it to configure, program, and monitor the status of PowerFlex 6000T drives. |
| PowerFlex 20-HIM-A6 and 20-HIM-C6S HIM (Human Interface Module), publication 20HIM-UM001 | Provides detailed instructions on how to use the Human Interface Module (HIM) capabilities for configuring PowerFlex 6000T drives. |
| PowerFlex Drives with TotalFORCE Control Built-in EtherNet/IP Adapter, publication 750COM-UM009 | Provides information about the dual-port, built-in EtherNet/IP™ adapter in PowerFlex 6000T drives and how to use the adapter for network communication. |
| EtherNet/IP Network Devices User Manual, ENET-UM006 | Describes how to configure and use EtherNet/IP devices to communicate on the EtherNet/IP network. |
| Ethernet Reference Manual, ENET-RM002 | Describes basic Ethernet concepts, infrastructure components, and infrastructure features. |
| System Security Design Guidelines Reference Manual, SECURE-RM001 | Provides guidance on how to conduct security assessments, implement Rockwell Automation products in a secure system, harden the control system, manage user access, and dispose of equipment. |
| Industrial Components Preventive Maintenance, Enclosures, and Contact Ratings Specifications, publication IC-TD002 | Provides a quick reference tool for Allen-Bradley industrial automation controls and assemblies. |
| Safety Guidelines for the Application, Installation, and Maintenance of Solid-state Control, publication SGI-1.1 | Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components. |
| Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1 | Provides general guidelines for installing a Rockwell Automation industrial system. |
| Product Certifications website, rok.auto/certifications. | Provides declarations of conformity, certificates, and other certification details. |

You can view or download publications at rok.auto/literature.

## Commissioning Support

After installation, Rockwell Automation is responsible for commissioning activities for the PowerFlex 6000 product line. Contact your local Rockwell Automation sales representative to arrange commissioning.

Rockwell Automation support includes, but is not limited to:

- quoting and managing product on-site startups
- quoting and managing field modification projects
- quoting and managing product training at Rockwell Automation facilities and on-site

## Notes:

# Before You Begin Tests, Maintenance, or Repairs



Read the information in this chapter before you begin tests, maintenance, or repairs on drive components.

| | |
|---|---|
| **IMPORTANT** | Once the product is connected to a power supply, always verify that system power is not present before performing any work on the product. See safety-related practices that are contained in publication NFPA 70E, Standard for Electrical Safety in the Work Place. |

## Product Advisories

Read the following precautions before you begin to test components, perform maintenance, or repair the drive.

### Qualified Personnel

**ATTENTION:** Only qualified personnel familiar with PowerFlex 6000T products and associated machinery should plan or implement the installation, startup, and subsequent maintenance of the system. Failure to comply can result in personal injury and/or equipment damage.

**ATTENTION:** These tasks require persons skilled in this type of detailed work. Read and understand this manual thoroughly before commencing. Contact Rockwell Automation with any questions or for clarification.

## Personal Safety

**ATTENTION:** To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before servicing.

**ATTENTION:** Potentially fatal voltages can result from improper usage of an oscilloscope and other test equipment. The oscilloscope chassis can 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 is used in the A minus B Quasi-differential mode and the oscilloscope chassis is grounded to an earth ground.

**ATTENTION:** Always perform Power Lockout procedure before servicing equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury, or death.

**ATTENTION:** Servicing energized Medium Voltage Motor Control Equipment can be hazardous. Severe injury or death can result from electrical shock, bump, or unintended actuation of controlled equipment. Recommended practice is to disconnect and lockout control equipment from power sources, and release stored energy, if present.For countries following NEMA standards, refer to National Fire Protection Association Standard No. NFPA70E, Part II and (as applicable) OSHA rules for Control of Hazardous Energy Sources (Lockout/Tagout) and OSHA Electrical Safety Related Work Practices safety related work practices, including procedural requirements for lockout/tagout, and appropriate work practices, personnel qualifications and training requirements, where it is not feasible to de-energize and lockout or tagout electric circuits and equipment before working on or near exposed circuit parts.For countries following IEC standards, refer to local codes and regulations.

**ATTENTION:** Only qualified personnel with the correct PPE (Personal Protective Equipment) should service the equipment. Be sure to follow the safety procedures and local regulations to disconnect the high voltage. After waiting for 15 minutes, open the cabinet door and verify the absence of medium voltage on the input, output, and power cell terminals with a high-voltage detector that is properly rated for the line and motor voltages. All status indicator lights on the power cells must be off and the drive be grounded with portable grounding cables on the input and output before servicing. Failure to follow the safety procedures can result in severe injury or death.

**ATTENTION:** Use suitable personal protective equipment (PPE) per local codes or regulations. Failure to do so may result in severe burns, injury, or death.

## Product Safety

**ATTENTION:** This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when you install, test, service, or repair this assembly. Component damage can result if ESD control procedures are not followed.

## Class 1 Light-emitting Diode 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.

## Safety Considerations

**SHOCK HAZARD:** Energized industrial control equipment can be dangerous. Severe injury or death can result from electrical shock, burn, or unintended actuation of control equipment. Hazardous voltages may exist in the drive cabinet even with the input circuit breaker in the off position. If it is necessary to work in the vicinity of energized equipment, the safety-related work practices that are outlined in Electrical Safety requirements for Employee Work places must be followed. Before attempting any work, verify that the system has been locked out and tested to have no potential.

Lockout and tagout the device feeding power to the input of the drive before performing any drive maintenance or component replacements. After the input device cabinet doors are opened, immediately test the outgoing power cables feeding the drive with a live-line tool (hot stick) while wearing high-voltage gloves. Repeat the live-line tool (hot stick) testing at the drive incoming line power cable connections to verify that medium voltage is not present. Pay special attention to any capacitors connected to medium voltage that can retain a charge for a period of time. Only after the drive equipment has been verified as isolated and de-energized can subsequent work be performed. Even though the input to the drive may be open, it is still possible for hazardous voltage to be present.

**Table 1 - Line-to-Ground Short-circuit Specifications**

| Attribute | Value |
|---|---|
| Line-to-Ground short-circuit current | 31.5 kA |
| Incoming circuit breaker withstand current short time | 4 s |
| Ik | ≥ 31.5 kA |
| Opening time | 40...60 ms |
| Breaking time | 50...75 ms |
| Inrush current | up to 12.5 p.u. |

See national and local safety guidelines for detailed procedures on how to isolate the equipment from hazards safely.

**ATTENTION:** The national and local electrical codes outline provisions for safely installing and working on electrical equipment. Installation must comply with specifications regarding wire type, conductor sizes, branch circuit protection, and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

## Remove Power from the System

Follow the appropriate procedures to remove power from the drive system.

**WARNING:** Remove power before you remove or make cable connections. When you remove or insert a cable connector with power applied, an electric arc can occur. An electric arc can cause personal injury or property damage in theses ways:

- An electric arc can send an erroneous signal to system field devices, which can cause unintended machine motion
- An electric arc can cause an explosion in a hazardous environment

Electric arcs cause excessive wear to contacts on both the module and its mating connector. Worn contacts can create electrical resistance.

1. Turn off and lockout all input power, including any external power sources.
2. Wait 15 minutes.

3. Measure the AC input and DC bus voltage to verify that there is no voltage present.

## Commonly Used Tools

The tools that are listed in this section are required to maintain the PowerFlex 6000T drives. Only a subset of the tools is required for specific drive preventive maintenance work.

**IMPORTANT** Care must be taken to be sure that tools and/or hardware components do not fall into open drive assemblies. Do not energize the drive unless all loose tools and/or hardware components have been removed from the drive assemblies and enclosure.

Tools required:

- 5 kV DC insulation resistance tester
- Digital multimeter
- Torque wrench
- Portable computer and related software, data connectivity
- Tool set (screwdriver, metric open-end wrench, metric socket wrench, and so on)
- Fast wrench
- 10 kV electroscope (up to and including 10 kV) and ground protection line (greater than 25 square feet)
- Safety gloves that can withstand at least 17 kV
- Vacuum cleaner with anti-static hose (provided by customers)
- Anti-static cleaning cloth
- Power cell lift cart (required for pull-out power cells)

Materials required:

- Torque seal (yellow), part number RU6048, or equivalent
- Electrical joint compound, Alcoa EJC number 2, or equivalent
- Shell number 7 aviation grease, part number 40025-198-01, or equivalent

Documents required:

- PowerFlex 6000T Drives Installation Instructions, publication 6000-IN100
- PowerFlex 6000T Drives Programming Manual, publication 6000-PM100
- Electrical and mechanical drawings of specific drive
- List of spare parts for specific drive

### Software Tools

Connected Components Workbench™ software is an application that can be used to upload and download parameter configuration and monitor system parameters.

Connected Components Workbench software version 12 or later, and the latest version of the PowerFlex drives device database files for Connected Components Workbench software, are required for use with PowerFlex 6000T products. For DeviceLogix™, the profile in Connected Components Workbench software can be used to set up programs.

You can also use Studio 5000 Logix Designer® application version 21 or later, with Add-on Profile (AOP) for PowerFlex drives and SMCs (all Logix versions) version 5.07 or later.

## Fastener Torque Sequences

**ATTENTION:** When mounting components to a drive heatsink, component fastener torque sequences and tolerances are crucial to component-to-heat sink heat dissipation.
Components can be damaged if initial tightening procedure is not performed to specification.

The following illustrates initial and final tightening sequences for components that are fastened to a heatsink by using two, four, and six screws. Initial torque is 1/3 (33%) of final torque, except six-point mountings, which require 0.7 N•m (6 lb•in) initial torque. The numeric illustration labels are for your assistance. Drive components do not contain these labels.

**Figure 1 - Two-point Mounting**

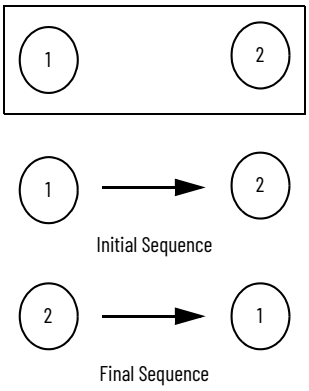



**Figure 2 - Four-point Mounting**

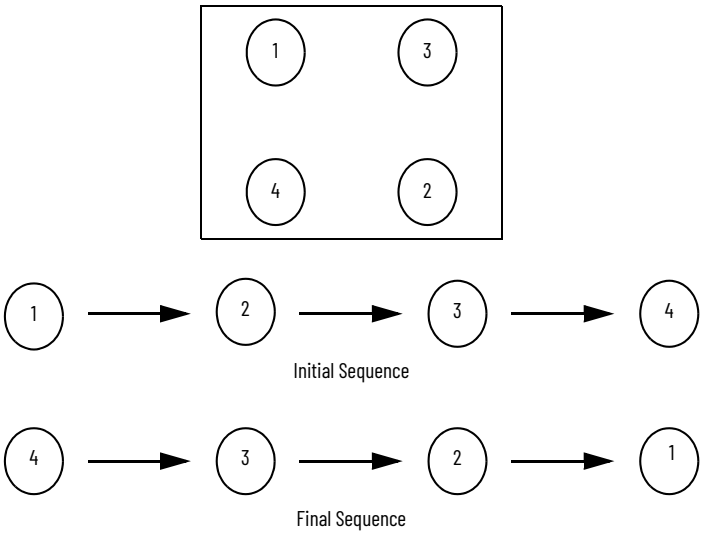
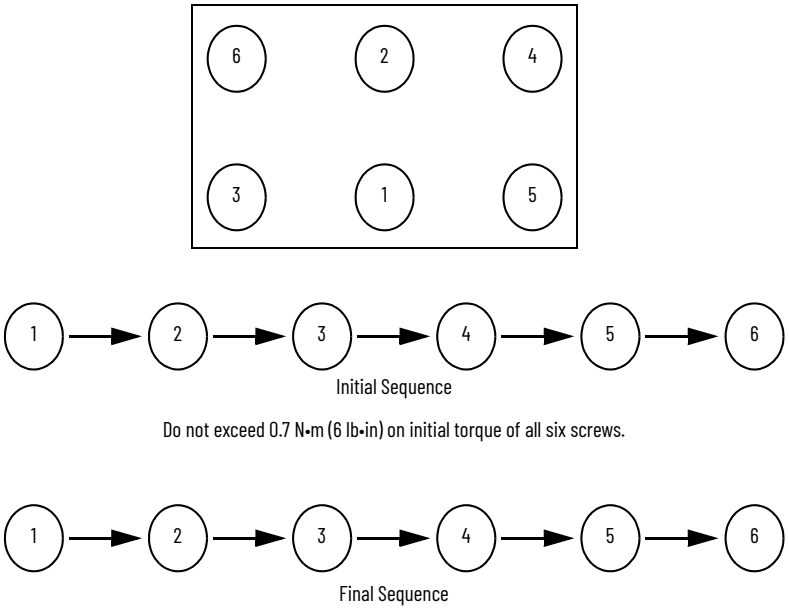


**Figure 3 - Six-point Mounting**




## Torque Requirements

Proper tightening torque must be used for installation and wiring.

**Table 2 - Torque Requirements**

| Thread Size | Torque | |
|---|---|---|
| | Class 8.8 | |
| | N•m | lb•ft |
| M4 | 3.0 | 2.2 |
| M5 | 5.9 | 4.4 |
| M6 | 10.5 | 7.7 |
| M8 | 26.0 | 19.2 |
| M10 | 51.0 | 37.6 |
| M12 | 89.0 | 65.7 |
| M14 | 141.0 | 104.1 |
| M16 | 215.0 | 158.7 |
| M20 | 420.0 | 310.0 |

# Preventative and Predictive Maintenance



This chapter provides information on preventative maintenance for components that can affect the life and operational characteristics of PowerFlex 6000T drives.

## Recommended Preventative Maintenance

The drive can experience reduced service life if operated outside of its design parameters. Verify that the operating environment is within specifications. Daily inspection and regular maintenance helps maximize the service life of the equipment.

This periodic preventative maintenance program includes the following primary tasks:

- A visual inspection of all drive components accessible from the front of the unit.
- Power supply voltage level checks
- General cleaning and maintenance
- Tightness checks on all accessible power connections

## Maintenance Schedule

The codes that are listed in Table 3 are used to identify the task that is associated with the components that are identified in the preventative maintenance schedule in Table 4.

**Table 3 - Schedule Codes Explanation**

| Code | Task | Description |
|---|---|---|
| I | Inspect | Inspect the component for signs of excessive accumulation of dust, dirt, or external damage. For example, inspect the filters/fan inlet screens for debris that can block the airflow path. |
| C | Clean | Clean the components that can be reused, specifically the door-mounted air filters and fan inlet screens. |
| M | Maintain | This type of maintenance task can include an inductance test of line reactors/DC links, or a full test of an isolation transformer, and so on. |
| R | Replace | This component has reached its mean operational life. Replace the component to decrease the chance of failure. It is likely that components can exceed the designed life in the drive, but component life is dependent on many factors such as usage and heat. |
| Rv | Review | A discussion with Rockwell Automation personnel is recommended to help determine whether any of the enhancements/changes made to the drive hardware and control could benefit the application. |
| RFB/R | Refurbishment/Replacement | The parts can be refurbished at lower cost OR the parts can be replaced with new ones. |

**ATTENTION:** Customers can replace components for the PowerFlex 6000T drives. However repairs must only be performed by qualified Rockwell Automation personnel.

## Table 4 - Periodic Preventative Maintenance Schedule

| | | | Drive Runtime (in hours from first operation commissioning date) | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Maintenance Run Time (hours)** | **–** | **7,680** | **16,440** | **25,200** | **33,960** | **42,720** | **51,480** | **60,240** | **69,000** | **77,760** | **86,520** | **95,280** | **104,040** | **112,800** | **121,560** | **130,320** | **139,080** | **147,840** | **156,600** | **165,360** | **174,120** |
| | | **Maintenance Number** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| **Component Location** | **Component Category** | **Component/Item** | | | | | | | | | | | | | | | | | | | | | |
| Isolation Transformer Cabinet | Air-cooling system | Door-mounted Air Filters | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R |
| | | Top-mounted Cooling Fans | | I | I | I | I | R | I | I | I | I | R | I | I | I | I | R | I | I | I | I | I |
| | Integral Magnetics | Isolation Transformer | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| | LV Control | Voltage Sensing Board | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| Power Cell Cabinet | Air-cooling system | Door-mounted Air Filters | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R | C / R |
| | | Top-mounted Cooling Exhaust Fans | | I | I | I | I | R | I | I | I | I | R | I | I | I | I | R | I | I | I | I | I |
| | Power Cell | Electrolytic Capacitors[1] | | I | I | I | I | I | I | I | I | I | I | I | I | R | I | I | I | I | I | I | I |
| | Misc. | HECS | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| LV Control Cabinet | Misc. | AC/DC Power Supplies | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| | UPS | UPS[2] | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| | Air-cooling system | Control Pod Printed Circuit Board Fans | | I | I | I | I | R | I | I | I | I | R | I | I | I | I | R | I | I | I | I | I |
| | | Door Fans | | I | I | I | I | R | I | I | I | I | R | I | I | I | I | R | I | I | I | I | I |
| | LV Control | Control Pod | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| | | Enhanced HIM | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| | | LV Control Relays | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| | | LV Control Circuit Breakers | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| All | Temperature Sensing | Temperature Sensors | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| | Connections | LV Component Terminal & Plug-in Connections | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| | | Medium Voltage Cable Connections | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| | | Transformer Secondary Winding Connections | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| | | Power Cell Input and Output Power Connections | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I |
| General | Enhancements | Firmware | | – | – | Rv | – | – | Rv | – | – | Rv | Rv | – | Rv | – | – | Rv | – | – | Rv | – | – |
| | | Hardware | | – | – | Rv | – | – | Rv | – | – | Rv | – | – | Rv | – | – | Rv | – | – | Rv | – | – |
| | Operational Conditions | Parameters / Variables | | I | I | Rv | I | I | Rv | I | I | Rv | I | I | Rv | I | I | Rv | I | I | Rv | I | I |
| | Spare Parts | Inventory Needs | | I | I | Rv | I | I | Rv | I | I | Rv | I | I | Rv | I | I | Rv | I | I | Rv | I | I |
| Filter Cabinet | Fans | Top-mounted Cooling Fans | | I | I | I | I | R | I | I | I | I | R | I | I | I | I | R | I | I | I | I | I |

(1) Based on full load/full speed operation at 8700 hours per year at 30 °C (86 °F) ambient temperature. For higher ambient temperatures the replacement should be done sooner, contact factory for details.
(2) Fully discharge and recharge the UPS batteries every 6 months, to extend battery life.

# Maintenance of Industrial Control Equipment

**ATTENTION:** Performing service on energized Industrial Control Equipment can be hazardous. Severe injury or death can result from electrical shock, bump, or unintended actuation of controlled equipment. Recommended practice is to disconnect and lockout control equipment from power sources, and release stored energy, if present. See National Fire Protection Association Standard No. NFPA 70E, Part II and (as applicable) OSHA rules for Control of Hazardous Energy Sources (lockout/tagout) and OSHA Electrical Safety Related Work Practices for safety-related work practices. These publications include procedural requirements for lockout/tagout, and appropriate work practices, personnel qualifications, and required training where it is not feasible to de-energize and lockout or tagout electric circuits and equipment before working on or near exposed circuit parts.

## Daily Inspection

Check the following items during normal operation of the drive:

- abnormal noise or vibration in the drive or motor
- abnormal temperature in the drive or motor
- ambient temperature in the control room above nominal
- accumulation of dust or particulate on control room floor or surfaces
- abnormal load current above nominal

## Clean the Air Filters

PowerFlex 6000T drives require a continuous, smooth airflow to cool the power components and the isolation transformer to deliver stable and reliable operation of the equipment. Obstruction of the air filters is the main cause of poor cooling airflow.

The drive uses a number of cooling fans that are installed at the top of the cabinet to deliver sufficient airflow to cool the power components and isolation transformer. When the equipment is running for some time, the air filters accumulate dust and obstructs the airflow. Failure to clean the air filters regularly may result in insufficient cooling airflow, which may cause some parts of the drive to send an overtemperature alarm or even trip[(a)]:

- Transformer overtemperature alarm / trip
- Power cell overtemperature trip

Immediately after receiving the overtemperature warning, you should plan to replace or clean the air filters. At this point there should be a few days or weeks before the air filters fail, but this depends on the amount of dust in the environment.

(a) Obstruction of the air filters is not the only cause of over temperature alarm and trip.

## Regular Maintenance Intervals

The periodic maintenance requirements are summarized in the preventative maintenance schedule on page 19 as a guideline. Detailed procedures referred to in that table are described the following chapters:

- Chapter 3, Component Inspection and Test Procedures on page 37
- Chapter 4, LV Control Cabinet on page 49
- Chapter 5, Isolation Transformer Cabinet on page 71
- Chapter 6, Power Cell Cabinet on page 77
- Chapter 7, Inspect Connections on page 83

Medium Voltage Motor control equipment should be inspected periodically. Inspection intervals should be based on environmental and operating conditions and adjusted as indicated by experience. An initial comprehensive inspection, within three to four months after installation, is suggested. See the following standards for general guidelines for setting-up a periodic maintenance program. For countries following NEMA standards, refer to National Electrical Manufacturers Association (NEMA) Standard No. ICS 1.1 (Safety Guidelines for the Application, Installation, and Maintenance of Solid-Sate Control) for MV Drives and ICS 1.3 (Preventive Maintenance of Industrial Control and Systems Equipment) for MV Controllers. For countries following IEC standards, refer to IEC 61800-5-1 Sec. 6.5 for MV Drives and IEC 60470 Sec. 10, IEC 62271-1 Sec. 10.4 for MV Controllers.

The maintenance work for PowerFlex 6000T drives should normally be performed every time the drive completes one year of runtime operation. This work is carried out by Rockwell Automation medium voltage drive customers. The customer may extend the maintenance interval appropriately according to the installation conditions and operating conditions of the drive. Determine the maintenance cycle and component/items according to the Preventative Maintenance alerts (page 26) for the drive. Check parameter 0:1064 [Maint Run Time] to verify the drive runtime hours and follow the guideline for that respective period of maintenance (Table 4). After maintenance is performed, acknowledge the relevant maintenance alerts.

**Figure 4 - Maintenance Acknowledgment Parameters**

| | | | | |
|---|---|---|---|---|
| 14 | 189 | ExhaustFan Ack | Ready | |
| 12 | 20 | PowerCellRplcAck | Ready | |
| 0 | 1053 | Prev Mnt Ack | Ready | |

The purpose of performing regular maintenance is to locate potential failures and take preventive measures before a real failure occurs. Therefore it is recommended to spend about 16 hours to perform maintenance to verify that the drive is functioning reliably. This can greatly reduce the risk of unplanned downtime.

Before starting preventative maintenance, you should record some important information, including:

- Report of the previous preventive maintenance (if any)
- Get motor parameters and applications

- Check the current settings of the drive
- Check the fault/warning queue
- Save parameters to a recipe file[a] or parameter record
- Record the board part number, serial number, and edition[b]

**IMPORTANT** The parameter values are tied to the Nonvolatile Memory (NVM) of the Motor Control Board (MCB), and hence constrained by the lifespan of the MCB.

If inspection reveals that dust, dirt, moisture, or other contamination has reached the control equipment, the cause must be eliminated. This could indicate unsealed enclosure openings (conduit or other) or incorrect operating procedures. Replace any damaged or embrittled seals, and repair or replace any other damaged or malfunctioning parts. Replace dirty, wet, or contaminated control devices unless they can be cleaned effectively by vacuuming or wiping.

**IMPORTANT** Compressed air is not recommended for cleaning because it may displace dirt, dust, or debris into other parts or equipment, or damage delicate parts.

## Physical Checks

**ATTENTION:** Performing service on energized Industrial Control Equipment can be hazardous. Severe injury or death can result from electrical shock, bump, or unintended actuation of controlled equipment. Recommended practice is to disconnect and lockout control equipment from power sources, and release stored energy, if present. See National Fire Protection Association Standard No. NFPA 70E, Part II and (as applicable) OSHA rules for Control of Hazardous Energy Sources (lockout/tagout) and OSHA Electrical Safety Related Work Practices for safety-related work practices. These publications include procedural requirements for lockout/tagout, and appropriate work practices, personnel qualifications, and required training where it is not feasible to de-energize and lockout or tagout electric circuits and equipment before working on or near exposed circuit parts.

### Power Connection Inspection

- Inspect PowerFlex 6000T drive, input/output/bypass sections, and all associated drive components for loose power cable connections and ground cable connections: torque them based on the required torque specifications.
- Inspect the bus bars and check for any signs of overheating / discoloration and tighten the bus connections to the required torque specifications.
- Clean all cables and bus bars that exhibit dust build-up.
- The torques of incoming / outgoing cable screws of the power unit shall be check if they are in the specified range.
- Use torque sealer on all connections. Conduct integrity checks on the signal ground and safety grounds.

(a) For devices with recipe function options.
(b) Records are required only if spare parts replacement is replaced after preventive maintenance activities.

## Physical Inspection

- Check for any visual/physical evidence of damage or degradation of components in the low voltage compartments.
  - This includes relays, contactors, timers, terminal connectors, circuit breakers, ribbon cables, control wires, optional UPS, AC/DC power supplies, and so on. Causes could be corrosion, excessive temperature, or contamination.
- Check for any visual/physical evidence of damage or degradation of components in the medium voltage compartments (cables, contactors, circuit breakers, isolation disconnecting blades, power units, and so on).
  - This includes main cooling fan, power devices, heatsinks, circuit boards, insulators, cables, capacitors, current transformers, potential transformers, fuses, wiring, and so on; Causes could be corrosion, excessive temperature, or contamination.
- Clean all contaminated components using a vacuum cleaner (DO NOT use a blower), and wipe clean components where appropriate.
- Conduct the physical inspection and verification for the proper operation of the contactor/isolator interlocks, and door interlocks.
- Conduct the physical inspection and verification for the proper operation of the key interlocks.
- Conduct the cleaning of the fans and verify that the ventilation passages are not blocked and the impellers are freely rotating without any obstruction.
- Conduct the insulation resistance (IR) test on the transformer, motor, and associated cabling.
- Check all bolts for fastening and adjust them as necessary.
- Check all labels for readability. If any labels are unreadable, damaged, or missing, contact Rockwell Automation for replacements.

## Medium Voltage Testing

Medium voltage insulation resistance (IR) or dielectric withstanding voltage tests should not be used to check solid-state control equipment. When performing IR tests on electrical equipment, such as transformers or motors, solid-state devices must be bypassed before performing the test. Even though no damage may be readily apparent after an IR test, the solid-state devices are degraded and repeated application of high voltage can lead to failure.

## Maintenance after a Fault Condition

Opening of the short circuit protective device (such as fuses or circuit breakers) in a properly coordinated motor branch circuit is an indication of a fault condition in excess of operating overload. Such conditions can cause damage to medium voltage motor control equipment. Before restoring power, the fault condition must be corrected and any necessary repairs or replacements must be made to restore the medium voltage motor control equipment to good working order. See NEMA Standards Publication No. ICS-2, Part ICS2-302 for procedures. Use only replacement parts and devices that are recommended by Rockwell Automation to maintain the integrity of the equipment. Verify that the parts are properly matched to the model, series, and revision level of the equipment. After maintenance or repair of the equipment,

always test the control system for proper functioning under controlled conditions (that avoid hazards in the event of a control malfunction). For additional information, see NEMA ICS 1.3, PREVENTIVE MAINTENANCE OF INDUSTRIAL CONTROL AND SYSTEMS EQUIPMENT, published by the National Electrical Manufacturers Association, and NFPA70B, ELECTRICAL EQUIPMENT MAINTENANCE, published by the National Fire Protection Association.

# General Tasks

## Review Firmware and Hardware

Verify the firmware revision in the device definition page on the integrated touch screen display (eHIM), and in the device info page or with parameters in Connected Components Workbench software.

Contact Rockwell Automation to determine whether there are any enhancements or changes that are made to the Drive Hardware and Control that would be valuable to the application.

Verify that the integrated touch screen display is operational. Check the status indicators on the control unit in the LV Control cabinet register as normal.

**ATTENTION:** Verify that there is no power to the drive and wear an anti-static wristband.

Remove any dirt or foreign material. Wipe components with an anti-static cloth, where applicable.

## Inspect/Review Spare Parts

Inspect and review the spare parts that are shipped with the drive (see the packing list if applicable). Check for signs of damage, dirt, or foreign material.

**ATTENTION:** Some circuit boards can be destroyed by static charges. Use of damaged circuit boards may also damage related components. Use a grounding wriststrap when handling sensitive circuit boards.

**ATTENTION:** Due to the characteristics of DC capacitors, rejuvenation is necessary on power cell DC capacitors if the power cell has not been energized in the last one year. Therefore the spare power cells must be energized annually.

## Professional Maintenance Service

Rockwell Automation also offers professional maintenance service that is provided by the Rockwell Automation field support engineer, contact your local Rockwell Automation sales person for more information.

## Miscellaneous Preventive Maintenance Work

- Communicate with the customer regarding problems found during the preventive maintenance process.
- Raise the problems found during the maintenance process.
- Provide relevant solutions and record them in the final report.
- Provide advice on operation and maintenance of the drive to the customer's maintenance personnel.
- Provide information about requirements for safe operation of the drive and safety instructions.
- Provide information about operating conditions (environment, temperature, and so on) required for stable operation of the drive.
- Obtain spare parts information from the customer to determine whether they have sufficient stock. Recommend the customer to purchase additional spare parts if necessary.

For more information, contact PF6000TechnicalSupport@ra.rockwell.com.

**Table 5 - Estimated Time Required for Maintenance Work**

| Activity | Time Required(1) |
|---|---|
| Daily maintenance | 0.5 hours for each air filter |
| Annual maintenance | |
| Initial collection of information | 0.5 hours |
| Visual inspection and cleaning<br>• Electrical connection<br>• Ground<br>• Control cabinet<br>• Transformer cabinet<br>• Power cabinet<br>• Inside the power cell<br>• Fan<br>• Door and mechanical parts<br>• Insulation | 6.0 hours |
| Low voltage check<br>• Control system<br>• Cooling fan<br>• Parameters | 2.0 hours |
| Final inspection before commissioning<br>• Final inspection<br>• Medium voltage test<br>• Run to maximum load | 2.0 hours |
| Miscellaneous work<br>• Survey<br>• Informal training<br>• Spare parts analysis | 2.0 hours |
| Final report | 4.0 hours |

(1) These inspection items and time are only estimated. Depends on the situation when conducting preventive maintenance and the operation of the drive.

## Replacement Schedule

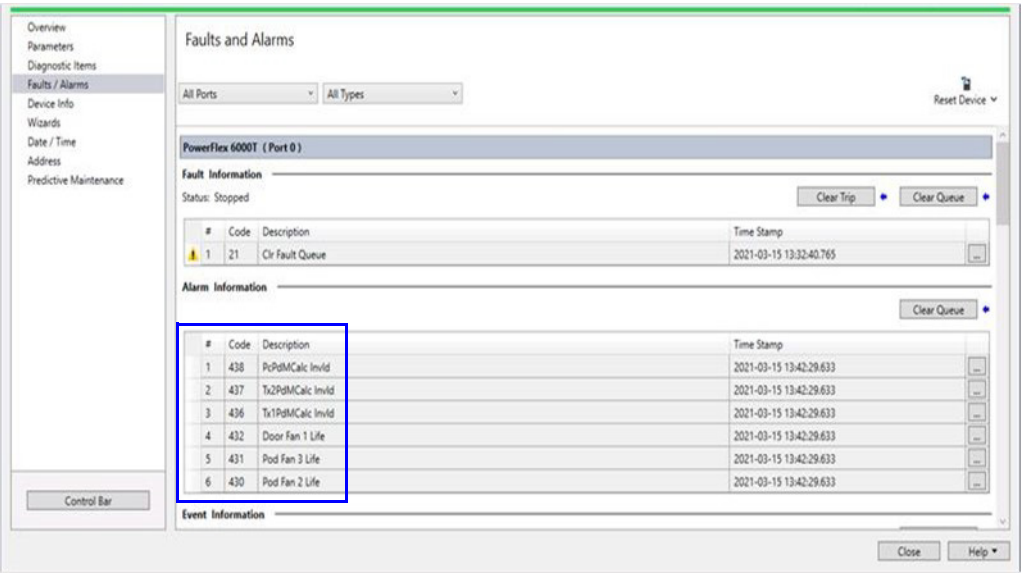
PowerFlex 6000T drives require periodic replacement of the cooling fans and power cells. “Replacement counters” provide regular alerts for the replacement of the components, depending on the operation runtime hours of the component.

There are four replacement counters:

- Power Cells
- Cooling Exhaust Fans
- Control Pod Printed Circuit Board Fans
- Door Fans

Once you receive the alert for the replacement of a component, follow this process to act on the alert and acknowledge that you have performed the required maintenance action.

1. Check the alert and locate the component on the drive. For information on how to locate and identify the component, see page 27.




2. Check the replacement schedule (Table 6) to replace the component.
3. Acknowledge the alert for the component.
   - For door fans and control pod fans, see page 28.
   - For cooling fans, see page 29.
   - For power cells, see page 30.

## Locate Components

Check the label inside the power cell door panel for a location map of the power cells, as shown in the following example. The power cell layout depends on the drive frame type.

**Figure 5 - Power Cell Identification Label Example, A-frame**

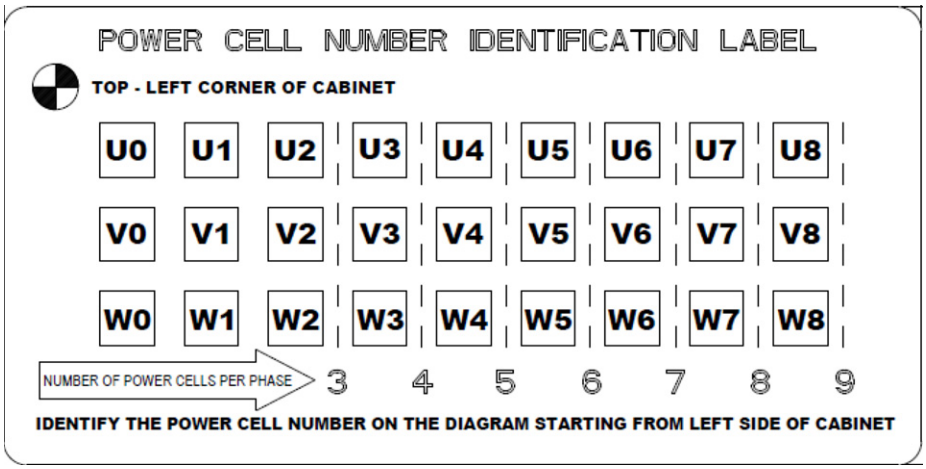
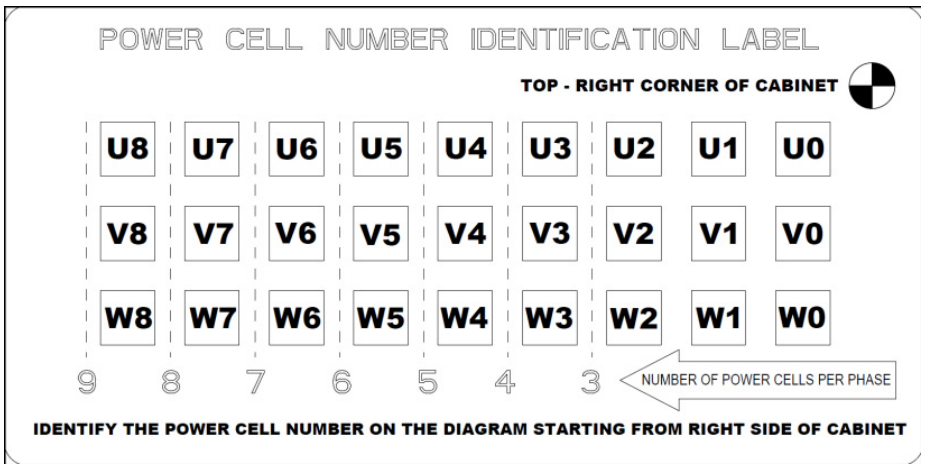



**Figure 6 - Power Cell Identification Label Example, B-frame**




The fans are also labeled with their number for easy identification as shown in the following example.

**Figure 7 - Fan Number Label Example**

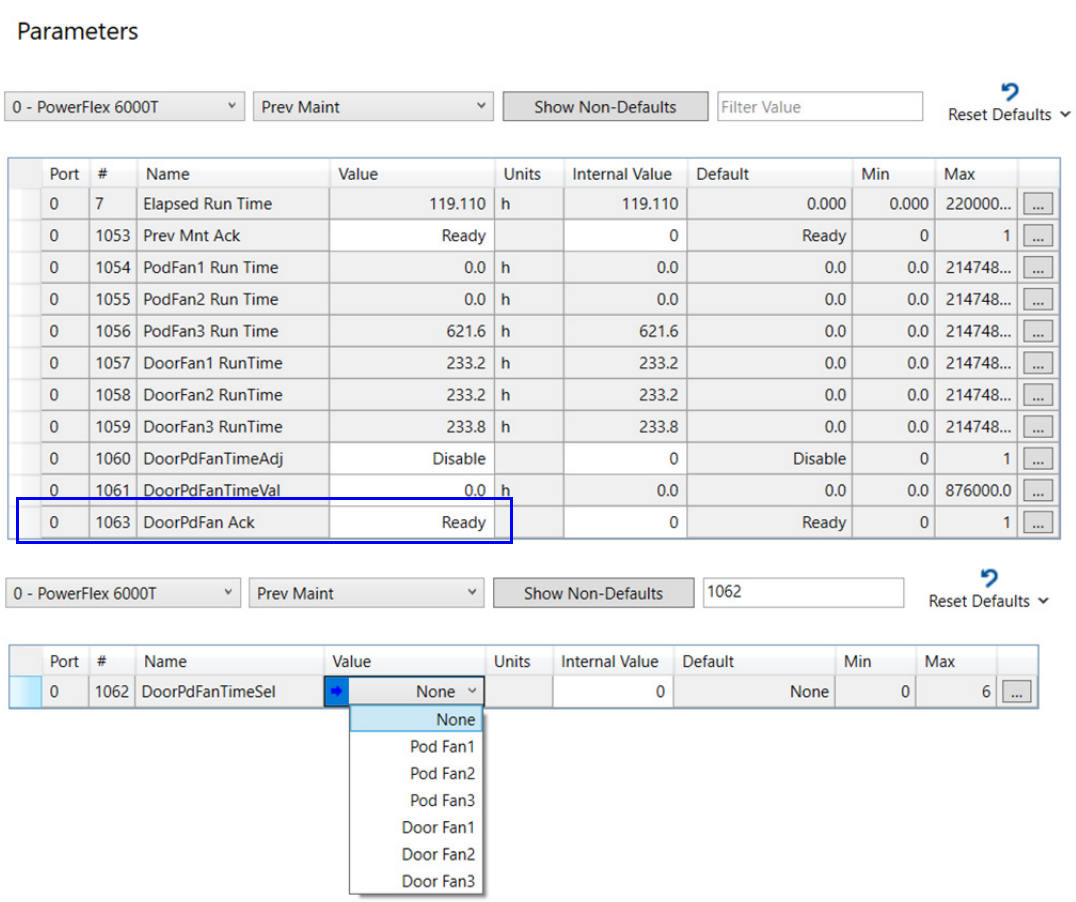
## Acknowledge Maintenance Alerts

After maintenance is performed, acknowledge the relevant maintenance alerts.

*Door Fans and Control Pod Fans*

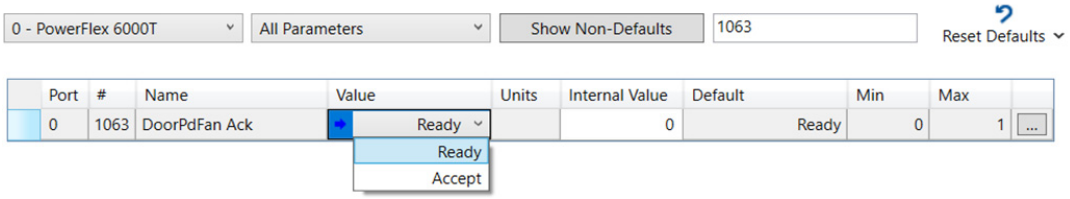
Locate the respective parameters for the door fans or control pod fans.

**Figure 8 - Door Fans and Control Pod Fans Parameters**




Acknowledge the alert and that you have replaced the component.

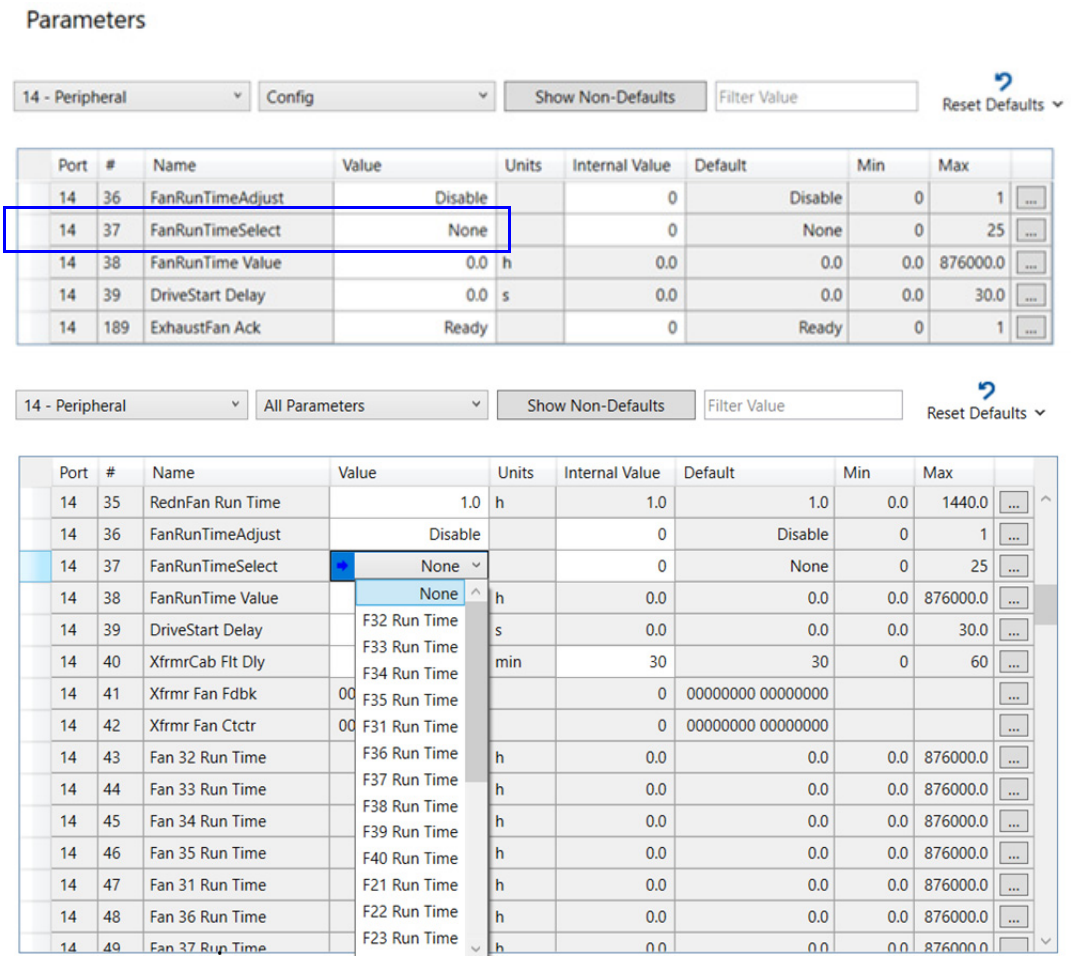
**Figure 9 - Acknowledge Door Fans and Control Pod Fans Alert**



### *Cooling Fans*

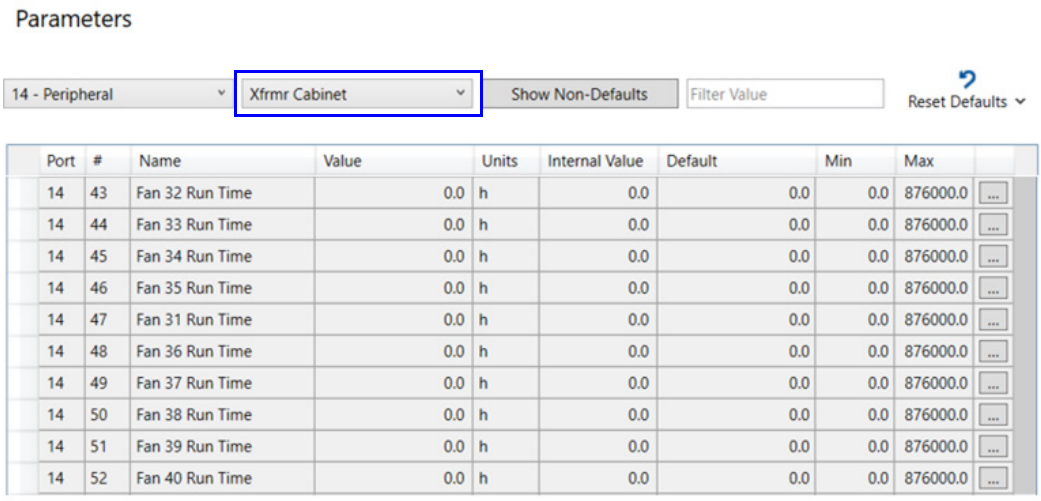
Locate the respective parameters for the cooling fans.

**Figure 10 - Cooling Fans Parameters**



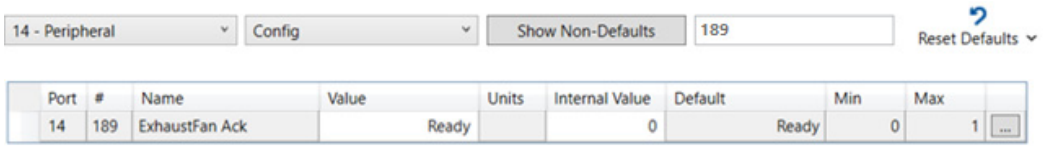

Select the cabinet according to the component number of the fan. For example, if the component is Fan 32, select the Isolation Transformer cabinet.

**Figure 11 - Select Fan Location**



Acknowledge the alert and that you have replaced the component.

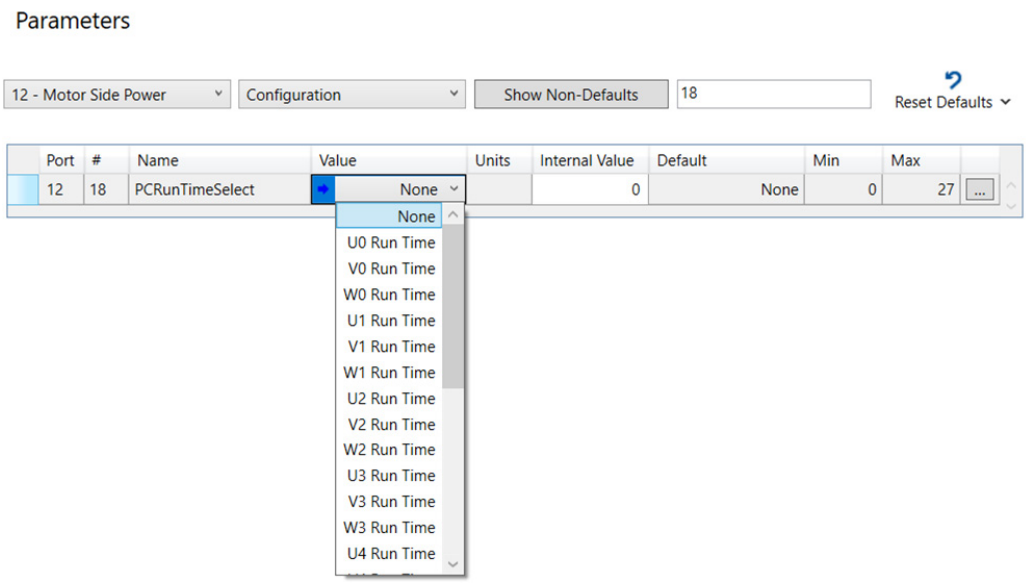
**Figure 12 - Acknowledge Cooling Fans Alert**




*Power Cells*

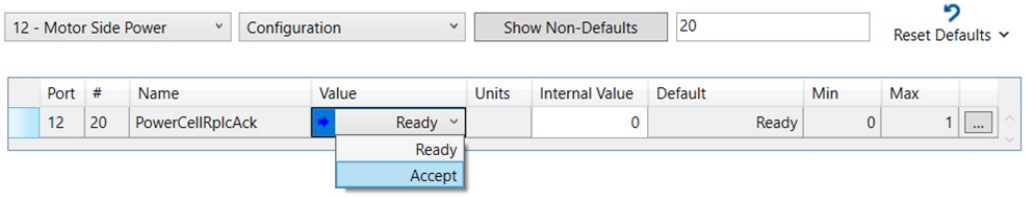
Locate the respective parameters for the power cells.

**Figure 13 - Power Cell Fans Parameters**




Acknowledge the alert and that you have replaced the component.

**Figure 14 - Acknowledge Power Cell Fans Alert**



## Table 6 - Component Replacement Schedule

| | | | Number of Runtime Hours Since Component Replacement | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Component Run Time (hours)** | **–** | **8,759** | **17,519** | **26,279** | **35,039** | **43,799** | **52,559** | **61,319** | **70,079** | **78,839** | **87,599** | **96,359** | **105,119** | **113,879** | **122,639** | **131,399** | **140,159** | **148,919** | **157,679** | **166,439** | **175,199** |
| **Component Location** | **Component Category** | **Component/Item** | | | | | | | | | | | | | | | | | | | | | |
| Isolation Transformer Cabinet | Fans | Top-mounted Cooling Exhaust Fans | | | | | | Rplc Fan*xx*-90d | | | | | | | | | | | | | | | |
| Power Cell Cabinet | Power Cell | • Electrolytic Capacitors<br>• IGBT, IGBT (Bypass)<br>• Diode | | | | | | | | | | | | | | Rplc PC*xx* - 90d | | | | | | | |
| | Fans | Top-mounted Cooling Exhaust Fans | | | | | | Rplc Fan*xx*-90d | | | | | | | | | | | | | | | |
| | | Control Pod Printed Circuit Board Fans | | | | | | Rplc Fan*xx*-90d | | | | | | | | | | | | | | | |
| | | Door Fans | | | | | | Rplc Fan*xx*-90d | | | | | | | | | | | | | | | |
| Filter Cabinet | Fans | Top-mounted Cooling Fans | | | | | | Rplc Fan*xx*-90d | | | | | | | | | | | | | | | |

## Upgrade Plan

If the drive firmware is upgraded from an earlier revision to 8.001 or later, the maintenance and replacement counters are available upon upgrade. The values in the earlier counters for the drive and components are used to set the initial values in the new counters.

If the counters were reset prior to the firmware upgrade, the periodicity of the alerts will not be accurate. In this scenario, use the following guidelines:

- For drive maintenance alerts – when referencing the Periodic Preventative Maintenance schedule (Table 4), consider the "maintenance number" as the approximate number of years from drive commissioning for the first alert and so forth.
- For replacement of critical parts – when referencing the Component Replacement schedule (Table 6), consider the alerts only after a new component is installed and the runtime counter for that component is reset.

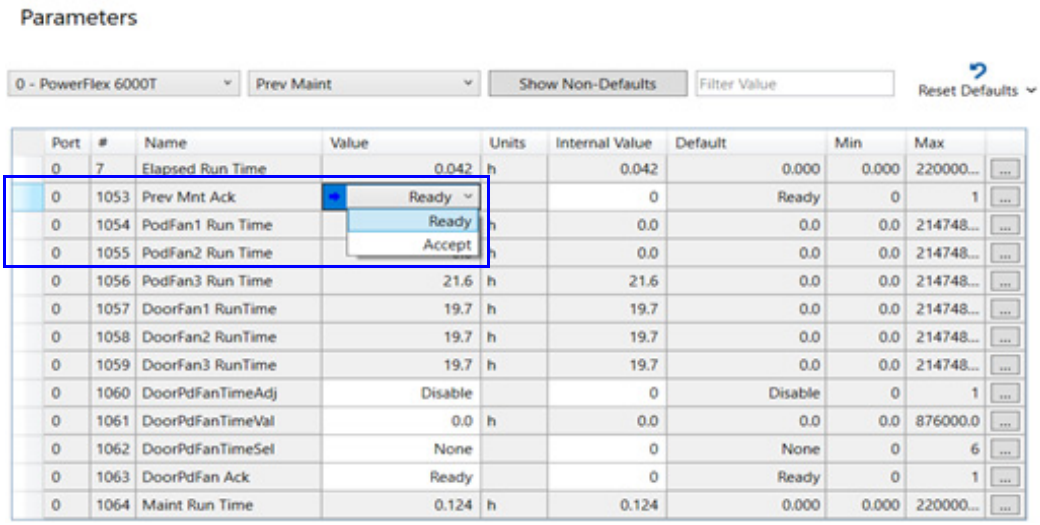
## Final Report

Record a complete and detailed report on all steps in the Preventative Maintenance procedures to identify changes.

Record a detailed description of all adjustments and measurements that were taken during the process (interlock adjustments, loose connections, voltage readings, insulation resistance (IR) test results, parameters, and so on).

Acknowledge the maintenance alert in Connected Components Workbench software or Studio 5000 Logix Designer application.

**Figure 15 - Maintenance Alert**



## Prepare Final Report

The Rockwell Automation service engineer will provide a maintenance report to the customer based on the outcome of the maintenance work. All steps in the preventative maintenance process are recorded in detail in the report and identifies changes that are made.

The final report includes:

- A complete copy of the Preventative Maintenance checklist.
- Problems that are found during the investigation process and rectification recommendations.
- Adjustments and measurements during maintenance (including mechanical adjustment, connection status, voltage reading, vibration test results, parameters, and so on).

This information will be sent to the PowerFlex 6000 Technical Support and Product Support for the latest on-site information for future maintenance and technical support.

# Predictive Maintenance

PowerFlex 6000T drives with TotalFORCE® technology include patented algorithms developed from extensive component life testing. They measure actual operating conditions, characterize how the drive is running, and make a prediction of remaining usable life.

90 days advance alarms are set to alert when a drive should be serviced and components replaced, before it leads to a downtime event.

These onboard models assess conditions that impact the longevity of critical drive and system fans to help ensure the timely service or replacement.

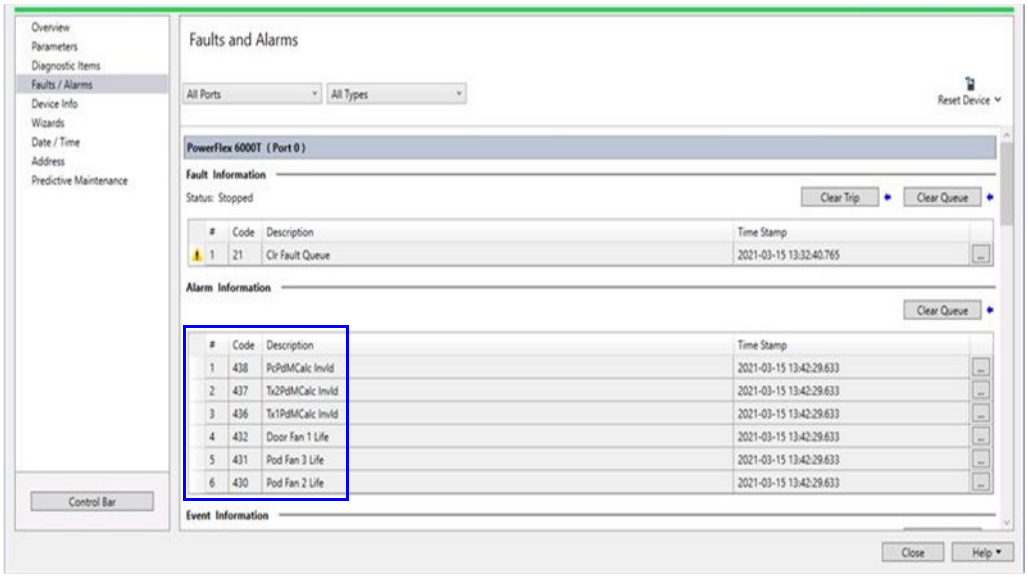
If the drive comes with firmware revision 8.001 or later, a predictive maintenance model is built-in to the firmware (as standard design, unless modified) to monitor the following components:

- Cooling Exhaust Fans
- Control Pod Printed Circuit Board Fans
- Door Fans

The remaining life of the fans can be viewed in the Predictive Maintenance page in the Connected Components Workbench software and Studio 5000 Logix Designer application. You can view the different fans based on type and location.

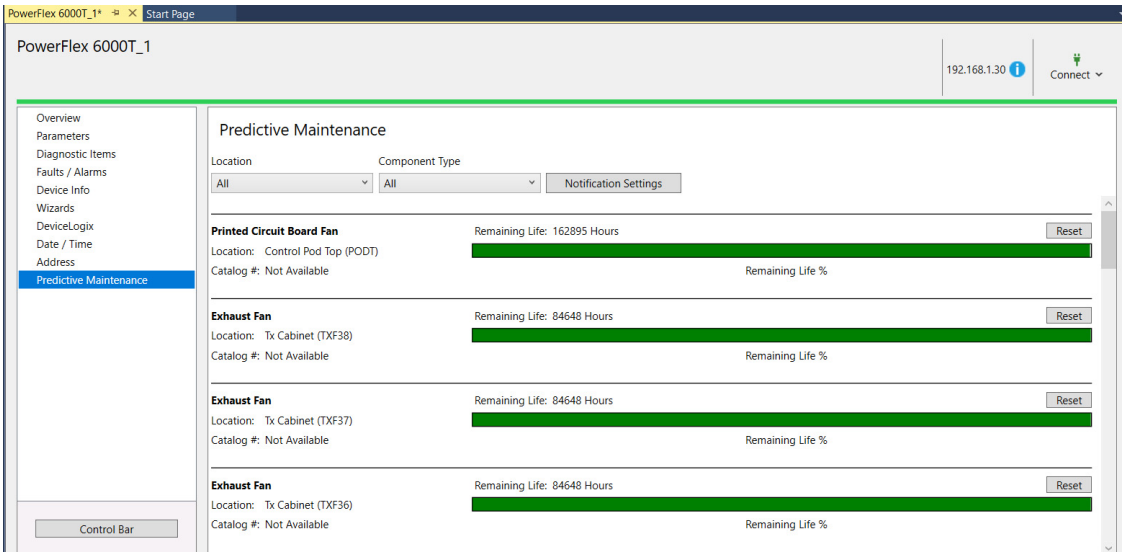
The life of the fans decreases with increased usage. An alert is generated when a fan reaches the equivalent of 90 runtime days of life remaining, at the prescribed ambient temperature.

**Figure 16 - View Fan Alarms**

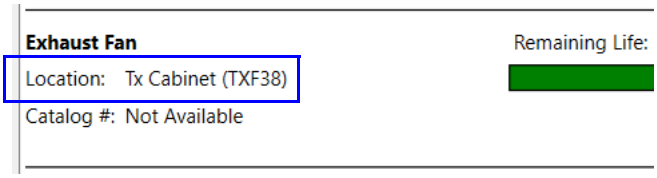



When you receive an alert, perform the following procedure to replace the component:

1. Check the alert and locate the components on the drive.



Record the location of the fans that need to be replaced.





You can also see the Hardware Drawings for the location of the fans.

2. Contact Rockwell Automation Customer Support and Maintenance. Provide your Rockwell Automation Drive Sales Order/Serial Number to verify the type of fans to purchase for replacement.
3. Procure and replace the fans.
4. Reset the counter for the component to start the counter for the remaining life of the new fan.

If the drive firmware is upgraded from an earlier revision to 8.001 or later, there is an option available to upgrade the Predictive Maintenance offering. See Upgrade Kit on page 35 for instructions on how to purchase the upgrade.

## Upgrade Kit

To purchase an upgrade kit for your drive, see the following procedure:

1. Verify your Rockwell Automation Drive Order or Serial Number.
2. Contact your Sales or Customer Support Representative to provide order information and obtain pricing.
3. Once confirmed by a Rockwell Automation Expert, a Field Support Engineer from Rockwell Automation installs the upgrade bundle for your drive, which includes the following:
   - New fans (Exhaust, Door, Control Pod) – Quantity and details as per drive configuration
   - Temperature sensor assembly – Sensor housing and mounting
   - Component labels – To identify exhaust fans
   - Other accessories – POINT I/O™ modules, power supplies, and so on
   - Update drive hardware configuration file (DHCF) with Predictive Maintenance enabled

## Notes:

# Component Inspection and Test Procedures



This chapter provides details on how to inspect and test the major components of the drive and includes recommendations for repairs. Review the Troubleshooting chapter in the PowerFlex 6000T Drives Programming Manual, publication 6000-PM100, for information on conditions that can cause a fault or alarm and how to troubleshoot these conditions.

## Component Inspection and Maintenance

Visually inspect the door filters and major components on the control pod, power cells, and components for dirt and damage. Dirt build-up on some components can lead to component damage or failure. Avoid damage to the product by replacing components and/or circuit boards with burn marks, breakage, or foil delamination. Follow these inspection and maintenance instructions along with the Recommended Preventative Maintenance information on page 17.

1. Review the Product Advisories on page 11.
2. Remove power from the system. See Remove Power from the System on page 13.
3. Remove the filters from the enclosure doors and inspect for dirt buildup or blockage. Clean or replace all filters as necessary.

   See the procedures on page 38 for removal instructions.
4. Inspect the enclosure fan assemblies for blockage and verify free rotation. Clean or replace as necessary.

   See the procedures on page 40 for removal instructions:
5. Inspect the door position limit switches for obvious signs of damage, dust, or foreign material. Remove any dirt or foreign material. Wipe components with an anti-static cloth, where applicable. Check that the aviation plug has a hand-tight connection.

   See the procedures on page 47 for removal instructions:

6. Remove the cover from the control pod and inspect all visible major components, including: circuit boards, wire harnesses, fiber-optic cables, and connectors. If any components show evidence of burn marks or breakage, replace the damaged components without further testing.
7. Visibly inspect all visible circuit boards, wire harnesses, fiber-optic cables, and connectors through-out the system. Replace any of these circuit boards, wire harnesses, or fiber-optic cables without further testing if they show evidence of burn marks, breakage, or foil delamination. See the appropriate removal and replacement procedures for the affected module/component.

## Replace/Clean Door-mounted Air Filters

Periodically remove and clean, or remove and replace, the air filters according to the Periodic Preventative Maintenance schedule (Table 4). The frequency with which you renew the filters depends on the cleanliness of the available cooling air.

There are two types of design for the air filters. The quantity of air filters on the cabinet door are different, depending on the drive ratings. However, the method to remove or clean the air filters is the same. The screens may be replaced while the drive is operating, but the procedure is easier to perform while the drive is shut down.

If the drive is running, you must replace the filter as soon as possible to prevent foreign material from entering into the drive.

### Recommended Cleaning Method of Filters

- Vacuum Cleaner – A vacuum cleaner on the inlet side of the filter will remove accumulated dust and dirt.
- Blow with Compressed Air – point compressed air nozzle in opposite direction of operating airflow (Blow from exhaust side toward intake side)
- Cold Water Rinse – Under normal conditions the foam media used in the filters, require no oily adhesives. Collected dirt is washed away quickly and easily using just a standard hose nozzle with plain water.

**ATTENTION:** The filter must be completely dry before reinstalling.

- Immersion in Warm Soapy Water – Where stubborn air-borne dirt is present, the filter may be dipped in a solution of warm water and mild detergent. Rinse in clear clean water, let stand until completely dry and free of moisture.

Use only Rockwell Automation-supplied or -approved replacement filters. Replace the filters in the reverse order of its removal. Check that there are no openings to allow foreign matter to enter the drive.

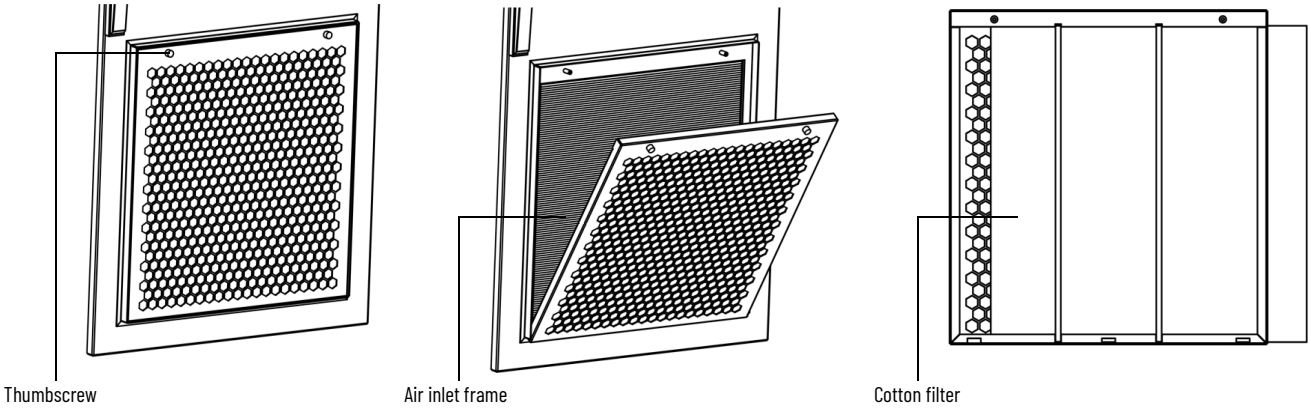
## Replace Filter for A-frame Drives

1. Unlatch the thumbscrews and remove the air filter frame.
2. Remove and clean the cotton filter, or replace with a new cotton filter.

**IMPORTANT** When removing the filter, prevent accumulated dirt on the inlet side of the filter from being sucked into the drive. It may be difficult to remove the filter material without tearing due to the suction at the air inlet.

3. Close the air filter frame and tighten thumbscrews.

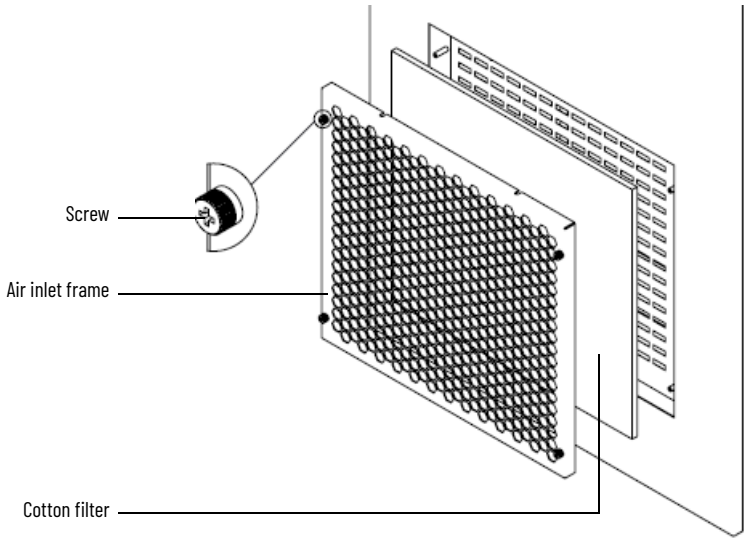
**Figure 17 - Replace the Filter, A-frame**




## Replace Filter for B-frame Drives

1. Unlatch and open the cabinet filter door more than 90°.

**Figure 18 - Replace the Filter, B-frame**




2. Remove the screens by pulling up out of the door.

**IMPORTANT** When removing the filter, prevent accumulated dirt on the inlet side of the filter from being sucked into the drive. It may be difficult to remove the filter material without tearing due to the suction at the air inlet.

3. Reinstall the cleaned or new air filter using reverse order of removal. Verify that the door is fully closed and locked.

## Inspect Top Mounted Cooling Fans

Inspect fans that are used for forced air cooling. Replace any that have bent, chipped, or missing blades, or if the shaft does not turn freely.

The fans are supplied with 380/460V AC power, which is fed by the low voltage taps of the Isolation Transformer. The control voltage is 220V. The voltage of the fan can be measured through a small door on the Isolation Transformer.

**ATTENTION:** Exercise caution when measuring the voltage of the fans.

Apply power momentarily to check operation.

- A-frame – Fans rotate when medium voltage is applied.
- B-frame – Transformer fans rotate when medium voltage is applied. Power cell fans do not rotate until you run the drive.

If unit does not operate, check and replace wiring, fuse, or fan motor as appropriate. Clean or change air filters as recommended in this manual. Verify that the aviation plug has a proper hand-tight connection. Verify that the ventilation passages are not blocked and the impellers can rotate freely without any obstruction.

## Replace Top Mounted Cooling Fans

There are two types of top fan housings. The top fan housing consists of a motor and impeller assembly. To replace the fan, it is necessary to remove the fan housing lid.

**ATTENTION:** Fan replacement requires working at a significant height from the floor. Complete this procedure on a safe, stable platform.

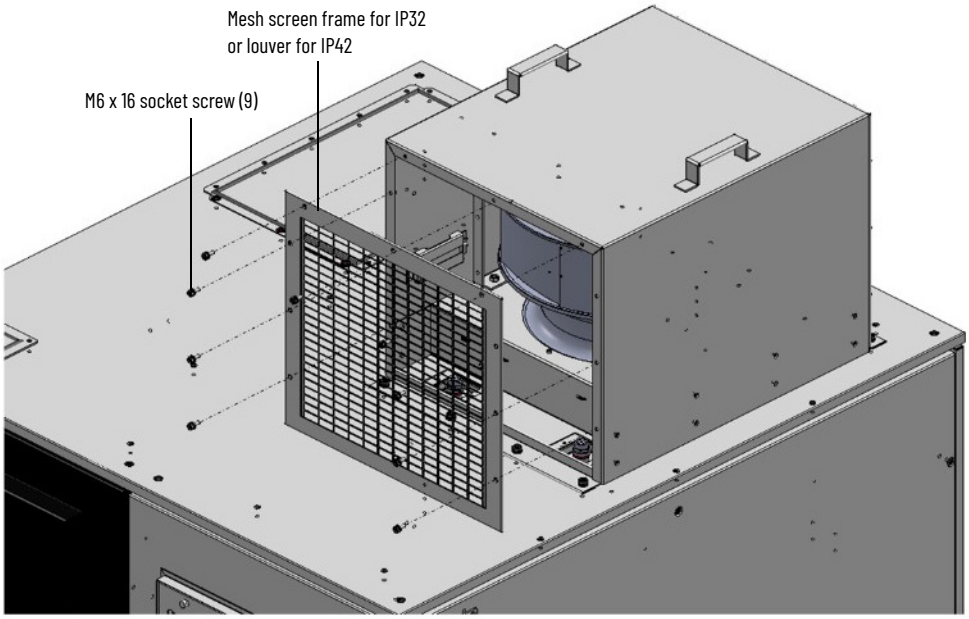
**ATTENTION:** Always perform Power Lockout procedure before servicing equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury, or death.

**ATTENTION:** Medium Voltage must be turned off when replacing the main cooling fans.

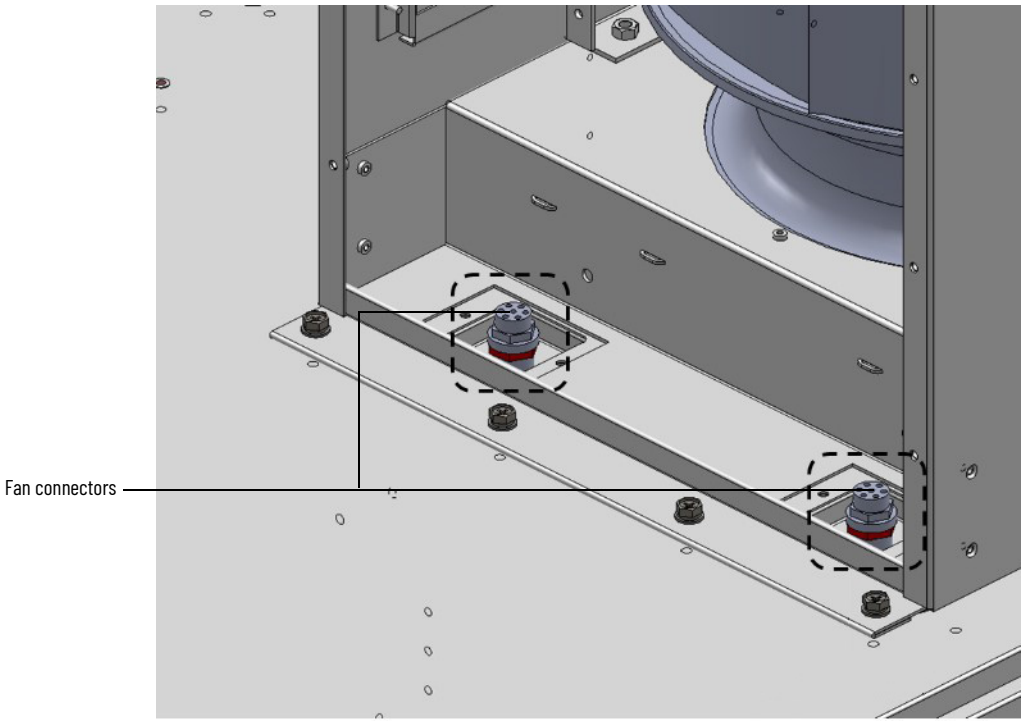
## Replace EC400 Fan Unit

To replace an EC400 fan unit follow these instructions:

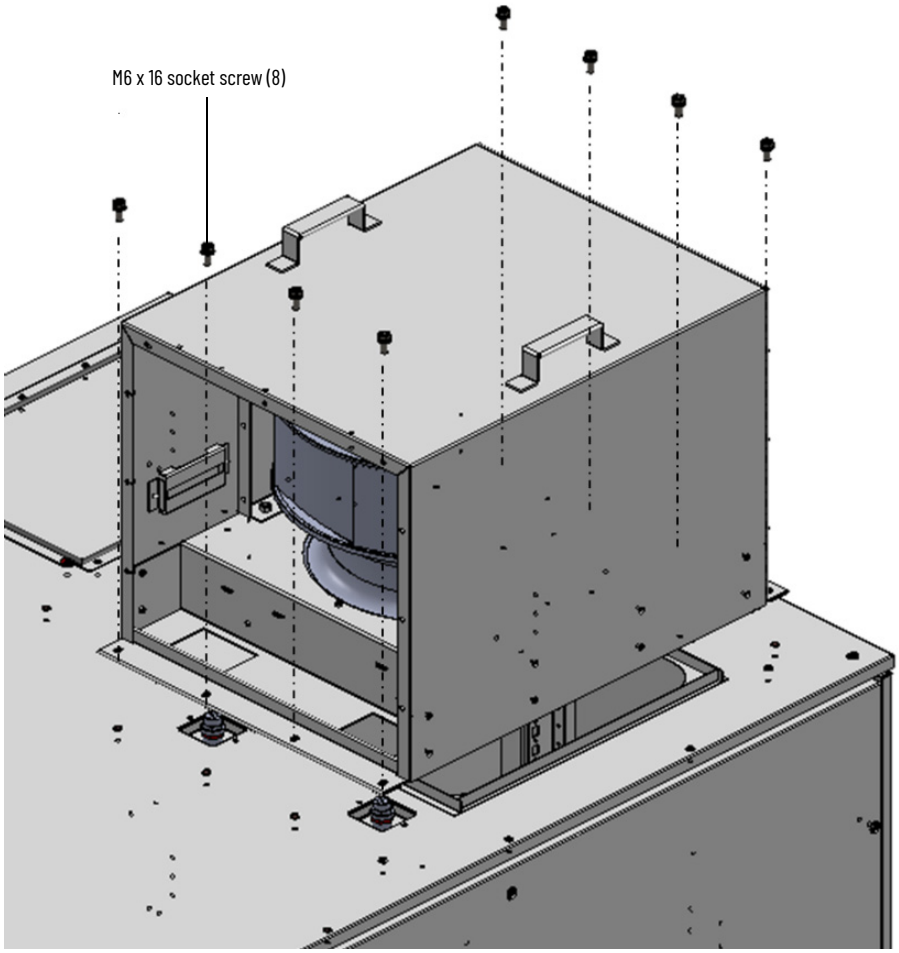
1. Remove and retain nine M6 x 16 hexagon socket screws around the front side of the fan unit.




2. Remove and retain the mesh screen frame for IP31, or louver for IP42.
3. Disconnect the two cables from the fan connectors.



4. Remove and retain eight M6 x 16 hexagon socket screws from the top plate and replace the fan unit.

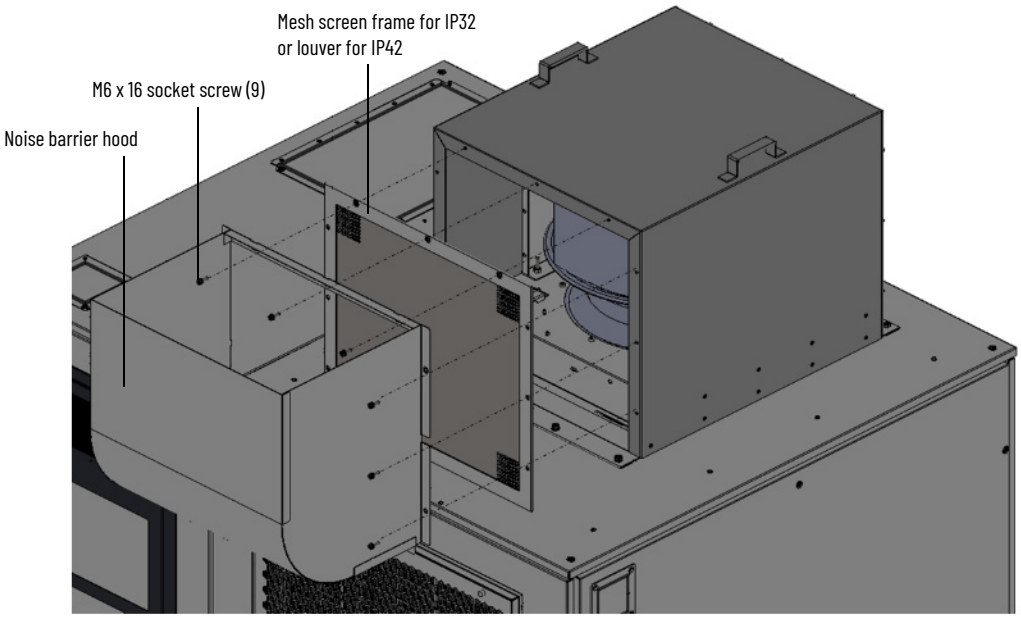



5. Install hardware in reverse order of removal.

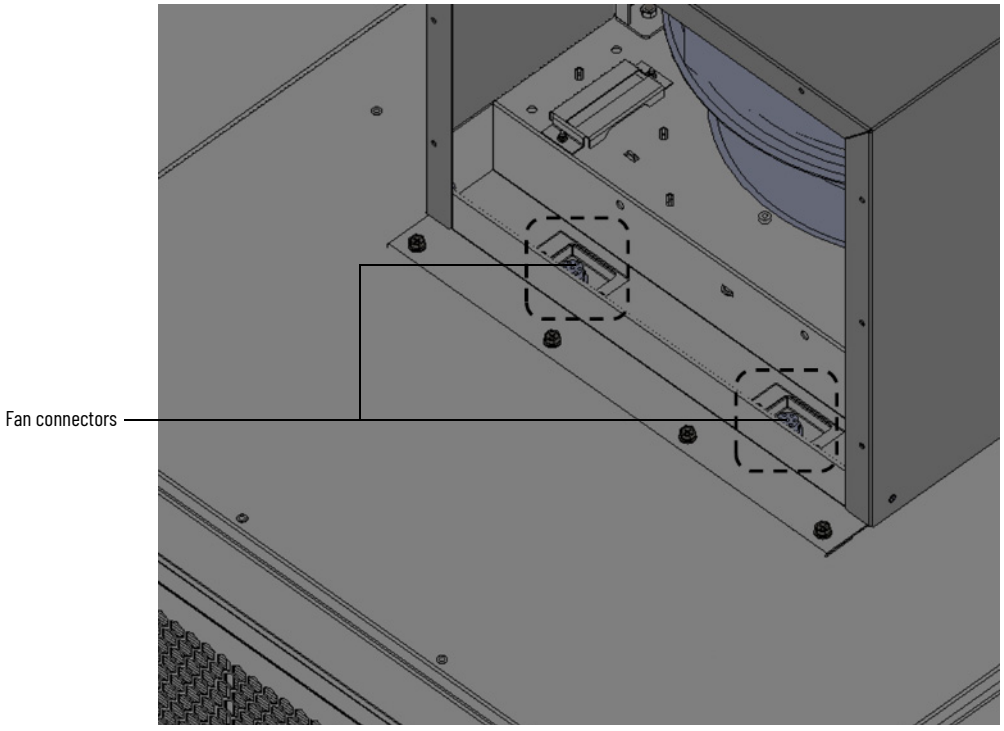
## Replace EC500 Fan Unit

To replace an EC500 fan, follow these instructions:

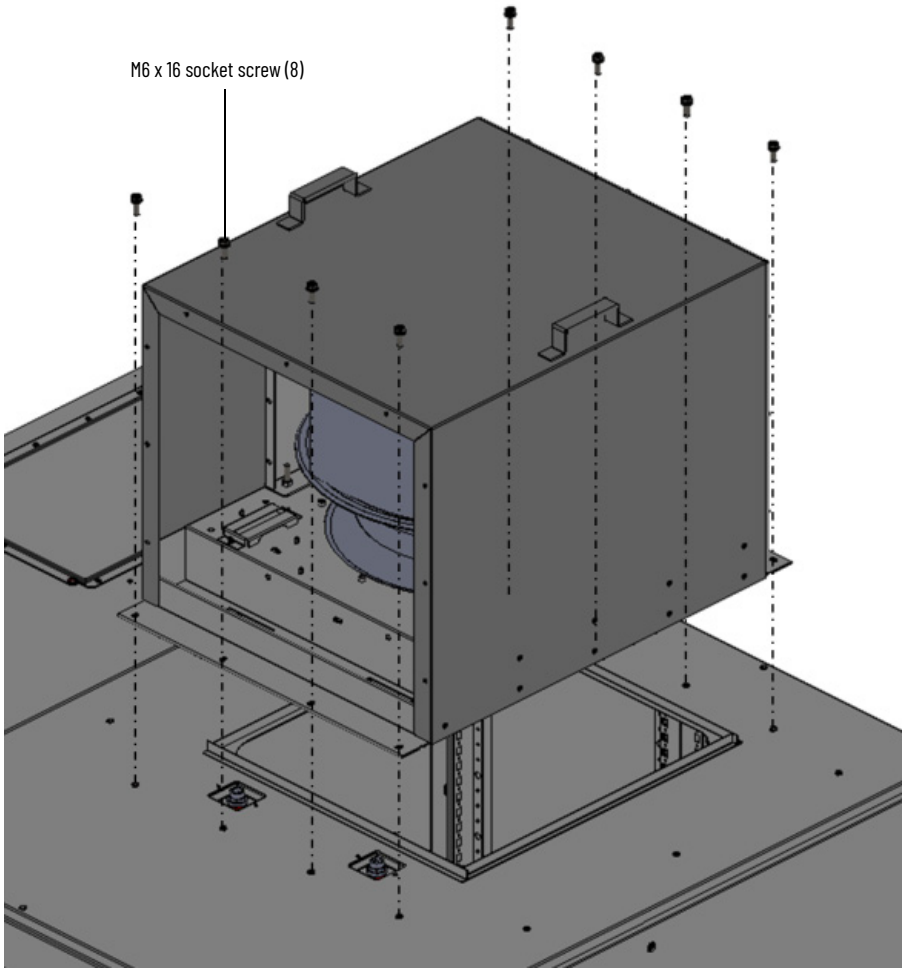
1. Remove and retain nine M6 x 16 hexagon socket screws around the front side of the fan unit.




2. Remove and retain the noise barrier hood (if present) and mesh screen frame for IP31, or louver for IP42.
3. Disconnect the two cables from the fan connectors.



4. Remove and retain eight M6 x 16 hexagon socket screws from the top plate and replace the fan unit.




5. Install hardware in reverse order of removal.

## Fan Balance

Fan impellers are statically and dynamically balanced within acceptable tolerances at the factory. Damage in shipping or from incorrect handling or installation may upset the balance. An improperly balanced impeller can lead to excessive vibration causing undue wear on the entire unit.

If vibration is excessive, shut down the fan and determine the cause. Common causes of excessive vibration include:

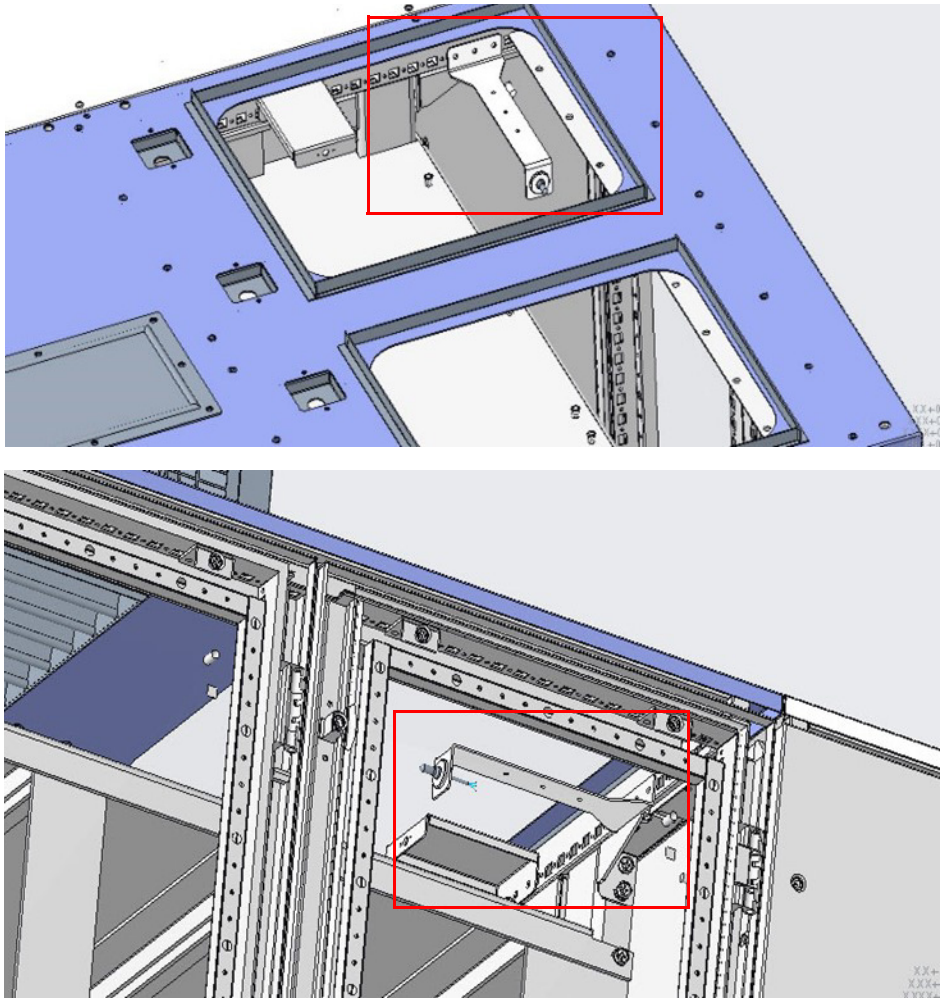
- Drive support structure not sufficiently rigid or level
- Loose mounting bolts
- Loose impeller or bushing

## Replace Sensors

Follow these steps to replace the sensors in the LV Control cabinet.

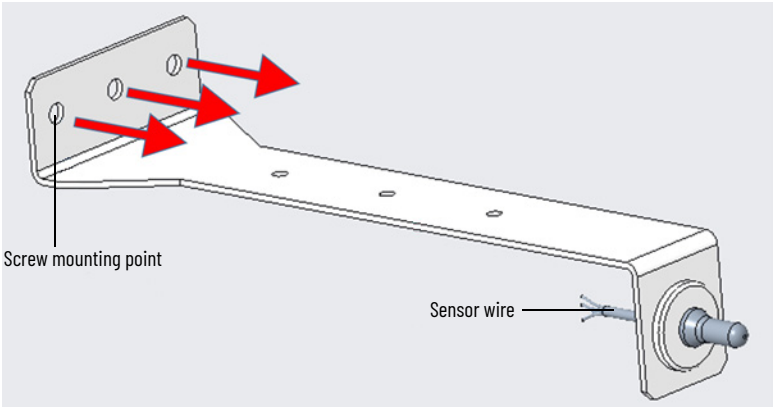
1. Observe the routing of the wires in the cabinet and the connection points in the LV Control cabinet.

**Figure 19 - Sensor Connection Point Example**



Consider taking pictures of the connection points and wire routes before removing the existing sensors. Electrical connections in the LV tub are also presented in the electrical diagrams.

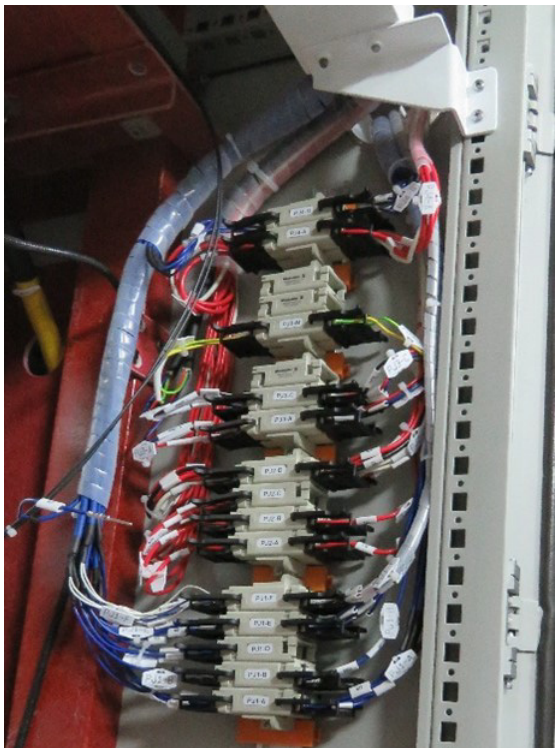
2. Disconnect the existing sensor from the cabinet structure by removing the three screws.




3. Disconnect the sensor wire along the path.

A-frame drives have the sensor wired directly into the LV Control cabinet section while B-frame drives that require a shipping split have a shipping split connector. Rockwell Automation supplies the connector for the shipping split in the replacement kit.

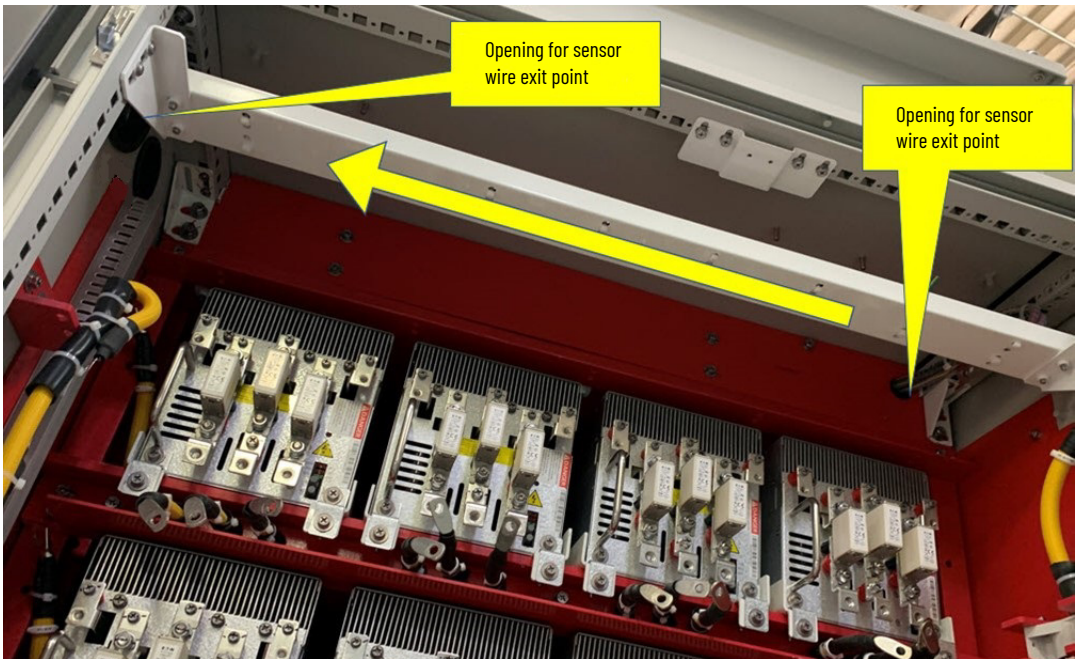
**Figure 20 - Shipping Split Connector Example**



4. Install the new sensor in the same position following the same wire routing and connection points like the original installation.

**WARNING:** It is important to follow the original wire routing in the MV sections to preserve the electrical clearances from the MV components. Wire ties are needed to secure the wire properly along the path.

**Figure 21 - Example of a Wire Exit Point in the Power Cell Cabinet, A-frame**



# Inspect/Replace Door Position Limit Switch

**ATTENTION:** Verify that the input circuit breaker feeding the drive is open. Lockout and tagout the input circuit breaker before performing any work on the drive or bypass units.

Follow these steps to replace the door position limit switch.

1. Open the drive cabinet door.
2. Disconnect the aviation plug from the back of the limit switch.
3. For A-frame drives – remove two M4 x 30 bolts from the mounting bracket.
   For B-frame drives – remove two M4 x 35 bolts and hardware from the mounting bracket.
4. Install the new limit switch in reverse order of removal.

**Figure 22 - Replace Door Position Limit Switch, A-frame**

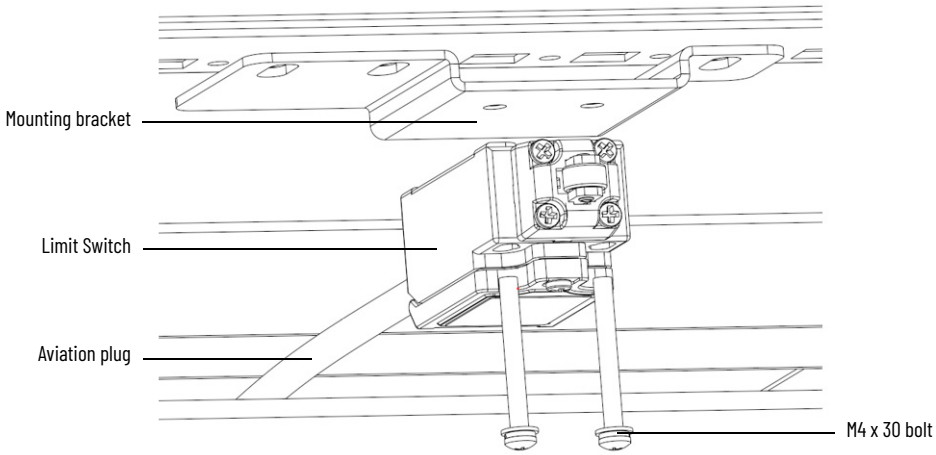
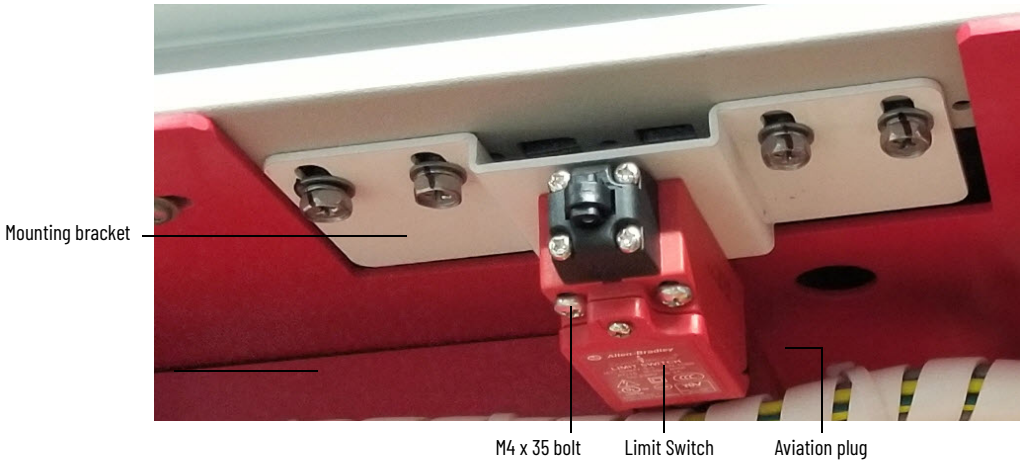



**Figure 23 - Replace Door Position Limit Switch, B-frame**



## Component Fuse Tests

Follow these steps to check the fuses for other components/modules.

1. Review the Product Advisories on page 11.
2. Remove power from the system. See Remove Power from the System on page 13.
3. Continuity test the fuse or fuses.
4. Replace a fuse as necessary.

# LV Control Cabinet



This chapter provides detailed instructions for how to remove and replace control cabinet and control pod components.

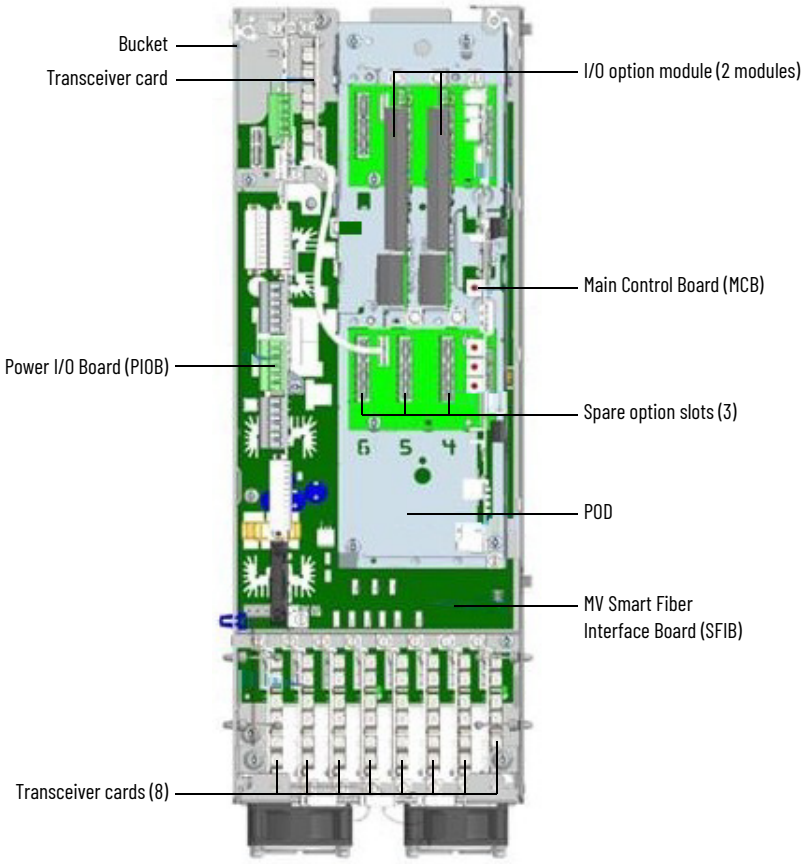
For more information about:

- features of the control pod, see the PowerFlex Drives with TotalFORCE Control Built-in EtherNet/IP Adapter User Manual, publication 750COM-UM009.
- configuring the control pod, see the PowerFlex 750-series AC Drives with TotalFORCE Control Quick Start, publication 750-QS100.

## Control Pod Overview

The following graphic shows the components inside the control pod.

**Figure 24 - Control Pod Components**




## Control Pod Cover Removal

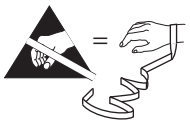
You must remove the control pod cover to access other components inside the pod.

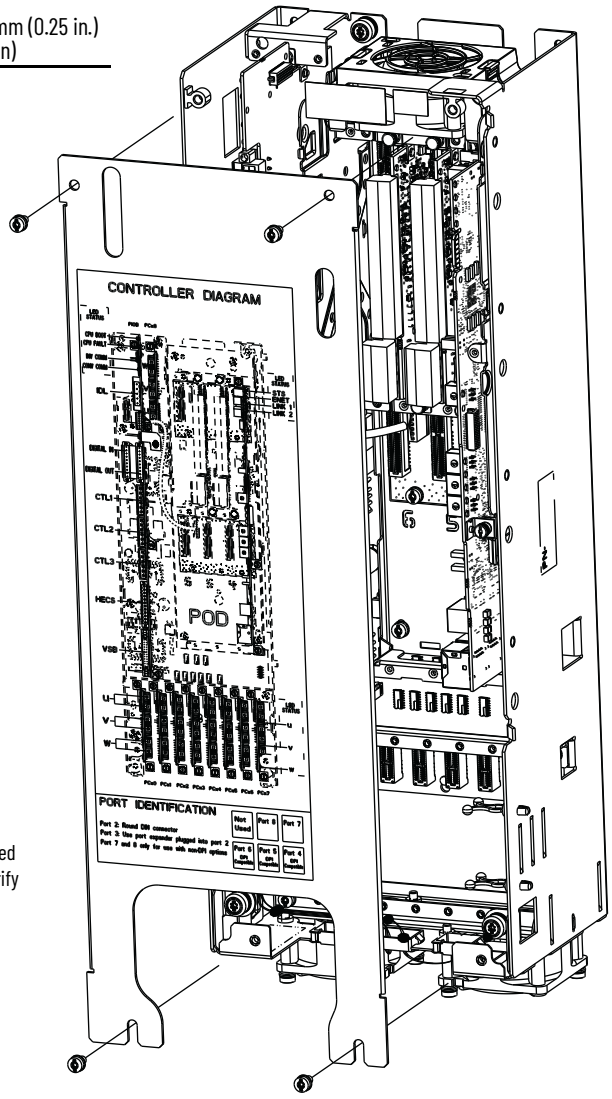
Follow these steps to remove the control pod cover.

1. Review the Product Advisories on page 11.
2. Remove power from the system. See Remove Power from the System on page 13.
3. Open the control bay enclosure door.
4. Loosen, but do not remove, the bottom two M4 x 8 mm slotted-torx screws that secure the cover to the assembly.

5. Remove the top two M4 x 8 mm slotted-torx screws that secure the cover to the assembly and remove the cover.

| | | |
|---|---|---|
| **4, 5** | | M4 x 8 mm<br>T20 or F - 6.4 mm (0.25 in.)<br>2.6 N•m (23 lb•in) |






The Control Pod is shown separated from the Control/Input Bay to clarify the instructions only.

6. To install the control pod cover, perform the operation in the reverse order of removal.

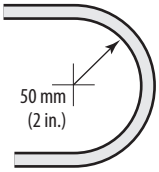
# Fiber Transceiver Circuit Board Replacement

Replace a fiber transceiver circuit board with kit part number PN-579788.

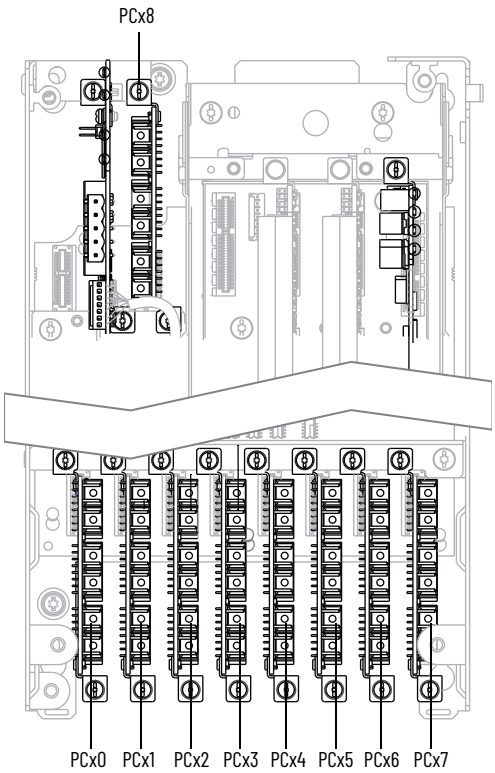
Follow these steps to replace the fiber transceiver circuit board.

1. Review the Product Advisories on page 11.
2. Remove power from the system. See Remove Power from the System on page 13.
3. Open the control bay enclosure door.
4. Remove the control pod cover. See Control Pod Cover Removal on page 50.
5. Remove the fiber-optic cables for the corresponding fiber transceiver circuit board from the cable management devices in the control pod.

**IMPORTANT** Minimum inside bend radius for fiber-optic cable is 50 mm (2 in.). Any bends with a shorter inside radius can permanently damage the fiber-optic cable. Signal attenuation increases as inside bend radius is decreased.

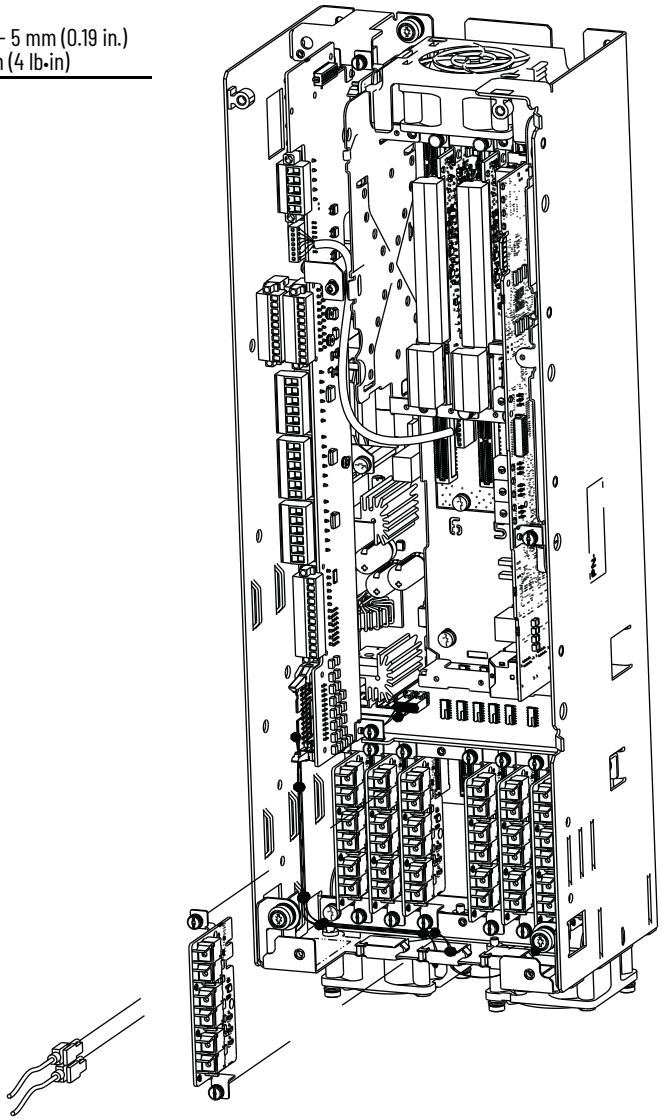



When all or many of the fiber-optic ports are used, it is easier to remove the fiber transceiver circuit boards from the pod before removing the fiber-optic cables. However, it is possible to remove the fiber-optic cables without removing the boards. This procedure assumes that all fiber-optic ports are used.



6. Loosen the two captive thumbscrews that secure the board and fiber-optic cables to the chassis and remove the board and cables.

| | | |
|---|---|---|
| 6 |  | –<br>T15 or F - 5 mm (0.19 in.)<br>0.45 N•m (4 lb•in) |



7. For each fiber-optic cable, remove the cable from the transceiver.
8. To install the fiber transceiver circuit board, perform the operation in the reverse order of removal.

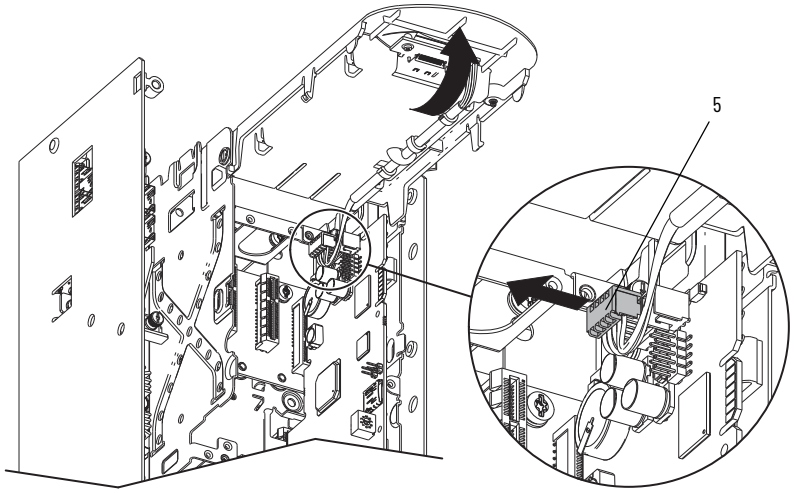
## Main Control Board Replacement

Replace a main control board (MCB) with kit part number PN-579785.

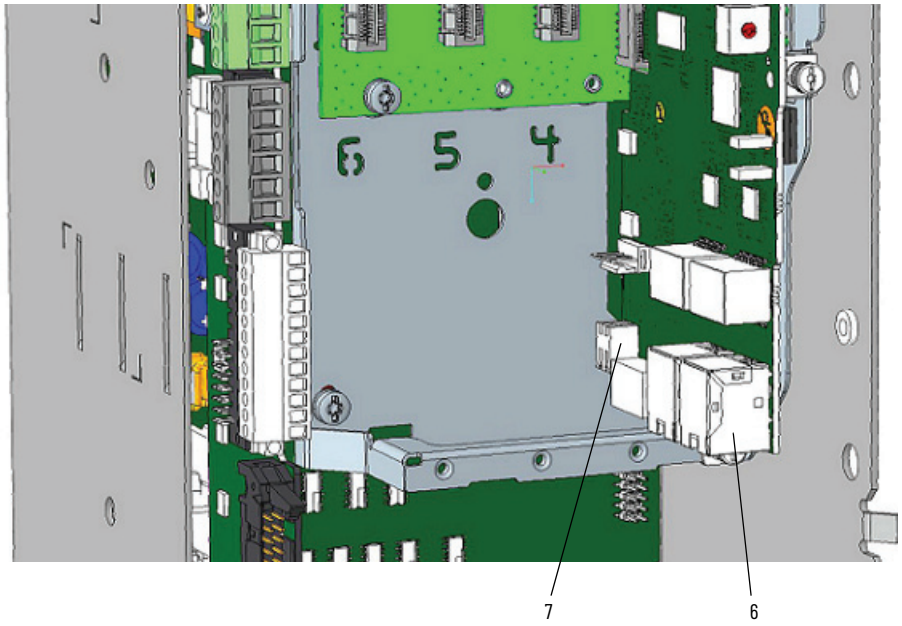
Follow these steps to replace the main control board.

1. Review the Product Advisories on page 11.
2. Remove power from the system. See Remove Power from the System on page 13.
3. Open the control bay enclosure door.
4. Remove the control pod cover. See Control Pod Cover Removal on page 50.

5. Remove the DPI™ cable from the port on the main control board if present.

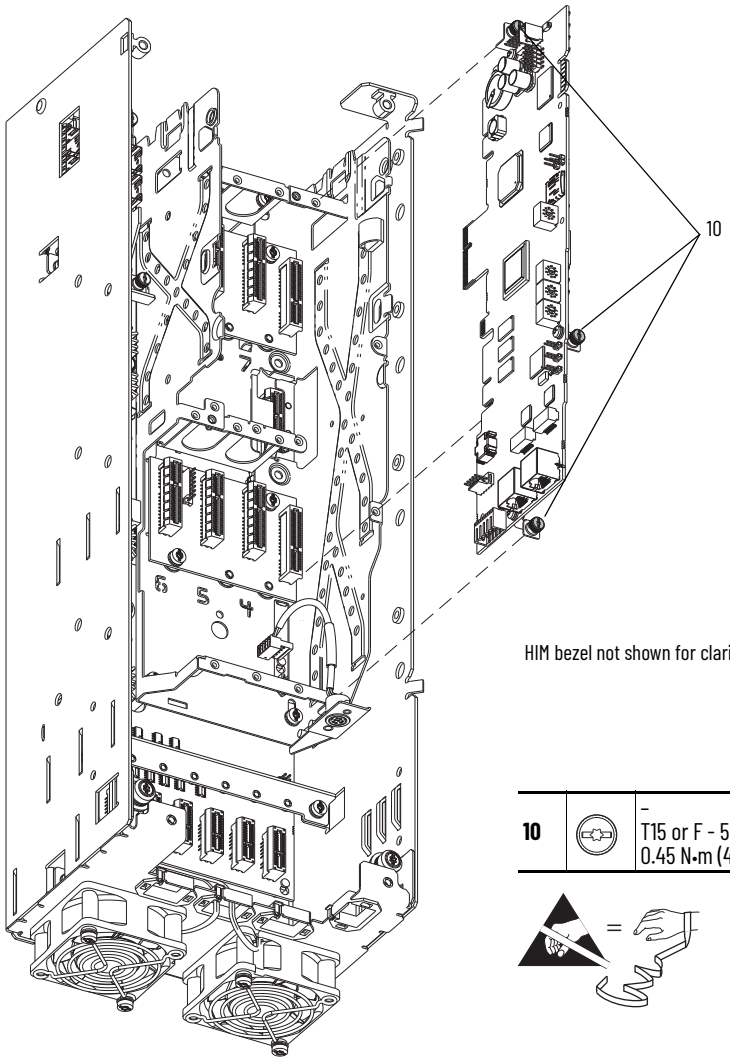



6. Disconnect any Ethernet cables from the ports on the bottom of the main control board.
7. Disconnect the plug-in terminal block (TB 1) on the bottom of the main control board.




8. Disconnect the plug-in terminal block P9 on the bottom of the main control board.
9. Disconnect the pod fan connector from the main control board.

10. Loosen the three captive thumbscrews that secure the main control board to the pod chassis and remove the board.




| | | |
|---|---|---|
| **10** | | –<br>T15 or F - 5 mm (0.19 in.)<br>0.45 N•m (4 lb•in) |

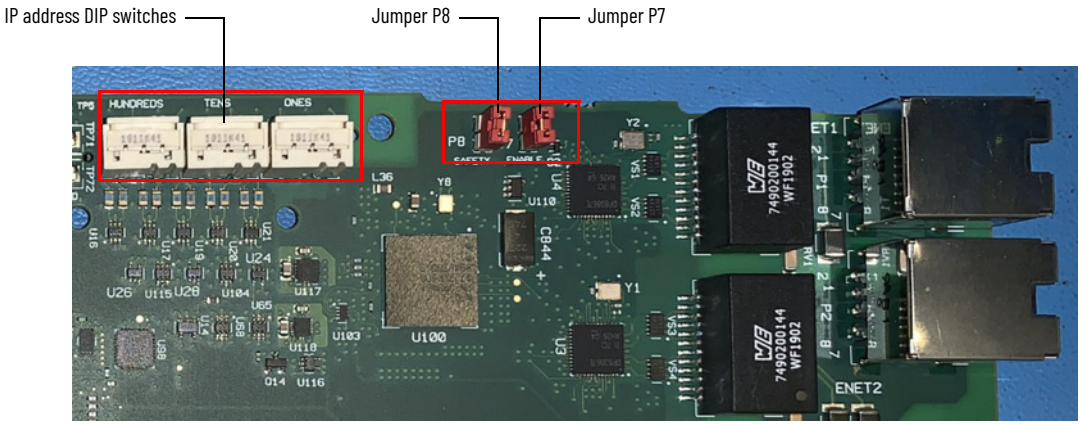
11. To install the main control board, perform the operation in the reverse order of removal. Check that the jumpers and switches are set the same as the board removed.

## Set Jumpers on MCB

Verify that the jumpers on the new main control board are set according to the following:

- Jumper P7 (MCB Input Disable) – Removed
- Jumper P8 (MCB Safety Enable) – Installed

**Figure 25 - Set MCB Jumpers**




## Set the IP Address

Set the IP address for the drive using the DIP switches on the main control board. (Figure 25). The main control board provides dual Ethernet ports and supports the Device Level Ring (DLR) network topology. For more information on how to configure the drive to use in a DLR network, see the PowerFlex Drives with TotalFORCE Control Built-in EtherNet/IP Adapter User Manual, publication 750COM-UM009.

**Table 7 - IP Address DIP Switches**

| Possible Settings | Description |
|---|---|
| 000, 255...887, 889...999 (1) | Use the value of parameter 0:300 [Net Addr Sel]:<br>• 1 = Parameters<br>– 0:302...0:305 [IP Addr Cfg 1...4]<br>– 0:306...0:309 [Subnet Cfg 1...4]<br>– 0:310...0:313 [Gateway Cfg 1...4]<br>• 2 = BOOTP<br>• 3 = DHCP |
| 001...254 | Use the value set by the DIP switches (192.168.1.***xxx***, where ***xxx*** = DIP switch settings). |
| 888 | Reset the IP address function to factory defaults.<br>This setting also resets most parameters to factory defaults on the drive. Afterwards, the drive must be powered down, the switches set to a value other than 888, and then the drive must be powered up again to accept the new IP address. |

(1) 999 is the default setting and disables the DIP switches.

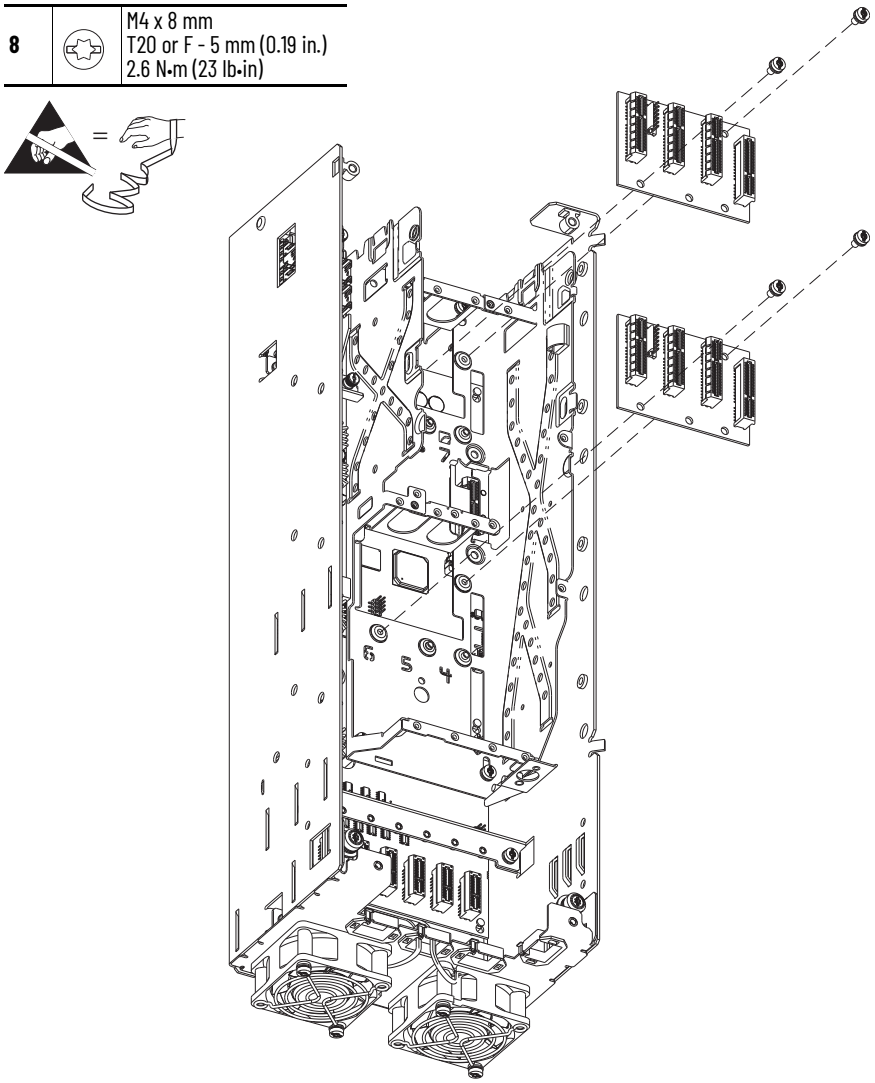
## Backplane Circuit Board Replacement

Replace a control pod backplane circuit board with kit catalog number SK-RM-PODBP1.

Follow these steps to replace the backplane circuit board.

1. Review the Product Advisories on page 11.
2. Remove power from the system. See Remove Power from the System on page 13.
3. Open the control bay enclosure door.
4. Remove the control pod cover. See Control Pod Cover Removal on page 50.
5. Remove the main control circuit board. See Main Control Board Replacement on page 53.
6. Remove the power cable from the backplane that goes to the Power I/O Board.
7. Disconnect and remove any option modules from the backplane circuit boards.
8. Remove the two M4 x 8 mm torx screws that secure the backplane circuit board to the pod chassis and remove the board.

| | | |
|---|---|---|
| **8** | | M4 x 8 mm<br>T20 or F - 5 mm (0.19 in.)<br>2.6 N•m (23 lb•in) |



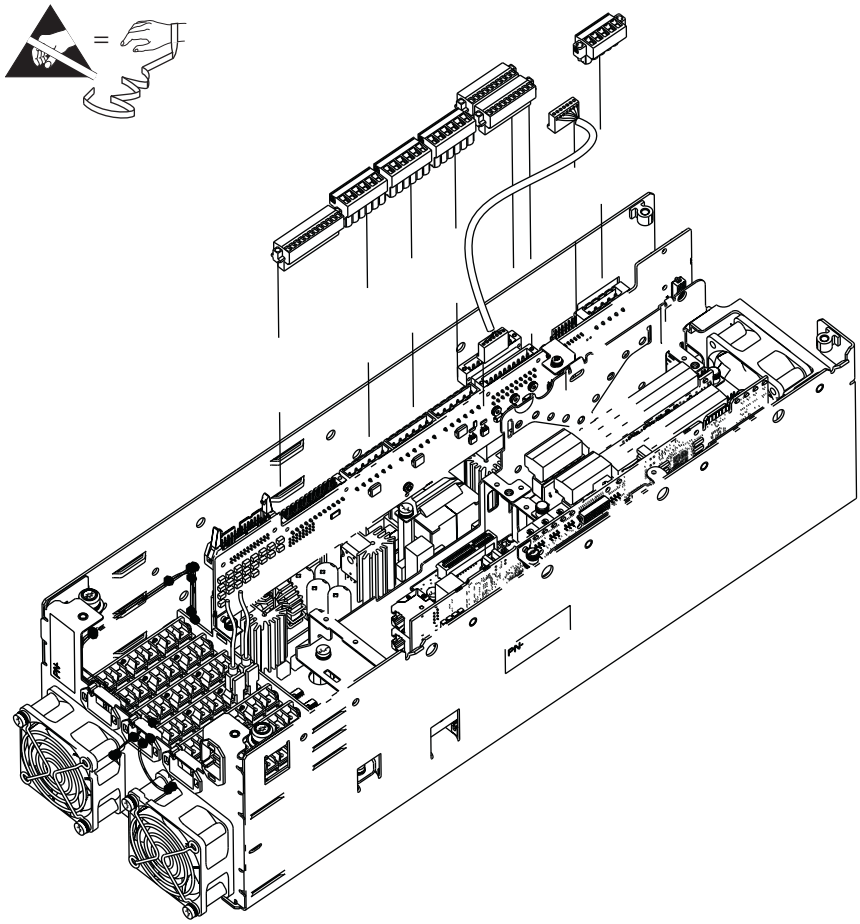
9. To install the backplane circuit board, perform the operation in the reverse order of removal.

# Power I/O Board Replacement

Replace a Power I/O board (PIOB) with kit part number PN-579786.

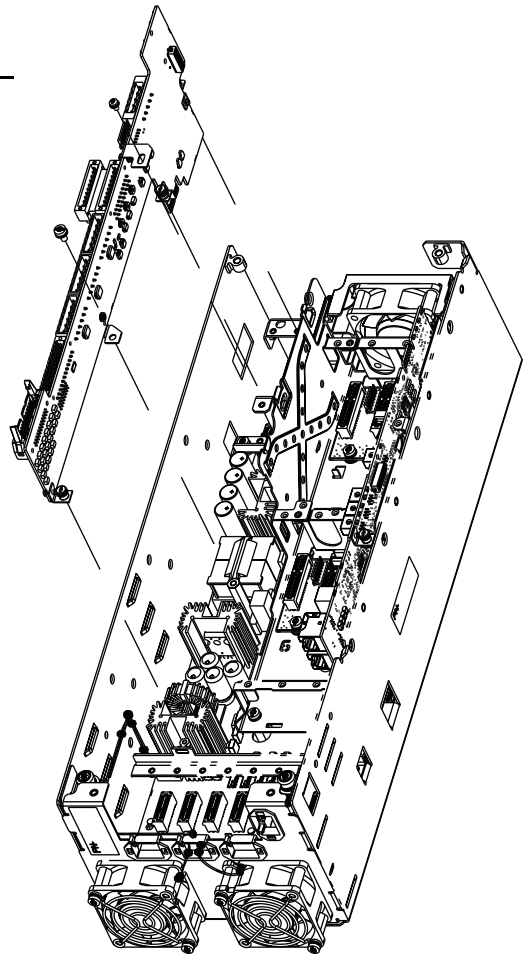
Follow these steps to replace the power I/O board.

1. Review the Product Advisories on page 11.
2. Remove power from the system. See Remove Power from the System on page 13.
3. Open the control bay enclosure door.
4. Remove the control pod cover. See Control Pod Cover Removal on page 50.
5. Disconnect all connectors from the power I/O board.



6. Loosen the three captive thumbscrews and remove the two loose screws that secure the power I/O board to the smart fiber interface circuit board.

| | | |
|---|---|---|
| **7** | | M4 x 8 mm<br>T20 or F - 5 mm (0.19 in.)<br>2.6 N•m (23 lb•in) |



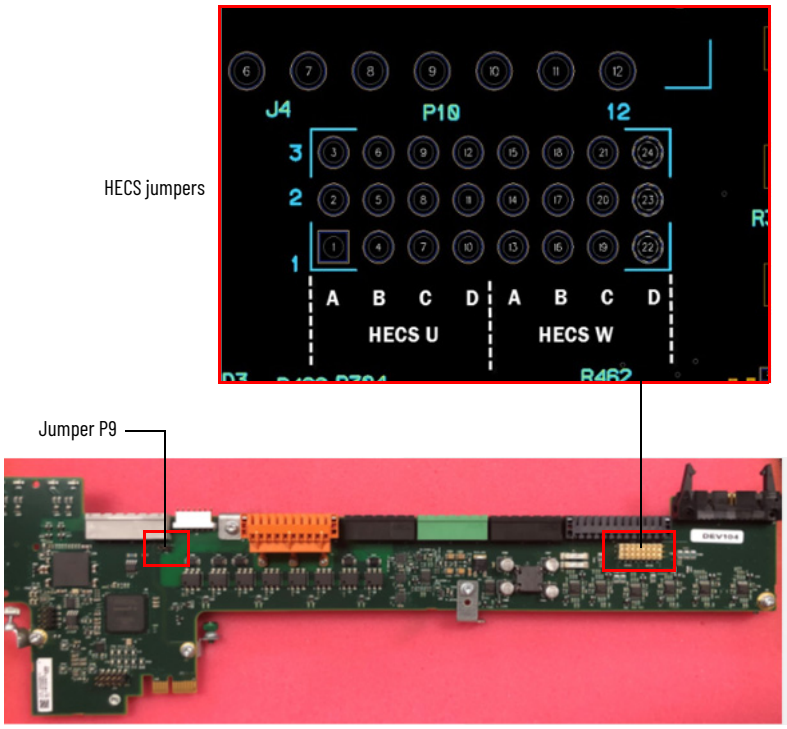
7. To install the power I/O board, perform the operation in the reverse order of removal.

## Set Jumpers on PIOB

Verify that the jumpers on the new power I/O board are set according to the following:

- Jumper P9 – Installed
- HECS Jumpers – Follow the setting on the previous power I/O board. If you encounter any issues, contact Rockwell Automation Customer Support and Maintenance for assistance.

**Figure 26 - Set PIOB Jumpers**



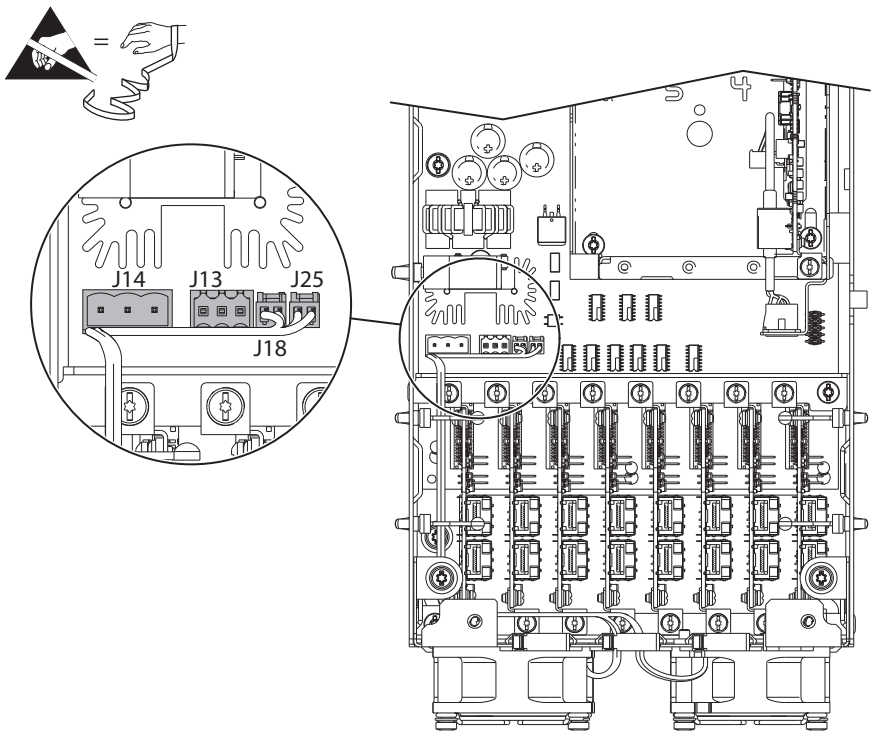

# Smart Fiber Interface Circuit Board Replacement

Replace a Smart Fiber interface circuit board with kit part number PN-579787.

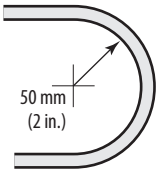
Follow these steps to replace the Smart Fiber interface circuit board.

1. Review the Product Advisories on page 11.
2. Remove power from the system. See Remove Power from the System on page 13.
3. Open the control bay enclosure door.
4. Remove the control pod cover. See Control Pod Cover Removal on page 50.
5. Disconnect connector P14 from connector J14 on the Smart Fiber interface circuit board.

6. Disconnect the two fan power supply connectors from connectors J18 and J25 on the Smart Fiber interface circuit board.




**IMPORTANT** Minimum inside bend radius for fiber-optic cable is 50 mm (2 in.). Any bends with a shorter inside radius can permanently damage the fiber-optic cable. Signal attenuation increases as inside bend radius is decreased.

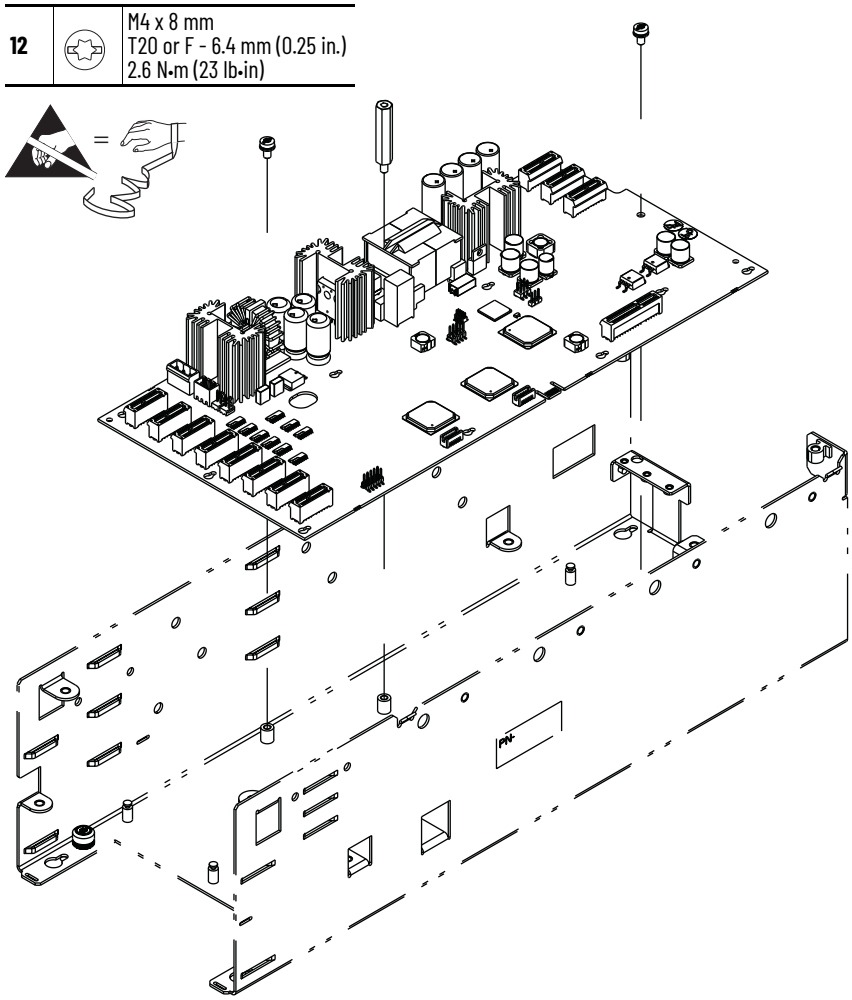



7. Remove the fiber-optic cables from the cable management devices in the control pod.
8. Remove the power I/O board. See Remove the Power I/O Board on page 58.
9. Remove the fiber transceiver circuit board. See Remove the Fiber Transceiver Circuit Board on page 52.
10. Remove the main control circuit board. See Main Control Board Replacement on page 53.
11. Remove the four M4 x 8 mm screws that secure the control pod chassis to the standoffs on the control panel, then remove control pod chassis.

**IMPORTANT** The four M4 x 8 mm screws that secure the control pod chassis to the control panel are not retentive. Take steps to be sure that the screws do not fall into the drive below.

12. Remove the three M4 x 8 mm long screws that secure the Smart Fiber interface circuit board to the control pod.
13. Move the Smart Fiber interface circuit board slightly upward toward top of the control pod, so that keyholes on board clear the mounting posts and lift off the board.

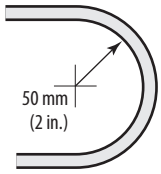
14. Rotate the left side of Smart Fiber interface circuit board away from the control pod so that the board clears the mounting tab on right sidewall of the control pod. Remove the board from the control pod.




15. To install the Smart Fiber interface circuit board, perform the operation in the reverse order of removal.

When installing the fiber-optic cables:

**IMPORTANT** Minimum inside bend radius for fiber-optic cable is 50 mm (2 in.). Any bends with a shorter inside radius can permanently damage the fiber-optic cable. Signal attenuation increases as inside bend radius is decreased.



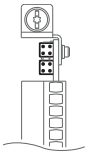
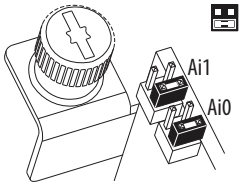
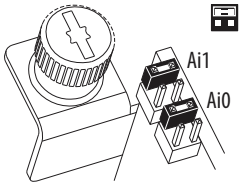

1. Without bending the cable to a radius less than 50 mm (2 in.), fully insert the fiber-optic cable into the transceiver.
2. Insert the transceiver and fiber-optic cable into the connector on the board, until you hear an audible 'click.'

## I/O Option Cards Settings

If you have installed an I/O option card (20-750-2262C-2R) in port 7 or 8, set the jumpers on the option card as follows:

- Port 7 – as needed
- Port 8 – Verify with the Electrical Drawings to determine the correct mode.
  - AI0 = Voltage Mode (Potentiometer)
  - AI1 = Current Mode (based on DCS speed reference selection)

**Table 8 - Input Mode Jumpers**

| Jumper Position | Voltage Mode | Current Mode |
|---|---|---|
|  |  |  |

For more information on the I/O option card, see the PowerFlex 750-Series I/O, Feedback, and Power Option Modules Installation Instructions, publication 750-IN111.

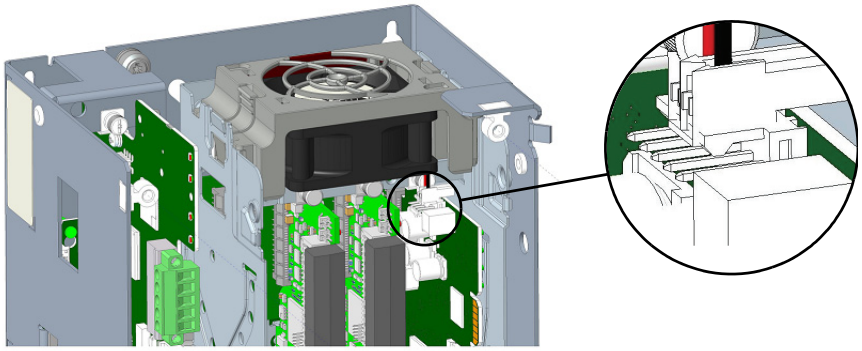
## Control Pod Fan Assembly Replacement

### Replace Upper Control Pod Fan Assembly

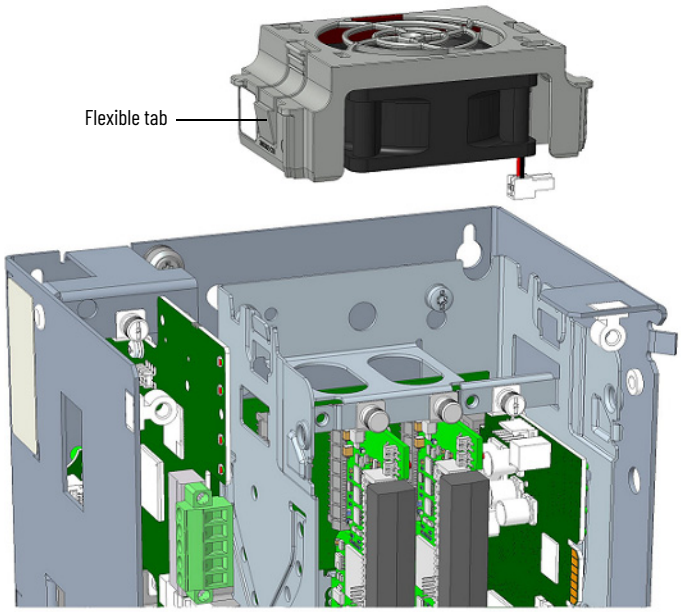
Replace the upper control pod fan assembly with kit part number PN-535604-R.

Follow these steps to replace the control pod fan assembly.

1. Review the Product Advisories on page 11.
2. Remove power from the system. See Remove Power from the System on page 13.
3. Open the control bay enclosure door.
4. Remove the control pod cover. See Control Pod Cover Removal on page 50.
5. Disconnect the fan power supply connector from the main control board.



6. Push the flexible tab at both sides of the fan assembly to unlock and remove it from the control pod.




7. To install the control pod fan assembly, perform the operation in the reverse order of removal.

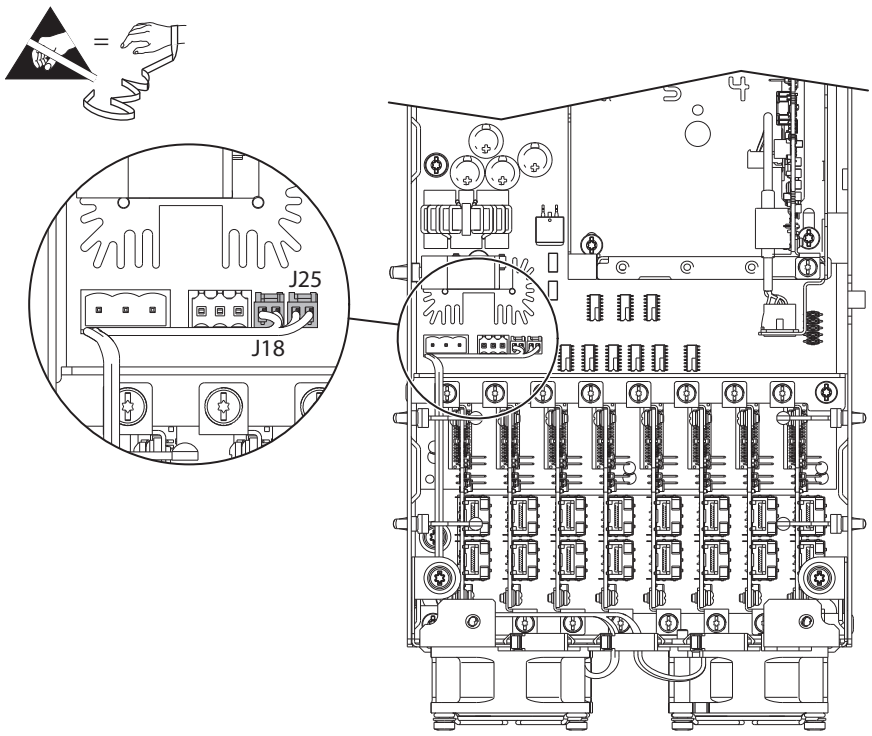
## Replace Lower Control Pod Fan Assembly

Replace the lower control pod fan assembly with kit catalog number SK-RM-PODFAN1-F8.

Follow these steps to replace the control pod fan assembly.

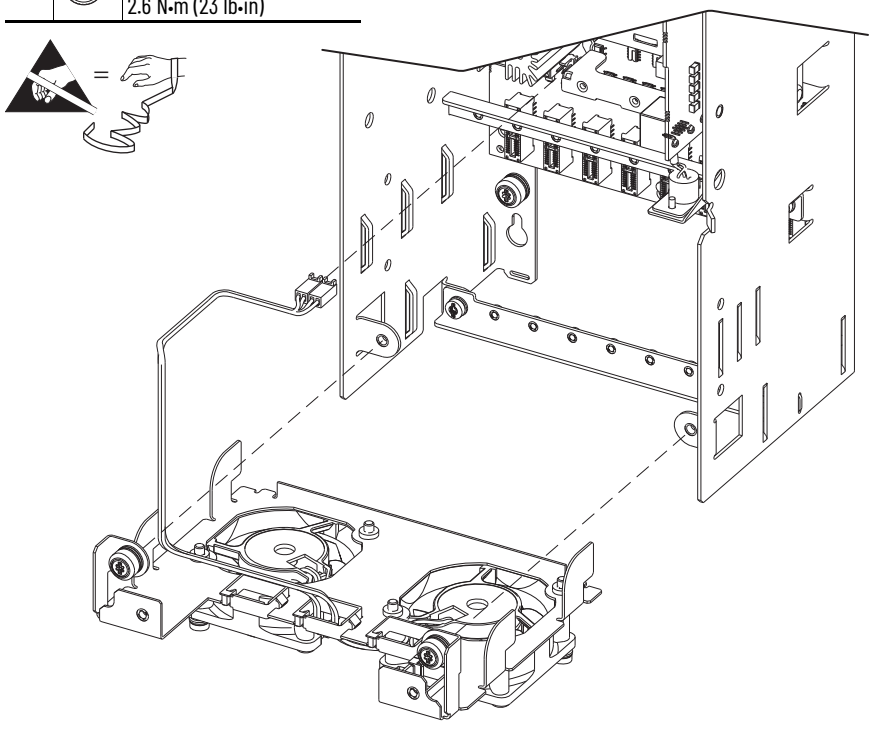
1. Review the Product Advisories on page 11.
2. Remove power from the system. See Remove Power from the System on page 13.
3. Open the control bay enclosure door.
4. Remove the control pod cover. See Control Pod Cover Removal on page 50.
5. Disconnect the two fan power supply connectors from connectors J18 and J25 on the fiber-optic interface board.

6. Remove the harness from the cable supports on the side of the pod chassis.




7. Loosen the two captive thumbscrews on the fan assembly and pull the assembly out and off the pod chassis.

| | | |
|---|---|---|
| **7** | | –<br>T20 or F - 6.4 mm (0.25 in.)<br>2.6 N•m (23 lb•in) |



8. To install the control pod fan assembly, perform the operation in the reverse order of removal.

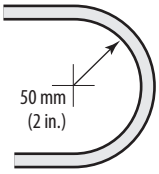
# Control Pod Replacement

Replace the control pod assembly with kit part number PN-579789.

Follow these steps to replace the control pod.

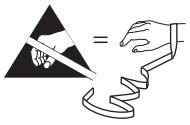
1. Review the Product Advisories on page 11.
2. Remove power from the system. See Remove Power from the System on page 13.
3. Open the control bay enclosure door.
4. Remove the control pod cover. See Control Pod Cover Removal on page 50.

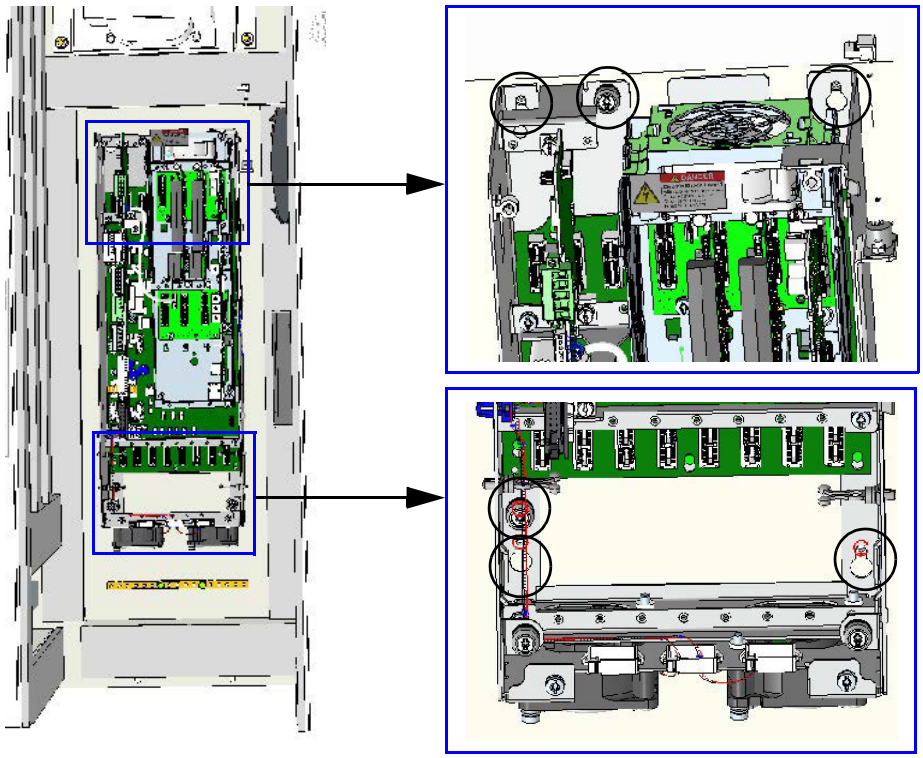
**IMPORTANT** Minimum inside bend radius for fiber-optic cable is 50 mm (2 in.). Any bends with a shorter inside radius can permanently damage the fiber-optic cable. Signal attenuation increases as inside bend radius is decreased.



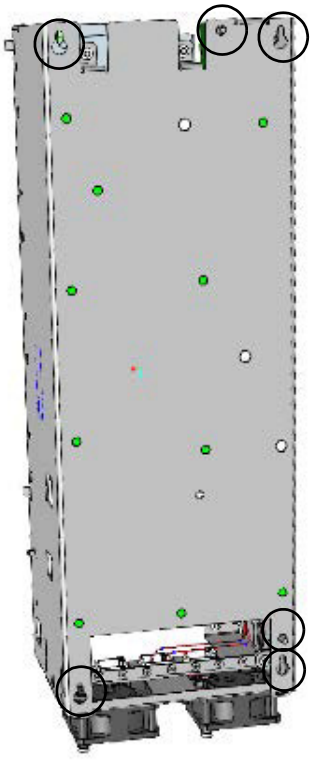

5. Remove the fiber-optic cables from the cable management devices in the control pod.
6. Remove the fiber transceiver circuit board. See Remove the Fiber Transceiver Circuit Board on page 52.
7. Unplug all cable harnesses to the main control board, control pod option cards, power I/O board, and smart fiber interface board.
8. Loosen the six M4 x 8 mm torx screws that secure the pod chassis to the back panel.

| | | |
|---|---|---|
| **8** | | M4 x 8 mm<br>T20 or F - 5 mm (0.19 in.)<br>2.6 N•m (23 lb•in) |

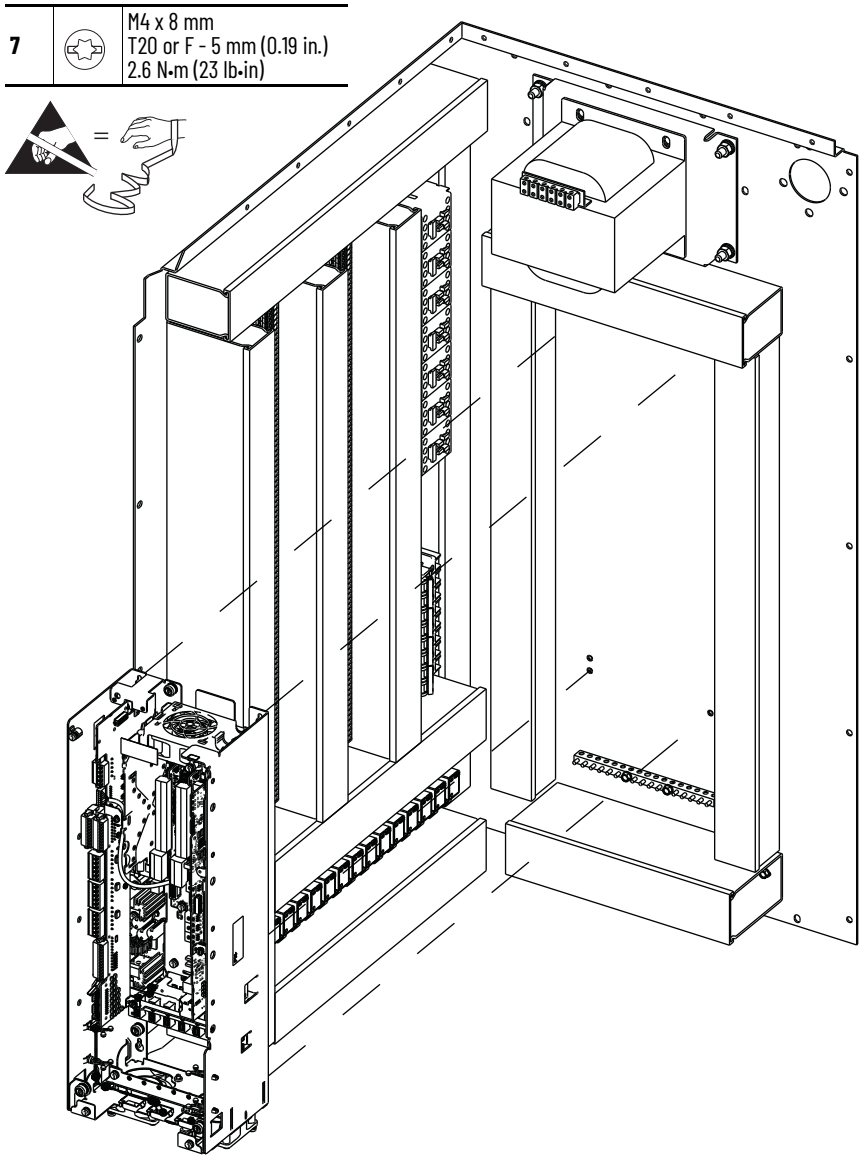




Rear view of screw locations



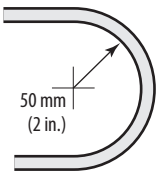
9. Slide the pod up, so that the keyholes on the pod clear the mounting screws, and remove the control pod.




10. To install the control pod, perform the operation in the reverse order of removal.

When installing the fiber-optic cables:

**IMPORTANT** Minimum inside bend radius for fiber-optic cable is 50 mm (2 in.). Any bends with a shorter inside radius can permanently damage the fiber-optic cable. Signal attenuation increases as inside bend radius is decreased.




1. Without bending the cable to a radius less than 50 mm (2 in.), fully insert the fiber-optic cable into the transceiver.
2. Insert the transceiver and fiber-optic cable into the connector on the board, until you hear an audible 'click.'

## Inspect the Integrated Touch Screen Display

1. Verify the input and output cables and communication cables are hand-tight.
2. Power up the integrated touch screen display.
3. Verify that the integrated touch screen display is operating normally.

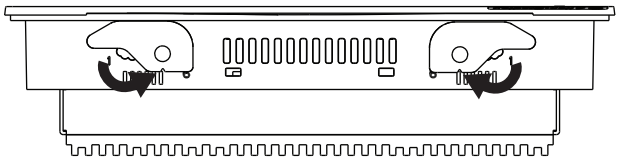
## Replace the Integrated Touch Screen Display

**ATTENTION:** Always perform Power Lockout procedure before servicing equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury, or death.

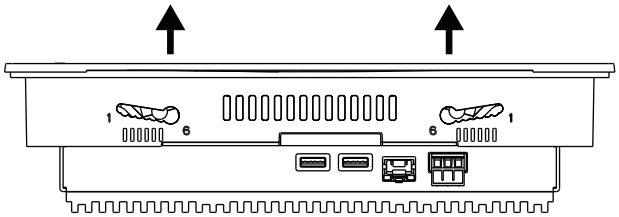
### Remove Existing Integrated Touch Screen Display from the Panel

Follow these steps to remove the display from the panel.

1. Disconnect power to the display.
2. Disconnect network cable from the display.
3. Release the mounting levers by rotating them in the direction indicated, slide them to the bottom of the mounting slot, and remove.



4. Grip the sides of the display and gently pull the display out of the panel opening.



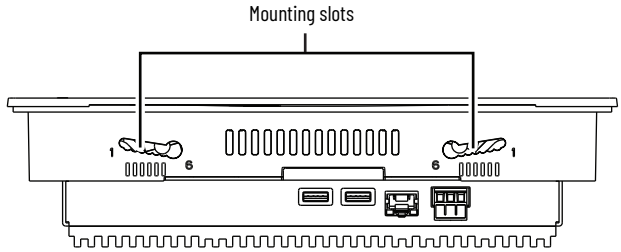

### Mount the Integrated Touch Screen Display in the Panel

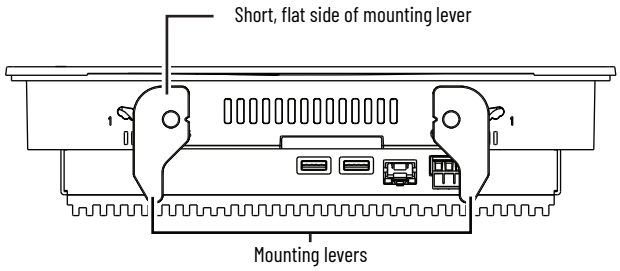
1. Make sure that the sealing gasket is properly positioned on the integrated touch screen display.

This gasket forms a compression type seal. Do not use sealing compounds.


2. Place the integrated touch screen display in the panel opening.
3. Install all mounting levers in the mounting slots on the integrated touch screen display.

   Slide each level until the short, flat side of the lever touches the surface of the panel.

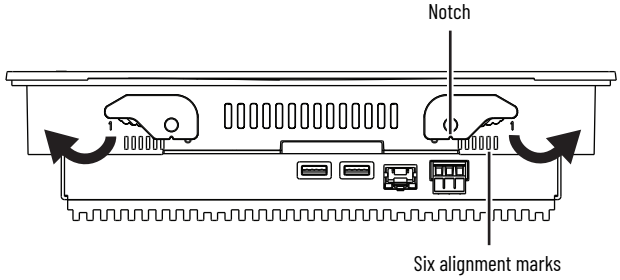


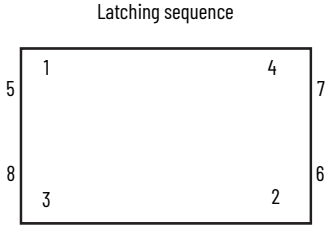




4. When all levers are in place, slide each lever and additional notch or tow until you hear a click.
5. Rotate each lever in the direction indicated until it is in the final latch position.

   Follow the latching sequence for the optimum fit.

Rotate until notch in lever aligns with proper alignment mark.



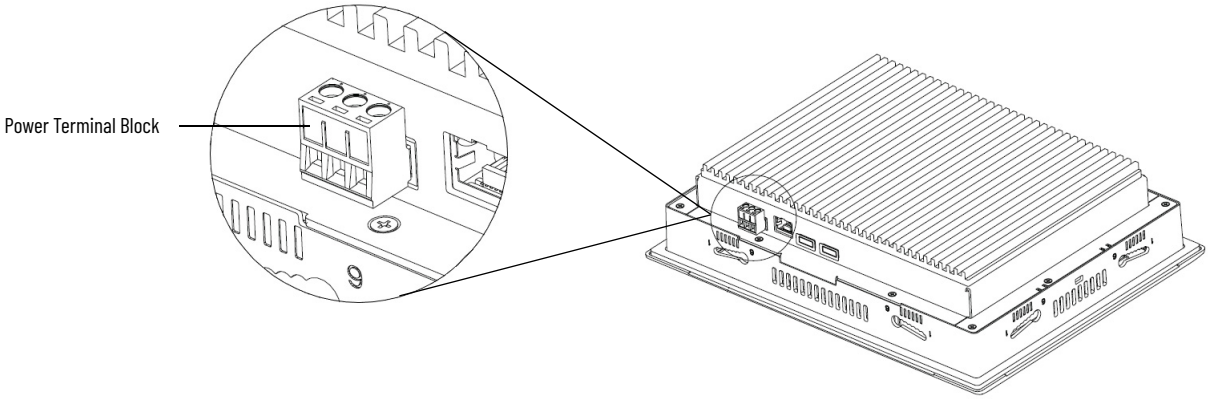
6. Reconnect all cables in reverse order of removal.

## Remove the Power Terminal Block

The integrated touch screen display ships with a power terminal block installed. You can remove the power terminal block for ease of installation, wiring, and maintenance.

Follow these steps to remove the terminal block.

1. Insert the tip of a small, flat-blade, screwdriver into the terminal block access slot.
2. Gently pry the terminal block away from the display to release the locking mechanism.




Follow these steps to replace the terminal block.

1. Press the terminal block base in first with the block leaning outward.
2. Gently push the top of the terminal block back to a vertical position to snap in the locking tab.

## Connect Power

Follow these steps to connect power.

1. Verify that the display is not connected to a power source.
2. Secure the 24V DC power wires to the terminal block.
3. Secure the functional earth ground wire to the functional earth ground terminal screw on the terminal block.
4. Apply 24V DC power to the terminal.

## Ground the Display

Integrated touch screen displays have a functional earth terminal that you must connect to a low-impedance earth ground. The functional earth connection is on the power input terminal block. The negative power terminal is not internally connected to earth ground.

# Isolation Transformer Cabinet



**ATTENTION:** Wait at least 15 minutes for the stored energy to discharge fully before performing maintenance on the Isolation Transformer cabinet. Failure to do so may result in severe burns, injury, or death.

## Inspect Isolation Transformer

1. Verify that the fan is rotating in the proper direction.
2. Verify the incoming and outgoing power cable connections are torqued to specifications. See Torque Requirements on page 16.
3. Check the cabinet interior and Isolation Transformer windings and remove any foreign material. Vacuum dust or debris from the Isolation Transformer cabinet.
4. Check for any physical evidence of damage or degradation of components.

## Inspect/Replace Voltage Sensing Board

Replace a voltage sensing board with kit part number PN-569153.

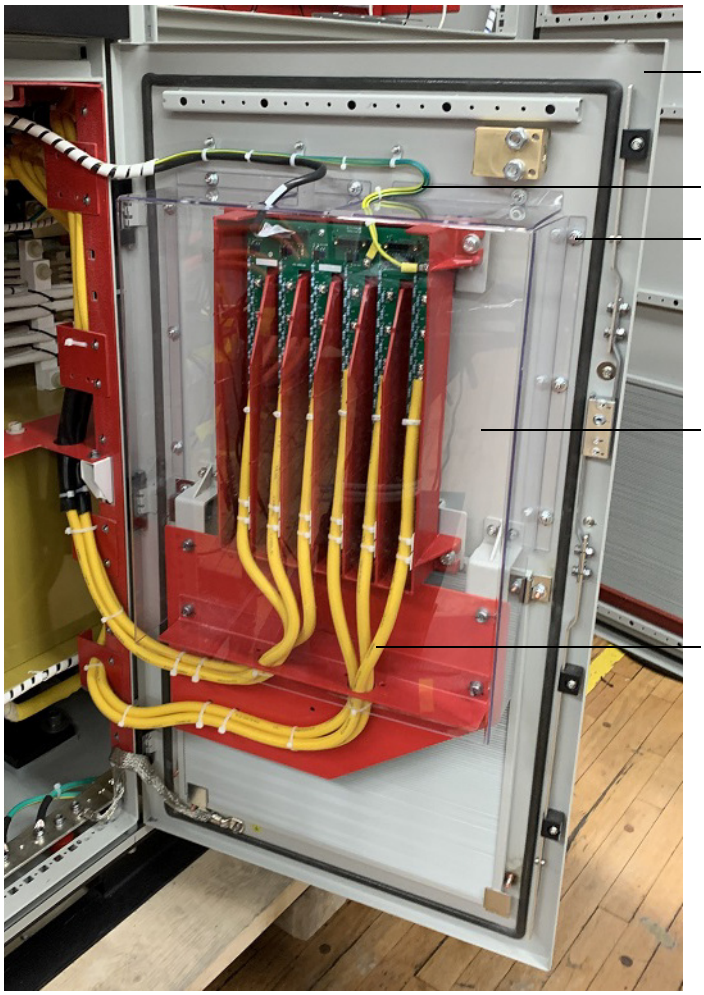
The VSB cable connections and wire connectors must be firmly fastened and show no signs of damage or accumulation of dirt, dust, or debris.

**ATTENTION:** To prevent electrical shock, disconnect the main power before working on the Voltage Sensing Board. Verify that all circuits are voltage-free, using a hot stick or appropriate high voltage-measuring device. Failure to do so may result in injury or death.

### Replace Voltage Sensing Board (A-frame)

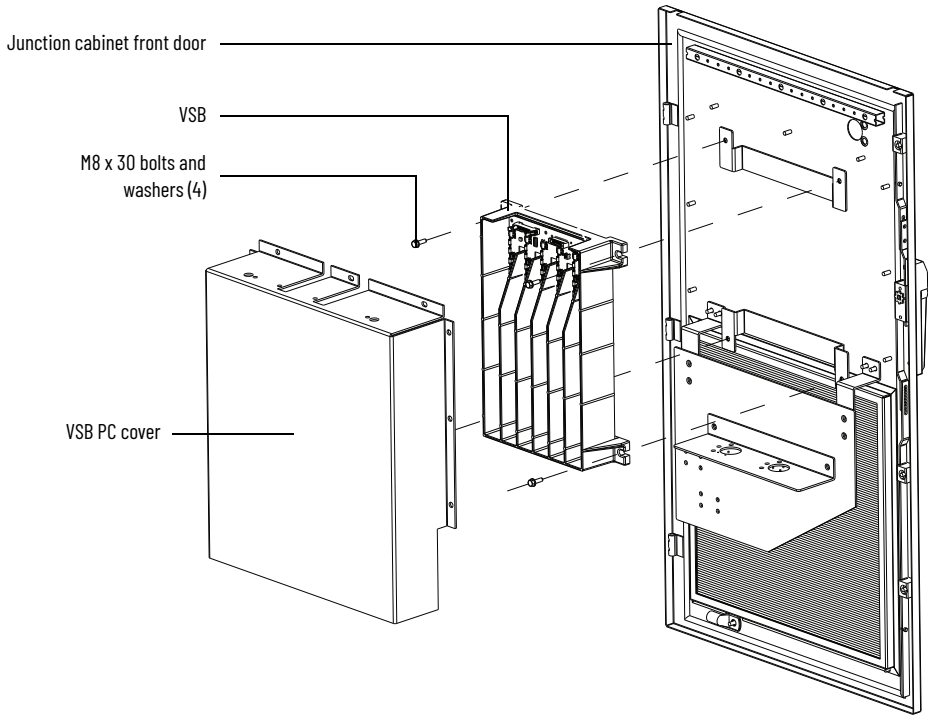
1. Open the front door of the Junction cabinet.

2. Remove and retain the nine M6 nuts, D6 washers, and D6 lock washers that secure the VSB PC cover, and remove the cover.




3. Remove the six medium voltage cables, one ribbon cable, and two grounds.
4. Remove and retain the four M8 x 30 bolts and washers that secure the VSB, and remove the VSB.

5. Install the new VSB in the reverse order of removal.




## Inspect/Replace HECS

There are three current sensors that are located inside the Isolation Transformer cabinet. Verify that the current sensor wire connector is properly seated. Check for obvious signs of damage.

**ATTENTION:** To prevent electrical shock, disconnect the main power before working on the drive. Verify that all circuits are voltage-free, using a hot stick or appropriate high voltage-measuring device. Failure to do so may result in injury or death.

1. Unplug the Current Sensor Connector from the HECS.

**Figure 27 - HECS for A-frame**

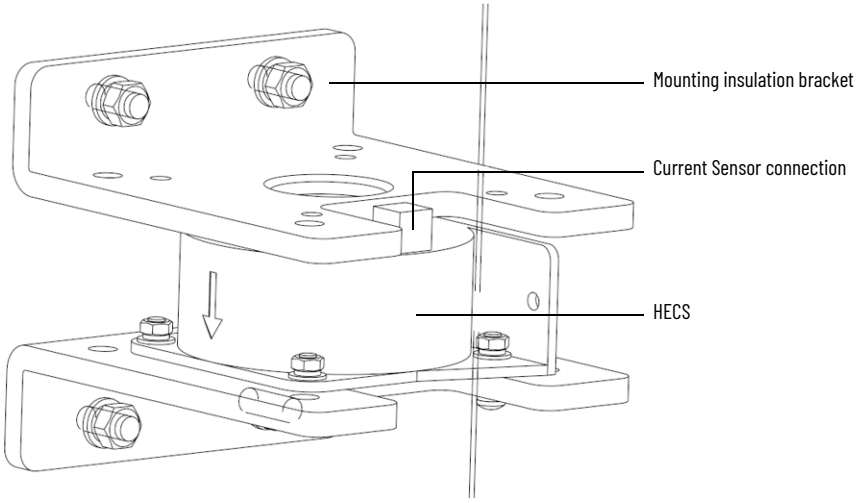
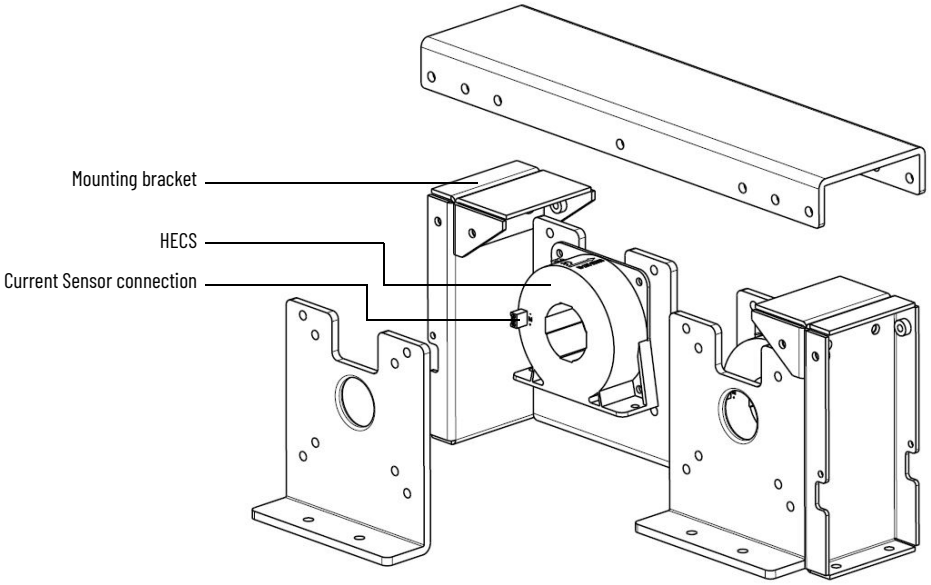


**Figure 28 - HECS for B-frame**




2. Disconnect one end of the power cable that goes through the HECS from the power cell.
3. Remove the Mounting Bracket with the HECS still attached.
4. Remove and retain hardware connecting the HECS to the Mounting Bracket.

**IMPORTANT** Note the orientation of the HECS on the bracket. The new HECS must be installed facing the same direction.

**Figure 29 - Exploded view of the HECS and Mounting Bracket for A-frame**

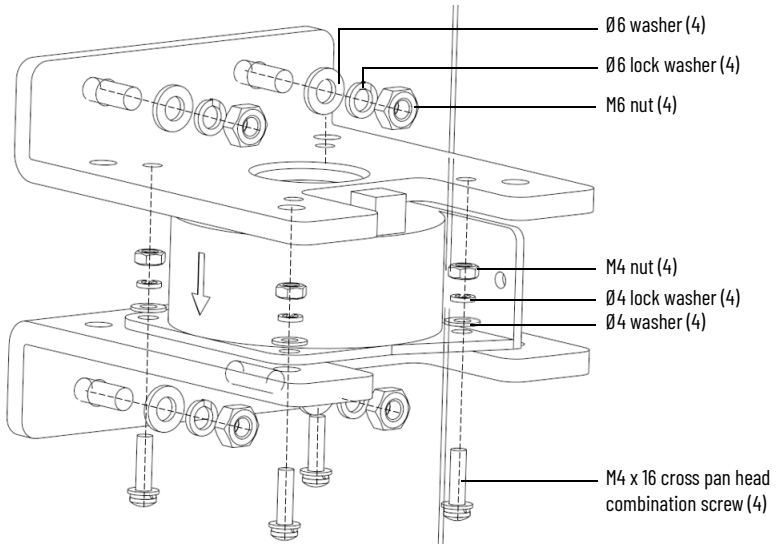
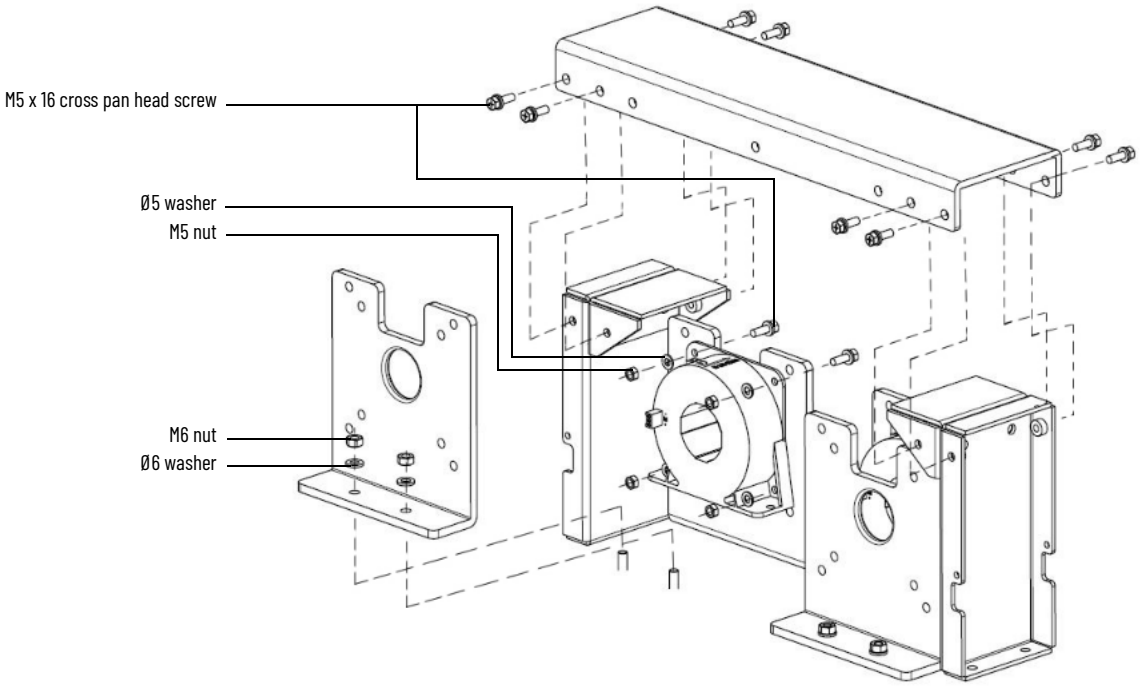


**Figure 30 - Exploded view of the HECS and Mounting Bracket for B-frame**




5. Install the HECS on the Mounting Bracket using the existing hardware.

**ATTENTION:** Verify that the current sampling direction is correct. This is indicated by an arrow symbol on the top of the HECS.

6. Install the Mounting Bracket to the cabinet using existing hardware.
7. Reroute the power cable through the HECS and reattach to the power cell.

## Notes:

# Power Cell Cabinet



## Inspect Power Cells

1. Inspect the power connections for loose connections or any evidence of discoloration of connections from heating.
2. Remove dust or debris from all ventilation openings on the power cell.
3. Inspect the electrolytic capacitors, which are located in the ventilation openings of the power cell.
   a. Inspect for signs of discoloration, odor, or leakage.
   b. Replace power cells if the capacitors have discoloration, odor, or leakage.

## Replace Power Cell

Some power cell output ratings may come with either two or three fuses. When replacing a power cell, always replace with a similar power cell for your specific configuration.

**Table 9 - Power Cell Specifications**

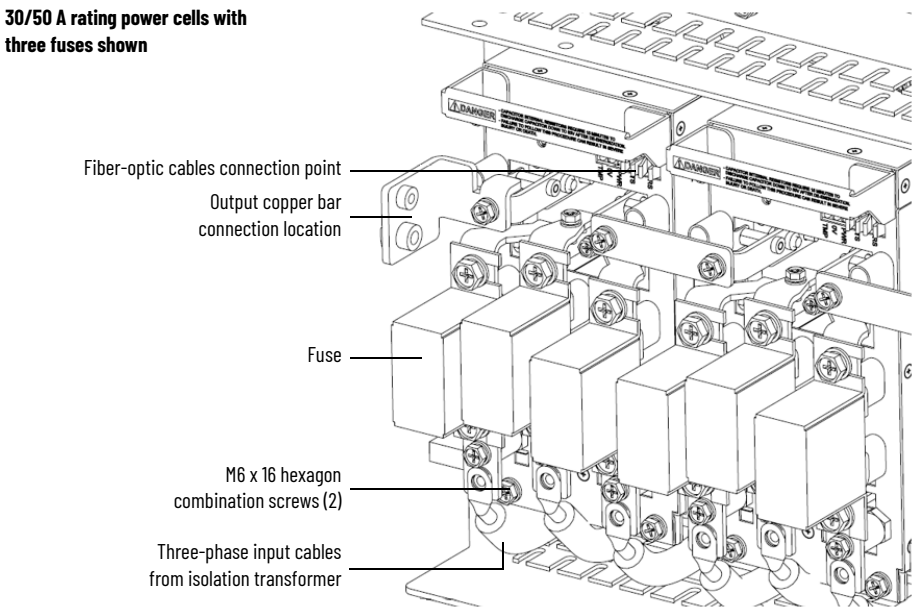
| Frame | Output Rating (Amps) | Dimensions (HxWxD) approx | Weight approx |
|---|---|---|---|
| A-frame | 36...70 A | 210 x 110 x 569 mm (8.3 x 4.3 x 22.4 in.) | 13 kg (28.6 lb) |
| | 71...140 A | 210 x 190 x 624.5 mm (8.3 x 7.5 x 24.6 in) | 25 kg (55 lb) |
| | 141...215 A | 210 x 215 x 674 mm (8.3 x 8.5 x 26.5 in) | 35 kg (77 lb) |
| B-frame | 201...305 A | 552.5 x 244.5 x 663 mm (21.8 x 9.6 x 26.1 in.) | 70 kg (154 lb) |
| | 351...680 A | 471 x 354 x 746 mm (18.5 x 13.9 x 29.4 in.) | 95 kg (209 lb) |

**ATTENTION:** At least two people are required to handle the power cells.

**ATTENTION:** The high-voltage power source must be switched off before replacing a power cell. Wait at least 15 minutes before opening the cabinet doors. Verify that all circuits are voltage-free, using a hot stick or appropriate high voltage-measuring device. Failure to do so may result in injury or death.

1. Remove the mounting bolts (M6 x 20) from both sides of the power cell.
2. Disconnect the three-phase input power cables.

**Figure 31 - Power Cell Component Location**




3. Remove the output copper bars that connect adjacent power cells (Figure 32).

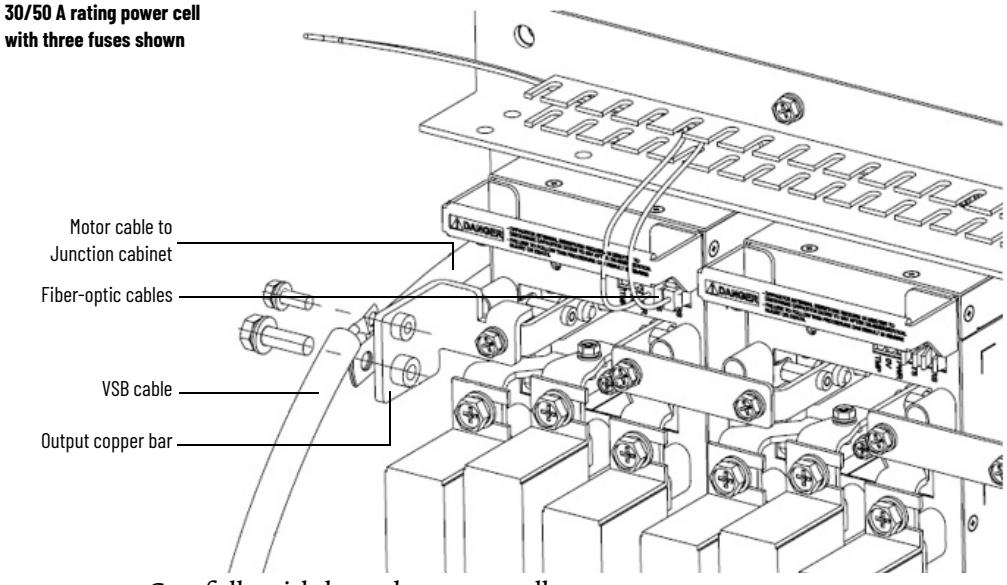
   If the power cell is at the end of a row, remove the VSB and motor cable instead of an output copper bus.

4. Disconnect the fiber-optic cables.

**ATTENTION:** When removing the fiber-optic cables, be careful to prevent the cables from straining or crimping as the resulting loss in light transmission will impact performance.

**ATTENTION:** Minimum bend radius that is permitted for the fiber-optic cables is 50 mm (2.0 in.). Any bends with a shorter inside radius can permanently damage the fiber-optic cable.

**Figure 32 - Close up of Fiber-optic Cable Location and Power Cables**




5. Carefully withdraw the power cell.

## Install the Power Cell

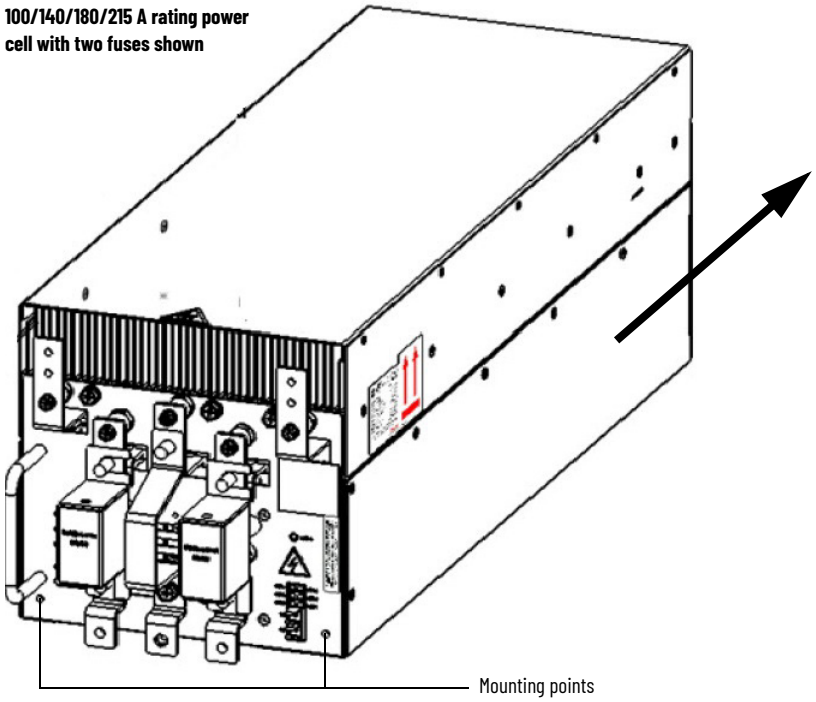
**ATTENTION:** Do not use the front-mounted positioning handles for lifting the power cells. They are designed to position or withdraw the power cell when on the tray assembly.

**ATTENTION:** The power cell finger assemblies must be fully seated on the cabinet stab assemblies.

**IMPORTANT** The power cell should be handled carefully. After removing the packaging, inspect the power cell to confirm that there is no damage and moisture.

*For A-frame Drives*

For A-frame drives, install the new power cell in reverse order of removal.



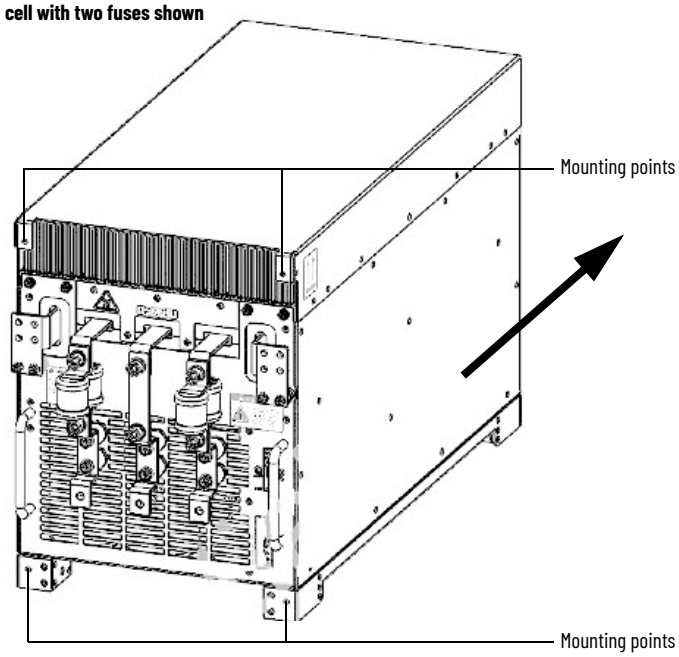

*For B-frame Drives*

For B-frame drives, follow these steps to install the power cell.

1. You can use the lift cart to move and position the power cell to the appropriate location in the cabinet. For more information on how to use the lift cart, see page 80.
2. Push the power cell slowly along the guide rails until it cannot be pushed in further.

3. After installing the power cell in place, use the mounting brackets and the M6 × 16 large flat pad galvanized nickel screws to fix the four corners, as shown in the following illustration.

**438/560/680 A rating power cell with two fuses shown**



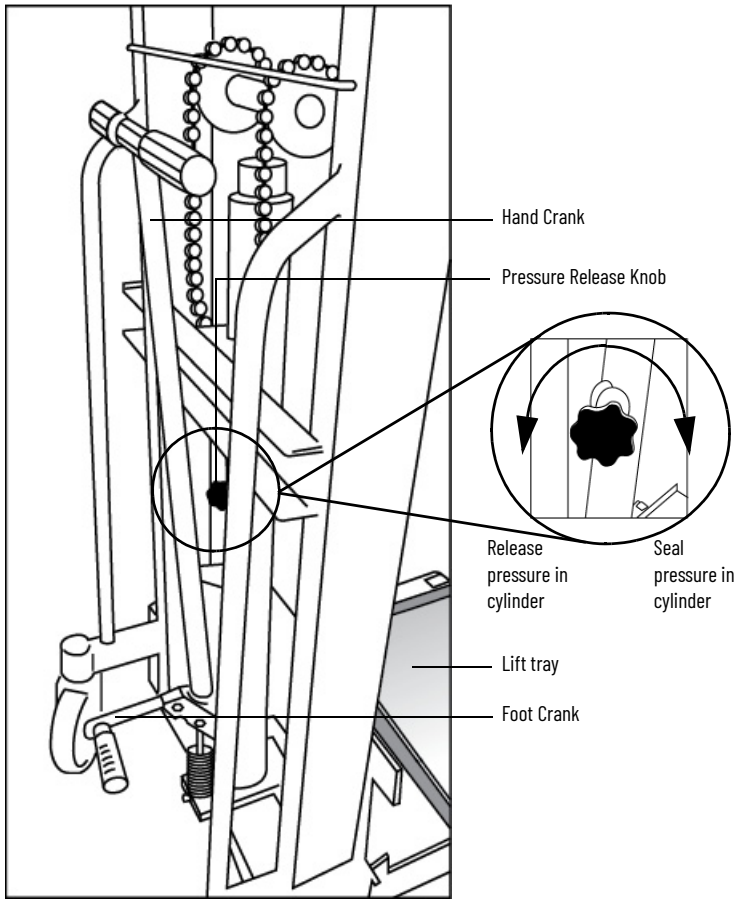

## Using the Lift Cart

Power cells that are rated above 350 A are shipped separately, therefore site installation and cable connection is needed. In this case, a lift cart is supplied for power cell replacement.

**ATTENTION:** Only authorized personnel should operate the lift cart. Keep hands and feet away from the lifting mechanism. Do not stand under the lift tray when in use. Store the lift cart with the tray fully lowered.

The lift cart's hydraulic cylinder can be operated by either a hand or foot crank. The lifting capacity is 400 kg (882 lb).

**Figure 33 - Lift Cart Procedure**




1. Check the lift tray before use to verify that the tray can be raised and lowered smoothly.
2. Rotate the Pressure Release Knob counterclockwise to verify that the tray is in the lowest position.
3. Move the power cell on the tray and lift the module to the appropriate height using the Foot Crank and complete the installation.

   The Foot Crank raises the lift tray faster than the Hand Crank. Use this to raise the power cell to just below the tray assembly in the drive. Use the Hand Crank for final precise positioning.
4. Rotate the Pressure Release Knob counterclockwise to lower the tray to its original position.
5. Repeat steps 1...4 to complete the installation for all power cells.

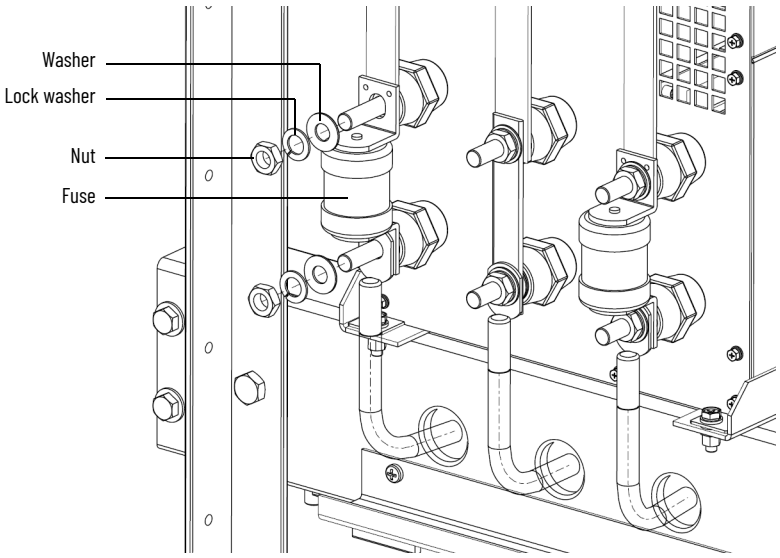
## Replace Power Cell Fuses

Follow these steps to replace the fuses on a power cell.

**ATTENTION:** Verify that the input circuit breaker feeding the drive is open. Lockout and tagout the input circuit breaker before performing any work on the drive or bypass units.

1. Remove the nut, lock washer, and washer from the top and bottom of the fuse.
2. Remove the cables from the top and bottom of the fuse, and remove another washer.
3. Install the new fuse, and replace cables and hardware in reverse order of removal.
4. Torque all hardware to specifications. See Torque Requirements on page 16.

**Figure 34 - Replace Power Cell Fuse Example**



# Inspect Connections



## Inspect LV Component Terminal and Plug-in Connections

All LV control connections must be secure. Check for dirt, debris, or foreign material, and clean with anti-static cloth if necessary.

Check relays, contactors, timers, terminal connectors, circuit breakers, ribbon cables, control wires, and so on. Check for corrosion, excessive temperature, or contamination. Clean all components with a vacuum cleaner.

## Inspect Medium Voltage Cable Connections

Verify that all MV power cable connections and grounding cables are torqued to specification. Apply torque sealer where necessary. Check for corrosion, excessive temperature, or contamination.

## Inspect Power Cable and Control Wire Terminals

Loose connections in power circuits can cause overheating that can lead to equipment malfunction or failure. Loose connections in control circuits can cause control malfunctions. Loose bonding or grounding connections can increase hazards of electrical shock and contribute to electromagnetic interference (EMI). Check the tightness of all terminals and busbar connections and tighten securely any loose connections. Replace any parts or wiring that is damaged by overheating, and any broken wires or bonding straps. See the User Manual for torque values that are required for power cable and bus hardware connections.

## Inspect Transformer Secondary Windings

Check the Incoming Line Power Cable connections (L1, L2, and L3), the Outgoing Motor Power Cable connections (U, V, W), and the Isolation Transformer Power Cable connections are torqued to specifications.

Inspect the busbars and cable connections. Check for any signs of overheating / discoloration and tighten the bus connections to the required torque specifications. Clean all cables and busbars that exhibit dust build-up. Check for corrosion, excessive temperature, or contamination.

## Inspect Power Cell Input and Output Power Connections

Verify that all power cell input line cables and output bus connections are properly torqued. Verify that the output cables, VSB Cables, and star connection cables are properly torqued. Apply torque sealer if necessary. Check for corrosion, excessive temperature, or contamination.

## M



## P



## R



## S



## T



## U



## V

## Rockwell Automation Support

Use these resources to access support information.

| | | |
|---|---|---|
| **Technical Support Center** | Find help with how-to videos, FAQs, chat, user forums, and product notification updates. | rok.auto/support |
| **Knowledgebase** | Access Knowledgebase articles. | rok.auto/knowledgebase |
| **Local Technical Support Phone Numbers** | Locate the telephone number for your country. | rok.auto/phonesupport |
| **Literature Library** | Find installation instructions, manuals, brochures, and technical data publications. | rok.auto/literature |
| **Product Compatibility and Download Center (PCDC)** | Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes. | rok.auto/pcdc |

## Documentation Feedback

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## Waste Electrical and Electronic Equipment (WEEE)

At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental compliance information on its website at rok.auto/pec.



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