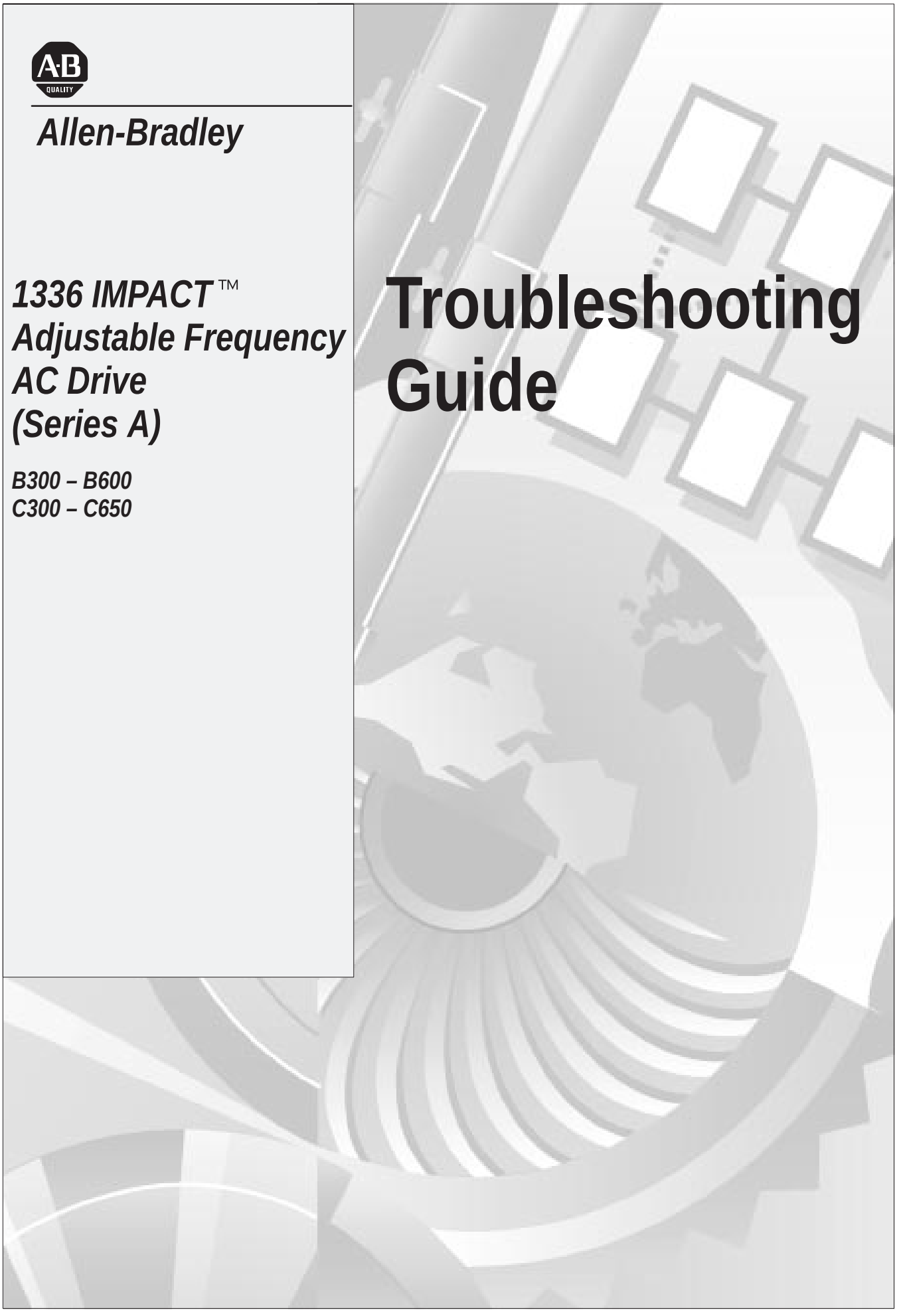
Allen-Bradley

1336 IMPACT™
Adjustable Frequency
AC Drive
(Series A)

B300 – B600
C300 – C650

Troubleshooting Guide



Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Rockwell Automation does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Rockwell Automation publication SGI-1.1, *Safety Guidelines for the Application, Installation, and Maintenance of Solid-State Control* (available from your local Rockwell Automation office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Throughout this manual we use notes to make you aware of safety considerations:

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

Attention statements help you to:

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

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

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❑ DESIGN / IMPLEMENT ELECTRICAL SYSTEMS
❑ TRAIN/EDUCATE MACHINE USERS
❑ SUPERVISE FLOOR OPERATIONS

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	NONE	LITTLE	MODERATE	EXTENSIVE
PROGRAMMABLE CONTROL	❑	❑	❑	❑
AC / DC DRIVES	❑	❑	❑	❑
PERSONAL COMPUTERS	❑	❑	❑	❑
NC / CNC CONTROLS	❑	❑	❑	❑
DATA COMMUNICATIONS / LAN	❑	❑	❑	❑

✓ **RATE THE OVERALL QUALITY OF THIS MANUAL BY CIRCLING YOUR RESPONSE BELOW. (1) = POOR (5) = EXCELLENT**

HELPFULNESS OF INDEX / TABLE OF CONTENTS	1	2	3	4	5
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Summary of Changes

The information below summarizes the changes to the company-wide templates since the last release.

Updated Information

No changes have been made to this manual.

Table of Contents

Preface

Control Logic Wiring and Adapters

Chapter 1

Troubleshooting and Error Codes

Chapter 2

Disassembly and Access Procedures

Chapter 3

Preface

Manual Objective

The information in this manual is designed to help troubleshoot or repair an Allen-Bradley 1336 IMPACT Adjustable Frequency AC Drive with ratings B300 – B600 and C300 – C650.

Who Should Use This Manual

This manual is intended for qualified service personnel responsible for troubleshooting and repairing the 1336 IMPACT Adjustable Frequency AC Drive. You should:

- Read this entire manual before performing maintenance or repairs to drives.
- Have previous experience with, and basic understanding of, electrical terminology, procedures, required equipment, equipment protection procedures and methods, and safety precautions.

This manual describes equipment, troubleshooting and disassembly procedures. You begin with general illustrations and end with greater detail concerning replacement parts and part locations on the drives. Later chapters may refer you back to earlier chapters for information on basic equipment and steps necessary to perform detailed diagnostics and part replacement.

Safety Precautions

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove and lock out power before you disconnect or reconnect wires, and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

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

ATTENTION: Only personnel familiar with the 1336 IMPACT Adjustable Frequency AC Drive and associated machinery should plan or implement the installation, start-up and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

Electrostatic Discharge Precautions

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, Guarding Against Electrostatic Damage, or any other applicable ESD protection handbook.

Electrostatic discharge generated by static electricity can damage the complementary metallic oxide semiconductor devices on various drive boards. It is recommended that you perform these procedures to guard against this type of damage when circuit boards are removed or installed:

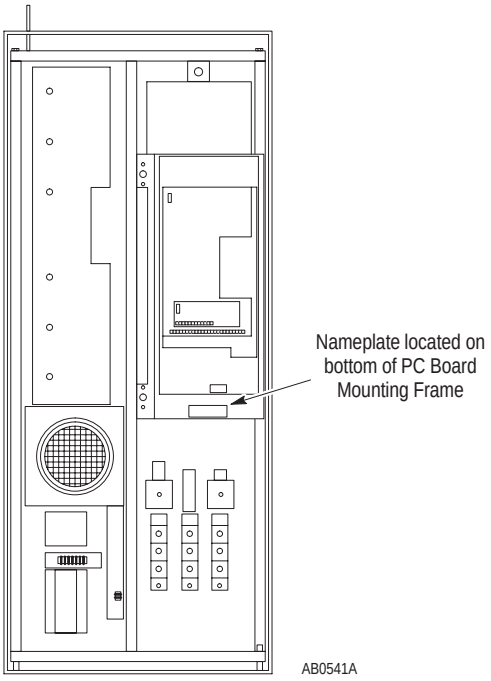
- Wear a wrist-type grounding strap that is grounded to the drive chassis.
- Attach the wrist strap before removing the new circuit board from the conductive packet.
- Remove boards from the drive and immediately insert them into their conductive packets.

1336 IMPACT Product Identification

Drive Nameplate Location

The drive nameplate is located on the face of the PC Board Mounting Frame. The drive nameplate contains the drive's catalog number and other important drive information. Reference the catalog number when ordering replacement parts.

Figure P.1
Drive Nameplate Location



Drive and Option Identification

The following is an explanation of the catalog numbering system for 1336 IMPACT Adjustable Frequency AC Drives and options. The catalog number is coded to identify the drive power rating and can be found on the drive shipping carton and nameplate.

1336 IMPACT Drive Catalog Numbers

Table P.A

1336E	– B600-AA	– EN	– L6	– HA1	– GM1
Bulletin No.	Rating-Enclosure (Must be Specified)	Language Module[1] (Must be Specified)	L Option[1] (Optional)	Human Interface[1] (Optional)	Communication Card[1] (Optional)

380 – 480V AC Input					
Drive Rating[2]			Enclosures		
			Open IP00 No Enclosure	NEMA Type 1 IP20 General Purpose	NEMA Type 12 IP54 Industrial Use
Frame Designation	Output Amps	Nominal HP	Code	Code	Code
G	406.4	300	B300-AN	B300-AA	B300C-AJ
	459.2	350	B350-AN	B350-AA	B350C-AJ
	505.1	400	B400-AN	B400-AA	B400C-AJ
	570.2	450	B450-AN	B450-AN	[3]
	599.2	500	B500-AN	B500-AN	[3]
	673.4	600	B600-AN	B600-AN	[3]

[1] Refer to the Language Module and Options tables following these Catalog Number tables.

[2] Drive rating is based on a carrier frequency of 2kHz maximum, an altitude of 1,000 meters or less, and a maximum ambient temperature of 40°C. Refer to Drive Rating Qualifications on page P-8.

[3] Not available.

Table P.B

1336E	– C600-AA	– EN	– L6	– HA1	– GM1
Bulletin No.	Rating-Enclosure (Must be Specified)	Language Module[1] (Must be Specified)	L Option[1] (Optional)	Human Interface[1] (Optional)	Communication Card[1] (Optional)

500 – 600V AC Input					
Drive Rating[2]			Enclosures		
			Open IP00 No Enclosure	NEMA Type 1 IP20 General Purpose	NEMA Type 12 IP54 Industrial Use
Frame Designation	Output Amps	Nominal HP	Code	Code	Code
G	298.0	300	C300-AN	C300-AA	C300C-AJ
	353.6	350	C350-AN	C350-AA	C350C-AJ
	406.4[3]	400	C400-AN	C400-AA	C400C-AJ
	459.2	450	C450-AN	C450-AA	[3]
	505.1	500	C500-AN	C500A-AA	[3]
	599.2	600	C600-AN	C600A-AA	[3]
	673.4	650	C650-AN	C650A-AA	[3]

[1] Refer to the Language Module and Options tables following these Catalog Number tables.

[2] Drive rating is based on a carrier frequency of 2kHz maximum, an altitude of 1,000 meters or less, and a maximum ambient temperature of 40°C. Refer to Drive Rating Qualifications on page P-8.

[3] Not available.

Table P.C

Language Modules	
Description	**Option Code**
English/English	EN
English/French	FR[1]
English/German	DE[1]
English/Italian	IT[1]
English/Japanese	JP[1]
English/Spanish	ES[1]

[1] Currently not available.

Table P.D

Options			
Code	**Description[1]**	**Code**	**Description**
Human Interface Modules, NEMA Type 1 (IP 20)		Communication Options	
HAB	Blank – No Functionality	GM1	Single Point Remote I/O
HAP	Programmer Only	GM2	RS-232/422/485, DF1
HA1	Programmer, LCD/Analog Pot	GM3	RS-232/422/485, DH485
HA2	Programmer, LCD/Digital Pot		
Human Interface Modules, NEMA Type 4/12 (IP 65/54)		L Option Boards	
HJP	Programmer Only	L4	Contact Closure
HJ2	Programmer, LCD/Digital Pot	L7E	Contact Closure & Encoder Feedback
		L5	+24V AC/DC
		L8E	+24V AC/DC & Encoder Feedback
		L6	115V AC
		L9E	115V AC & Encoder Feedback

[1] For a more functionally complete description of each option, refer to Publication 1336 IMPACT-1.0.

Table P.E
380 – 480V Drives[1]

Catalog Number	Base Derate Amps[1]	Derate Curve[1][2]	Heat Dissipation Drive Watts[2][3][4]	Heat Sink Watts[4]	Total Watts[4]
B300	406.4	None	1005	4805	5810
B350	459.2	None	1055	5455	6510
B400	505.1	None	1295	6175	7470
B450	570.2	None	1335	6875	8210
B500	599.2	[4]	1395	7800	9200
B600	673.4	[4]	1485	8767	10252

Table P.F
500 – 600V Drives[1]

Catalog Number	Base Derate Amps[1]	Derate Curve[1][2]	Heat Dissipation Drive Watts[2][3][4]	Heat Sink Watts[4]	Total Watts[4]
C300	298.0	None	926	5015	5941
C350	353.6	None	1000	5935	6935
C400	406.4	[4]	1430	7120	8550
C450	459.2	[4]	1465	8020	9485
C500	505.1	[4]	1500	8925	10425
C600	599.2	[4]	1610	10767	12377
C650	673.4	[4]	1700	12000	14000

[1] Amp Rating is at 2kHz. If carrier frequencies above 2kHz are selected, drive Amp Rating must be derated. Refer to the User Manual for carrier frequency vs. Amp deratings.

[2] Drive Ambient Temperature Rating is 40°C. If ambient exceeds 40°C, the drive must be derated.

[3] Drive Rating is based on altitudes of 1,000m (3,000 ft) or less. If installed at higher altitude, drive must be derated.

[4] Refer to 1336 IMPACT User Manual.

Drive Rating Qualifications

Several factors can affect drive rating. If more than one factor exists, consult Rockwell Automation.

Enclosure Type

The first character, A, indicates the Enclosure Code.

The second character indicates the type of enclosure shipped from the factory:

Table P.G
Enclosure Type Code Description

Enclosure Type Code	Description
A	NEMA Type 1 (IP 20)
J	NEMA Type 12 (IP 54)
F	NEMA Type 4 (IP 65)
N	Open (IP 00)

Conventions

To help differentiate parameter names and display text from other text in this manual, the following conventions will be used:

- Parameter Names will appear *italicized*.
- Display Text will appear in “quotes”.

The following is a list of conventions used throughout this manual, and definitions of the conventions. For a list of terminology and definitions, refer to the Glossary in the back of this manual.

Auxiliary Interlock

The Auxiliary Interlock is a user supplied circuit consisting of reset, overload, or other interlocking circuitry. The Interlock is wired to the drive Not External Fault Input.

Bit

A bit is a single character or status point used in programmable logic. Eight bits form a BYTE, 16 bits form a word. Drive parameters are actually eight bits or 16 bit words.

Check

To check means to examine either the physical condition of something or the setting of some control, such as a Parameter. Checking a drive board or component may also require measurements and tests.

Connector

A connector connects one drive board to another. Connectors come in two designs, male and female. Male connectors are stationary and contain pins, which are sometimes joined by jumpers. Female connectors are at the ends of wires or ribbon cables and plug into male connectors.

Default

When a drive function defaults, it automatically changes to a pre-programmed setting.

Enable Input

The Enable Input is a terminal connection on the L Option Board. This connection provides an external input to enable or disable the Drive Output section. It must be true to permit the drive to operate.

False

False refers to a logical false state. For instance, an L Option signal on TB3 is false when the input contact is open or the appropriate voltage is not applied to the L Option Board.

Jumper

A jumper completes a circuit between two pins within a male connector on a drive board. In the absence of certain optional equipment using female connectors, jumpers are applied to certain pins within a male connector to complete specific and necessary circuits.

L Option Board

An L Option Board plugs into connectors J7 and J9, located on the lower portion of the Main Control Board. This board is identified as L4, L5, L6, L7E, L8E, or L9E and provides optional control wiring configurations for a drive.

Not External Fault Input

The Auxiliary Input is a terminal connection on the L Option Board. This connection provides an external input for use as an Auxiliary Interlock. Unless this interlock is closed, the drive will be faulted with an External Fault.

Parameter

Parameters are programmable drive functions that define various operating functions or status displays of a drive. Refer to 1336 IMPACT Adjustable Frequency AC Drive User Manual for parameter details.

Press

Press a button on the Human Interface Module to change parameter settings and drive functions.

True

True refers to a logical true state. For instance, an L Option signal on TB3 is true when: L4/L7E contact input is closed, L5/L8E input terminal registers 24V, or L6/L9E input terminal registers 115V AC.

Related Publications

The following lists other Allen-Bradley publications that apply to the 1336 IMPACT Adjustable Frequency AC Drives:

- Product Pricing Bulletin (1336 IMPACT-3.0)
- 1336 IMPACT User Manual (1336 IMPACT-5.0)
- Renewal Parts List[1]
- Options Manuals/Instructions
- Product Data DriveTools Software (9303-2.0)
- Bulletin 1201 Graphic Programming Terminal User Manual (1201-5.0)

[1] Current 1336 IMPACT spare parts information, including recommended parts, catalog numbers, and pricing, can be obtained from the following sources.
- Allen–Bradley home page on the World Wide Web at:
http://www.ab.com
Select **Drives**, and the select **Information for Drives, Including Part Lists . . .** Select documents **1060.pdf** (230V drives) and/or **1070.pdf** (460 & 575V drives).
- Standard Drives "AutoFax" service–an automated system that you can call to request a "faxed" copy of the spare parts information (or other technical documentation).
Simply call **444–646–6701** and follow the phone prompts to request document(s) **1060** (230V drives) and/or **1070** (460 &575V drives).

Chapter 1

Control Logic Wiring and Adapters

Chapter Objectives

This chapter introduces you to terminal block locations and wiring and to adapter locations and functions.

Chapter Overview

This chapter illustrates and describes:

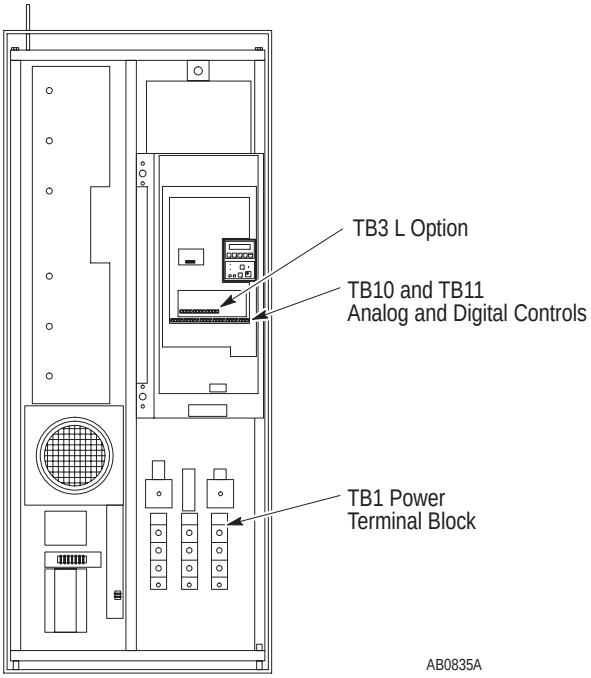
- L Option boards L4, L5, L6, L7E, L8E, and L9E, including terminal block TB3
- TB3 L Option mode selections and functions
- TB3 terminal designations

Important: All printed circuit boards, except the Main Control Board assembly, are referenced to negative ground (–bus).

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove power before you disconnect or reconnect wires and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, Guarding Against Electrostatic Discharge, or any other applicable ESD protection handbook.

Figure 1.1
terminal block Locations



ATTENTION: The National Electric Code (NEC) and local codes outline provisions for safely installing electrical equipment. Installation must comply with specifications regarding wire types, conductor sizes, branch circuit protection and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

L Option Board

The L Option Board provides a means of interfacing various signals and commands to the 1336 IMPACT drive by using contact closures.

Six different versions of the L Option are available:

L4	Contact Closure Interface[1]
L7E	Contact Closure Interface with Encoder Feedback[1]
L5	+24V AC/DC Interface
L8E	+24V AC/DC Interface with Encoder Feedback
L6	115V AC Interface
L9E	115V AC Interface Interface with Encoder Feedback

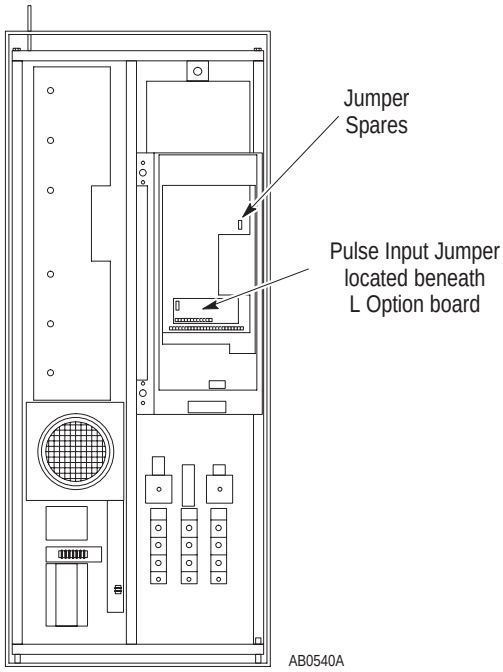
[1] Uses internal +5V DC supply.

The user inputs are connected to the L Option Board through TB3. The L4, L5, and L6 options each have nine inputs: seven user-configurable inputs and two factory-defined control inputs. The function of each L Option must be selected through programming as explained later in this section. The L7E, L8E, and L9E options are similar to L4, L5, and L6 with the addition of encoder feedback inputs.

L Option Board Jumpers

Important: If the L Option Board is being installed, Main Control Board jumpers at pins 3 & 4 and 17 & 18 of J2 must be removed. If these jumpers are removed, they can be stored on the “spares” location on the Main Control Board. If this board is removed, these jumpers must be reinstalled and the *L Option Mode* parameter must be programmed to “1”.

Figure 1.2
Jumper Locations



Available Inputs

The L Option allows the combination of the following functions:

Accel/Decel Rates	Process Trim
Digital Potentiometer (MOP)	Ramp
Enable	Reset
Flux Enable	Run Forward
Forward/Reverse	Run Reverse
Jog	Speed Selects
Local Control	Speed Torque Selections
Not Ext Flt	Start
Not Stop, Clear Fault	Stop Mode Selects

The available combinations are shown in Figure 1.4. Programming the *L Option Mode* parameter to one of the L Option Mode numbers listed selects that combination of input functions.

Important: The *L Option Mode* parameter can be changed at any time; however, programming changes will not take effect until power has been cycled to the drive. When changing an input mode, it is important to note that the corresponding inputs to TB3 may also change.

The programming options of the L Option Board allow you to select an input combination to meet the needs of a specific installation. Appropriate selection of a combination may be done by using Table 1.A. First determine the type of start/stop/direction control desired. Then select the remaining control functions available. After selecting a group of L Option Modes, use Table 1.A for specific mode selection. Record the selected mode number below.

Selected Mode Number:_____

Local Programming

For local programming and control information, refer to the 1336 IMPACT User Manual.

Table 1.A
L Option Mode Selection

Start/Stop Type	Direction Control	Communication Compatibility	Mode(s) to Use
Stop & Enable Only	None	Control must be provided by HIM or Communication Option.	1
Momentary Pushbutton (3 Wire)	Maintained Switch (Open-Forward, Closed-Reverse) Single-Source	Start/Stop – works like the HIM and Communication Options. Direction Control will not work with HIM or Communication Options. User must select direction control from either HIM and Communication Options or TB3 input.	2 – 6, 17, 18, and 27[2]
Momentary Pushbutton (3 Wire)	Momentary Pushbuttons (Forward and Reverse) Multi-Source	Start/Stop – works in parallel with HIM and Communication Options. Direction – works in parallel with HIM or Communication Options.	7 – 11, 19 – 22, and 28, 29[2]
Maintained switches for combined run and direction control (2 wire, Run Forward, Run Reverse)		Start – works differently than three-wire control.[1] Direction – works differently than three-wire control.[1] Stop – always works.	12 – 16, 23 – 25, and 30[2]

[1] Refer to two-, three-wire notes in the user manual.

[2] Diodes 27–30 are available with versions 2.02 and later.

Figure 1.3 provides the terminal designations for TB3. The maximum and minimum wire sizes accepted by TB3 are 2.1 and 0.30 mm^2 (14 and 22 AWG). Maximum torque for all terminals is 1.36 N-m (12 lb-in.). Use copper wire only.

Figure 1.3
TB3 Terminal Designations

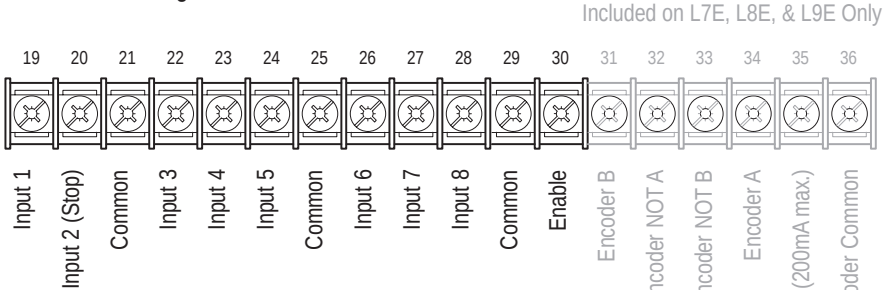
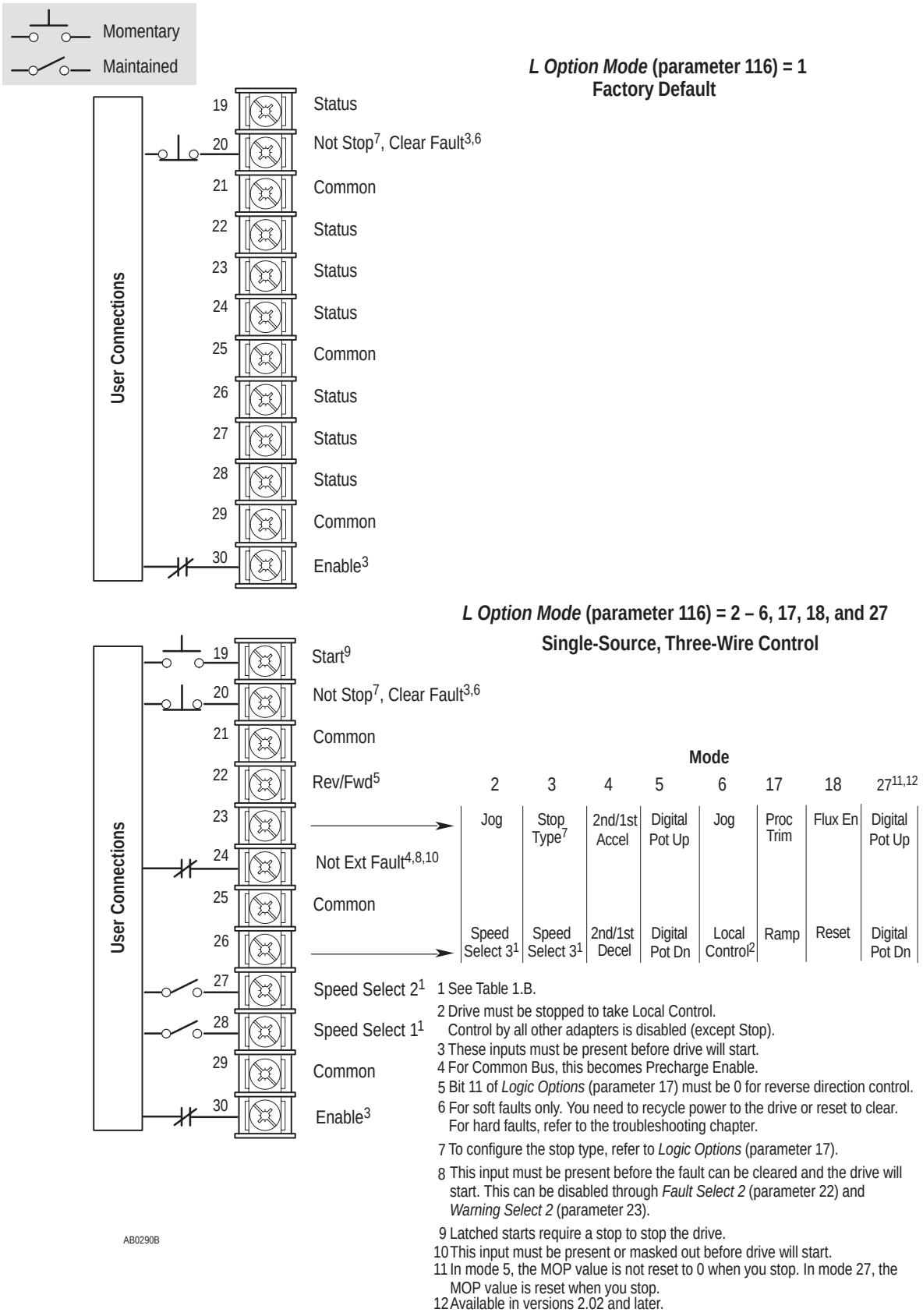
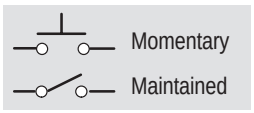


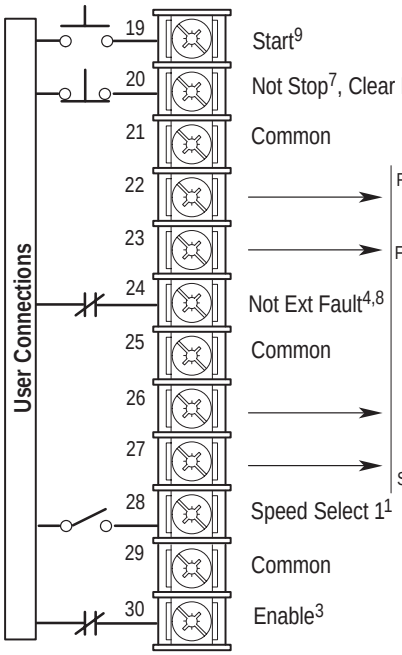
Figure 1.4
L Option Mode Selection and Typical TB3 Connections



1 See Table 1.B.
2 Drive must be stopped to take Local Control. Control by all other adapters is disabled (except Stop).
3 These inputs must be present before drive will start.
4 For Common Bus, this becomes Precharge Enable.
5 Bit 11 of *Logic Options* (parameter 17) must be 0 for reverse direction control.
6 For soft faults only. You need to recycle power to the drive or reset to clear. For hard faults, refer to the troubleshooting chapter.
7 To configure the stop type, refer to *Logic Options* (parameter 17).
8 This input must be present before the fault can be cleared and the drive will start. This can be disabled through *Fault Select 2* (parameter 22) and *Warning Select 2* (parameter 23).
9 Latched starts require a stop to stop the drive.
10 This input must be present or masked out before drive will start.
11 In mode 5, the MOP value is not reset to 0 when you stop. In mode 27, the MOP value is reset when you stop.
12 Available in versions 2.02 and later.

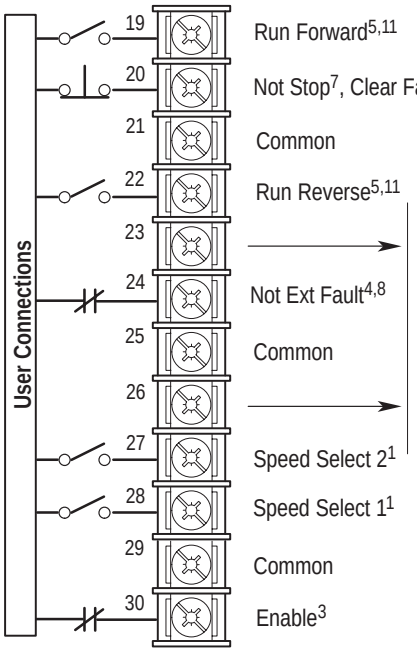


L Option Mode (parameter 116) = 7 – 11, 19 – 22, 28, and 29
Multi-Source, Three-Wire Control



	Mode										
	7	8	9[12]	10[12]	11	19	20	21	22	28[12,13]	29[12,13]
22	Reverse[5]	Reverse[5]	Digital Pot Up	Reverse[5]	1st Accel	Speed/ Torque 3[10]	Speed/ Torque 3[10]	Reverse[5]	Speed/ Torque 3[10]	Digital Pot Up	Reverse[5]
23	Forward[5]	Forward[5]	Digital Pot Dn	Forward[5]	2nd Accel	Speed/ Torque 2[10]	Speed/ Torque 2[10]	Forward[5]	Speed/ Torque 2[10]	Digital Pot Dn	Forward[5]
26	Jog	Speed Select 3[1]	Speed Select 3[1]	Digital Pot Up	1st Decel	Speed/ Torque 1[10]	Speed/ Torque 1[10]	Ramp	Speed/ Torque 1[10]	Speed Select 3[1]	Digital Pot Up
27	Speed Select 2[1]	Speed Select 2[1]	Speed Select 2[1]	Digital Pot Dn	2nd Decel	Process Trim	Flux Enable	Reset	Speed Select 2[1]	Speed Select 2[1]	Digital Pot Dn

L Option Mode (parameter 116) = 12 – 16, 23 – 26, and 30
Single-Source, Two-Wire Control



	Mode									
	12	13	14	15[12]	16	23	24	25	26	30[12,13]
23	Local Control[2]	Stop Type[7]	2nd/1st Accel	Digital Pot Up	Local Control[2]	Process Trim	Flux Enable	Process Trim	Jog	Digital Pot Up
26	Speed Select 3[1]	Speed Select 3[1]	2nd/1st Decel	Digital Pot Dn	Stop Type	Reset	Reset	Ramp	Speed Select 3[1]	Digital Pot Dn

1 See Table 1.B.

2 Drive must be stopped to take Local Control. Control by all other adapters is disabled (except Stop).

3 These inputs must be present before drive will start.

4 For Common Bus, this becomes Precharge Enable.

5 Bit 11 of *Logic Options* (parameter 17) must be 0 for reverse direction control.

6 For soft faults only. You need to recycle power to the drive to clear. For hard faults, refer to the troubleshooting chapter.

7 To configure the stop type, refer to *Logic Options* (parameter 17).

8 This input must be present before the fault can be cleared and the drive will start. This can be disabled through *Fault Select 2* (parameter 22) and *Warning Select 2* (parameter 23).

9 Latched starts require a stop to stop the drive.

10 See Speed/Torque Select table.

11 Unlatched start.

12 In modes 9, 10 and 15, the MOP value is not reset to 0 when you stop. In mode 28, 29, and 30, the MOP value is reset when you stop.

13 Available in versions 2.02 and later.

AB0291B

Table 1.B defines the input state of the Speed Select inputs for a desired speed reference source.

Table 1.B
Speed Select/Speed Reference

Speed Select 3	Speed Select 2	Speed Select 1	Frequency Source
O	O	O	Speed Ref 1
O	O	X	Speed Ref 2
O	X	O	Speed Ref 3
O	X	X	Speed Ref 4
X	O	O	Speed Ref 5
X	O	X	Speed Ref 6
X	X	O	Speed Ref 7
X	X	X	Last State

O=Open = Removed = 0

X=Closed = Applied = 1

Table 1.C defines the input state of the Speed/Torque Mode Select inputs for a desired speed/torque mode.

Table 1.C
Speed/Torque Select

Speed/Torque Mode Select 3	Speed/Torque Mode Select 2	Speed/Torque Mode Select 1	Speed/Torque Mode
O	O	O	Zero Torque
O	O	X	Speed Regulate
O	X	O	Torque Regulate
O	X	X	Minimum Torque/Speed
X	O	O	Maximum Torque/Speed
X	O	X	Sum of the Torque and Speed
X	X	O	Zero Torque
X	X	X	Zero Torque

O=Open = Removed = 0

X=Closed = Applied = 1

Human Interface Module (HIM)

Description

When the drive-mounted HIM is supplied, it will be connected as SCANport Adapter 1 (refer to Figure 1.5). The HIM can be divided into two sections: Display Panel and Control Panel. The Display Panel provides a means of programming the drive and viewing the various operating parameters. The Control Panel allows different drive functions to be controlled. For HIM operation, refer to the 1336 IMPACT User Manual.

Important: The operation of HIM functions depends upon drive parameter settings. Default parameter values allow full HIM functionality.

Figure 1.5
Human Interface Module

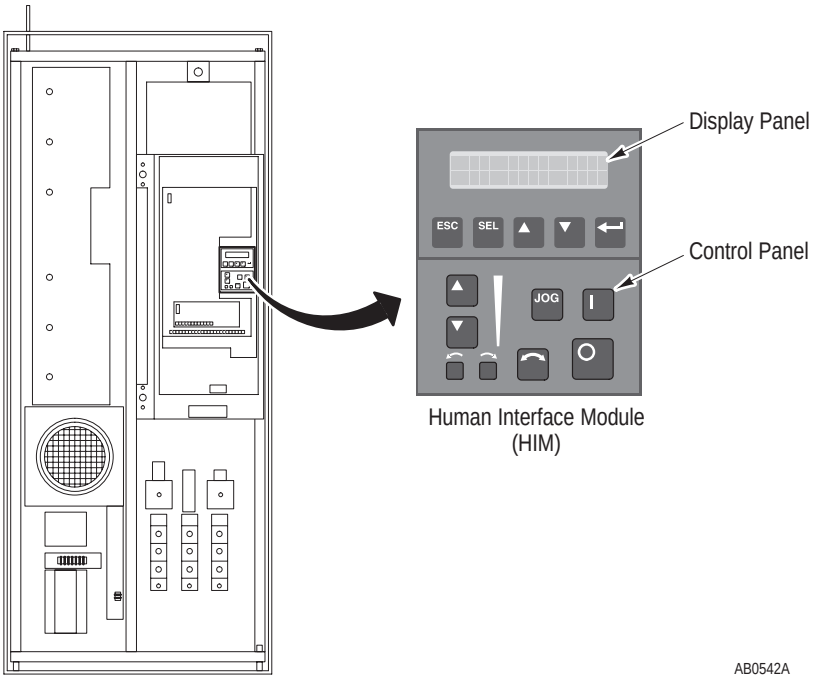
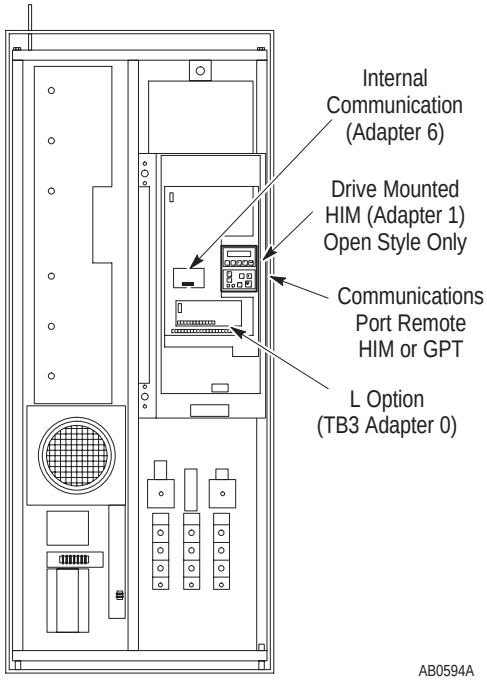


Figure 1.6
Adapter Locations



Removing the HIM

For handheld operation, you can remove the module and place it up to 10 meters (33 feet) from the 1336 IMPACT drive. (You do need a cable to do this.)

ATTENTION: Some voltages present behind the drive front cover are at incoming line potential. To avoid an electric shock hazard, use extreme caution when removing/replacing the HIM.

Important: Removing a HIM (or other SCANport device) from a drive while power is applied causes a Serial Fault, unless *SP Enable Mask* (parameter 124) or *Fault Select 1* (parameter 20) have been set to disable this fault or *Control Logic* (from the *Control Status* menu) has been disabled (only available on a Series A, version 3.0 or Series B HIM). Setting bit 1 of *SP Enable Mask* to 0 disables Serial Fault from a HIM on port 1. It also disables all HIM control functions except Stop. Setting bit 9 of *Fault Select 1* to 0 disables the serial fault from the HIM on port 1 but still allows HIM control.

ATTENTION: Hazard of personal injury or equipment damage exist. If you initiate a command to start motor rotation (command a start or jog) and then disconnect the programming device, the drive will not fault if you have the SCANport communications fault set to be ignored for that port.

To remove the HIM, you need to:

1. Either remove the power or clear the port bit, which corresponds to the port the HIM is attached to, in *SP Enable Mask* (parameter 124) or *Fault Select 1* (parameter 20) to prevent the drive from faulting.
2. Remove the front cover of the drive.
3. Push release at the bottom of the HIM cradle and slide the module down out of its cradle.

To use the module from anywhere up to 10 meters (33 feet) from your drive, you need to:

1. Connect the appropriate cable between the HIM and the communications port (adapter 2, 3, 4, or 5) or adapter 1 (the HIM cradle).
2. Set *SP Enable Mask* to enable the port that you plugged the HIM into and/or *Fault Select 1* (parameter 20).

To replace the module, follow these steps:

1. Slide the module up into its cradle.
2. Replace the front cover of the drive.
3. Apply power, set *SP Enable Mask* or set *Fault Select 1*.

HIM Operation

When power is first applied to the drive, the HIM will cycle through a series of displays. These displays will show drive ID and communication status. Upon completion, the Status Display (refer to Figure 1.7) will be shown. This display shows the current status of the drive (i.e. Stopped, Running, etc.) or any faults that may be present (Not Enabled, etc.).

Refer to the 1336 IMPACT User Manual for HIM operation.

Figure 1.7
Status Display

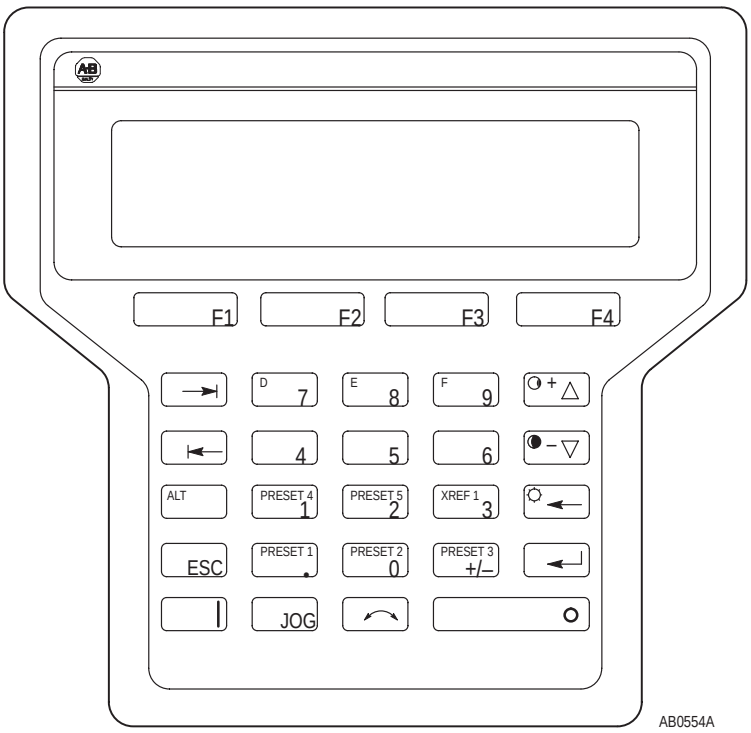
Graphic Programming Terminal

GPT Description

The optional GPT (Figure 1.8) is a remote device with a 1.8 meter (6 foot) long cable. The GPT offers a 40-by-8 character display that can also be used as a graphics display. For GPT operation, refer to the 1201 GPT User Manual.

Important: Main Menu screens are dynamic and will change based on functionality provided by adapter and drive status.

Figure 1.8
Graphic Programming Terminal



DriveTools

DriveTools software is a Windows 3.1 compatible family of application programs allowing the user to perform programming, monitoring, and diagnostic operations on Allen-Bradley AC and DC digital drive products. The software consists of five Windows applications. For operation, refer to the Product Data DriveTools Software manual.

Control Firmware Function

All control functions in the 1336 IMPACT drive are performed through the use of parameters that can be changed with a programming terminal or DriveTools. Refer to an overview Block Diagram of the Control Firmware Function in the 1336 IMPACT User Manual.

Feedback information is derived from hardware devices as part of the process equipment used. Analog signals are converted to digital signals for use by the drive. Control signals may be provided to the drive by the Main Control Board.

All setup and operation information used by the drive is stored in a system parameter table. Every parameter, including Setup and Configuration parameters (Sources and Destinations), has an entry in the parameter table. For example, parameter 29 is named the *Speed Ref 1* parameter and contains a number value representing the speed reference. The speed reference can originate from an external control device such as a potentiometer connected to the analog input of the Main Control Board. Refer to the 1336 IMPACT User Manual, Publication 1336 IMPACT-5.0.

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Troubleshooting and Error Codes

Chapter Objectives

This chapter provides information to help troubleshoot your 1336 IMPACT drive.

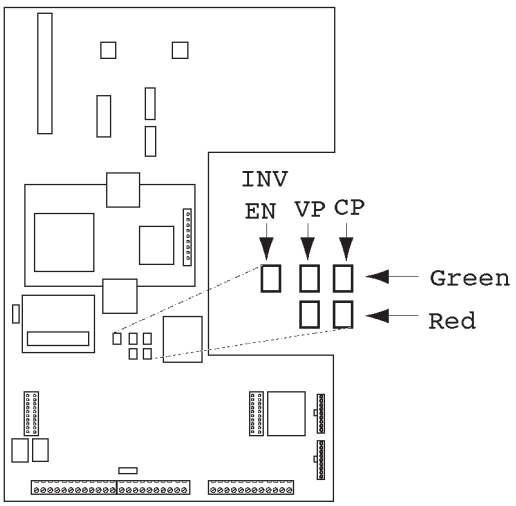
ATTENTION: Do not troubleshoot or maintain the 1336 IMPACT drive unless you are familiar with your drive system and the associated machinery. You may be injured and/or the equipment may be damaged if you do not comply.

During the start-up procedure, you should have recorded board jumper settings for each board, board software version numbers, and the drive and motor nameplate data in Table 6.A of the *1336 IMPACT™ Adjustable Frequency AC Drive User Manual*. If this information was not recorded, record it before beginning any troubleshooting sequences.

Fault/Warning Handling

When a problem occurs with your drive, check the VP and CP lights on your drive on the main control board. Figure 2.1 shows the location of the VP and CP lights.

Figure 2.1
VP and CP LED Locations



Frames B – H

The lights on the motor control board indicate the status of the velocity processor (VP) and current processor (CP):

If the VP or CP LED is:	Then, for that processor:
Solid green	No fault occurred.
Flashing green	A drive warning occurred.
Flashing red	A drive soft fault occurred.
Solid red	A drive hard fault occurred.

Faults fall into three basic categories:

This type of fault:	Has the following definition:	To remove this fault, you need to:
Hard	Trips the drive causing it to stop. You cannot regain control until you reset the drive.	Perform a *Drive Reset* command or cycle drive power.
Soft	Trips the drive causing it to stop.	1 Address the condition that caused the fault. 2 Perform a *Clear Faults* command.
Warning	Indicates an undesirable condition. The drive will not stop, but the condition may lead to a fault that will stop the drive.	Address the condition that caused the warning.

Faults are annunciated on the Human Interface Module (HIM) at the time they occur. Warnings are not annunciated on the HIM.

To help troubleshoot your 1336 IMPACT drive, the drive logs any faults or warnings in either the fault or warning queue. The faults and warnings that are contained in the queues are either configurable or non-configurable.

This fault type:	Refers to faults that you:
Configurable	Can set up to either trip the drive or provide only a visual warning while the drive continues to operate.
Non-configurable	Cannot disable. These faults are the result of a condition that could damage the drive if allowed to persist.

You can reset the soft faults by pressing the stop button on the HIM.

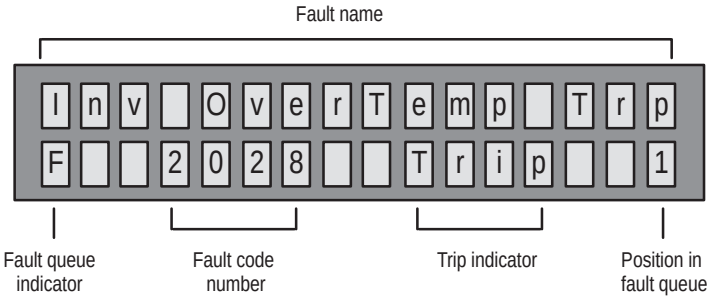
Viewing the Fault and Warning Queues on the HIM

You can use the HIM to view the fault and warning queues. To view the fault queue, you need to:

1. Press the *Escape* key until you reach the *Choose Mode* level.
2. Use the *Increment* or *Decrement* key to scroll through the *Choose Mode* options until *Control Status* is displayed.
3. Press the *Enter* key.

4. Use the *Increment* or *Decrement* key to scroll through the *Control Status* options until *Fault Queue* is displayed.
5. Press the *Enter* key.
6. Press the *Enter* key when *View Queue* is displayed.

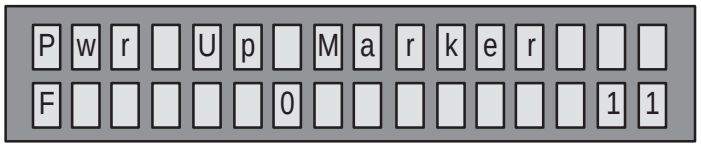
The fault queue can contain up to 32 faults. The 1336 IMPACT drive reports the faults using the following format:



The trip indicator is only present if this fault caused the drive to trip.

The last number (1) indicates the position of this fault within the fault queue.

A marker is placed in the queue when the first fault occurs after a power up sequence. This power up marker is as shown.



The 1336 IMPACT drive tracks the time that has elapsed since power up. The drive uses this information as a time stamp so that you can tell when a fault occurred in relation to when the drive was powered up.

To clear the fault queue, select *Clear Queue* from the *Fault Queue* options.

To view the warning queue, select *Warning Queue* from the *Control Status* options. The remaining steps are the same as for the fault queue.

What Are the Fault Descriptions

When a fault occurs, the fault is displayed until you initiate a *Drive Reset* or a *Clear Faults* command. A *Drive Reset* clears all faults, while a *Clear Faults* command only clears soft and warning faults. You can perform a *Drive Reset* and *Clear Faults* either through bits in *Logic Input Sts* (parameter 14) or with a terminal.

The fault codes are defined as shown in Table 1.A.

Table 2.ATable 2.B
Fault Descriptions

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
01027 *Autotune Diag*	VP, Flashing red	Soft	The drive encountered a problem while running the autotune tests. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Check *Autotune Errors* (parameter 176). For additional information about *Autotune Errors*, refer to Chapter 13, *Understanding the Autotuning Procedure*, in the user manual.
01051 *MtrOvrld Pnd*	VP, Flashing red	Soft	A motor overload is pending. The drive has reached 95% of the level required for a motor overload trip (see fault 01052).	Check for possible motor overheating. • If the motor temperature is excessive, reduce the accel/decel times (parameters 42–45) or reduce the load. • If the motor temperature is acceptable, increase the value of *Motor Overload %* (parameter 26). If you do not want this condition to be reported as a fault, change bit 3 in *Fault Select 2* (parameter 22) to 0.
01052 *MtrOvrld Trp*	VP, Flashing red	Soft	Motor overload tripped. The drive has reached the level of accumulated motor current over time as set by *Motor Overload %* (parameter 26).	Check for possible motor overheating. • If the motor temperature is excessive, reduce the accel/decel times (parameters 42–45) or reduce the load. • If the motor temperature is acceptable, increase the value of *Motor Overload %* (parameter 26). If you do not want this condition to be reported as a fault, change bit 4 in *Fault Select 2* (parameter 22) to 0.
01053 *Mtr Stall*	VP, Flashing red	Soft	The drive is in a limit condition for a period of time in excess of the value specified in *Motor Stall Time* (parameter 25) with the motor at zero speed.	Check *Torque Limit Sts* (parameter 87) to see which limit has occurred. Increase the appropriate limit parameter or reduce the load. If you do not want this condition to be reported as a fault, change bit 5 in *Fault Select 2* (parameter 22) to 0.
01083 *MtrOvrld Pend*	VP, Flashing green	Warning	Motor overload pending. The drive has reached 95% of the level required for a motor overload trip (see fault 01084).	Check for possible motor overheating. • If the motor temperature is excessive, reduce the accel/decel times (parameters 42–45) or reduce the load. • If the motor temperature is acceptable, increase the value of *Motor Overload %* (parameter 26). If you do not want this condition to be reported as a warning, change bit 3 in *Warning Select 2* (parameter 23) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
01084 *MtrOvrld Trp*	VP, Flashing green	Warning	Motor overload tripped. The drive has reached the level of accumulated motor current over time as set by *Motor Overload %* (parameter 26).	Check for possible motor overheating. • If the motor temperature is excessive, reduce the accel/decel times (parameters 42–45) or reduce the load. • If the motor temperature is acceptable, increase the value of *Motor Overload %* (parameter 26). If you do not want this condition to be reported as a warning, change bit 4 in *Warning Select 2* (parameter 23) to 0.
01085 *Mtr Stall*	VP, Flashing green	Warning	The drive is in a limit condition for a period of time in excess of the value specified in *Motor Stall Time* (parameter 25) with the motor at zero speed.	Check *Torque Limit Sts* (parameter 87) to see which limit has occurred. Increase the appropriate limit parameter or reduce the load. If you do not want this condition to be reported as a warning, change bit 5 in *Warning Select 2* (parameter 23) to 0.
02028 *Inv Overtemp Trp*	VP, Flashing red	Soft	Inverter overtemperature trip. There is excessive temperature at the heatsink. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Check the cabinet filters, drive fans, and heatsinks. Check the thermal sensor and sensor wiring (connector). Reduce the load or duty cycle if possible. Lower the value of *PWM Frequency* (parameter 10).
02049 *Inv Overtemp Pnd*	VP, Flashing red	Soft	An inverter overtemperature is pending. The inverter heatsink temperature is approaching the trip level.	Check the cabinet filters, drive fans, and heatsinks. Check the thermal sensor and sensor wiring (connector). Reduce the load or duty cycle if possible. Lower the value of *PWM Frequency* (parameter 10). If you do not want this condition to be reported as a fault, change bit 1 in *Fault Select 2* (parameter 22) to 0.
02061 *InvOvld Pend*	VP, Flashing red	Soft	An inverter (IT) overload is pending. The inverter current has been in excess of 105% of *Inverter Amps* (parameter 11) too long. Continued operation at this load level will cause an overload.	Reduce the load or duty cycle if possible. If you do not want this condition to be reported as a fault, change bit 13 in *Fault Select 2* (parameter 22) to 0.
02063 *Inv Overload*	VP, Flashing red	Soft	Inverter (IT) overload. The inverter current has been in excess of 105% of *Inverter Amps* (parameter 11) too long.	Reduce the load or duty cycle if possible. If you do not want this condition to be reported as a fault, change bit 15 in *Fault Select 2* (parameter 22) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
02081 *Inv Overtemp Pnd*	VP, Flashing green	Warning	An inverter overtemperature is pending. The inverter heatsink temperature is approaching the trip level.	Check the cabinet filters, drive fans, and heatsinks. Check the thermal sensor and sensor wiring (connector). Reduce the load or duty cycle if possible. Lower the value of *PWM Frequency* (parameter 10). If you do not want this condition to be reported as a warning, change bit 1 in *Warning Select 2* (parameter 23) to 0.
02093 *InvOvld Pend*	VP, Flashing green	Warning	An inverter (IT) overload is pending. The inverter current has been in excess of 105% of *Inverter Amps* (parameter 11) too long. Continued operation at this load level will cause an overload.	Reduce the load or duty cycle if possible. If you do not want this condition to be reported as a warning, change bit 13 in *Warning Select 2* (parameter 23) to 0.
02095 *Inv Overload*	VP, Flashing green	Warning	Inverter (IT) overload. The inverter current has been in excess of 105% of *Inverter Amps* (parameter 11) too long.	Reduce the load or duty cycle if possible. If you do not want this condition to be reported as a warning, change bit 15 in *Warning Select 2* (parameter 23) to 0.
03008 *HW Malfunction*	VP, Red 1 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the main control board.
03009 *HW Malfunction*	VP, Red 2 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the main control board.
03010 *HW Malfunction*	VP, Red 3 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the main control board.
03011 *HW Malfunction*	VP, Red 4 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the main control board.
03012 *HW Malfunction*	VP, Red 5 blink	Hard	A hardware malfunction was detected on power up or reset. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the main control board.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
03014 *EE Checksum*	VP, Flashing red	Soft	The parameter database is corrupt.	Initialize parameters or: • Perform a Recall Values operation. • Perform a Save Values operation. • Verify the parameters. • Reset the drive. If the fault still occurs, replace the main control board.
03015 *HW Malfunction*	VP, Flashing red	Soft	A hardware malfunction has occurred.	Recycle the power. If the fault does not clear, replace the main control board.
03022 *Diff Drv Type*	VP, Flashing red	Soft	The main control board has been initialized on a different size drive.	Issue a *Reset Defaults* command to set the drive parameters back to the default values.
03023 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred.	Recycle the power. If the fault does not clear, replace the main control board. If the fault still occurs, replace the gate driver board.
03024 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the main control board.
03025 *Absolute Overspd*	VP, Flashing red	Soft	The motor speed has exceeded the speed limit plus *Absolute Overspd* (parameter 24) settings. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	If operating in torque mode, check if the load is allowing excessive motor speed. Check if the setting of *Absolute Overspd* (parameter 24) or the speed limits (parameters 40 and 41) are too low.
03026 *Analog Spply Tol*	VP, Flashing red	Soft	The analog supply tolerance voltage is outside of the 13V to 18V range. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Possible faulty analog 15V power supply. The gate driver board or the main control board may require replacement.
03029 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred.	Recycle the power. If the fault does not clear, replace the main control board.
03030 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Recycle the power. If the fault does not clear, replace the main control board.
03031 *SW Malfunction*	VP, Solid red	Hard	A software malfunction has occurred.	Recycle the power. If the fault does not clear, replace the main control board.
03040 *mA Input*	VP, Flashing red	Soft	A loss of 4–20mA input has occurred.	Check your wiring and connections. If the fault does not clear, replace the main control board. If you do not want this condition to be reported as a fault, change bit 8 in *Fault Select 1* (parameter 20) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
03057 *Param Limit*	VP, Flashing red	Soft	A parameter limit has occurred.	Examine the parameter limit testpoints to determine the exact cause. Refer to the *Understanding Parameter Limit Faults* section in the troubleshooting chapter of the user manual. If you do not want this condition to be reported as a fault, change bit 9 in *Fault Select 2* (parameter 22) to 0.
03058 *Math Limit*	VP, Flashing red	Soft	A math limit has occurred.	Examine the math limit testpoints to determine the exact cause. Refer to the *Understanding Math Limit Faults* section in the troubleshooting chapter of the user manual. If you do not want this condition to be reported as a fault, change bit 10 in *Fault Select 2* (parameter 22) to 0.
03072 *mA Input*	VP, Flashing green	Warning	A loss of 4–20mA input has occurred.	Check your wiring and connections. If you do not want this condition to be reported as a warning, change bit 8 in *Warning Select 1* (parameter 21) to 0.
03089 *Param Limit*	VP, Flashing green	Warning	A parameter limit has occurred.	Examine the parameter limit testpoints to determine the exact cause. Refer to the *Understanding Parameter Limit Faults* section in the troubleshooting chapter of the user manual. If you do not want this condition to be reported as a warning, change bit 9 in *Warning Select 2* (parameter 23) to 0.
03090 *Math Limit*	VP, Flashing green	Warning	A math limit has occurred.	Examine the math limit testpoints to determine the exact cause. Refer to the *Understanding Math Limit Faults* section in the troubleshooting chapter of the user manual. If you do not want this condition to be reported as a warning, change bit 10 in *Warning Select 2* (parameter 23) to 0.
05048 *Spd Fdbk Loss*	VP, Flashing red	Soft	A loss of feedback occurred.	Check the encoder wiring. Verify that the encoder signals are free of noise. If you do not want this condition to be reported as a fault, change bit 0 in *Fault Select 2* (parameter 22) to 0.
05054 *External Flt In*	VP, Flashing red	Soft	The external fault input from the L Option board is open.	Check the external circuit for cause of an open input signal. If you do not want this condition to be reported as a fault, change bit 6 in *Fault Select 2* (parameter 22) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
05080 *Spd Fdbk Loss*	VP, Flashing green	Warning	A loss of feedback occurred.	Check the encoder wiring. Verify that the encoder signals are free of noise. If you do not want this condition to be reported as a warning, change bit 0 in *Warning Select 2* (parameter 23) to 0.
05086 *External Flt In*	VP, Flashing green	Warning	The external fault input from the L Option board is open.	Check the external circuit for cause of an open input signal. If you do not want this condition to be reported as a warning, change bit 6 in *Warning Select 2* (parameter 23) to 0.
06041 *SP 1 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 1 has been disconnected and the logic mask bit for port 1 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 9 in *Fault Select 1* (parameter 20) to 0.
06042 *SP 2 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 2 has been disconnected and the logic mask bit for port 2 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 10 in *Fault Select 1* (parameter 20) to 0.
06043 *SP 3 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 3 has been disconnected and the logic mask bit for port 3 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 11 in *Fault Select 1* (parameter 20) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
06044 *SP 4 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 4 has been disconnected and the logic mask bit for port 4 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 12 in *Fault Select 1* (parameter 20) to 0.
06045 *SP 5 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 5 has been disconnected and the logic mask bit for port 5 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 13 in *Fault Select 1* (parameter 20) to 0.
06046 *SP 6 Timeout*	VP, Flashing red	Soft	The SCANport adapter at port 6 has been disconnected and the logic mask bit for port 6 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 14 in *Fault Select 1* (parameter 20) to 0.
06047 *SP Error*	VP, Flashing red	Soft	SCANport communications have been interrupted.	If the adapter was not intentionally disconnected: • Check the amount of noise on the system. • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a fault, change bit 15 in *Fault Select 1* (parameter 20) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
06073 *SP 1 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 1 has been disconnected and the logic mask bit for port 1 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 9 in *Warning Select 1* (parameter 21) to 0.
06074 *SP 2 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 2 has been disconnected and the logic mask bit for port 2 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 10 in *Warning Select 1* (parameter 21) to 0.
06075 *SP 3 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 3 has been disconnected and the logic mask bit for port 3 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 11 in *Warning Select 1* (parameter 21) to 0.
06076 *SP 4 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 4 has been disconnected and the logic mask bit for port 4 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 12 in *Warning Select 1* (parameter 21) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
06077 *SP 5 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 5 has been disconnected and the logic mask bit for port 5 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 13 in *Warning Select 1* (parameter 21) to 0.
06078 *SP 6 Timeout*	VP, Flashing green	Warning	The SCANport adapter at port 6 has been disconnected and the logic mask bit for port 6 is set (1).	If the adapter was not intentionally disconnected: • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 14 in *Warning Select 1* (parameter 21) to 0.
06079 *SP Error*	VP, Flashing green	Warning	SCANport communications have been interrupted.	If the adapter was not intentionally disconnected: • Check the amount of noise on the system. • Check the wiring to the SCANport adapters. • Replace wiring, SCANport expander, SCANport adapters, and main control board. • Replace drive, if required. If you do not want this condition to be reported as a warning, change bit 15 in *Warning Select 1* (parameter 21) to 0.
12016 *Overvoltage*	CP, Solid red	Soft	The DC bus voltage has exceeded the maximum value. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Monitor the AC line for high line voltage or transient conditions. Increase the deceleration time or install the dynamic brake option because motor regeneration can also cause bus overvoltages. Refer to the user manual for a description of *Bus Options* (parameter 13) for additional information about bus overvoltages. If you are using flux braking, refer to Chapter 9, *Applications*, in the user manual for information about flux braking.
12017 *Desaturation*	CP, Solid red	Soft	There was too much current in the system. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Run the power structure diagnostics. Check for a shorted motor or motor wiring. Replace the drive.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
12018 *Ground Fault*	CP, Solid red	Soft	A current path to earth ground in excess of drive rated current has been detected at one or more of the drive output terminals. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Run the power structure diagnostics. Check the motor and external wiring to the drive output terminals for a grounded condition. Replace the drive.
12019 *Overcurrent*	CP, Solid red	Soft	There was too much current in the system. When this condition occurs, the drive coasts to a stop regardless of the selected stop type.	Run the power structure diagnostics. Check for shorted motor or motor wiring. Replace drive.
12032 *RidethruTime*	CP, Flashing red	Soft	There was a bus voltage drop of 150V and power did not return within 2 seconds.	Check the incoming power and fuses. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 0 in *Fault Select 1* (parameter 20) to 0.
12033 *Prechrg Time*	CP, Flashing red	Soft	The precharge function could not complete within 30 seconds.	Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 1 in *Fault Select 1* (parameter 20) to 0.
12034 *Bus Drop*	CP, Flashing red	Soft	The bus voltage dropped 150V below the bus tracker voltage.	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 2 in *Fault Select 1* (parameter 20) to 0.
12035 *Bus Undervlt*	CP, Flashing red	Soft	The DC bus voltage fell below the trip value (388V DC at 460V AC input).	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 3 in *Fault Select 1* (parameter 20) to 0 or decrease the bus undervoltage setpoint.

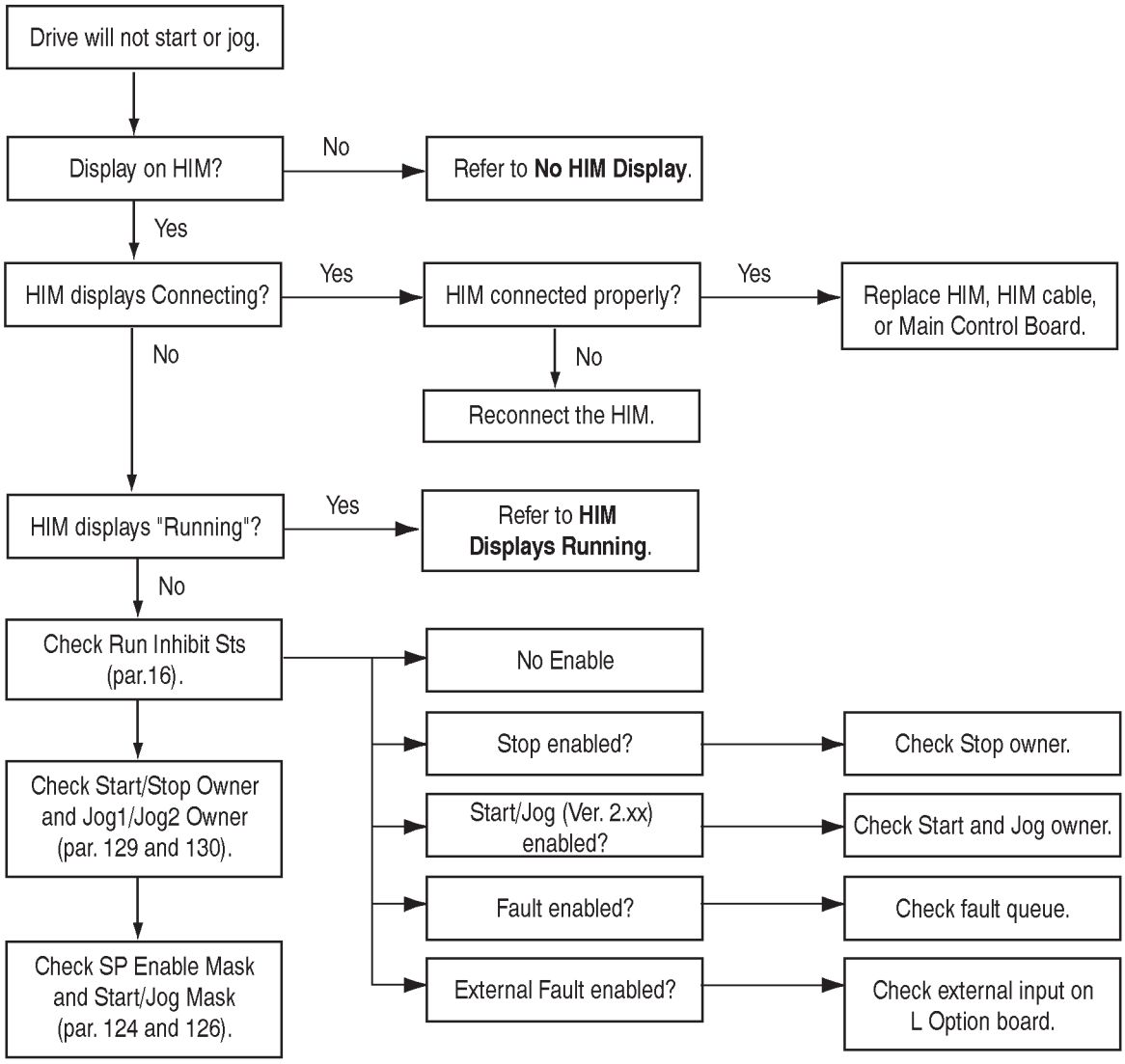
Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
12036 *Bus Cycle>5*	CP, Flashing red	Soft	At least 5 ridethrough cycles have occurred within a 20 second period. This indicates a converter problem or a problem with the incoming power.	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 4 in *Fault Select 1* (parameter 20) to 0.
12037 *Open Circuit*	CP, Flashing red	Soft	The fast flux up current is less than 50% of commanded.	Make sure the motor is properly connected. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a fault, change bit 5 in *Fault Select 1* (parameter 20) to 0.
12064 *RidethruTime*	CP, Solid green	Warning	There was a drop of 150V and power did not return within 2 seconds.	Check the incoming power and fuses. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 0 in *Warning Select 1* (parameter 21) to 0.
12065 *Prechrg Time*	CP, Solid green	Warning	The precharge function could not complete within 30 seconds.	Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 1 in *Warning Select 1* (parameter 21) to 0.
12066 *Bus Drop*	CP, Solid green	Warning	The bus voltage dropped 150V below the bus tracker voltage.	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 2 in *Warning Select 1* (parameter 21) to 0.

Fault Code and Text	LED Information	Fault Type	Description	Suggested Action
12067 *Bus Undervlt*	CP, Solid green	Warning	The DC bus voltage fell below the minimum value (388V DC at 460V AC input).	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 3 in *Warning Select 1* (parameter 21) to 0.
12068 *Bus Cycle>5*	CP, Solid green	Warning	At least 5 ridethrough cycles have occurred within a 20 second period. This indicates a converter problem or a problem with the incoming power.	Monitor the incoming AC line for low voltage or line power interruption. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 4 in *Warning Select 1* (parameter 21) to 0.
12069 *Open Circuit*	CP, Solid green	Warning	The fast flux up current is less than 50% of commanded.	Make sure the motor is properly connected. Refer to the *Understanding Precharge and Ridethrough Faults* section in the troubleshooting chapter of the user manual for more information. If you do not want this condition to be reported as a warning, change bit 5 in *Warning Select 1* (parameter 21) to 0.
13000 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the main control board.
13001 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the main control board.
13002 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the main control board.
13003 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the main control board.
13004 *HW Malfunction*	CP, Solid red	Hard	A hardware malfunction occurred.	Recycle the power. If the fault does not clear, replace the main control board.

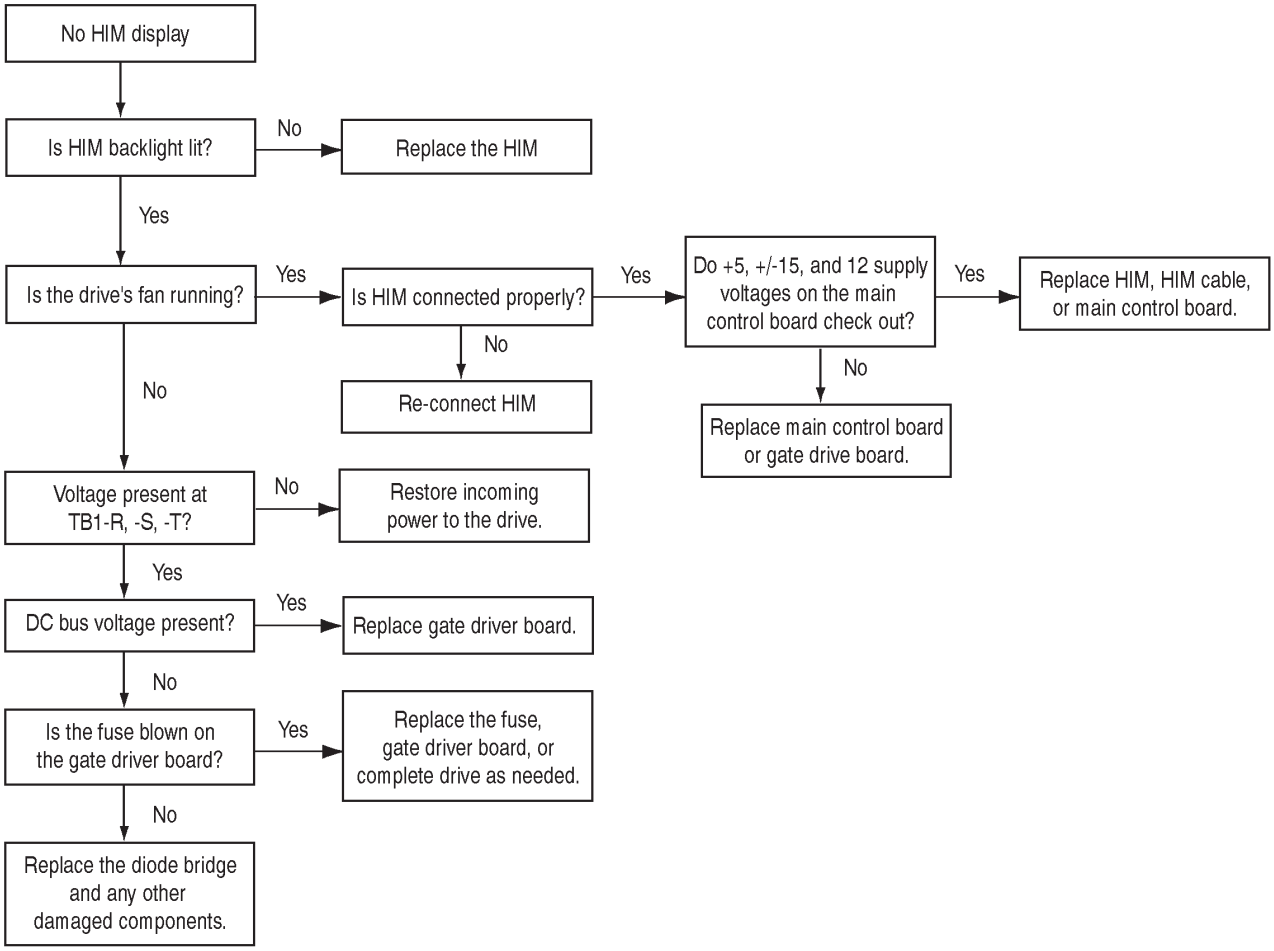
Diagnostic Procedures by Symptom

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

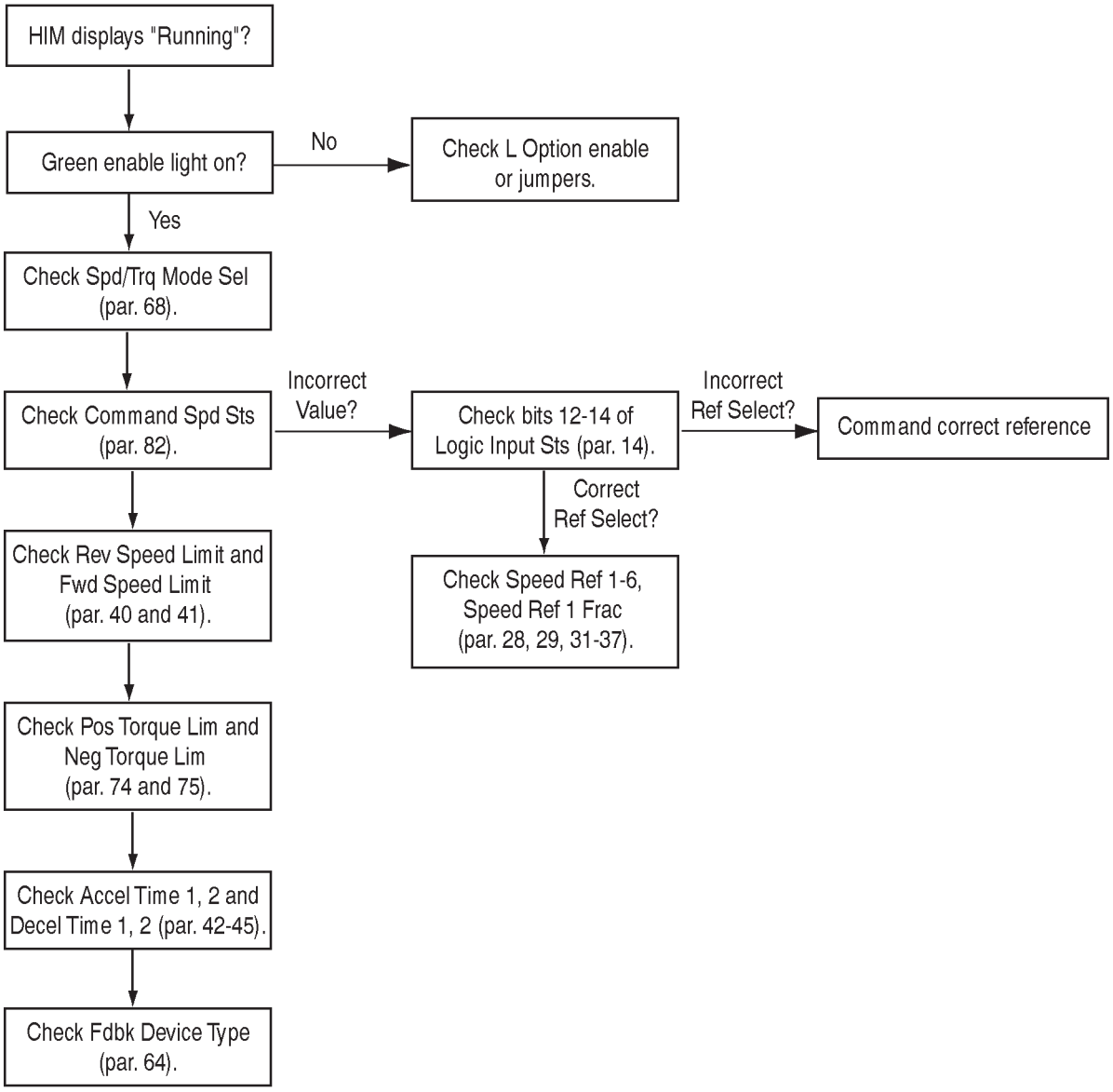
Drive Will Not Start or Jog



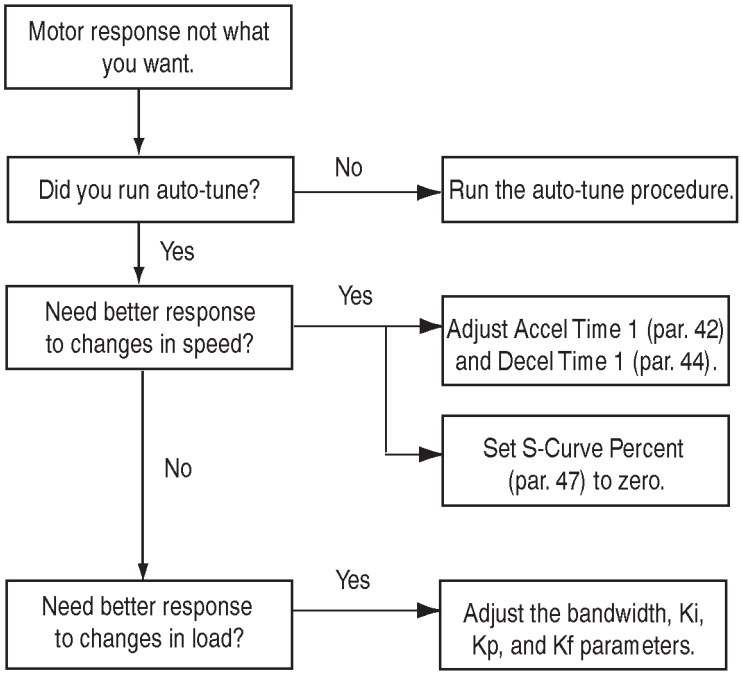
No HIM Display



HIM Displays “Running”



Motor Response Not Where You Want It



Start Up Troubleshooting Procedures

If you are having problems with the start up procedure, refer to this table for possible solutions before calling for help.

If:	Then:
You powered up your drive and cannot access the start up routine.	The start up procedure is not supported on a Series A Human Interface Module (HIM). To verify that you have a Series A HIM, check the series letter located on the back side of the HIM or check the HIM version when you first power up your drive.
You got a *Feedback Loss Fault*.	You have specified that an encoder is on the system but it has been disconnected.
The motor does not turn during the phase rotation test.	Remove the load from the motor and try running the autotune tests again. Afterwards, you will need to attach the load again and run the inertia test manually.

During the phase rotation test you were asked to swap the encoder leads. You changed the leads and ran start up again. You were asked to swap the leads again.	The drive is not getting any speed feedback information. You need to:
	• Check the connection between the encoder and the motor.
	• Run the phase rotation test again and escape out to the status display at the first question. Check the motor speed. It should ramp to 3 Hz (90 rpm) for a 60 Hz 4 pole motor. If the motor speed is 0 rpm, you should:
	  • Check the encoder wiring.
	  • Check the encoder itself.

Miscellaneous Troubleshooting Procedures

If you are having problems with how your 1336 IMPACT drive is operating, refer to this table for possible solutions before calling for help.

If:	Then you should:
The drive starts and then stops.	• Check if the mode specified in *L Option Mode* (parameter 116) is 2 or 3 wire. • Check *SP 2 Wire Enable* (parameter 181). • Check to see if the HIM displays a fault message. • Check the L Option Board wiring. • Check the settings on your gateway (communications module).
There is a delay before the stop command takes effect.	• Check the value of *Stop Dwell Time* (parameter 18).
The motor waits before starting.	• Check *Start Dwell Time* (parameter 194). • Check *Pos Torque Lim* (parameter 74) and *Neg Torque Lim* (parameter 75). • Check *Fast Flux Level* (parameter 78) and bit 8 of *Bus/Brake Opts* (parameter 13). • Check *S–Curve Percent* (parameter 47).
The drive coasts on stop.	• Check the stop type bits in *Logic Options* (parameter 17). • Check *Zero Speed Tol* (parameter 19).

If:	Then you should:
You cannot clear faults.	• Check if the port is enabled in *SP Enable Mask* (parameter 124). • Check if clear faults is enabled in *Clr Flt/Res Mask* (parameter 127). • Check if clear fault owners in *Ramp/ClFlt Owner* (parameter 131) is set. If set, check stop owners in *Start/Stop Owner* (parameter 129) and remove stop conditions. • The fault is a hard fault which requires a power cycle or drive reset.
The motor does not turn or run at the correct speed.	• Check which speed reference the drive is following in *Drive/Inv Status* (parameter 21) bits 13–15. • Check if *Spd/Trq Mode Sel* (parameter 68) is set correctly. • Check if *Spd Desired BW* (parameter 161) is non-zero. • Set the drive defaults and run start up again to tune the drive.
The HIM pot does not control motor speed.	• Check if *SP An In1 Select* (parameter 133) or *SP An In2 Select* (parameter 136) is set to the HIM port number. • Check if *SP An In1 Scale* (parameter 135) or *SP An In2 Scale* (parameter 138) is 0.125. • Check if a *Speed Ref 1–7* (parameters 29 through 36) is linked to *SP An In1 Value* (parameter 134) or *SP An In2 Value* (parameter 137). • Check which speed reference the drive is following in *Drive/Inv Status* (parameter 21) bits 13–15. The speed reference should be set to the speed reference that *SP An In1 Value* (parameter 134) or *SP An In2 Value* (parameter 137) is linked to.
The drive will not change direction.	• Check if the port is enabled in *SP Enable Mask* (parameter 124). • Check if Direction is enabled in *Dir/Ref Mask* (parameter 125). • Check if Direction owner in *Dir/Ref Owner* (parameter 128) has any bit set. If so, remove the command direction. • Check to make sure that bit 11 in *Logic Options* (parameter 17) is clear (0).

You cannot change the speed reference.	• Check if the port is enabled in *SP Enable Mask* (parameter 124).
	• Check if Reference is enabled in *Dir/Ref Mask* (parameter 125).
	• Check if Reference owner in *Dir/Ref Owner* (parameter 128) has any bit set. If so, remove the command reference. If bit 0 (for the L Option control) is set, you need to do one of the following to remove ownership:
	  • Clear bit 0 in *Dir/Ref Mask* (parameter 125).
	  • If *L Option Mode* (parameter 116) is 2, 3, 8, 9, 23, 24, or 26, close the L Option inputs for speed references 1, 2, and 3.

The drive does not run correct torque.	• Set the drive defaults and run start up again to tune the drive. • Check *Spd/Trq Mode Sel* (parameter 68) and *Slave Torque %* (parameter 70).
The drive cannot control current and trips on an overcurrent fault.	• If you are using an encoder, check that you have entered the correct PPR into *Encoder PPR* (parameter 8).
The MOP does not work.	• Check *L Option Mode* (parameter 116). • Make sure that *Mop Value* (parameter 119) is linked to a speed reference.

If:	Then you should:
The pulse input does not work.	• Make sure that the pulse input jumper is set correctly. • Make sure that the input is differential and not single ended. • Check the values of *Pulse In PPR* (parameter 120), *Pulse In Scale* (parameter 121), and *Pulse In Offset* (parameter 122). • Check the link on *Pulse In Value* (parameter 123).
The external fault does not work.	• Check the mode in *L Option Mode* (parameter 116). • Check bit 6 in *Fault Select 2* (parameter 22) and *Warning Select 2* (parameter 23).
You keep getting motor overload trips.	• Reduce the load. • Check bits 3 and 4 in *Fault Select 2* (parameter 22) and *Warning Select 2* (parameter 23). • Check *Motor Overload %* (parameter 26).
The motor reduced the speed range.	• Check *SP An In1 Scale* (parameter 135) or *SP An In2Scale* (parameter 138) if your speed input is coming from the HIM pot. • Check *An In 1 Offset* (parameter 97), *An In 1 Scale* (parameter 98), *An In 2 Offset* (parameter 100), *An In 2 Scale* (parameter 101), *mA Input Offset* (parameter 103), and *mA Input Scale* (parameter 104) if your speed input is coming from the analog inputs. • Check *Speed Scale 1* (parameter 30) or *Speed Scale 7* (parameter 37). • Check *Absolute Overspd* (parameter 24). • Check *Min Speed Limit* (parameter 215).

Encoderless Troubleshooting Procedures

If you are having problems with encoderless mode, refer to this table for possible solutions before calling for help.

If:	Then you should:
The motor will not accelerate or does not start smoothly	• Increase the bandwidth in *Spd Desired BW* (parameter 161). If the bandwidth is too low, the motor may not accelerate, although the current increases to current limit. • If the regen power limit is 0, increase it to at least –5%. • Increase the torque and current limits to the maximum. • Increase the value of *Kp Freq Reg* (parameter 178).
The motor oscillates after it is up to speed	• Decrease the bandwidth in *Spd Desired BW* (parameter 161) if the process will allow. If this does not help, depending on your application, you need to either increase or decrease the value of *Error Filter BW* (parameter 162).
The inverter trips on absolute overspeed during starting	• Increase the acceleration time. • If the overspeed occurs during a fast acceleration, increase the value of *Kp Freq Reg* (parameter 178) until the trip stops occurring. • Increase the bandwidth in *Spd Desired BW* (parameter 161). • If the overspeed occurs during a reversal, increase the deceleration time (slower deceleration).

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Disassembly and Access Procedures

Chapter Objectives

This chapter describes general disassembly procedures required to access internal drive components.

Disassembly and Access Overview

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove and lock out power before you disconnect or reconnect wires, and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Servicing energized industrial control equipment can be hazardous. Electrical shock, burns, or unintentional actuation of controlled industrial equipment may cause death or serious injury. Follow the safety-related practices of NFPA 70E, Electrical Safety for Employee Workplaces, when working on or near energized equipment. Do not work alone on energized equipment.

Electrostatic Discharge Precautions

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, Guarding Against Electrostatic Discharge, or any other applicable ESD protection handbook.

Electrostatic discharge generated by static electricity can damage the complementary metallic oxide semiconductor devices on various drive boards. It is recommended that you perform these procedures to guard against this type of damage when circuit boards are removed or installed:

- Wear a wrist-type grounding strap that is grounded to the chassis.
- Attach the wrist strap before removing the new circuit board from the conductive packet.
- Remove boards from the drive and immediately insert them into their conductive packets.

Tools

You need the following tools to disassemble and assemble the drive:

- Pliers
- Phillips screwdrivers (small, medium, and large)
- Standard screwdrivers (small, medium, and large)
- Metric socket set up to 19 mm
- Torque wrench to 34 N-m or 280 in.-lbs
- Torque screwdriver to 10 N-m or 80 in.-lbs
- Nylon tie wraps

Fastener Torque Specifications

Torque Sequence

When mounting components to a drive's heat sink, component-fastener torque sequences and tolerances are crucial to component-to-heat sink heat dissipation.

ATTENTION: Component can be damaged if temporary tightening procedure is not performed to specification.

The following illustrates temporary and final tightening sequences for components fastened to a heat sink using two, four, and six screws. Temporary torque is 1/3 (33%) of final torque, except six-point mountings, which require 0.5 N-m (4 in.-lb). The numeric illustration labels are for your assistance. Drive components do not carry these labels.

Figure 3.1
Two-Point Mounting

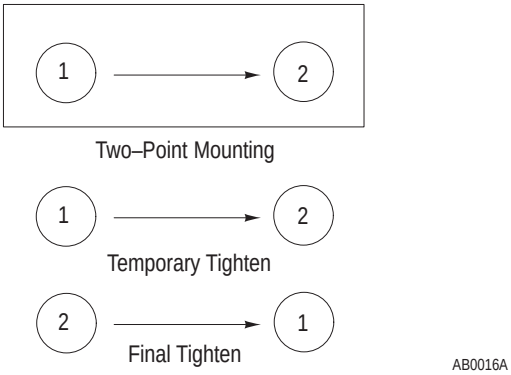


Figure 3.2
Four-Point Mounting

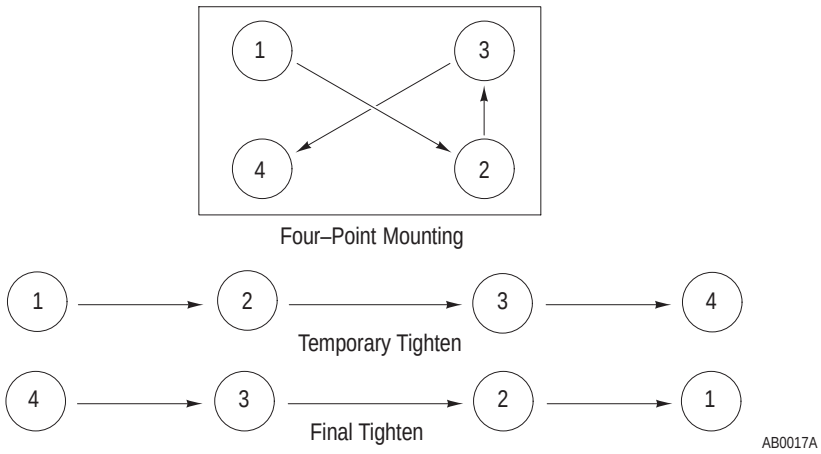
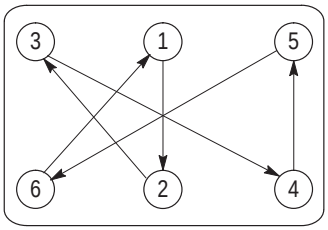


Figure 3.3
Six-Point Mounting



▶ Do not exceed 0.4 Newton-meters (3 in.-lb) on initial torque or 3.8 Newton-meters (32 in.-lb) final torque of all six screws.

Torque Specifications

The following table lists fastener locations by component, how the fasteners are used, and torque specifications. Refer to Torque Sequence in this chapter for fastening two-point, four-point and six-point components to the heat sink.

Table 3.A
Fastener Torque Specifications

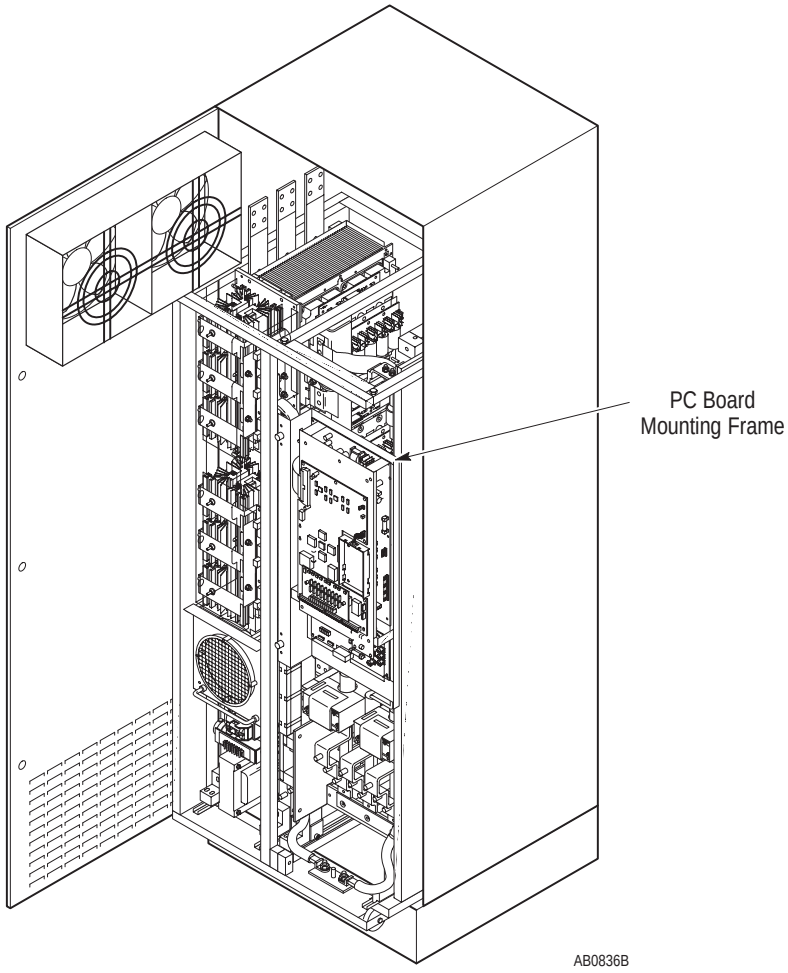
Component	Fastener Application	Torque in.-lb	Torque N-m
Fan Motor	Motor to Fan Cover Assembly	14	2
Fan Transformer	Transformer to chassis	75	9
Fan Capacitor	Capacitor to chassis	Hand-tighten	
MOV Surge Suppressor	MOV to chassis	18	2
Snubber Resistor	Resistor to heat sink	26	3
Snubber Bracket	Bracket to Power Module Laminated Bus	90	11
Snubber Board	Board to Brackets	18	2
Snubber Board	Board to Input Rectifier Bracket	18	2
Volt Sharing Resistor	Resistor to heat sink	26	3
Volt Sharing Resistor	Wires to Capacitor Bus Bar Assembly	50	6
Thermistor	Thermistor to heat sink	14	2
Bus Capacitor Holder	Holder to Bus Capacitors	26	3
Capacitor Bus Bar Assembly	Assembly to Bus Capacitors	50	6
Power Module Gate Interface Board	Board to Power Modules	18	2
Power Module Bus Bar	Bus Bar to Power Modules	90	11
Power Module	Module to heat sink	Refer to Figure 3.3	
Input Rectifier (SCR)	Rectifier to heat sink	[1]	
Transitional Bus Bar Assembly	Assembly to Power Module Bus Bar Assembly	80	9
Bus Fuse F1 – F3	Fuse to Transitional Bus Bar Assembly	240	28
DC Bus Inductor L1	Inductor to chassis	75	9
Bus Bar Cable Adaptor	Adaptor to Transitional Bus Bar Assembly and DC Bus Inductor, right side of Motor Flex Bus	75	9
Converter Bus and Motor Bus Bars	All connections	240	28
Wires (PE)	Wires to Ground Stud	175	21
Wire (TE)	Wire on Main Control Board Mounting Plate	26	3
Wires	Wires to TB1	16	1.8
Wires	Wires to TB2	7	0.8
Wires	Wires to TB3	8 – 10	09 – 1.1
Power Cables	Cables to terminals	240	28
Main Control, Gate Driver, Precharge Board Mounting Plates	Plates to chassis	26	3
Heat Sink Guard	Guard to chassis	18	2
T-Bar Mounting Bolt	T-Bar to Main Frame	240	28.8
Capacitor Mounting Bolt	Capacitor Bank Assembly to Main Frame	240	28.8
Inverter Housing Assembly Lock-Down Bolt	Inverter Housing Assembly to Main Frame	240	28.8
Wheel Chock Fasteners	Wheel Chocks to tracks	75	9
Ground Cable Bolts	Ground Cables from both assemblies to Main Frame	75	9

[1] Refer to the gauge on the clamp, which indicates pounds of IMPACT. The reading should be 400 lbs.

Disassembly and Access Procedures

Opening the Drive Enclosure

Figure 3.4
Drive Enclosure



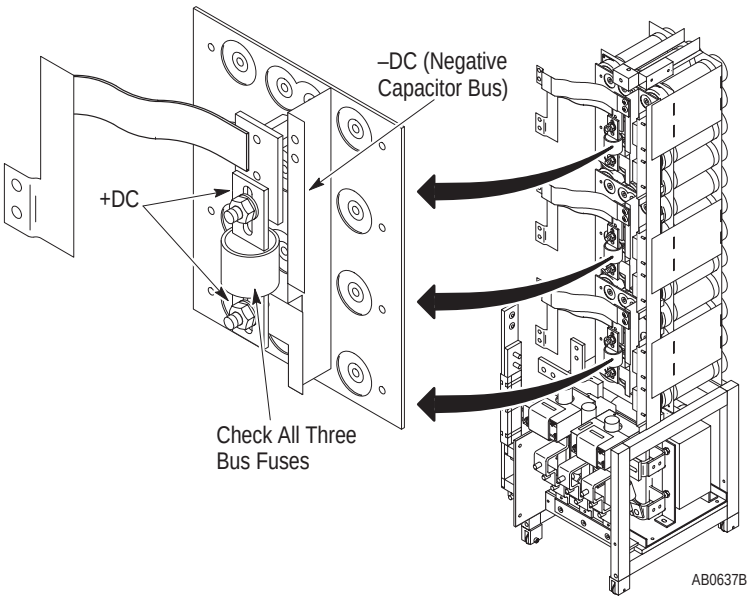
Opening

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

1. Remove power from the drive.
2. Turn the enclosure door latches 1/4 turn counterclockwise to open the enclosure door.
3. Turn the latches, located on the left side of the PC Board Mounting frame, to open the PC Board Mounting Frame. Refer to Figure 3.4.
4. Check for zero volts between +DC and –DC. Refer to Figure 3.5.

Figure 3.5
DC Voltage Check



ATTENTION: A blown fuse can create a hazard of shock which may result in death or serious injury. Check voltage between the bus bar and both ends of all three fuses.

5. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
6. Remove the customer-supplied wiring from the drive.

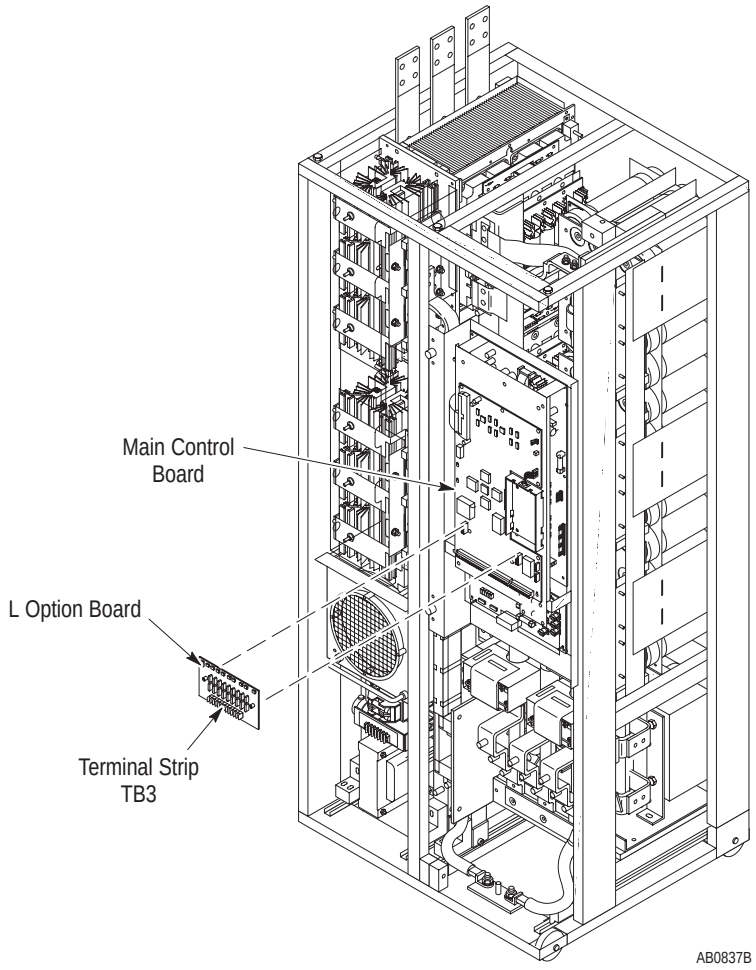
Closing the Drive Enclosure

Close the drive enclosure in reverse order of opening.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing the L Option Board

Figure 3.6
L Option Board



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the enclosure door and PC Board Mounting Frame. Refer to Opening the Drive Enclosure in this chapter.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Remove all wires from Terminal Strip TB3.
6. Loosen the two captive screws fastening the L Option Board to the Main Control Board.
7. Grip the right and left sides of the L Option Board and pull the board straight out from the Main Control Board.

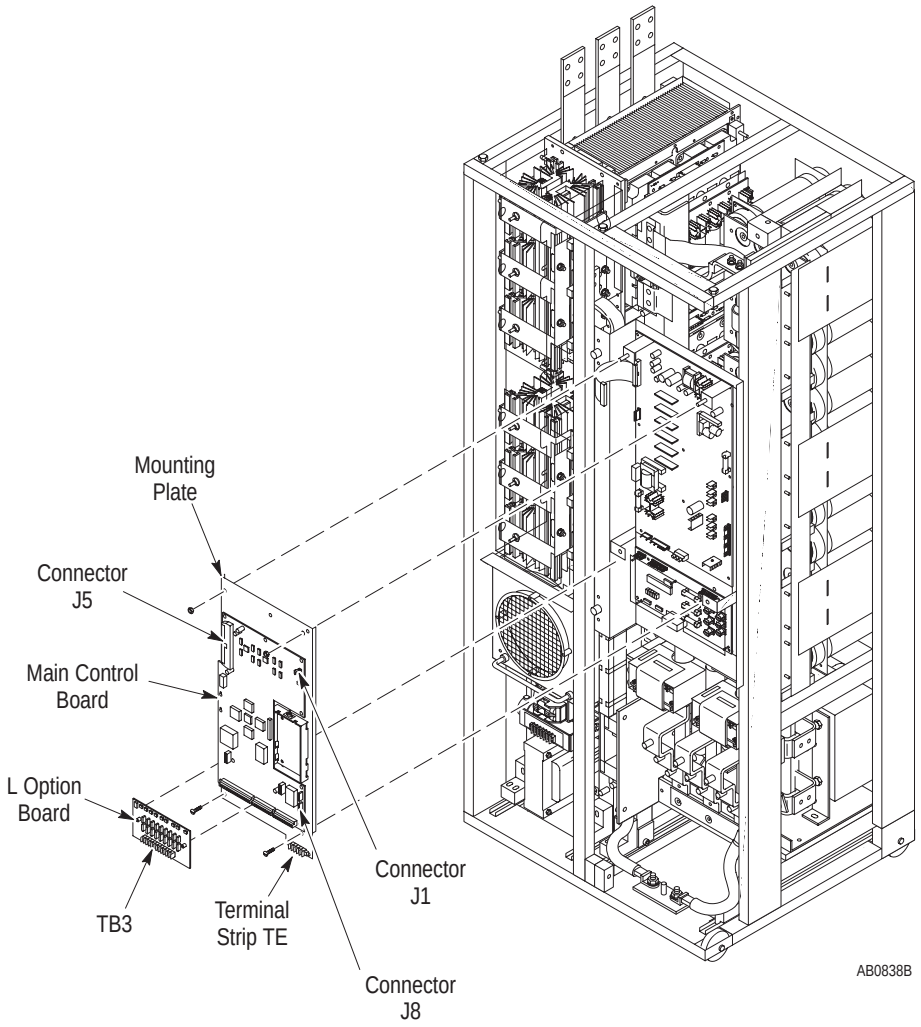
Installation

Install the L Option Board in reverse order of removal.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing the Main Control Board Mounting Plate

Figure 3.7
Main Control Board and Mounting Plate



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the enclosure door and PC Board Mounting Frame. Refer to Opening the Drive Enclosure in this chapter.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Disconnect the following from the Main Control Board:
   - J1 connector
   - J5 ribbon cable connector
   - J7 connector
   - Ground wires from terminal strip TE
   - Chassis ground wire at the top-right corner of the Main Control Board Mounting Plate
6. Remove the screws fastening the Main Control Board Mounting Plate to the PC Board Mounting Frame.
7. Slide the Main Control Board Mounting Plate toward the top of the drive to release it from the slide-mount stand-offs and connector J7.
8. Remove the nuts fastening the top of the Main Control Board Mounting Plate to the PC Board Mounting Frame.
9. Lift the Main Control Board Mounting Plate out of the drive.

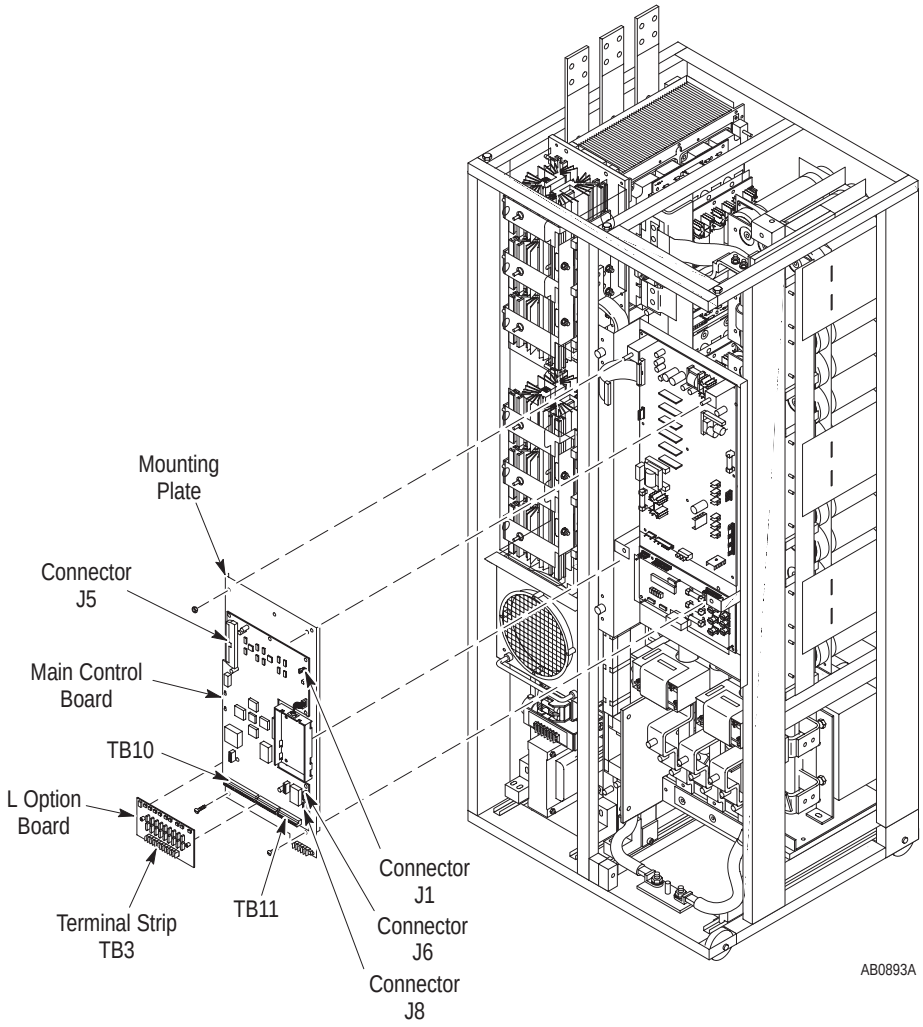
Installation

Install the Main Control Board Mounting Plate in reverse order of removal. Refer to Table 3.A – Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing the Main Control Board

Figure 3.8
Main Control Board and Mounting Plate



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the enclosure door and PC Board Mounting Frame. Refer to Opening the Drive Enclosure in this chapter.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Remove all wires from Terminal Strip TB3 if an L Option Board is used.
6. Disconnect the following from the Main Control Board:
   - J1 connector
   - J5 ribbon cable connector
   - J6 connector
   - J7 connector
   - Ground wire at stake-on connector
   - All wires from the terminals on TB10 and TB11

7. Remove the five screws fastening the Main Control Board to the mounting plate.
8. Slide the Main Control Board toward the top of the drive to release it from the slide-mount stand-offs.
9. Store the Main Control Board in an anti-static bag.

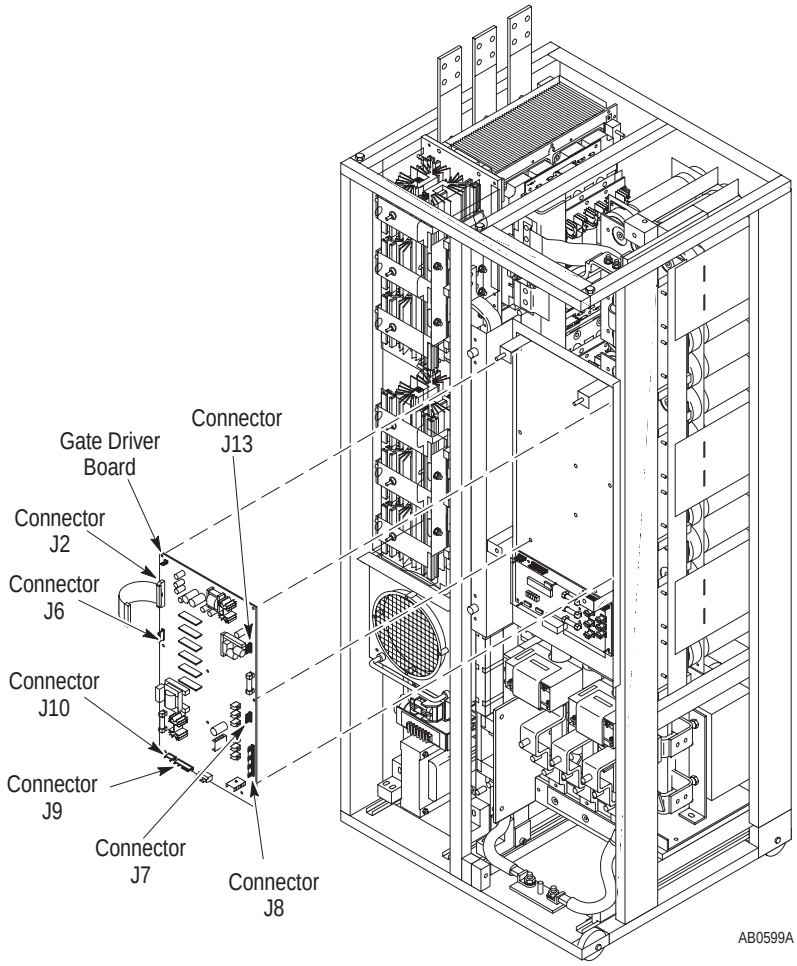
Installation

Install the Main Control Board Mounting Plate in reverse order of removal.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing the Gate Driver Board

Figure 3.9
Gate Driver Board



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the enclosure door and PC Board Mounting Frame. Refer to Opening the Drive Enclosure in this chapter.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Remove the Main Control Board Mounting Plate. Refer to Removing the Main Control Board Mounting Plate in this chapter.
6. Disconnect the following from the Gate Driver Board:
   - J2 connector
   - J6 connector
   - J7 connector
   - J8 connector
   - J9 connector
   - J10 connector
   - J13 connector

7. Turn the eight stand-offs, fastening the Gate Driver Board to the PC Board Mounting Frame, 1/4 turn counterclockwise.
8. Pull the Gate Driver Board away from the stand-offs.
9. Store the Gate Driver Board in an anti-static bag.

Installation

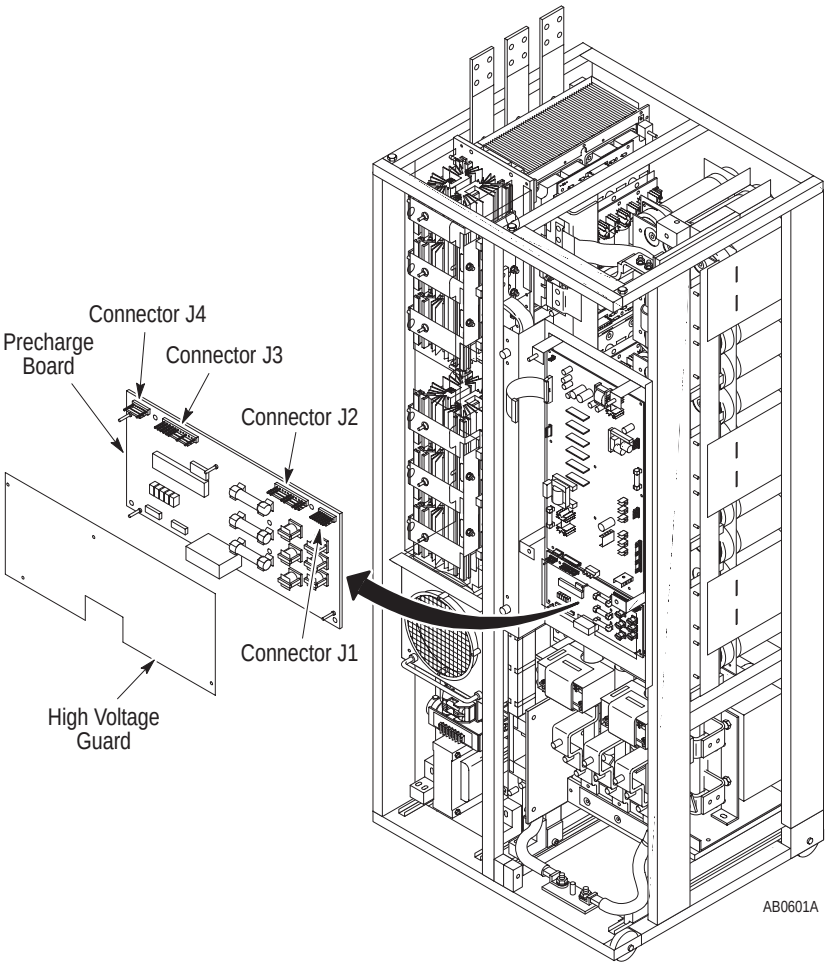
Install the Gate Driver Board in reverse order of removal. Refer to Table 3.A – Fastener Torque Specifications.

ATTENTION: When installing the wire harness connecting Gate Driver Board connector J9 to Precharge Board connector J3, align the wires on the harness terminals with the pins on the board connectors. Incorrect harness connection may result in faulty drive operation and may damage the equipment.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing the Precharge Board

Figure 3.10
Precharge Board



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the enclosure door and PC Board Mounting Frame. Refer to Opening the Drive Enclosure in this chapter.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Remove the High Voltage Guard.
6. Disconnect the following from the Precharge Board:
   - J1 connector
   - J2 connector
   - J3 connector
   - J4 connector
7. Turn the four stand-offs 1/4 turn counterclockwise to remove the Precharge Board High Voltage Guard.
8. Turn the six stand-offs, fastening the Precharge Board to the PC Board Mounting Frame, 1/4 turn counterclockwise to remove the board.
9. Store the Precharge Board in an anti-static bag.

Installation

Install the Precharge Board in reverse order of removal.

ATTENTION: When installing the wire harness connecting Gate Driver Board connector J9 to Precharge Board connector J3, align the wires on the harness terminals with the pins on the board connectors. Incorrect harness connection may result in faulty drive operation and may damage the equipment.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Access to the Inverter Housing and Capacitor Bank Assemblies

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

ATTENTION: These assemblies weigh about 500 pounds each. Before you pull either one from the drive, you must have a platform in place to hold the assembly. You cannot remove the assembly without a platform. The top of the platform must be even with the assembly's track. The platform must be strong enough to support the assembly and the personnel servicing the drive. Refer to Figure 3.14 in this chapter.

ATTENTION: To remove either the Inverter Housing Assembly or the Capacitor Bank Assembly safely requires two persons. Attempting to remove either assembly by yourself may result in death or serious injury.

ATTENTION: Do not remove both the Inverter Housing and the Capacitor Bank assemblies at the same time.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

The three main parts of this drive are the PC Board Mounting Frame, the Inverter Housing Assembly, and the Capacitor Bank Assembly. Some procedures in this manual require access to these assemblies and refer to this section.

Each assembly has wheels that roll in tracks built into the base of the drive. Chocks bolted into the tracks prevent assembly movement. The drive itself also has wheels, built into the main framework of the drive. Because of the size, weight, and physical characteristics of the drive, any service procedures requiring removal of either the Inverter Housing Assembly or the Capacitor Bank Assembly require two people.

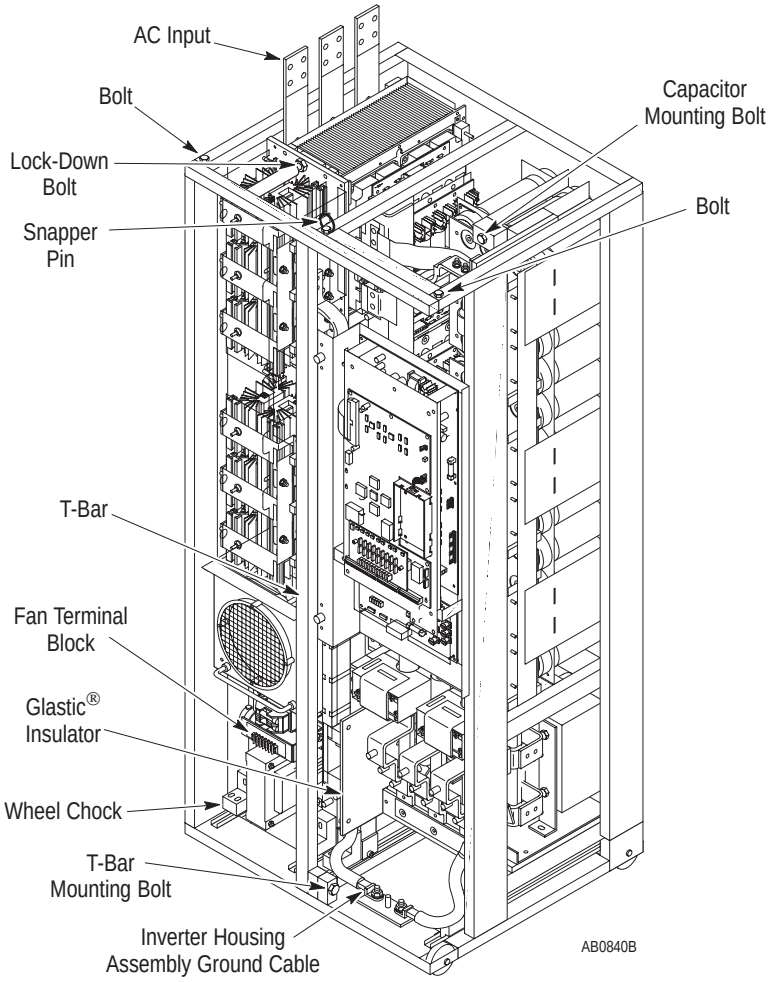
Access to the Inverter Housing Assembly

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

Figure 3.11
Access to the Inverter Housing Assembly



Removal

ATTENTION: To remove either the Inverter Housing Assembly or the Capacitor Bank Assembly safely requires two persons. Attempting to remove either assembly by yourself may result in death or serious injury.

ATTENTION: Do not remove both the Inverter Housing and the Capacitor Bank assemblies at the same time.

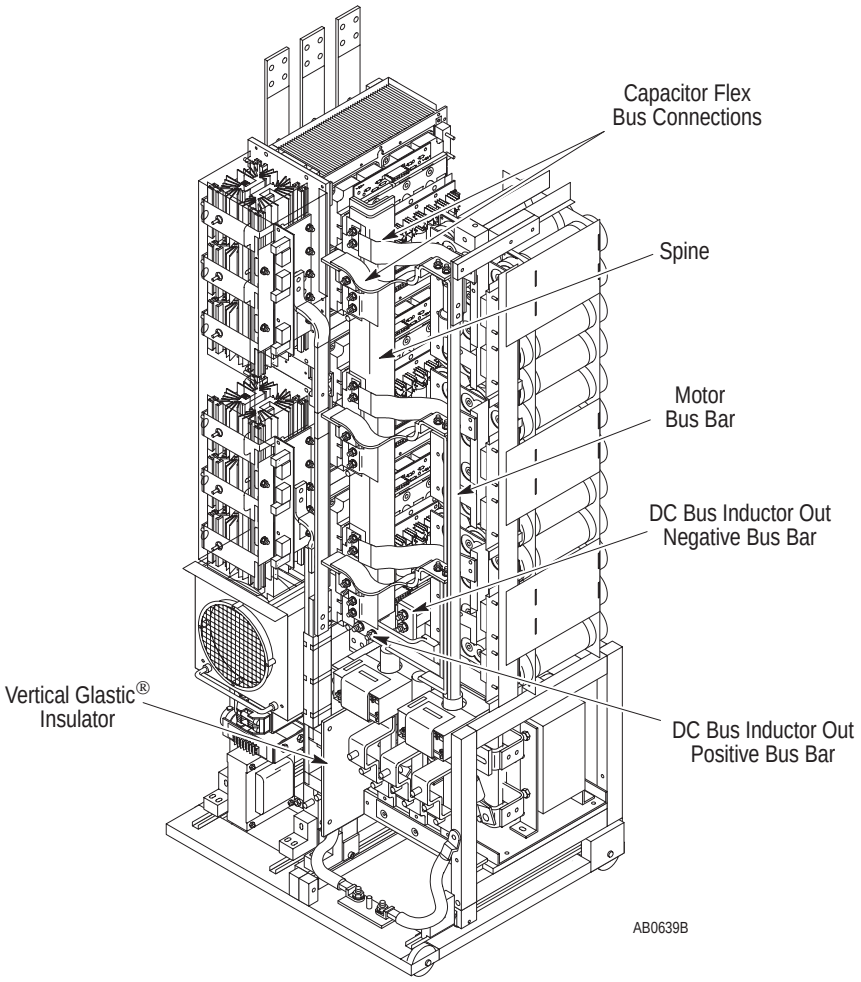
Access the drive:

1. Remove power from the drive.
2. Turn the enclosure door latches 1/4 turn counterclockwise to open the enclosure door.
3. Open the PC Board Mounting frame.
4. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
5. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
6. Disconnect the AC input lines at the top left of the drive.
7. Disconnect the wires to the door-mounted external fans at the fan terminal block located on the Inverter Housing Assembly.

Remove the T-bar from the front of the drive:

1. Release the locking nut between the inverter housing and the left side of the T-bar.
2. Remove the T-bar mounting bolt at the bottom of the upright.
3. Remove the bolts fastening each end of the crossbar.
4. Release the snapper pin at the top of the upright.

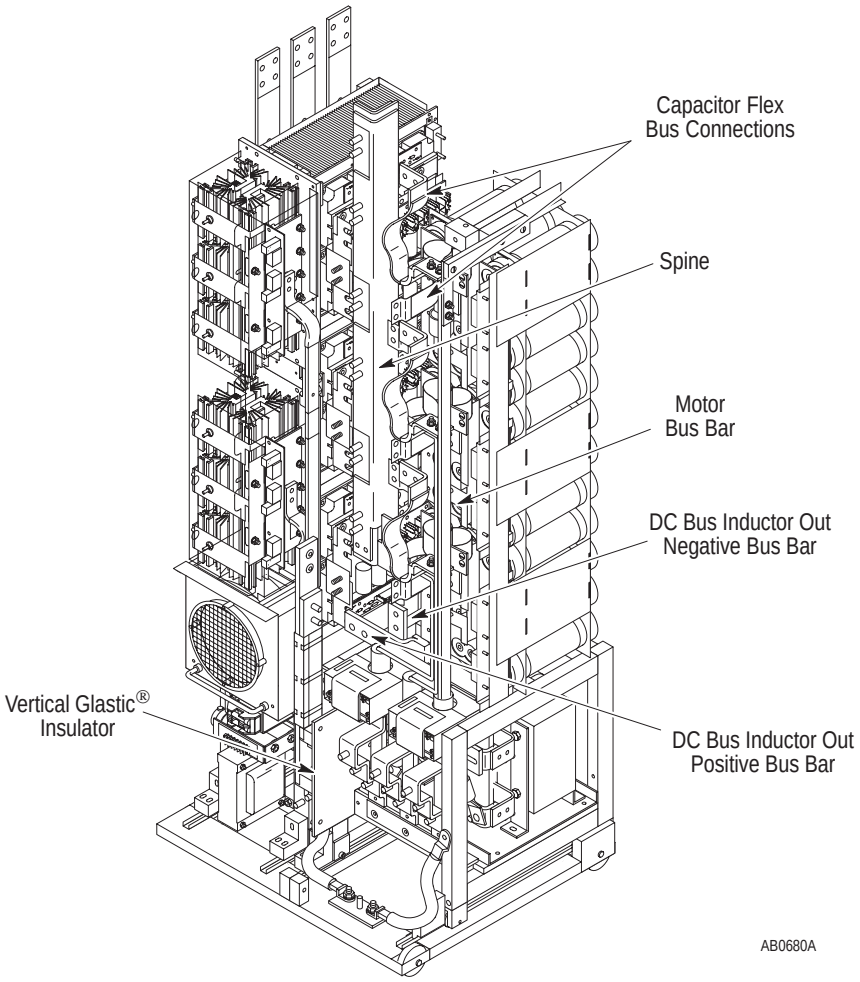
Figure 3.12
Disconnecting the Spine



Remove the connections between assemblies:

1. Remove the four connections to the DC Bus Inductor.
   - Two connections to the left of the vertical Glastic® insulator at the left of the motor leads.
   - Two connections to the left of the U-phase 350 amp bus fuse (capacitor fuse).
2. Remove the six nuts fastening the left end of the flex motor buses to the three Power Module Bus Bars.
3. Remove the 12 nuts fastening the left side of the capacitor flex bus connections to the spine.
4. Pull all the flexible leads to the right, out of the way.

Figure 3.13
Removing the Spine



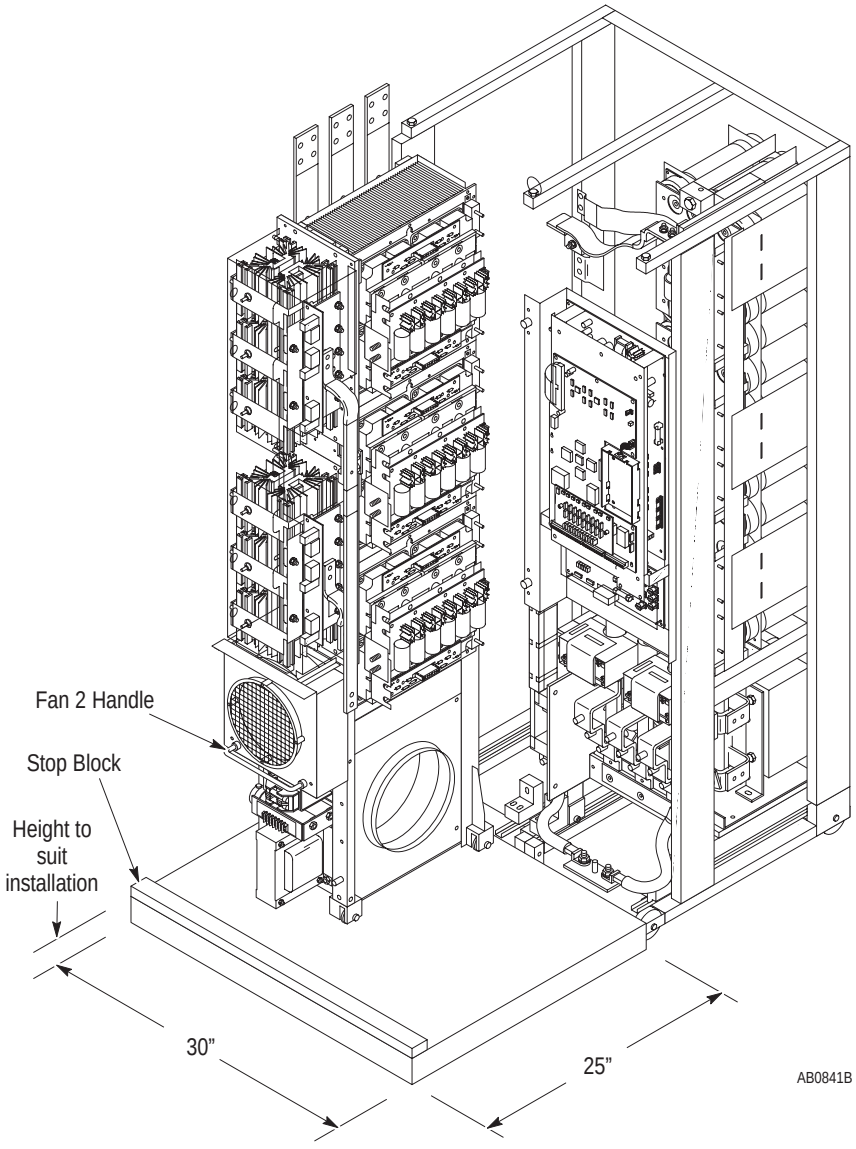
Remove the spine:

1. Remove the spine.
   - Push the spine carefully to the right.
   - Lift it out of the drive without forcing it.
2. Remove the six Gate Driver connectors from the Power Module Gate Interface Boards. Pinch the sides of the connector body while pulling back.
3. Disconnect any remaining wiring between the Inverter Housing Assembly and the Capacitor Bank Assembly.
4. Disconnect the Inverter Housing Assembly ground cable from the ground plate at the bottom of the main assembly.
5. Remove the wheel chocks at the bottom of the Inverter Housing Assembly.

6. Pull the assembly onto a platform. Refer to Figure 3.14 for recommendations. Use the handle attached to the Fan 2 housing.

ATTENTION: Hazard of tipping and severe injury exists. This process requires two people. The platform must be able to support 909 kg (2,000 lbs).

Figure 3.14
Service Platform



Installation

Install the Inverter Housing Assembly in reverse order of removal.

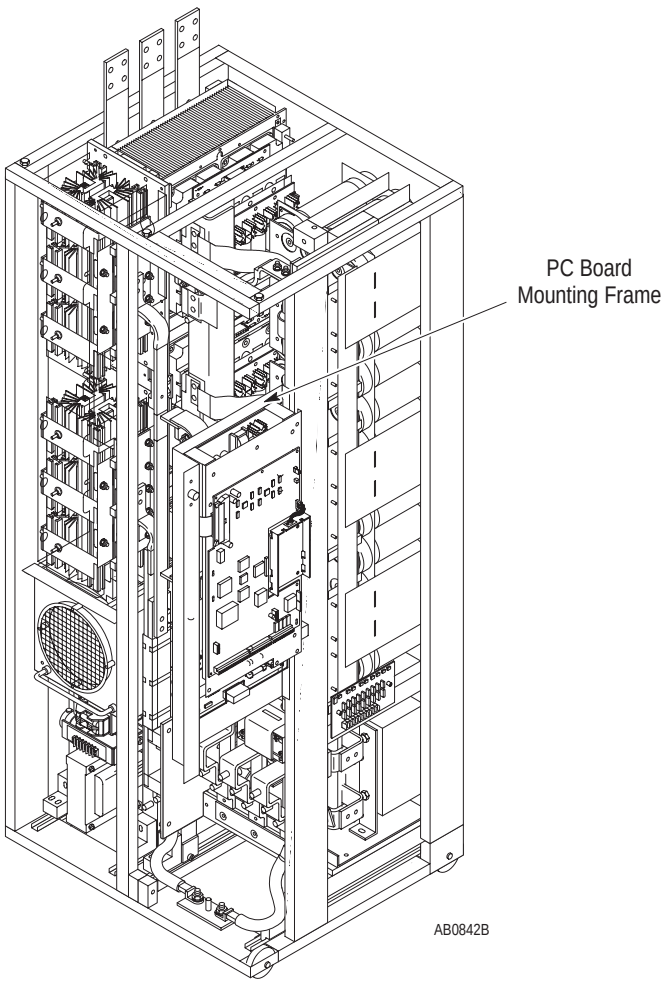
Important: When pushing the Inverter Housing Assembly into the drive, you may need to have someone tip the unit slightly to the left or right to center it between the guides at the back of the Enclosure. Adjust the angle brackets at the ends of the T-bar crossbar.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing the PC Board Mounting Frame

The PC Board Mounting Frame must be removed to pull the Capacitor Bank Assembly from the drive.

Figure 3.15
PC Board Mounting Frame



ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

Removal

1. Remove power from the drive.
2. Open the enclosure door and PC Board Mounting Frame. Refer to Opening the Drive Enclosure in this chapter.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Disconnect any wires connecting the PC Board Mounting Frame with either main assembly.
6. Open the PC Board Mounting Frame all the way to the right.
7. Lift the frame straight up to remove it from the hinges.

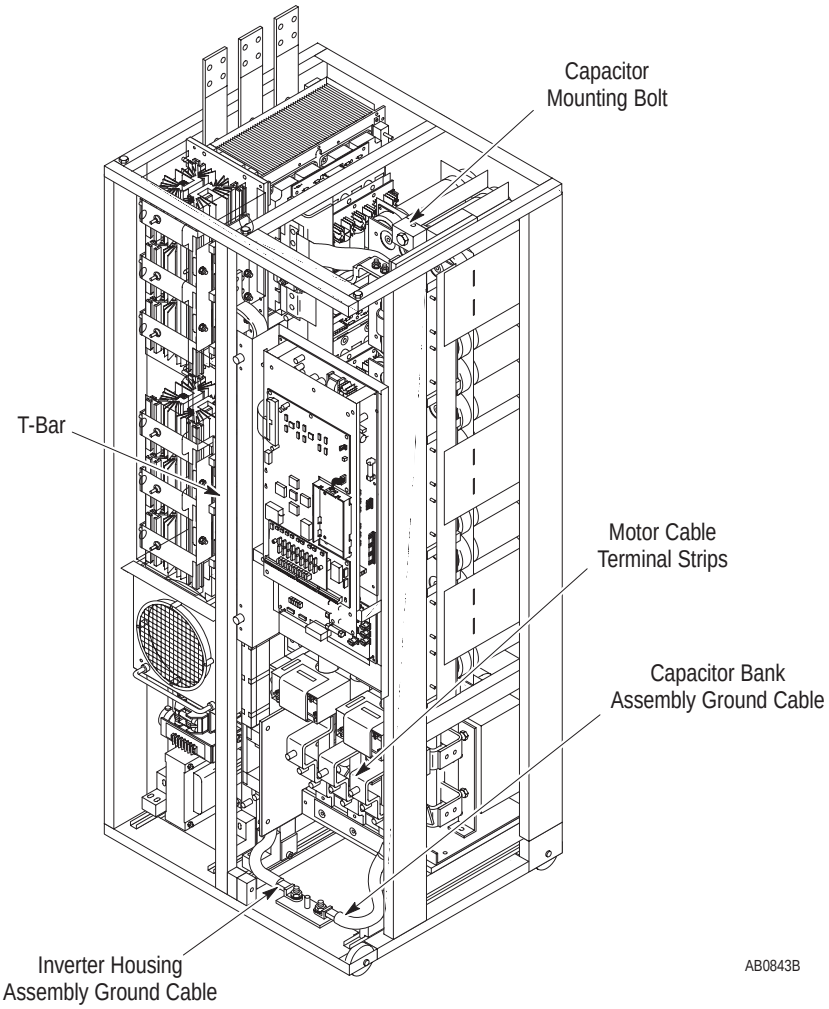
Installation

Install the PC Board Mounting Frame in reverse order of removal.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Access to the Capacitor Bank Assembly

Figure 3.16
Capacitor Bank Assembly



ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

Removal

ATTENTION: To remove either the Inverter Housing Assembly or the Capacitor Bank Assembly safely requires two persons. Attempting to remove either assembly by yourself may result in death or serious injury.

ATTENTION: Do not remove both the Inverter Housing and the Capacitor Bank assemblies at the same time.

ATTENTION: Hazard of tipping and severe injury exists. This process requires two people. The platform must be able to support 909 kg (2,000 lbs). Refer to Figure 3.14 in this chapter for platform specifications.

Access the drive:

1. Remove power from the drive.
2. Open the enclosure door and PC Board Mounting Frame. Refer to Opening the Drive Enclosure in this chapter.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Remove the motor cable connections from the terminal strips at the bottom right of the drive.
6. Remove the PC Board Mounting Frame. Refer to Removing the PC Board Mounting Frame in this chapter.

Remove the T-bar:

Important: Refer to Figure 3.11.

1. Release the locking nut between the inverter housing and the left side of the T-bar.
2. Remove the T-bar mounting bolt at the bottom of the upright.
3. Remove the bolts fastening each end of the crossbar.
4. Release the snapper pin at the top of the upright.

Remove the connections between assemblies:

Important: Refer to Figure 3.12.

1. Remove the four connections to the DC Bus Inductor.
   - Two connections to the left of the vertical Glastic® insulator at the left of the motor leads.
   - Two connections to the left of the U-phase 350 amp bus fuse (capacitor fuse).
2. Remove the six nuts fastening the left end of the motor flex buses to the three Power Module Bus Bars.
3. Remove the 12 nuts fastening the left side of the capacitor flex bus connections to the spine.
4. Pull all the flexible leads to the right, out of the way.
5. Remove the spine.
   - Push the spine carefully to the right.
   - Lift it out of the drive without forcing it.

Access the Capacitor Bank Assembly:

1. Disconnect the Inverter Housing Assembly ground cable from the ground plate at the bottom of the main frame.
2. Disconnect the Capacitor Bank Assembly ground cable.
3. Disconnect any ground wires that obstruct removal of the assembly.
4. Remove the capacitor mounting bolt at the top center of the capacitor frame.
5. Remove the wheel chocks at the bottom of the Capacitor Bank Assembly.
6. Pull the assembly onto a platform. Refer to Figure 3.14.

Installation

Install the Capacitor Bank Assembly in reverse order of removal.

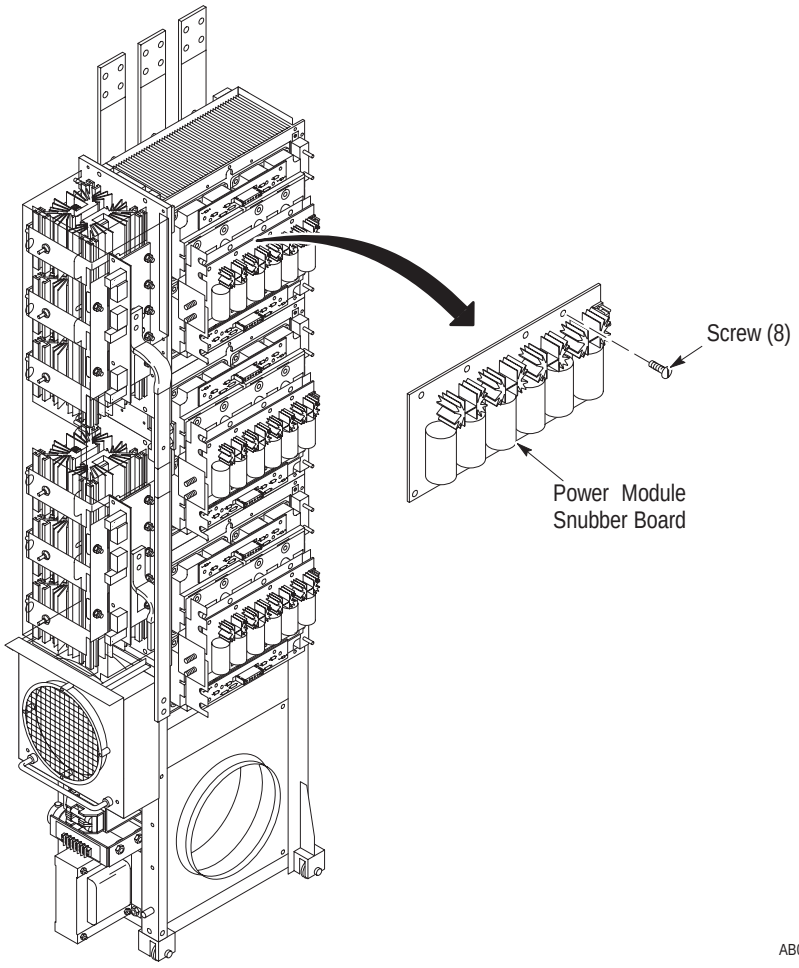
Important: Guide the unit into place so that it mates with the lock-down bolt at the top of the capacitor frame. Adjust the angle brackets at the ends of the T-bar crossbar.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing a Power Module Snubber Board

The Power Module Snubber Boards are located on the Inverter Heat Sink assembly.

Figure 3.17
Power Module Snubber Board



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Hazard of electric shock exists. Up to 1,600 VDC will be on Power Module Snubber Board Connector J1 if the Snubber Resistor is open. Measure for zero VDC from Snubber Board terminal TP3 to plus (+) bus before removing connector J1. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, between pins 1 and 2 of connector J1 to discharge any voltage.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the enclosure door and PC Board Mounting Frame. Refer to Opening the Drive Enclosure in this chapter.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Access the Inverter Housing Assembly. Refer to Accessing the Inverter Housing Assembly in this chapter.

6. Remove the snubber resistor J1 and J2 connections from the snubber board.
7. Remove the screws fastening the Power Module Snubber Board to the Snubber Bus Bars.

Installation

ATTENTION: Do not substitute longer or shorter hardware when fastening the Power Module components to the Power Modules. Use the same size fastener to fasten the components as was originally used. Using different fastener lengths will damage the Power Modules.

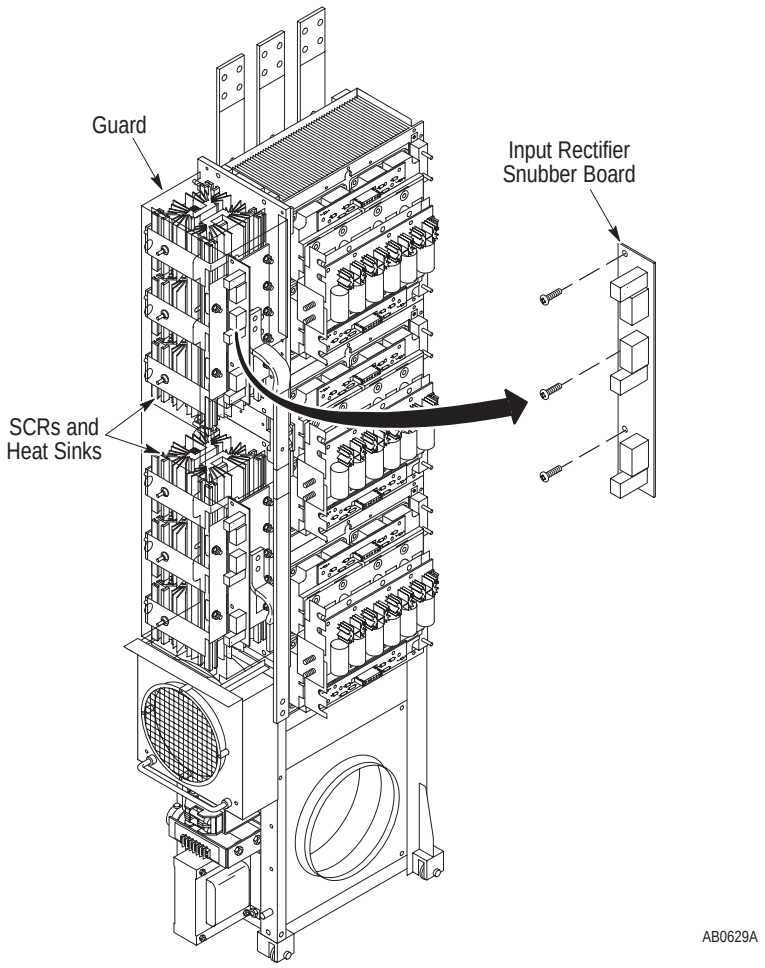
Install the Power Module Snubber Board in reverse order of removal. Refer to Table 3.A – Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Removing an Input Rectifier Snubber Board

The Input Rectifier Snubber Boards are located on the Inverter Housing Assembly, under the Guard, between the heat sinks and the vertical bus.

Figure 3.18
Input Rectifier Snubber Board



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the enclosure door and PC Board Mounting Frame. Refer to Opening the Drive Enclosure in this chapter.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Access the Inverter Housing Assembly. Refer to Accessing the Inverter Housing Assembly in this chapter.
6. Remove the plastic guard by removing the screws fastening the left side of the guard to the SCR heat sink assembly.
7. Remove the screws fastening the Input Rectifier Snubber Board to the AC and DC snubber buses.
8. Remove the snubber board.

Installation

Install the Input Rectifier Snubber Board in reverse order of removal. Refer to Table 3.A – Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Component Test Procedures

Chapter Objectives

The following tests help you troubleshoot B300 – B600 and C300 – C650 drives.

Component Test Overview

In some cases, different tests troubleshoot components of the same name. These similar tests vary according to the rating of the drive being tested. Verify that the rating on the drive matches the rating for the test you are performing.

The component test procedures in this chapter asssume that the drive you are servicing either has no enclosure or that the enclosure is open. For more information on opening the drive enclosure, refer to Chapter 3 – Disassembly and Access Procedures, Opening the Drive Enclosure.

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove and lock out power before you disconnect or reconnect wires, and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Servicing energized industrial control equipment can be hazardous. Electrical shock, burns, or unintentional actuation of controlled industrial equipment may cause death or serious injury. Follow the safety-related practices of NFPA 70E, Electrical Safety for Employee Workplaces, when working on or near energized equipment. Do not work alone on energized equipment.

Electrostatic Discharge Precautions

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, Guarding Against Electrostatic Discharge, or any other applicable ESD protection handbook.

Electrostatic discharge generated by static electricity can damage the complementary metallic oxide semiconductor devices on various drive boards. It is recommended that you perform these procedures to guard against this type of damage when circuit boards are removed or installed:

- Wear a wrist-type grounding strap that is grounded to the chassis.
- Attach the wrist strap before removing the new circuit board from the conductive packet.
- Remove boards from the drive and immediately insert them into their conductive packets.

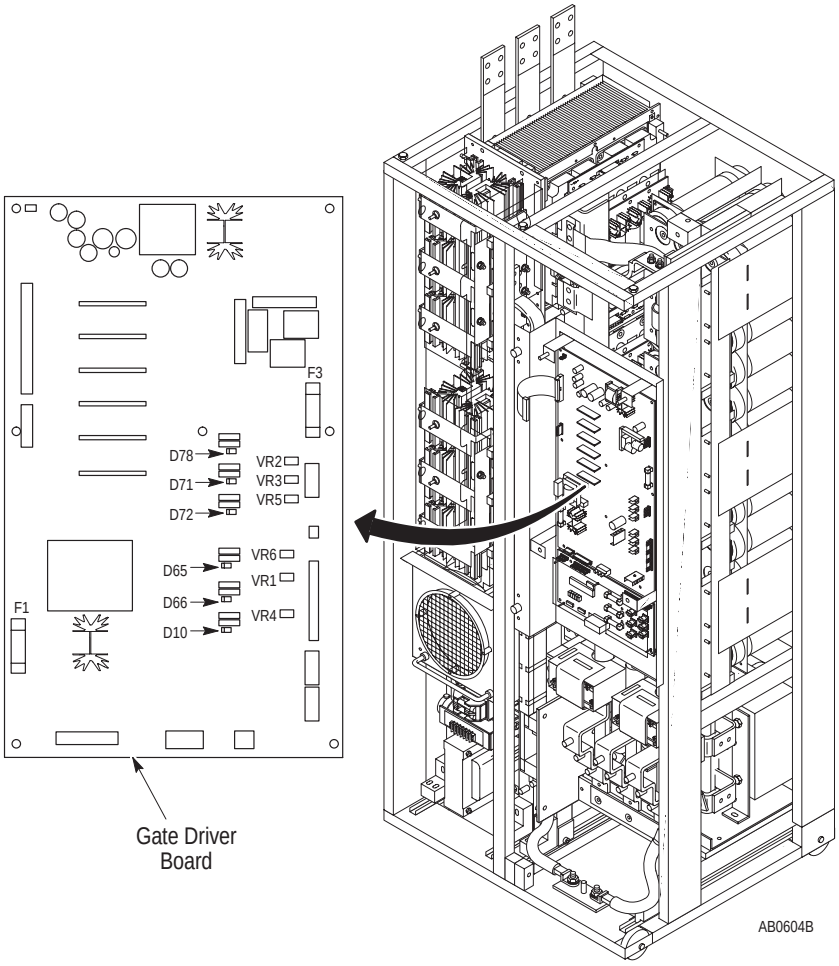
Tools

For a list of tools required, tightening sequences, and fastener torque specifications, refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

Test 1 – Testing the Gate Driver Board

The Gate Driver Board is located behind the Main Control Board, on the PC Board Mounting Frame. If power modules were replaced, replace the Gate Driver Board. If a new Gate Driver Board is not available, test the old board using the following procedure.

Figure 4.1
Gate Driver Board Test



ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions in Chapter 3 – Disassembly and Access Procedures.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Remove the Main Control Board Mounting Plate. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Main Control Board Mounting Plate.
6. Test Gate Driver Board fuses F1 and F3 for an open condition. Replace the Gate Driver Board if either fuse shows an open condition.
7. Set your meter to test diodes.
8. Test VR1 – VR6. The following table shows meter connections at the components and ideal meter readings for those connections. Refer to the previous illustration for component locations.

Table 4.A
Gate Driver Board Test

Component	Meter (+) Lead	Meter (–) Lead	Nominal Meter Reading*
VR1 – VR6	+	–	1.06
	–	+	1.8

Important: Typical malfunction is shorted in both directions.

* Meter Used: Fluke® Model 87, set to "Diode" range.

9. Replace the Gate Driver Board if your readings do not match the table readings. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Gate Driver Board.

10. Check all six reverse-bias Zener diodes: D10, D66, D65, D72, D71, and D78. The following table shows meter connections at the components and ideal meter readings for those connections. Refer to the previous illustration for component locations.

Table 4.B
Zener Diode Test

Component	Meter (+) Lead	Meter (–) Lead	Nominal Meter Reading
D78	+	–	less than 1
	–	+	open
D71	+	–	less than 1
	–	+	open
D72	+	–	less than 1
	–	+	open
D65	+	–	less than 1
	–	+	open
D66	+	–	less than 1
	–	+	open
D10	+	–	less than 1
	–	+	open

11. Replace the Gate Driver Board if your readings do not match the table, or if any diode is shorted or open in both directions. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Gate Driver Board.

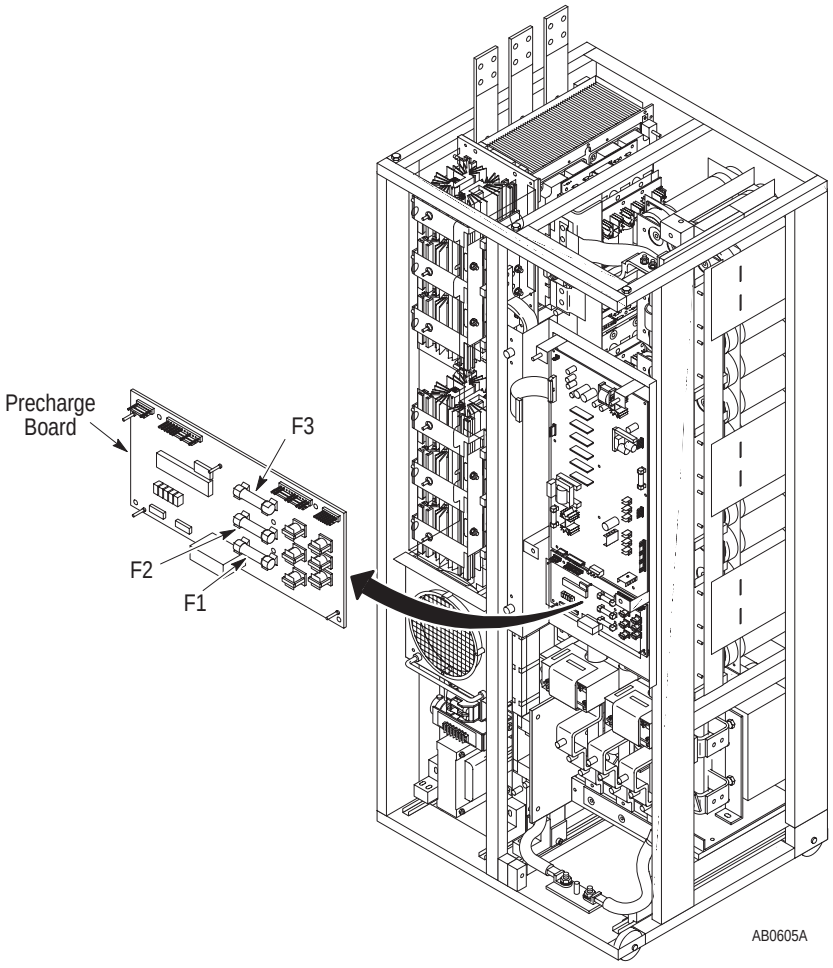
ATTENTION: When removing the entire wire harness connecting Gate Driver Board connector J9 to Precharge Board connector J3, align the wires on the harness terminals with the pins on the board connectors. Incorrect harness connection may result in faulty drive operation and may damage the equipment.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Test 2 – Testing the Precharge Board

If Power Modules have been replaced, you must test the Power Module Snubber Board, the Precharge Board, and the Gate Driver Board.

Figure 4.2
Precharge Board Test



ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions in Chapter 3 – Disassembly and Access Procedures.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

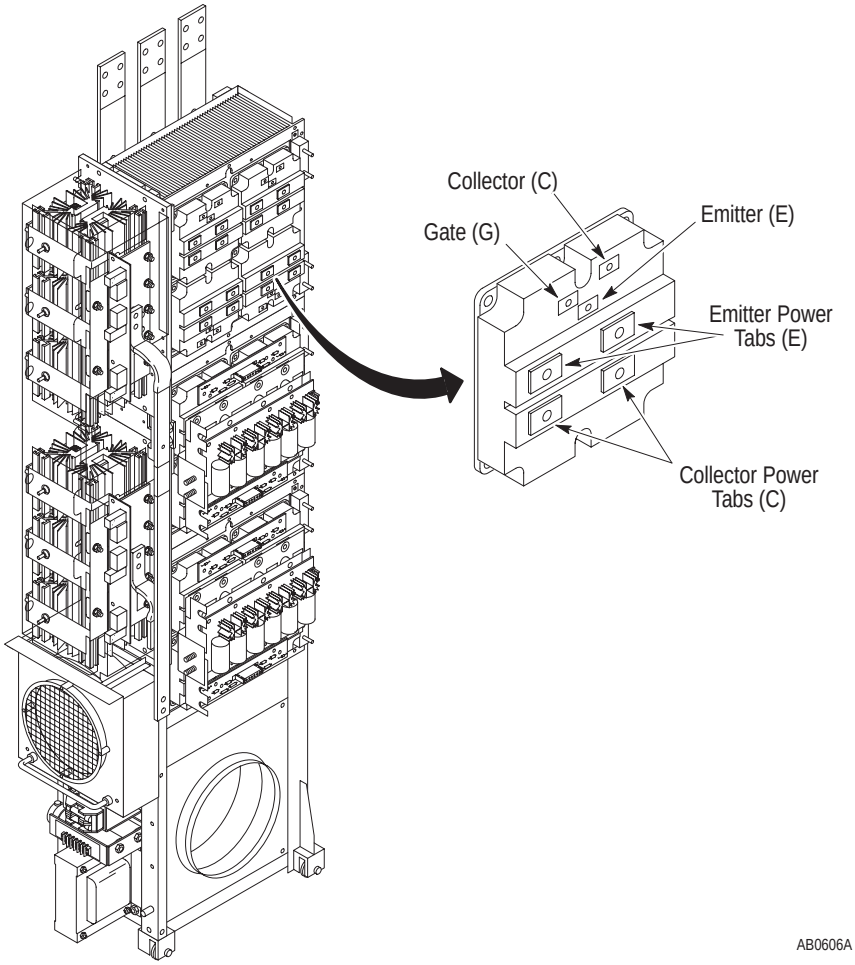
1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Set your meter to test resistance.
6. Test Precharge Board fuses F1, F2, and F3 for open conditions.
7. Replace the Precharge Board if any fuse shows an open condition. Refer to Chapter 3 – Disassembly and Access Procedures, Removing the Precharge Board.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Test 3 – Testing the Power Modules

The Power Modules are located on three heat sinks in the Inverter Housing Assembly. If Power Modules have been replaced, you must check the corresponding Power Module Snubber Board and Snubber Resistor in addition to replacing the Gate Driver Board. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

Figure 4.3
Power Module Test



ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions in Chapter 3 – Disassembly and Access Procedures.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Access the Inverter Housing Assembly. Refer to Chapter 3 – Disassembly and Access Procedures, Access to the Inverter Housing Assembly.
6. Remove the Power Module Snubber Board. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.
7. Set your meter to test diodes.
8. Test the Power Modules. The following table shows meter connections and ideal meter readings for those connections. Refer to the former illustration for meter connection locations.

Table 4.C
Power Modules

Meter (+) Lead	Meter (–) Lead	Nominal Meter Reading
E	C	0.218–0.418
E	G	Infinite
C	E	Infinite
C	G	Infinite
G	E	Infinite
G	C	Infinite

9. Replace a Power Module if meter readings are not as shown. Refer to Chapter 5 – Part Replacement Procedures, Power Modules.

10. Set your meter to measure resistance.

11. Test the Power Module Snubber Resistors. The reading should be 16 ohms each. If open, replace the snubber resistor.

▶ Two 16-ohm resistors are in parallel when plugged into a snubber board, resulting in 8 ohms total.

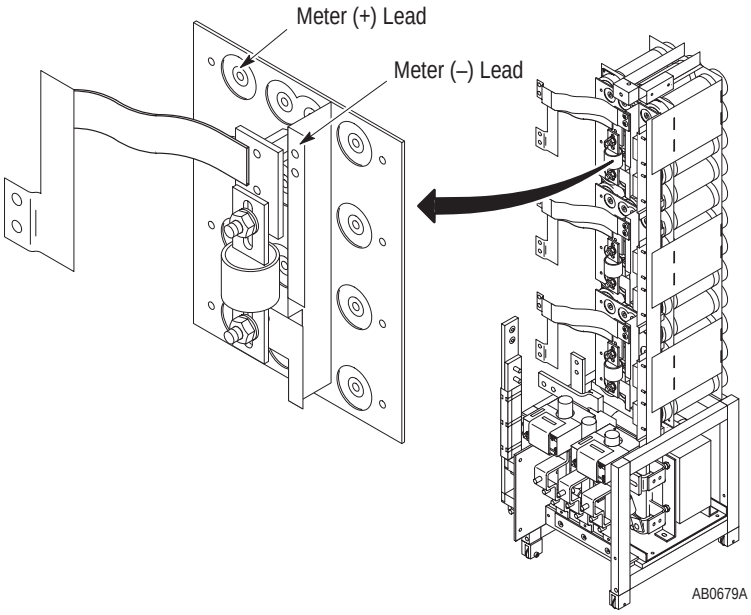
12. Assemble the drive in reverse order of disassembly.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Test 4 – Testing the Bus Capacitors

The Bus Capacitor Bank is located in the Capacitor Bank Assembly.

Figure 4.4
Bus Capacitor Bank Test



ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions in Chapter 3 – Disassembly and Access Procedures.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

Access the drive:

1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)

Test the Capacitors:

1. Set your meter to test voltage.
2. Connect the negative lead of the meter to –DC and the positive lead to the capacitor terminal called out in Figure 4.4.

ATTENTION: Servicing energized industrial control equipment can be hazardous. Electrical shock, burns, or unintentional actuation of controlled industrial equipment may cause death or serious injury. Follow the safety-related practices of NFPA 70E, Electrical Safety for Employee Workplaces, when working on or near energized equipment. Do not work alone on energized equipment.

3. Apply power **AFTER** the meter is connected; otherwise, your meter will read zero volts.

Refer to Table 4.D for nominal meter readings.

Table 4.D
Capacitor Test Meter Readings

Drive Series	Input Volts	Meter[1]
B	380 V	178 V
	415 V	193 V
	480 V	218 V
C	500 V	233 V
	575 V	267 V
	600 V	283 V

[1] If the capacitors are normal, the meter reading should be one third the voltage across the total capacitor bank.

4. Using this procedure, test each of the three Capacitor Bank sections. Table 4.E shows the correct voltage for the total Capacitor Bank.

Table 4.E
Bus Capacitor Bank Test

Drive Rating	Input Volts	Meter Reading
B	380	535V DC +/–10%
	415	580V DC +/–10%
	480	650V DC +/–10%
C	500	700V DC +/–10%
	575	800V DC +/–10%
	600	850V DC +/–10%

5. If the voltage is out of tolerance, check the following:

- An open condition at an Input Rectifier
- A voltage drop due to DC Bus Inductor resistance
- A voltage drop between an Input Rectifier and the bus capacitors due to loose or resistive wires or connections
- Precharge circuit problems

6. If the above check does not reveal a problem, replace the Bus Capacitor Bank and Load-Sharing Resistors. Refer to Chapter 5 – Part Replacement Procedures, Bus Capacitor Bank.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Test 5 – Testing the SCRs

The SCRs are located in the heat sinks on the Inverter Housing Assembly.

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions in Chapter 3 – Disassembly and Access Procedures.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

Access the drive:

1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)

Test the SCRs:

1. Set your meter to test resistance.
2. Measure resistance from AC inputs L1, L2, and L3 to +DC. Refer to Table 4.F.
3. Measure between each pair of gate and cathode terminals on the Precharge Board. Refer to Table 4.G.

The following tables show meter connections and ideal meter readings for those connections. Refer to the schematic in this manual for more information.

Table 4.F
SCR Test at AC Input

Meter (+) Lead	Meter (–) Lead	Nominal Meter Reading
L1	+DC	Infinite
L2		
L3		
L1	–DC	
L2		
L3		

Table 4.G
SCR Test at Precharge Board

SCR	Meter (+) Lead	Meter (–) Lead	Nominal Meter Reading
	J1 Connector		
SCR1	R1G	R1K	10
	R1K	R1G	10
SCR3	S1G	S1K	10
	S1G	S1G	10
SCR5	T1G	T1K	10
	T1K	T1G	10
	J2 Connector		
SCR4	R2G	R2K	10
	R2K	R2G	10
SCR6	S2G	S2K	10
	S2K	S2G	10
SCR2	T2G	T2K	10
	T2K	T2G	10

4. Replace the SCR if any meter readings are not as shown. Refer to Chapter 5 – Part Replacement Procedures, SCRs.

5. If an SCR requires replacement, check the Power Modules for damage. Refer to Testing the Power Modules in this chapter.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Part Replacement Procedures

Chapter Objective

This chapter describes procedures required to replace drive components. This chapter references Chapter 3 – Disassembly and Access Procedures for basic drive component access.

Part Replacement Overview

The part replacement procedures in this chapter assume that the drive you are servicing either has no enclosure or that the enclosure is open. For more information on opening the drive enclosure, refer to Chapter 3 – Disassembly and Access Procedures, Opening the Drive Enclosure.

Safety Precautions

ATTENTION: Some printed circuit boards and drive components may contain hazardous voltage levels. Remove power before you disconnect or reconnect wires, and before you remove or replace fuses and circuit boards. Verify bus voltage by measuring the voltage between between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

Electrostatic Discharge Precautions

ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, reference Rockwell Automation Publication 8000-4.5.2, Guarding Against Electrostatic Discharge, or any other applicable ESD protection handbook.

Electrostatic discharge generated by static electricity can damage the complementary metallic oxide semiconductor devices on various drive boards. It is recommended that you perform these procedures to guard against this type of damage when circuit boards are removed or installed:

- Wear a wrist-type grounding strap that is grounded to the chassis.
- Attach the wrist strap before removing the new circuit board from the conductive packet.
- Remove boards from the drive and immediately insert them into their conductive packets.

For a list of tools required, tightening sequences, and fastener torque specifications, refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

Major Component Replacement

This section explains in detail how to replace the following drive components:

- Bus Capacitor Bank
- Thermistor
- Power Modules
- Power Module Snubber Resistor
- SCRs
- Fans and Transformer Assembly
- DC Bus Inductor
- Ground Sense CT
- Bus Fuses
- LEMs
- MOV Surge Suppressor
- Thermal Switch

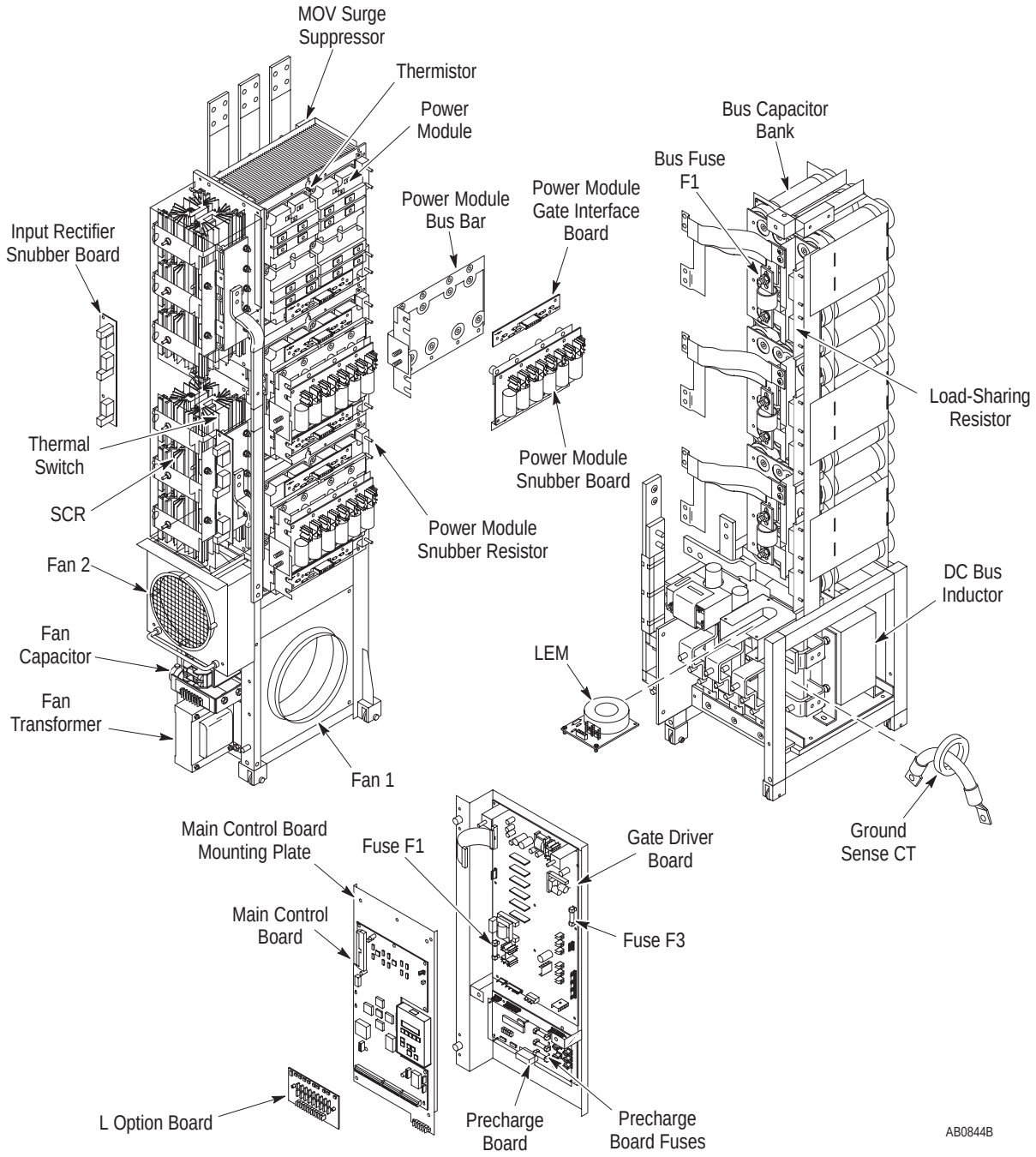
For Gate Driver Board, Precharge Board, Main Control Board, Snubber Board, and L Option Board installation and removal procedures, refer to Chapter 3.

Detailed Product Identification

Allen-Bradley Adjustable Frequency AC Drives are modular by design to enhance troubleshooting and spare parts replacement, thereby helping reduce production down-time.

The following illustration calls out the main components of a typical drive. Component designs vary slightly among the different drive ratings, but component locations are identical.

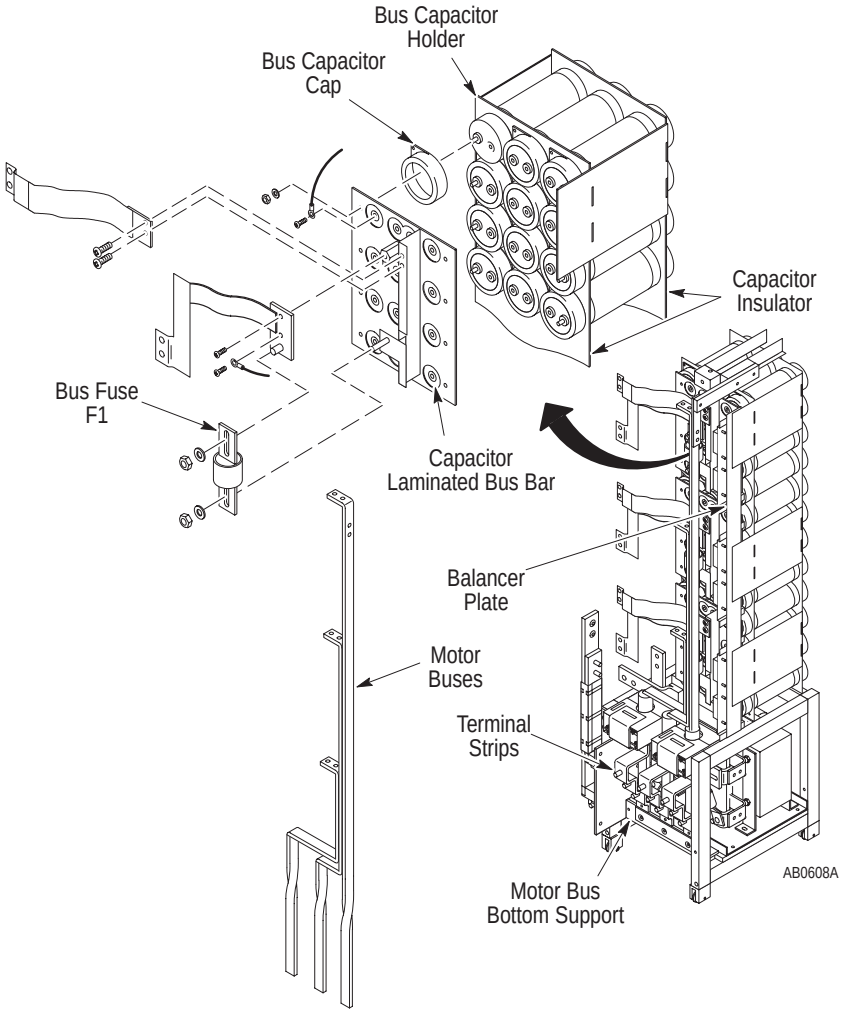
Figure 5.1
Main Drive Components



Bus Capacitor Bank

The Bus Capacitor Bank is located in the Capacitor Bank Assembly.

Figure 5.2
Bus Capacitor Bank



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Access the Capacitor Bank Assembly. Refer to Chapter 3 – Disassembly and Access Procedures, Access to the Capacitor Bank Assembly.

Remove the Motor Buses:

1. Remove the screws fastening each motor bus to the top of its Terminal Strip near the bottom of the Capacitor Bank Assembly.
2. Remove the screws fastening the motor buses to the Motor Bus Bottom Support.
3. Remove the motor buses.

Access the Capacitors:

1. Remove the screws fastening the wires from the Balancer Plate assembly to the capacitors.

2. Remove the screws, nuts, and washers fastening the Capacitor Laminated Bus Bar to the capacitors.
3. Remove the Capacitor Laminated Bus Bar and attached components.
4. Remove the plastic caps at the four corners of each capacitor insulator.
5. Remove the capacitors from the drive.

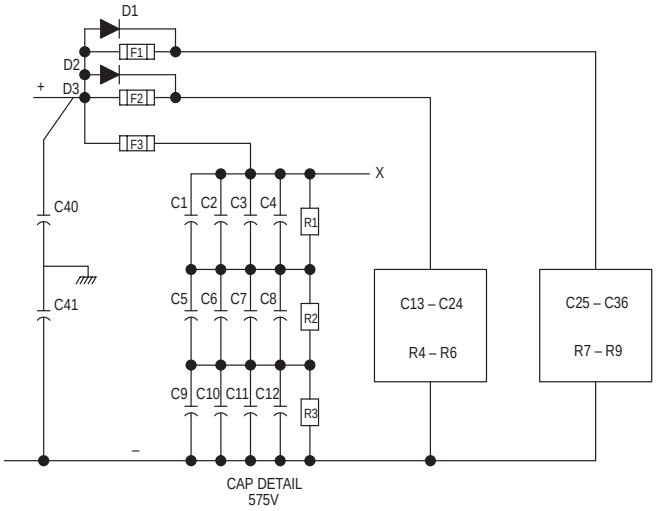
Installation

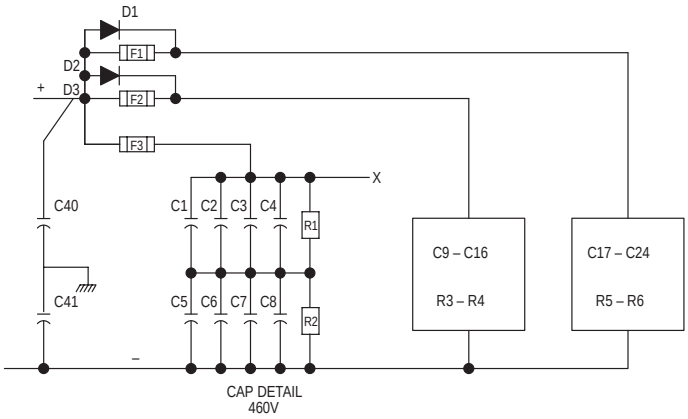
1. Install the capacitor assembly in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

Important: Position the notch and vent hole on the Bus Capacitors to the top of the drive.

2. Connect the Load-Sharing Resistors to the Bus Capacitors according to the following diagram. Refer to the schematic diagrams in this manual for more information on component configurations.

Figure 5.3
Load-Sharing Resistor Connections to Bus Capacitors





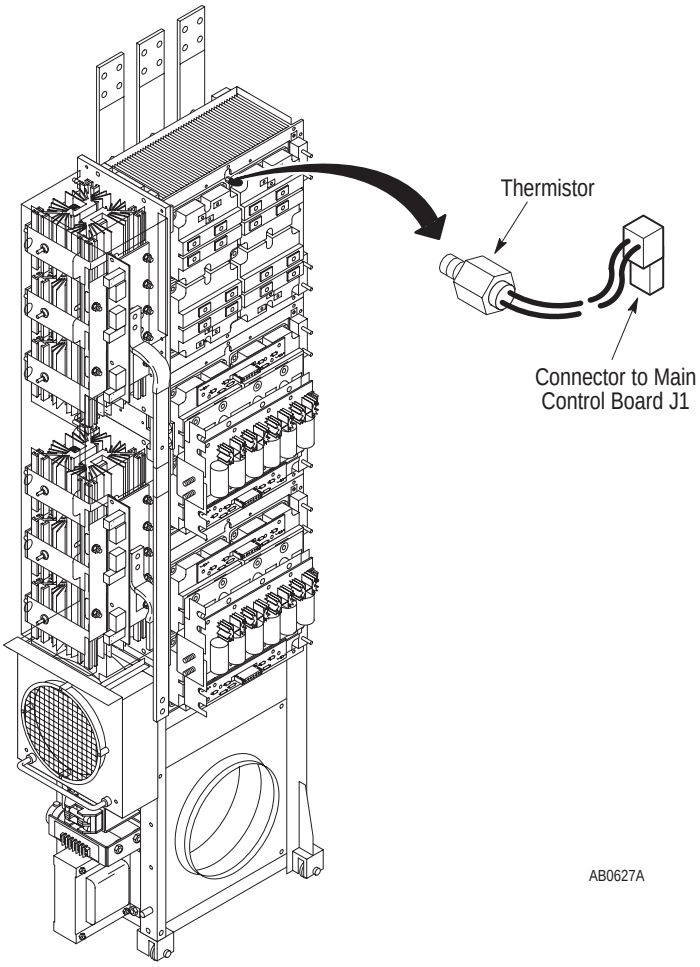
ATTENTION: Capacitors not installed correctly will explode or vent and may cause death or serious injury. Observe correct polarities.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Thermistor

The Thermistor is located at the top of the heat sink in the Inverter Housing Assembly.

Figure 5.4
Thermistor



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Hazard of electric shock exists. Up to 1,600 VDC will be on Power Module Snubber Board Connector J1 if the Snubber Resistor is open. Measure for zero (0) VDC from Snubber Board terminal TP3 to plus (+) bus before removing Connector J1. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, between TP3 and plus (+) bus to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)

5. Disconnect Main Control Board Connector J1.

6. Remove the Thermistor.

Installation

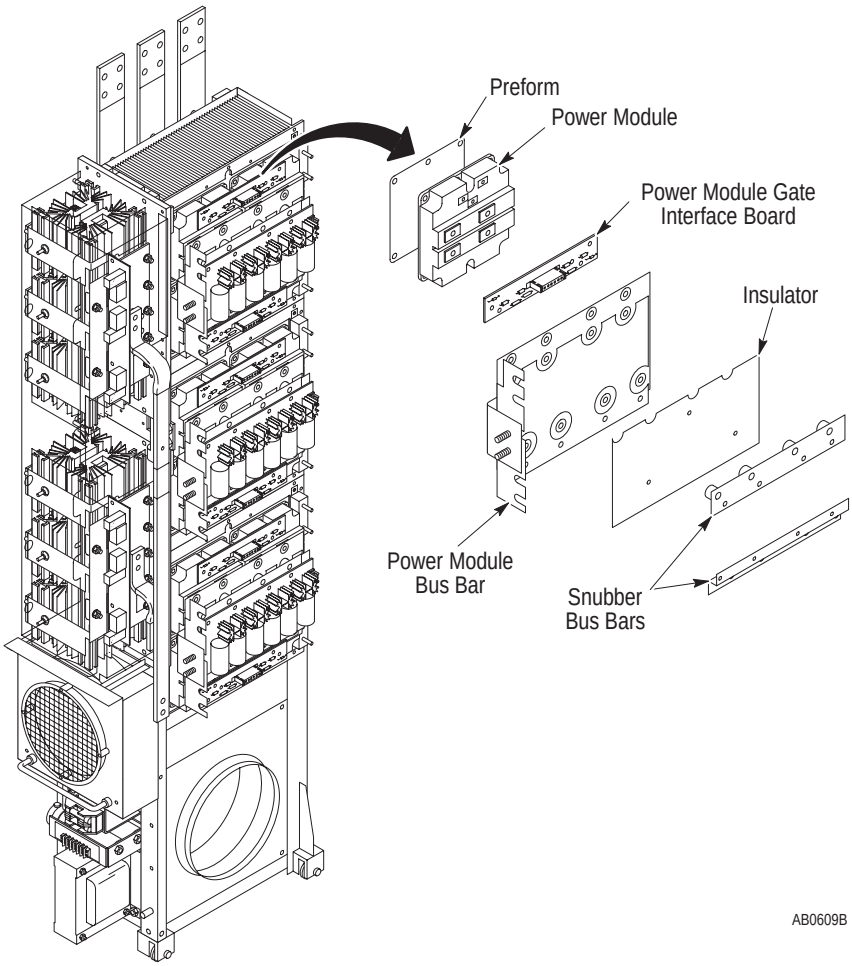
Install the Thermistor in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Power Modules

The Power Modules are located on the heat sink toward the back of the Inverter Housing Assembly. If one or more Power Modules is replaced, you must check the Power Module Snubber Board, the Precharge Board, and the Gate Driver Board.

Figure 5.5
Power Modules



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Hazard of electric shock exists. Up to 1,600 VDC will be on Power Module Snubber Board Connector J1 if the Snubber Resistor is open. Measure for zero (0) VDC from Snubber Board terminal TP3 to plus (+) bus before removing connector J1. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, between TP3 and plus (+) bus to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)

5. Access the Inverter Housing Assembly. Refer to Chapter 3 – Disassembly and Access Procedures, Access to the Inverter Housing Assembly.
6. Remove the screws fastening the positive and negative snubber bus bars to the Power Module Bus Bar.
7. Remove the screws fastening the Power Module Bus Bar to the Power Modules.
8. Carefully remove the bus bar. Do not damage the insulation.
9. Remove the screws fastening the Power Module Gate Interface Boards to the Power Modules.
10. Remove the Power Module Gate Interface Boards.
11. Remove the screws fastening the Power Module to the heat sink. Refer to Figure 3.3 in Chapter 3 – Disassembly and Access Procedures. Follow the torque sequence, as illustrated, for both removal and installation.

Installation

1. Clean all surfaces between the Power Module and the heat sink using a soft, clean cloth.
2. Replace the preform between the Power Module and the heat sink.
3. Install the Power Module in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

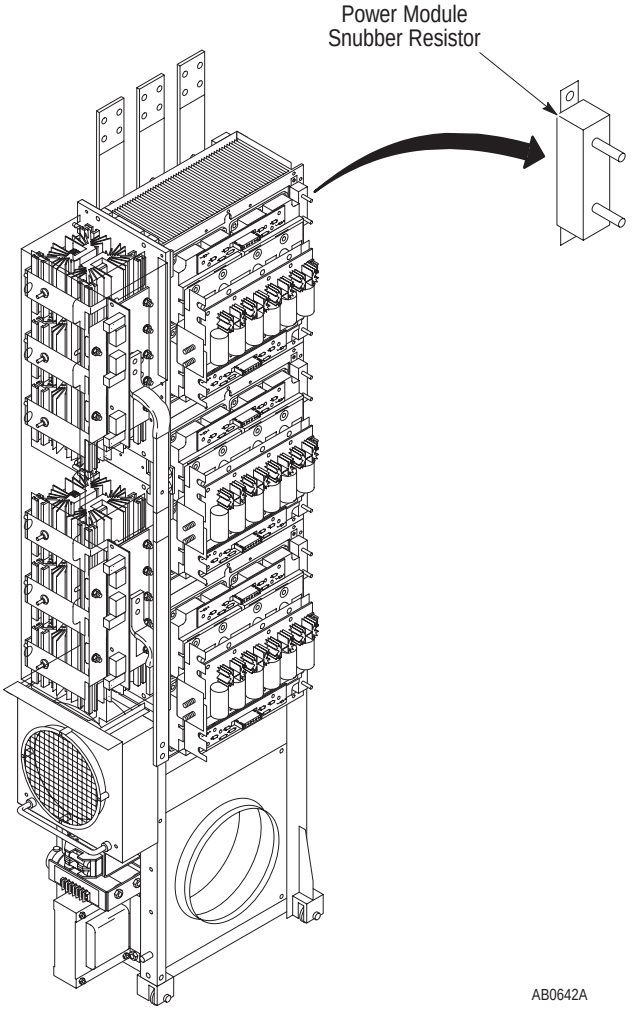
ATTENTION: Do not substitute longer or shorter hardware when fastening the Power Module components to the Power Modules. Use the same size fastener to fasten the components as was originally used. Using different fastener lengths will damage the Power Modules.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Power Module Snubber Resistor

The Power Module Snubber Resistors are located on the main heat sink at the back of the Inverter Housing Assembly.

Figure 5.6
Power Module Snubber Resistor



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Access the Inverter Housing Assembly. Refer to Chapter 3 – Disassembly and Access Procedures, Access to the Inverter Housing Assembly.
6. Remove the Power Module Snubber Resistor connectors from the J1 and J2 connectors on the Power Module Snubber Board.
7. Remove the screws fastening the Power Module Snubber Resistor to the main heat sink.

Installation

Install the Power Module Snubber Resistor in reverse order of removal.

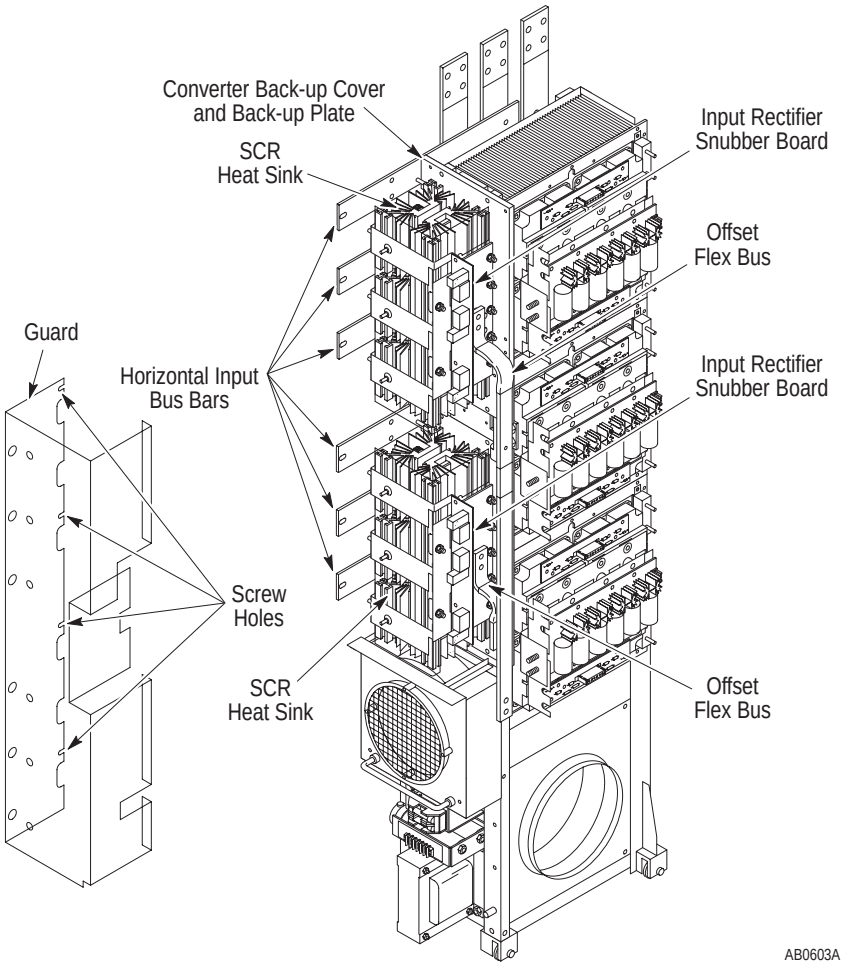
Important: Install the resistors with the markings to the right.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

SCRs

The SCRs are located in the heat sinks on the upper front part of the Inverter Housing Assembly. Each of the two heat sinks contains one long and three short sections. The cross bars link the sections, holding the SCRs in the middle. Refer to Figure 5.8.

Figure 5.7
SCR Location



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Hazard of electric shock exists. Up to 1,600 VDC will be on Power Module Snubber Board Connector J1 if the Snubber Resistor is open. Measure for zero (0) VDC from Snubber Board terminal TP3 to plus (+) bus before removing Connector J1. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, between TP3 and plus (+) bus to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

Access the heat sink:

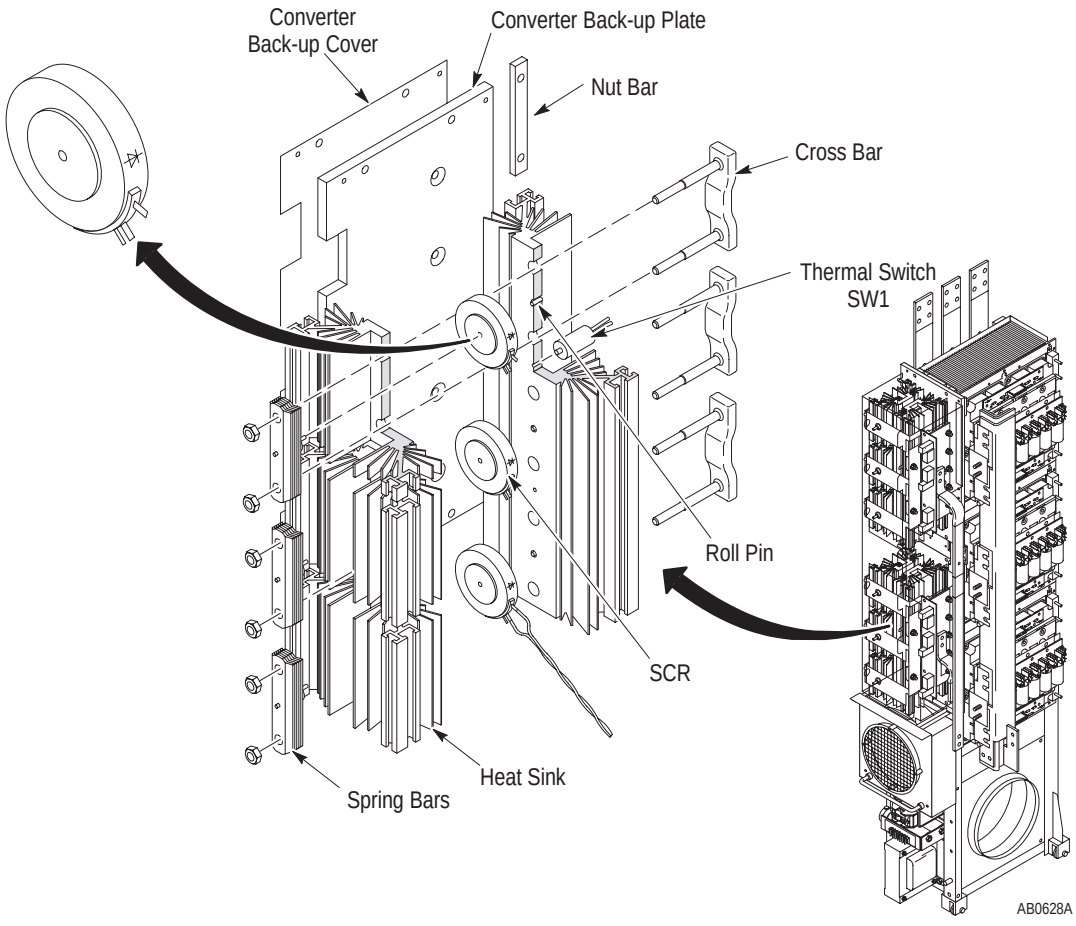
1. Remove power from the drive.

Important: Check Polarity Orientation. Refer to Figure 5.8.

2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.

4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Access the Inverter Housing Assembly. Refer to Chapter 3 – Disassembly and Access Procedures, Access to the Inverter Housing Assembly.
6. Remove the Input Rectifier Snubber Boards. Refer to Chapter 3 – Disassembly and Access Procedures, Removing an Input Rectifier Snubber Board.
7. Remove the snubber insulator and attached snubber buses.

Figure 5.8
SCR Heat Sinks



Remove the short section of the heat sink:

1. Remove the nuts from the ends of the cross bars.
2. Remove the spring bars.

3. Remove the short section of the heat sink. The long section, attached to the Converter Back-up Plate, remains in place.

Access the SCRs:

1. Remove the wires from the SCR.
2. Remove the SCR.

Installation

1. Adjust the roll pins in each heat sink half to extend 1.5 mm (0.060 in) toward the inside of the heat sink.
2. Apply silicone oil to the heat sink in the areas around the roll pins.
3. Clean the surface of the SCR and place it on the roll pin.
4. Apply silicone oil to the other side of the SCR.
5. Install the SCR Heat Sink in reverse order of removal. Allow access to the SCR gate connections.
6. Attach the wires to the SCR.

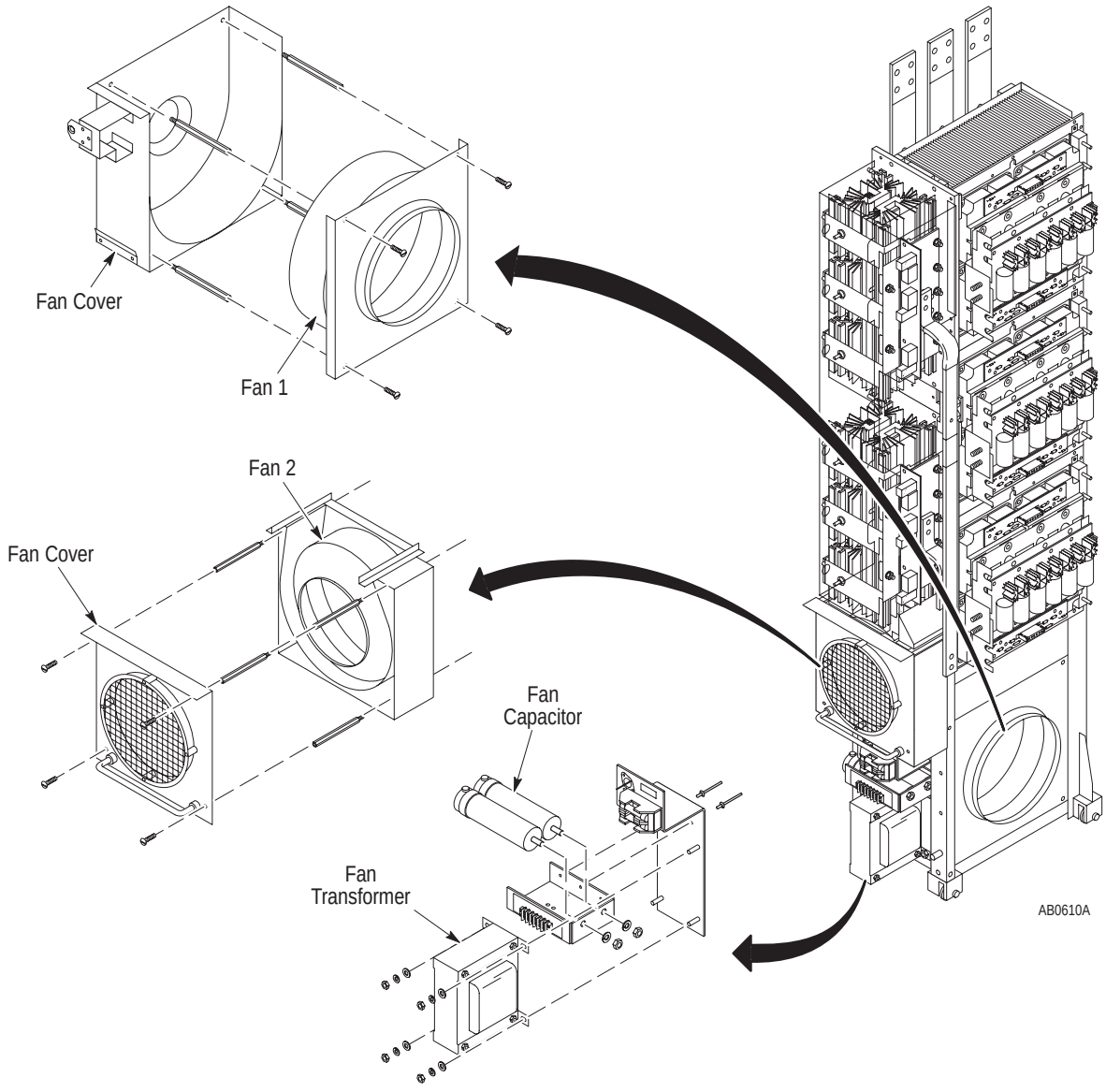
Important: Refer to the torque gauge on the spring bars on the left side of the heat sink. Without load, the torque gauge should read zero. If it does not, replace the spring bar assembly. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Fan and Transformer Assembly

The two fans are located at the bottom of the Inverter Housing Assembly. The Fan Transformer and Fan Capacitors are located in the bottom left corner, attached to Fan 1. Both fans and the Transformer Assembly can be replaced without pulling out the Inverter Housing Assembly.

Figure 5.9
Fan and Transformer Assembly



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Hazard of electric shock exists. Up to 1,600 VDC will be on Power Module Snubber Board Connector J1 if the Snubber Resistor is open. Measure for zero VDC from Snubber Board terminal TP3 to plus (+) bus before removing Connector J1. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, between TP3 and plus (+) bus to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)

Remove the Fan Transformer:

1. Remove the wiring harness to the Fan Transformer Assembly.
2. Turn the thumb latch, fastening the Transformer Assembly to Fan 1-1/4 turn counterclockwise.
3. Tilt the Transformer Assembly forward and lift it from the mounting bracket.

Remove Fan 1:

1. Disconnect the fan wiring harness.
2. Pull down on both spring pins fastening the fan to the Inverter Housing Assembly.
3. Pull the fan toward you to remove it.

Remove Fan 2:

1. Disconnect the Fan wiring harness.
2. Remove the screws fastening the fan cover to the fan.
3. Turn the standoffs, fastening the fan to the Inverter Housing Assembly, 1/4 turn counterclockwise to remove the fan.

Installation

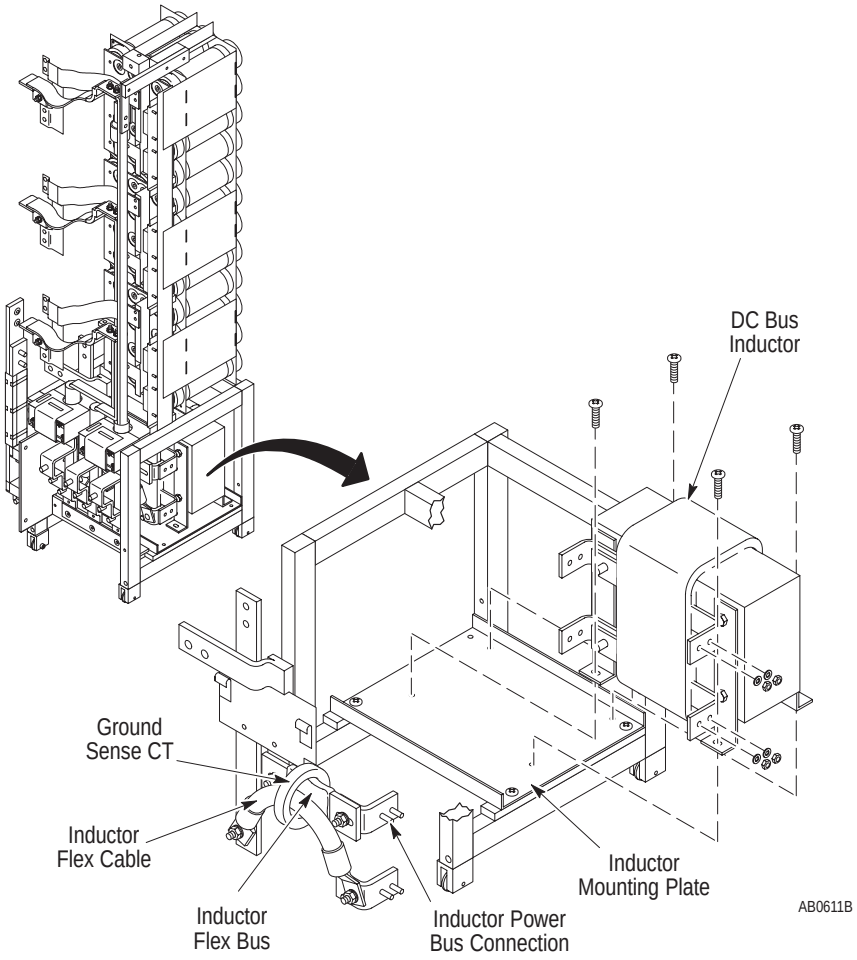
Install the Fan and Transformer Assembly in reverse order of removal.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

DC Bus Inductor

The DC Bus Inductor is located in the lower part of the Capacitor Bank Assembly behind the Terminal Strips and Motor Buses.

Figure 5.10
DC Bus Inductor



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Access the Capacitor Bank Assembly. Refer to Chapter 3 – Disassembly and Access Procedures, Access to the Capacitor Bank Assembly.
6. Remove the Inductor Flex Cable and the Ground Sense CT. Refer to Removing the Ground Sense CT in this chapter.
7. Remove the Inductor Flex Bus.
8. Remove the two Inductor Power Bus Connections.
9. Remove the screws fastening the inductor to the Inductor Mounting Plate.

Important: Note the position and orientation of the Ground Sense CT (CT3) around the (–)Bus terminal at the top of the DC Bus Inductor. The Ground Sense CT is removed with the inductor. Install the Ground Sense CT in the same position. Check that the (+)Bus cable to the fuse passes through the Ground Sense CT during assembly.

10. Remove the DC Bus Inductor from the drive.

Installation

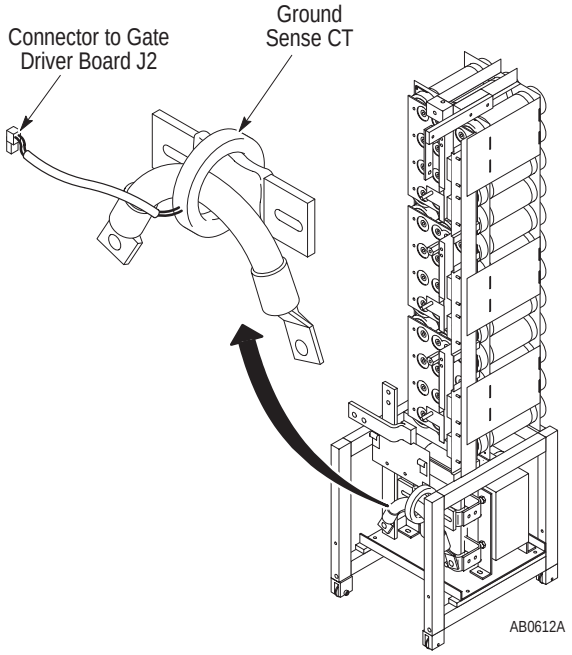
Install the DC Bus Inductor in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Ground Sense CT

The Ground Sense CT is located between the DC Bus Inductor and the Transitional Bus Bar Assembly.

Figure 5.11
Ground Sense CT



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Access the Capacitor Bank Assembly. Refer to Chapter 3 – Disassembly and Access Procedures, Access to the Capacitor Bank Assembly.
6. Remove the Ground Sense CT connector J2 from the Gate Driver Board.
7. Remove the nut and washers fastening the end of the Inductor Flexible Cable to the right-angled connector on the right side of the DC Bus Inductor.
8. Remove the Inductor Flex Cable from the right side inductor power bus connection.
9. Slide the Ground Sense CT from the Inductor Flex Cable.

Installation

Install the Ground Sense CT in reverse order of removal, inserting the Inductor Flex Cable through the center of the Ground Sense CT. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

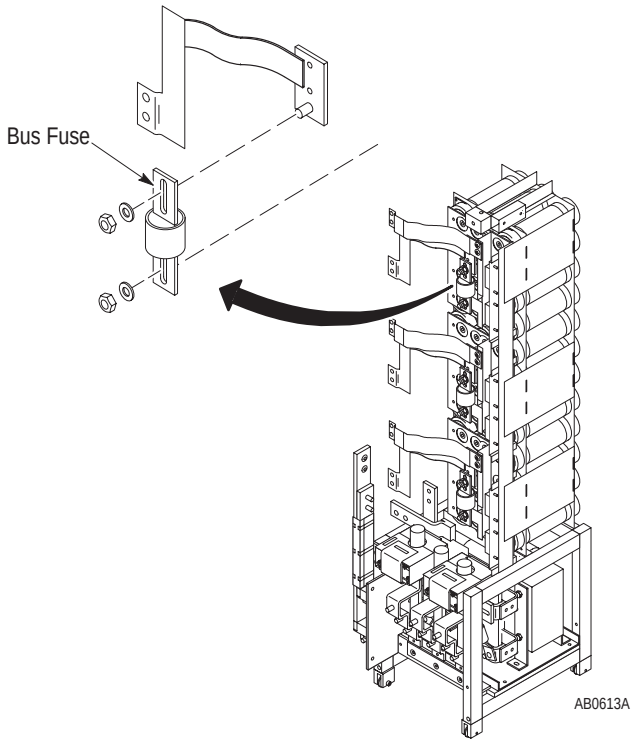
ATTENTION: A possible short-circuit hazard exists. Position the fuse-to-inductor wire with the shrink-wrapped end of the wire connected to the DC Bus Inductor. Failure to position the wire as illustrated may result in serious injury or equipment damage.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Bus Fuses

The Bus Fuses are located on the Transitional Bus Bar assembly.

Figure 5.12
Bus Fuse



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

Access the drive:

1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Remove the nuts and washers fastening the Bus Fuse to the drive.

Installation

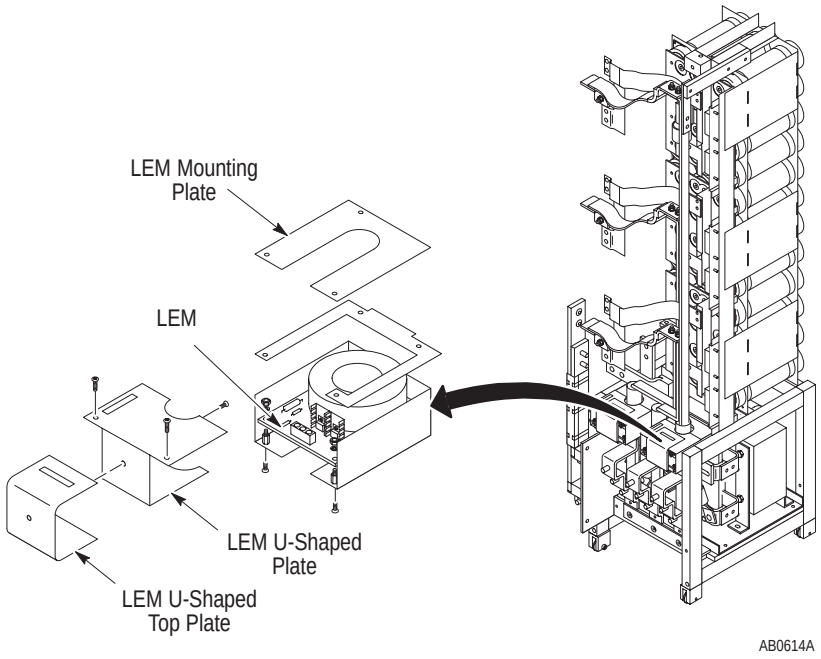
Install the Bus Fuse in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

LEMs

The LEMs are located in the Capacitor Bank Assembly above the Terminal Strips.

Figure 5.13
LEMs



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

Access the LEMs:

1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Access the Capacitor Bank Assembly. Refer to Chapter 3 – Disassembly and Access Procedures, Access to the Capacitor Bank Assembly.

Remove the LEM:

1. Remove the wires from the LEM connectors.
2. Remove the two screws fastening the LEM mounting plate to the LEM.
3. Remove the LEM U-shaped top plate and the LEM U-shaped plate.
4. Remove the screws and standoffs fastening the LEM to the assembly frame.
5. Remove the Terminal Strip from the motor bus.
6. Disconnect the motor bus from the Motor Bus Support.
7. Disconnect the motor bus at its upper end.
8. Remove the motor bus and LEM from the Capacitor Bank Assembly frame.
9. Remove the LEM from the motor bus.

Installation

Install the LEMs in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

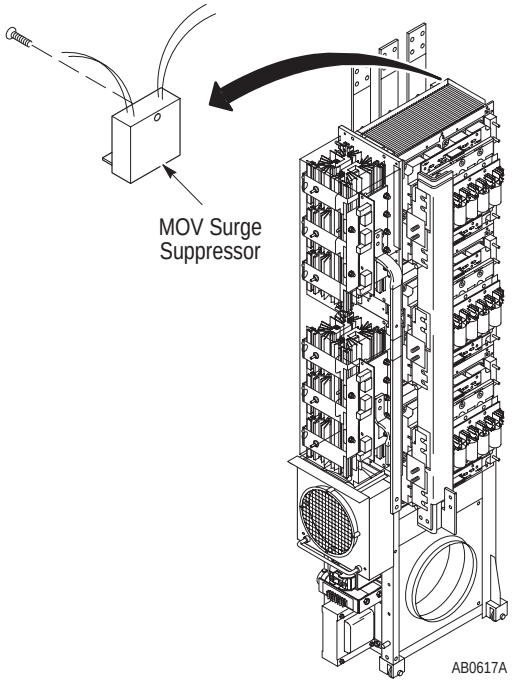
ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

MOV Surge Suppressor

The MOV Surge Suppressor is located on the left side of the Inverter Housing Assembly in the top-left corner at the back of the drive near the vertical bus bars.

The MOV protects the drive from high voltage surges above approximately 1,000 volts. Replace it if it is burned, expanded, or ruptured after a lightening strike or inadvertent connection of the drive input to a voltage source substantially above nameplate voltage.

Figure 5.14
MOV Surge Suppressor



Removal

ATTENTION: Disconnect and lock out power from the drive before disassembling the drive. Failure to disconnect power may result in death or serious injury. Verify bus voltage by measuring the voltage between the Negative Capacitor Bus and both ends of all three 350 amp fuses. An open fuse does not show voltage across both ends of the fuse. Failure to measure voltage at both ends of the fuses may result in death or serious injury. Refer to Figure 3.5. Do not attempt to service the drive until the bus voltage has discharged to zero volts.

ATTENTION: Hazard of electric shock exists. Up to 1,600 VDC will be on Power Module Snubber Board Connector J1 if the Snubber Resistor is open. Measure for zero VDC from Snubber Board terminal TP3 to plus (+) bus before removing connector J1. Use a resistor greater than 1 ohm and less than 100 ohm, rated for 25 watts minimum, between TP3 and plus (+) bus to discharge any voltage. Refer to Chapter 3 – Disassembly and Access Procedures, Removing a Power Module Snubber Board.

ATTENTION: Wear a wrist-type grounding strap when servicing 1336 IMPACT drives. Failure to protect drive components against ESD may damage drive components. Refer to Electrostatic Discharge Precautions at the beginning of this chapter.

Important: Before you remove connections and wires from the drive components, mark the connections and wires to correspond with their component connections and terminals to prevent incorrect wiring during assembly.

1. Remove power from the drive.
2. Open the PC Board Mounting Frame. Refer to Opening the Drive Enclosure in Chapter 3.
3. Check for zero volts between +DC and –DC. Refer to Figure 3.5.
4. Check for the absence of control voltage at:
   - TB10
   - TB11
   - L Option Board (if used)
5. Access the Inverter Housing Assembly. Refer to Chapter 3 – Disassembly and Access Procedures, Access to the Inverter Housing Assembly.
6. Remove the MOV wire harness from the vertical bus bars on the left at the back of the Inverter Housing Assembly.
7. Remove the screw fastening the MOV to the Inverter weldment.

Installation

Install the MOV Surge Suppressor in reverse order of removal. Refer to Chapter 3 – Disassembly and Access Procedures, Fastener Torque Specifications.

ATTENTION: Replace all guards before applying power to the drive. Failure to replace guards may result in death or serious injury.

Replacement Parts List

Chapter Objectives

This chapter illustrates and lists replacement parts for the 1336 IMPACT Drives rated B300 – B600 and C300 – C650 and describes replacement parts ordering procedures.

The following illustration and table show you parts, part names, part numbers, locations, and chapters for replacement procedures.

Ordering Replacement Parts

For your convenience, the Allen-Bradley Drives Division and the Rockwell Automation Support Division provide efficient and convenient repair and exchange for eligible equipment.

A product service report number is required to return any equipment for repair. Your local Rockwell Automation distributor or area sales and support office can provide you with a product service report number.

You should return equipment to be repaired to the area sales and support center nearest you. Reference the product service report number on the carton and packing slip. Include:

- Your company name
- Your company address
- The repair purchase order number
- A brief description of the problem

Contact your local Rockwell Automation distributor or sales office for a complete listing of area sales and support centers near you.

For parts catalog numbers, refer to the 1336 IMPACT Spare Parts Pricing publication included with your drive documentation set. See next page for more information.

Spare Parts Information

Current 1336 IMPACT drive spare parts information including recommended parts, catalog numbers and pricing can be obtained from the following sources:

Allen-Bradley home page on the World Wide Web at

http://www.ab.com

then select . . .

"**Drives and Motors**" *followed by . . .*

"**1336 IMPACT" from the Product Directory**" *and . . .*

"**Technical Support . . .**"

Select "Parts List"

Replacement Parts Listing

Figure 6.1
Parts for B300 – B600, and C300 – C650

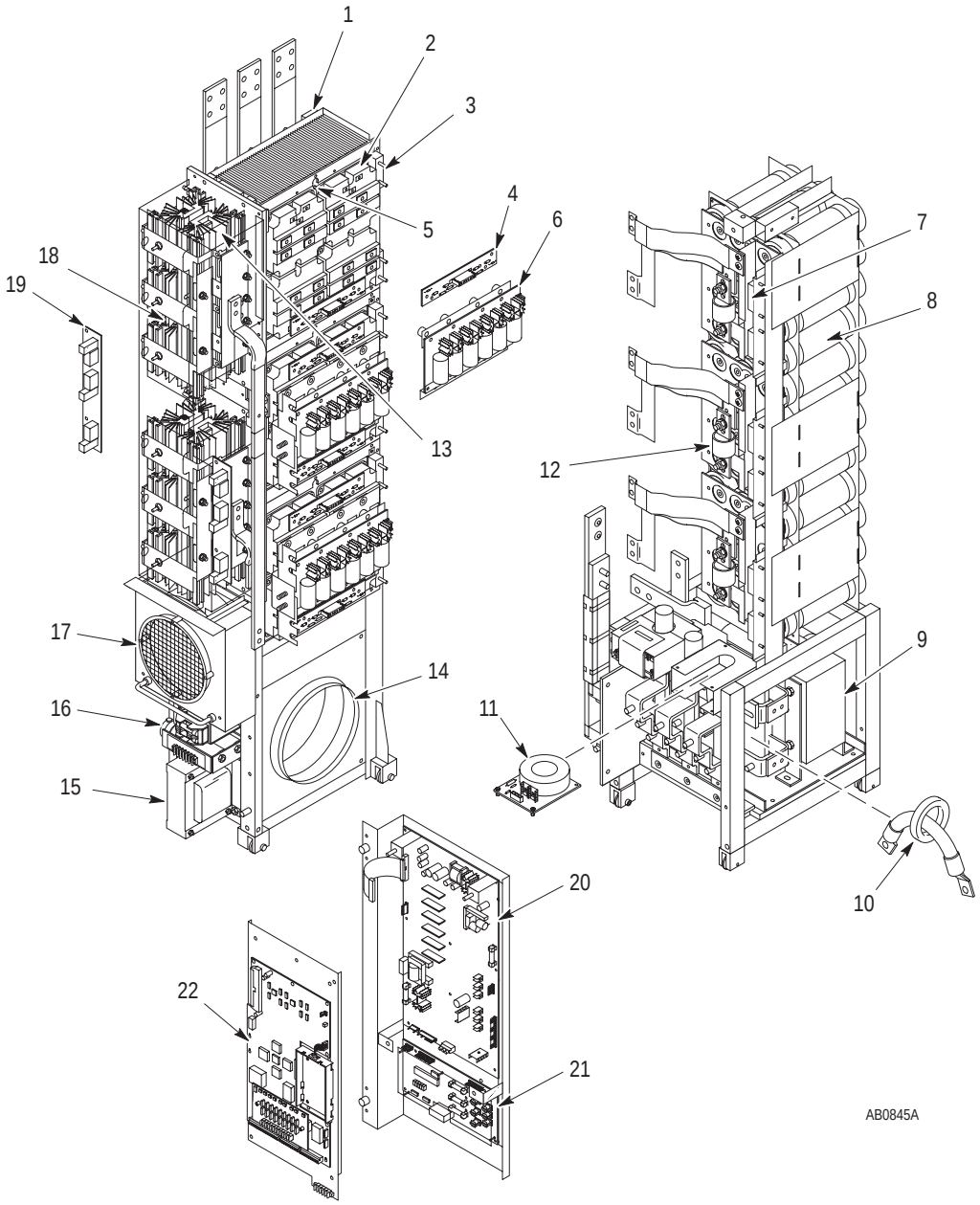


Table 6.A
Replacement Parts for B300 – B600, C300 – C650, and BX250 Drives

Callout	Symbol	Description	Location	Replacement Procedures
1	MOV	MOV Surge Suppressor	Inverter Housing Assembly	Chapter 5, MOV Surge Suppressor
2	Q11, Q12, Q21, Q22 Q31, Q32, Q41, Q42 Q51, Q52, Q61, Q62	Transistor (Power Module)	Inverter Housing Assembly main heat sink	Chapter 5, Power Modules
3	R20 – R25	Power Module Snubber Resistor	Inverter Housing Assembly main heat sink	Chapter 3, Removing a Power Module Snubber Board
4	A23 – A28	Power Module Gate Interface Board	Power Module	Chapter 5, Power Modules
5	NTC1	Thermistor	Inverter Housing Assembly main heat sink	Chapter 5, Thermistor
6	A20 – A22	Power Module Snubber Board	Power Module	Chapter 3, Removing a Power Module Snubber Board
7	R1 – R9	Load-Sharing Resistor	Capacitor Bank Assembly	Chapter 5, Bus Capacitor Bank
8	C1 – C36	Bus Capacitors	Capacitor Bank Assembly	Chapter 5, Bus Capacitor Bank
9	L1	DC Bus Inductor	Capacitor Bank Assembly	Chapter 5, DC Bus Inductor
10	CT3	Ground Sense CT	Capacitor Bank Assembly	Chapter 5, Ground Sense CT
11	CT1, CT2	LEM	Capacitor Bank Assembly	Chapter 5, LEMs
12	F1 – F3	Bus Fuse, 350 amp	Capacitor Bank Assembly	Chapter 5, Bus Fuses
13	THS1	Thermal Switch SW1	Inverter Housing Assembly, upper SCR heat sink	Chapter 5, SCRs
14	FAN 1	Fan 1	Inverter Housing Assembly	Chapter 5, Fan and Transformer Assembly
15	T1	Fan Transformer	Inverter Housing Assembly	Chapter 5, Fan and Transformer Assembly
16	C38, C39	Fan Capacitor	Inverter Housing Assembly	Chapter 5, Fan and Transformer Assembly
17	FAN 2	Fan 2	Inverter Housing Assembly	Chapter 5, Fan and Transformer Assembly
18	SCR1 – SCR6	SCR	Inverter Housing Assembly, SCR heat sinks	Chapter 5, SCRs
19	A11 – A13	Input Rectifier Snubber Board	Inverter Housing Assembly, SCR heat sinks	Chapter 3, Removing the Input Rectifier Snubber Board
20	A1	Gate Driver Board	PC Board Mounting Frame	Chapter 3, Removing the Gate Driver Board
21	A10	Precharge Board	PC Board Mounting Frame	Chapter 3, Removing the Precharge Board
22	MAIN CTL	Main Control Board	PC Board Mounting Frame	Chapter 3, Removing the Main Control Board

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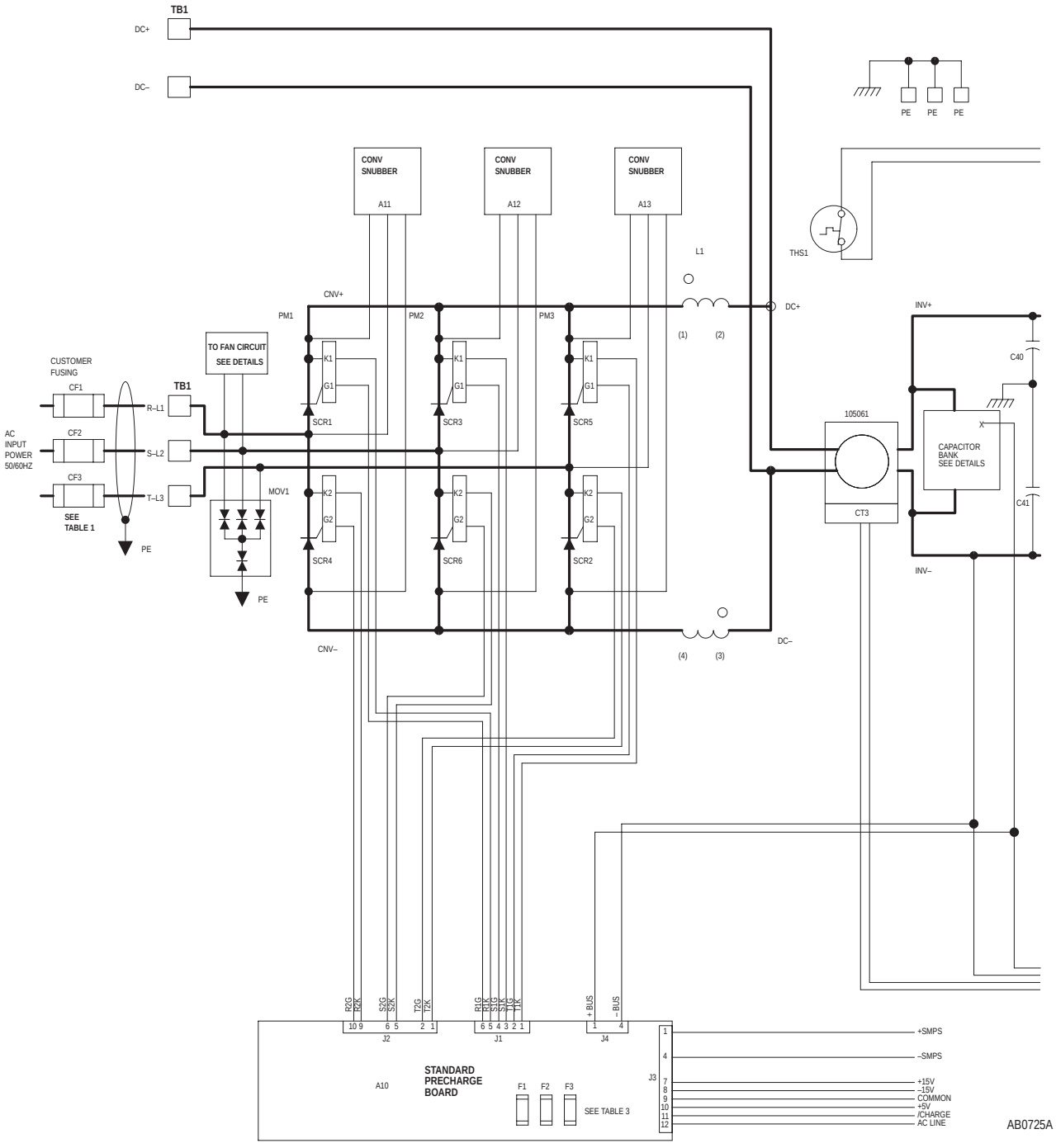
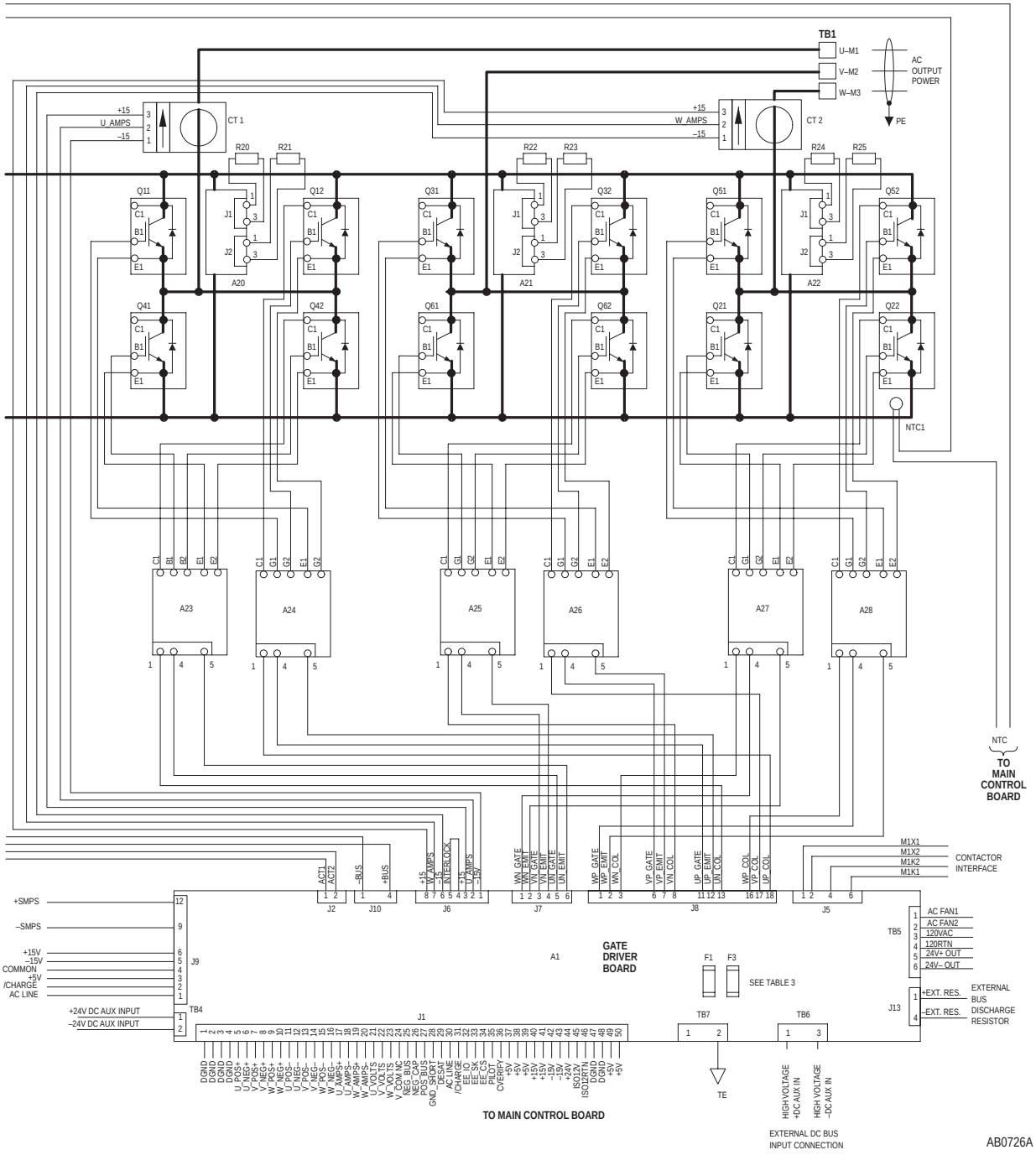
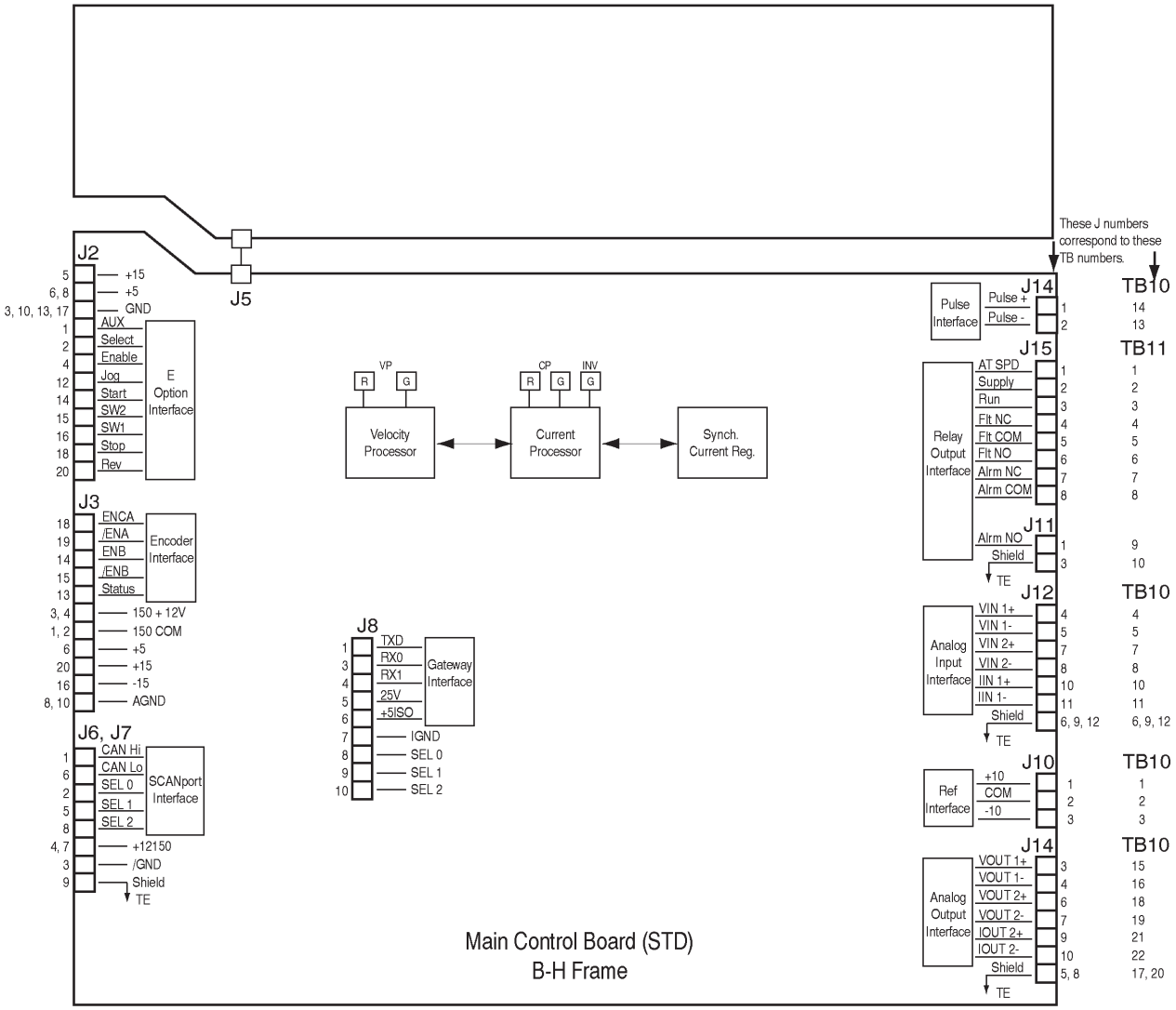
Schematics — 300 – 650 HP 1336 IMPACT Drives



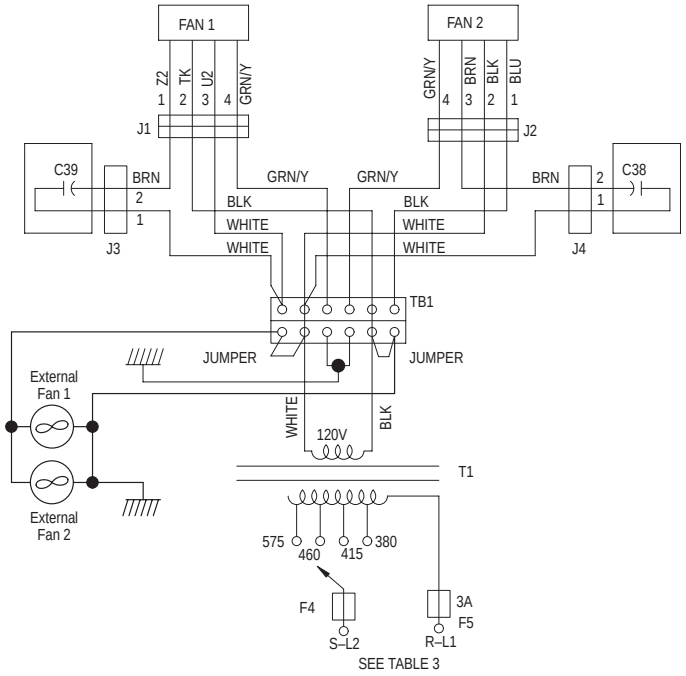
SCHEMATIC DIAGRAM
STAND ALONE
X250 – 650 HP


TB1
U–M1
V–M2
W–M3
AC OUTPUT POWER
PE
+15
U_AMPS
–15
CT 1
+15
W_AMPS
–15
CT 2
R20
R21
R22
R23
R24
R25
Q11
Q12
Q31
Q32
Q51
Q52
Q41
Q42
Q61
Q62
Q21
Q22
A20
A21
A22
NTC1
A23
A24
A25
A26
A27
A28
NTC
TO MAIN CONTROL BOARD
M1X1
M1X2
M1K2
M1K1
CONTACTOR INTERFACE
ACT1
ACT2
–BUS
+BUS
+15
W_AMPS
INTERLOCK
–15
U_AMPS
WN_GATE
WN_EMIT
WN_COL
VN_GATE
VN_EMIT
UN_GATE
UN_EMIT
WP_GATE
WP_EMIT
WN_COL
VP_GATE
VP_EMIT
VN_COL
UP_GATE
UP_EMIT
UN_COL
WP_COL
VP_COL
UP_COL
J2
J10
J6
J7
J8
J5
+SMPS
–SMPS
+15V
–15V
COMMON
+5V
/CHARGE
AC LINE
J9
TB4
+24V DC AUX INPUT
–24V DC AUX INPUT
A1
GATE DRIVER BOARD
F1
F3
SEE TABLE 3
TB5
AC FAN1
AC FAN2
120VAC
120RTN
24V+ OUT
24V– OUT
J13
+EXT. RES.
–EXT. RES.
EXTERNAL BUS DISCHARGE RESISTOR
J1
TB7
TB6
TE
HIGH VOLTAGE +DC AUX IN
HIGH VOLTAGE –DC AUX IN
EXTERNAL DC BUS INPUT CONNECTION
TO MAIN CONTROL BOARD
AB0726A

Main Control Board



Fan Circuit Detail

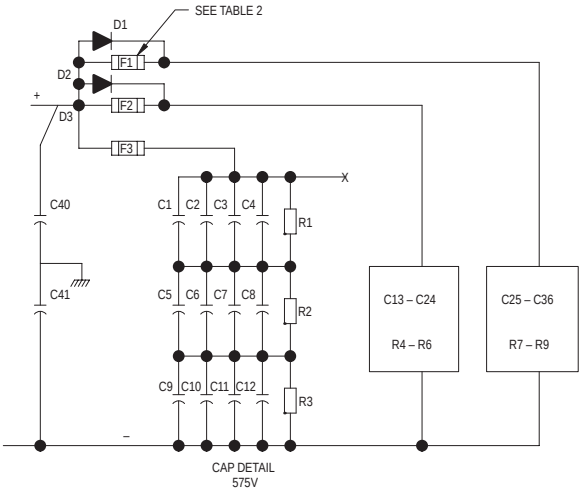


BASED ON DRIVE INPUT VOLTAGE, EITHER A 380/460V OR A 575V FAN AUTOTRANSFORMER WILL BE PROVIDED. THE TABLE BELOW DEFINES THE AUTOTRANSFORMER TAP VOLTAGE.

TAP DEFINITION	380/460V TRANSFORMER	575V TRANSFORMER
NOMINAL	460	575
–10%	415	500
OPTIONAL	380	N/A

Capacitor Detail

575V



460V

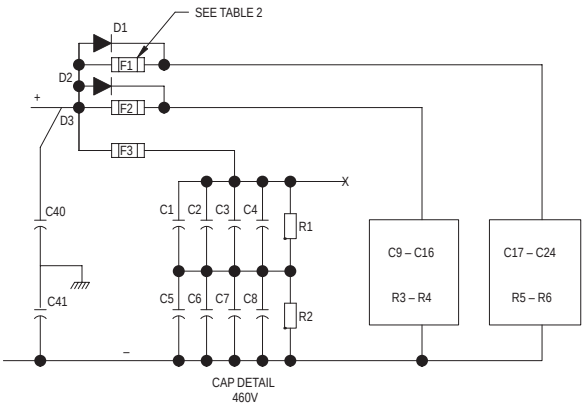


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TABLE 1: CUSTOMER FUSING
BASED ON MAXIMUM DRIVE RATING THE FOLLOWING FUSES OR APPROVED EQUIVALENT MUST BE USED:

HORSEPOWER	380/460V FUSE I/TYPE	575VAC FUSE CURRENT/TYPE
X250	450 A70C OR FWH	
300	450 A70C OR FWH	400 A70C OR FWH
350	500 A70C OR FWH	450 A70C OR FWH
400	600 A70C OR FWH	500 A70C OR FWH
450	800 A70C OR FWH	600 A70C OR FWH
500	800 A70C OR FWH	800 A70C OR FWH
600	900 A70C OR FWH	800 A70C OR FWH
650		900 A70C OR FWH

TABLE 2: BASED ON DRIVE HORSEPOWER, THE INVERTER DC + BUS FUSE WILL CHANGE AMP RATING. THE TABLE BELOW DEFINES THE FUSE RATING.

DRIVE HORSEPOWER, INPUT VOLTAGE	FUSE INFORMATION		
	RATING	TYPE	P/N
HP, 380/460VAC			
HP, 575VAC			
500HP, 380/460VAC	300A	A70Q	25178–310–14
600HP, 575VAC	300A	A70Q	25178–310–14

TABLE 3: THE FOLLOWING IS A LISTING OF ALL PRINTED CIRCUIT ASSEMBLIES VERSUS FUSE & DOCUMENTATION INFORMATION. THE FUSE RATING.

ITEM	B/M	SCHEMATIC DIAGRAM	FUSE INFORMATION			
			DESIGNATOR	RATING	TYPE	P/N
A1	74101–163–XX	74101–167	F1	1.0A/600V	KTK–R	25172–260–08
			F3	1.5A/600V	KTK–R	25172–260–09
A10	74101–181–XX	74101–179	F1–F3	1.5A/600V	KTK–R	25172–260–09
A11–13	74101–367–XX	74101–365	NONE			
A20–22	74101–146–XX	74101–144	NONE			
A23–28	74101–177–XX	74101–175	NONE			
		74101–121	F4–F5	3A/600V	FNQR	25184–254–20

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Notes

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Allen-Bradley Headquarters, 1201 South Second Street, Milwaukee, WI 53204 USA, Tel: (1) 414 382-2000 Fax: (1) 414 382-4444

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