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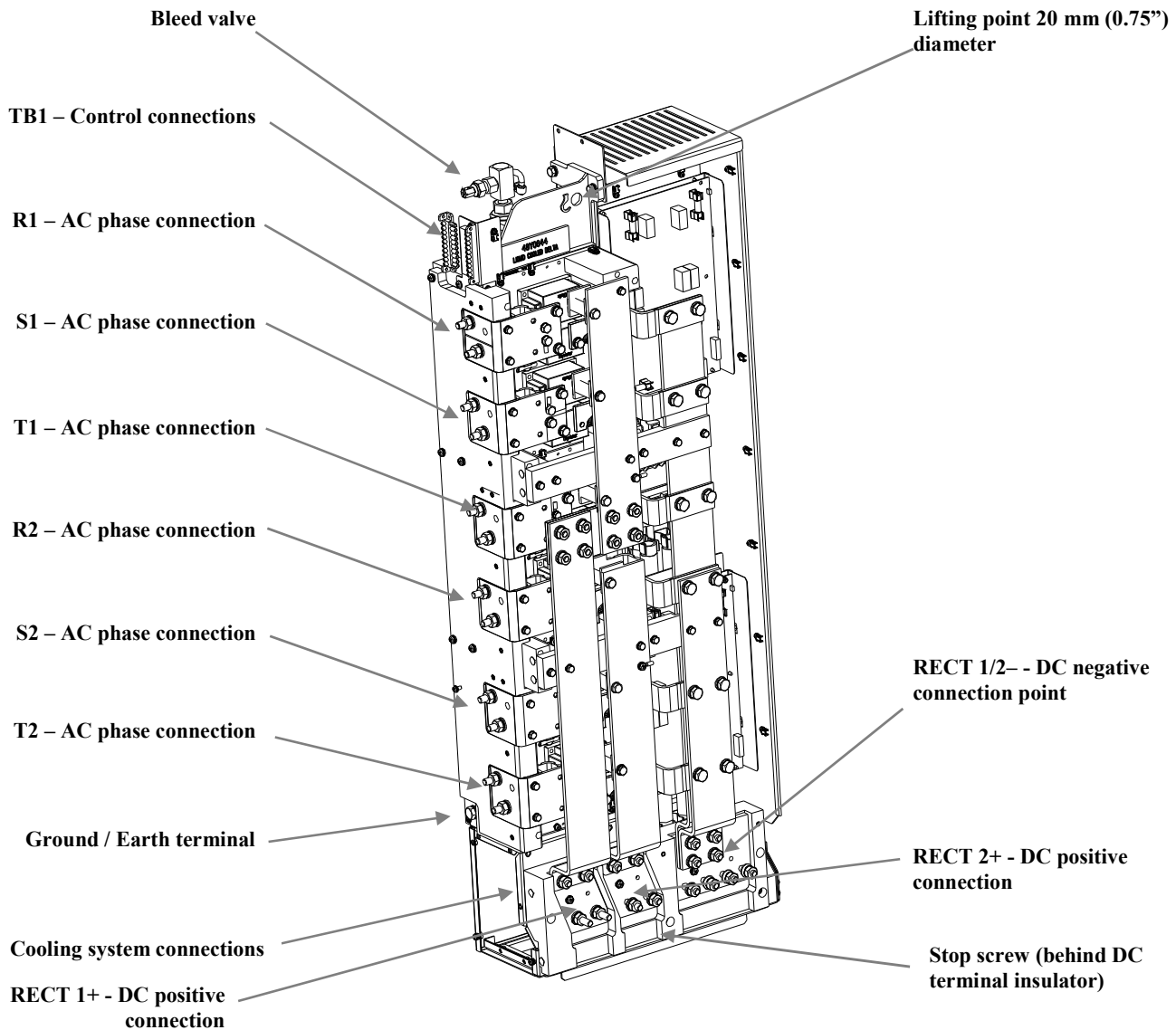
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## 1. Introduction

- The MVRL2100-4601-A is manufactured by Avid Controls under license from the General Electric Company.
- In an MV3000 DELTA drive system, rectifier modules shown below are used in network bridges to convert an AC supply into a rectified, unsmoothed DC supply.
- The rectifier module is available in a single rating. Larger rectifier power ratings can be achieved by connecting the modules in parallel. Each module has a pair of three-phase, six pulse rectifiers, with individual AC input terminals. Two DC positive terminals and a single DC negative output terminal are provided.
- The rectifier module may be operated as a 12-pulse network bridge. This configuration is achieved by connecting the DC positive outputs together through an inter-bridge transformer and one AC input being phase-shifted in relation to the other by an external supply transformer.



## 2. Features

- The rectifier module includes a circuit which is capable of pre-charging the transistor modules. This circuit charges the DC link capacitors of the transistor modules via current limiting resistors in the rectifier module.
- Modules fit in the standard DELTA mounting frames.
- Metal oxide varistors are included to absorb surge energy from the mains. Supply impedance is necessary for this to function correctly.
- Protection against DC link short circuits is with the use of recommended semi-conductor fuses.
- Modules carry thermostat and thermistor temperature sensing devices, which are monitored by the MV3000e controller to provide over-temperature protection.

## 3. Interfaces

- Signals between the controller and rectifier module are by individual wires.
- The AC and DC power connections have stud terminals and are designed for cable connection.

## 4. External Requirements

- For parallel operation of rectifier modules, external sharing reactors must be fitted;
- Similarly, for parallel operation of the two six-pulse rectifiers within a MVRL2100-4601 module, external sharing reactors must be fitted;
- For 12-pulse operation, the two supplies must be phase shifted by 30° to each other, and be of balanced voltage. The DC output must be through an inter-bridge transformer;
- Protection of the main input rectifier devices is by the addition of external semi-conductor fuses. For recommended fuses, see FUSES section The AC and DC terminals on the modules are not suitable to support the weight of any attached cables. These cables must have additional mechanical support;
- These liquid cooled modules must be cooled by an externally derived cooling system.

## 5. Related Documents

- Failure to comply with any of the general requirements for installation, operation and maintenance provided in the technical manuals will significantly increase the risk of mal-operation, fire or electric shock.
- Instructions for removing and installing the module, and for commissioning the drive, are contained in the following General Electric manuals:
- T1676EN, MV3000 Getting Started Manual for AC-fed Drives
- T2002EN, MV3000 Getting Started Manual for Active Energy Management Drives
- T1693EN, MV DELTA Liquid Cooled Drive System
- T1679EN, MV3000 Drive Range Software Technical Manual

## 6. Spares

- The MVRL2100-4601-A module contains no user serviceable components.

## 7. Electrical Connections

### 7.1 Power Connections

- The AC and DC terminals on the modules are not suitable to support the weight of any attached cables. These cables must have additional mechanical support.
- The bending radii limits of all cables must be respected.
- AC and DC Power connections are based on High Temperature Cable, e.g. Von Roll Isola silicone rubber type SIWO-KUL or equivalent.

#### AC Terminals

- All AC power terminals are located on the front of the module and are marked R1, S1, T1 and R2, S2, T2.
- Each terminal provides two M10 studs which are suitable for ring-crimp connection.
- Maximum 2 x 150mm<sup>2</sup> cable per phase.

#### DC Terminals

- The DC terminals are located on the lower right-hand side of the module.
- Each DC positive connection, marked RECT1 + and RECT2 +, have two M10 studs.
- The DC negative connection, marked RECT1/2 -, has four M10 studs.
- Maximum 150mm<sup>2</sup> cable per connection.

#### Ground / Earth Connection

- The ground/earth terminal, see Figure 2–7, is a single M10 threaded insert, located on the lower front of the module and identified as shown :

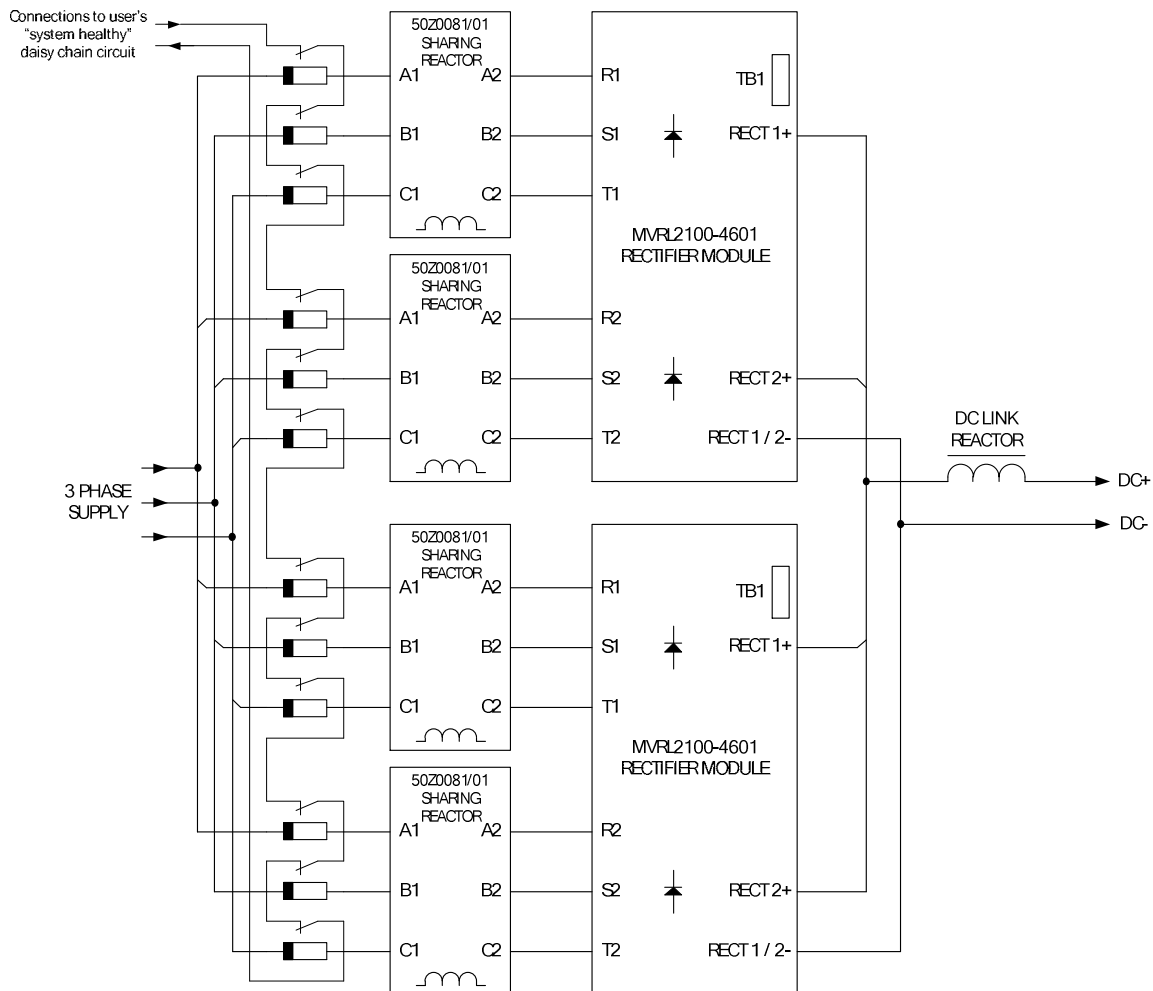


## 7.2 Torque Settings

- The figures included in the table below are for electrical connections of copper conductor crimps to device terminals.

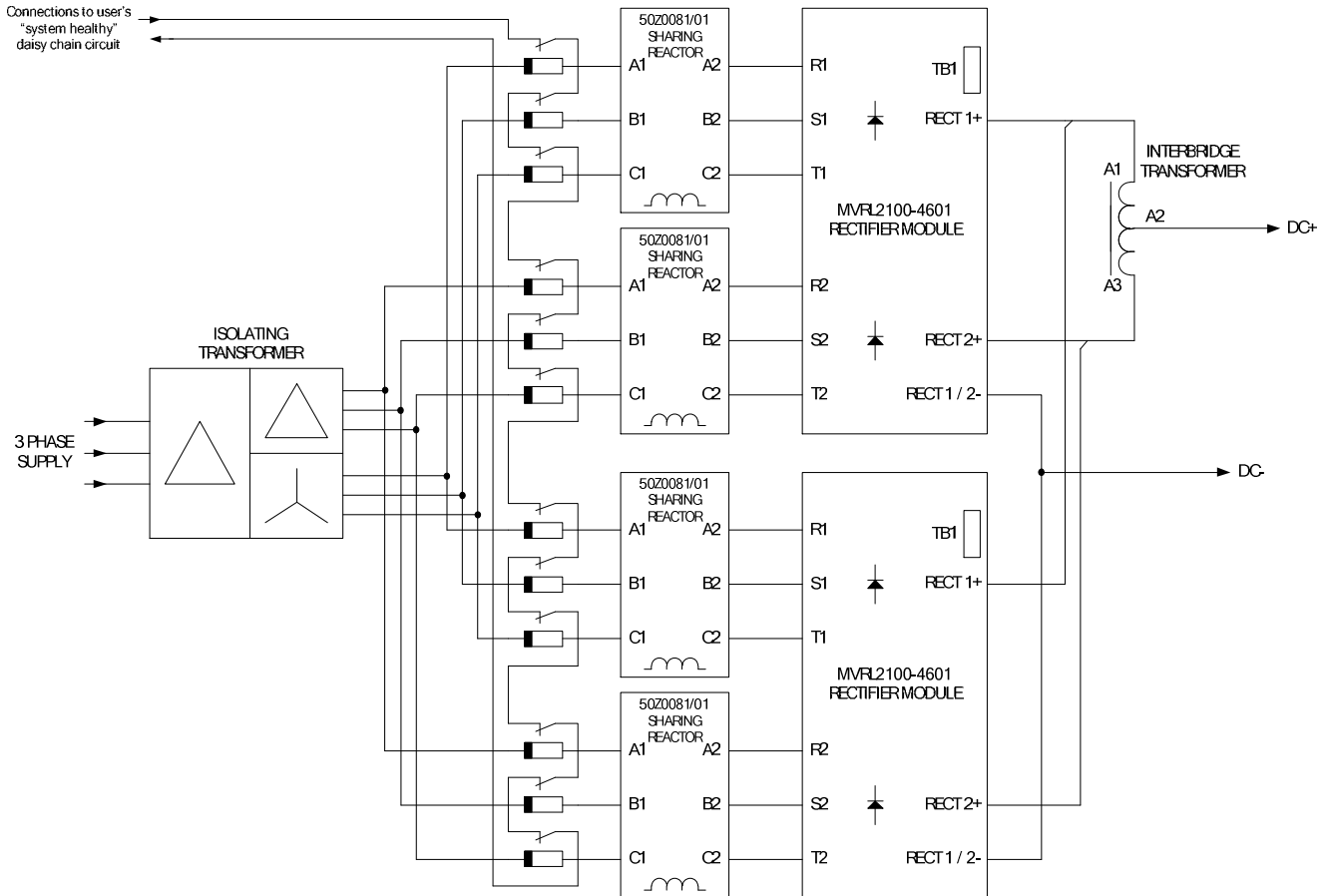
Fastener Size Carbon Steel (8.8)	Torque Setting		
	Nm	lbf. in	lbf. ft.
M5	3.5 - 5.5	30 - 48	2.5 - 4
M6	7 - 10	60 - 90	5 - 7.5
M8	10.5 - 16	96 - 144	8 - 12
M10	27 - 40	240 - 360	20 - 30
M12	40 - 60	360 - 576	30 - 48
M16	90 - 135	780 - 1200	65 - 100

## 7.3 6 Pulse Supply, Dual Rectifier Module Configuration



Power Connections, 6 Pulse Supply, Dual Rectifier Modules

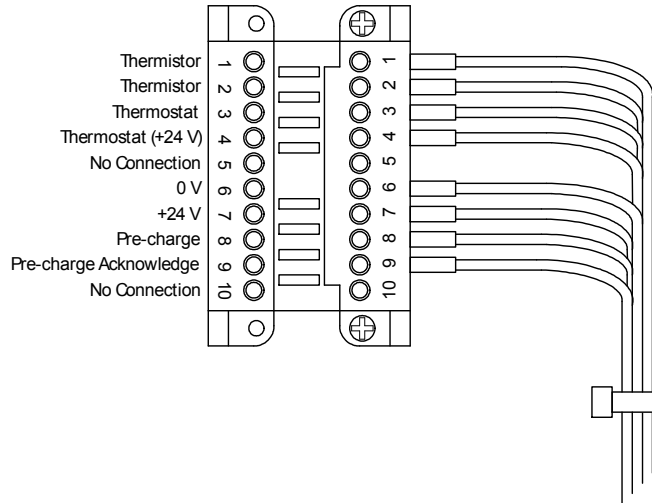
**7.4 12 Pulse Supply, Dual Rectifier Module Configuration**



**Power Connections, 12 Pulse Supply, Dual Rectifier Modules**

### 7.5 Control Connections

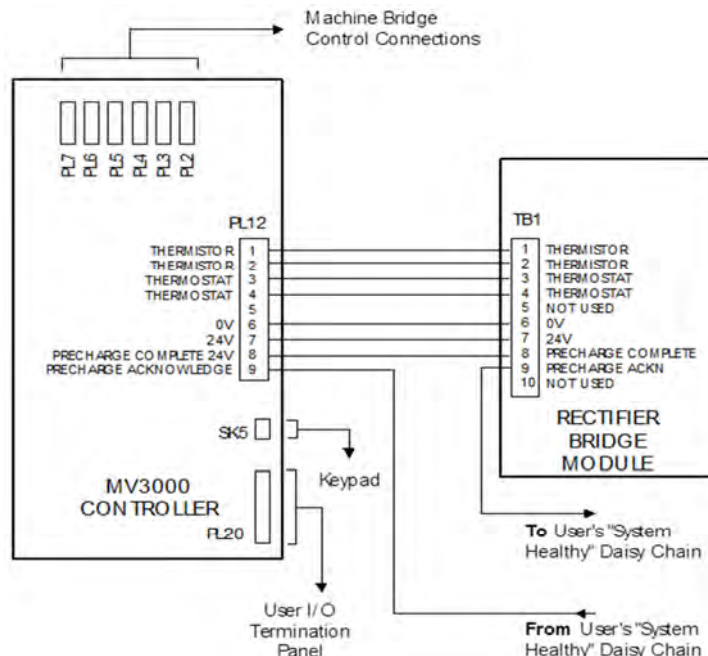
- The rectifier control terminals are mounted at the top of the front face of the Rectifier module as below. The customer terminals are the left half of a 10-pin plug and socket, referenced TB1, and may be unplugged for ease of wiring. See **Error! Reference source not found.** below for the terminal layouts and functions.



**Rectifier Module Control Terminals at TB1**

- Terminals will accept up to 2.5 mm<sup>2</sup> (12 AWG) flexible cables. To prevent failure of the Rectifier module pre-charge components, the rectifier pre-charge acknowledge signal (TB1/9) must be connected to the control module. If this signal is not healthy the control module will not allow the drive to run.

### 7.6 CDC Interface





## 8. Commissioning

- Refer to the WARNINGS and CAUTIONS in the relevant Manual(s).
- Commissioning of the unit is dependent upon the application of the unit. Refer to the relevant manual(s) for details of the commissioning procedure.

### WARNING

- *Surfaces on the coolant pipes can reach high temperatures and remain hot for some time after power is removed.*
- *Ensure that all coolant has cooled down and the equipment is suitably drained and isolated before the external pipework is disconnected from the equipment.*

## 9. Specifications

### 9.1 Mechanical Specification

Width :	247 mm (9.7 in)
Depth :	538 mm (21.2 in)
Height :	1263 mm (49.7 in)
Weight :	85 kg (187.4 lb.)

- The unit is designed to slide in between a lower guide plate and an upper cross member of a Liquid Cooled DELTA mounting frame.
- Enclosure is IP00 (to IEC 60529: 1989; BS EN 60529:1992), (NEMA 1). These modules must always be installed in an appropriate enclosure with restricted access.

### 9.2 Electrical Specification

Supply Voltage :	690 V ac rms (nominal), +/- 10% long term, +/- 15% for 0.5 to 30 cycles with loss of performance but no trip.
Operational Supply Frequency Range :	45 to 63 Hz
Maximum Continuous Operating Voltage :	1122 V DC
Maximum Allowed Regenerative Voltage :	1250 V DC
Current Rating with 1.1 x Overload* :	2100 A
Current Rating with 1.5 x Overload* :	1570 A
* Refer to Avid Controls for rating factors at different coolant temperatures.	

### 9.3 Electrical Supply

Network Type :	TN or TT (i.e. earthed/grounded neutral). Can also be connected to IT network (i.e. isolated neutral) if IT network separated from public mains supply by an isolating transformer.
Voltage Unbalance :	Negative sequence voltage not to exceed 3%
Insulation Standards :	UL 840, CSA C22-2 No. 0.2, EN 50178: TN or TT network : Overvoltage Category III IT network : Overvoltage Category II For full compliance with UL 508C, transient suppressers complying with UL 1449 must be fitted external to the drive.

### 9.4 Heat Losses

- Losses at 1.1 Current Rating (2100A DC) : 6,800 W
- Losses at 1.5 Current Rating (1570A DC) : 5,114 W

## 9.5 Environmental

Function		Specification			
<b>Operating</b>	Ambient air temperature	0 to 50°C (32°F to 122°F)			
	Relative humidity	5 to 95% (non-condensing)			
	Altitude	Normal operating altitude up to 1000 m (3280 ft.) above sea level. From 1000 m (3280 ft.) to a maximum of 2000 m (6551 ft.) de-rate by 7.3% per 1000 m (3280 ft.).			
	Cooling air	Pollution Degree 2 (IEC 60664-1, UL 840 and CSA C22.2 No. 0.2-93) i.e. clean, free from dust, condensation and conductive or corrosive gases. If conductive pollution or condensation are expected (Pollution Degree 3), the drive must be placed in an enclosure which achieves Pollution Degree 2 by: - excluding the conductive pollution e.g. by the use of filtered air; - preventing condensation e.g. by use of anti-condensation heaters. In extreme environments dual circuit heat exchangers are recommended.			
	Coolant temperature	Inlet temperature 0 to 60°C (32°F to 140°F)			
	Chemicals (max.)	15 ppm H2S    25 ppm NO2    25 ppm SO2			
	Vibration	To IEC 61800-2 which specifies 'Class 3M1' of IEC 60721-3-3 and to the vibration requirements of EN50178. The products comply with the more severe requirements from both standards - this is given as the 'Composite' data represented in the following table.			
		Frequency	IEC 61800-2	EN 50178	Composite
2 Hz to 9 Hz		0.3 mm amplitude		0.3 mm amplitude	
9 Hz to 18.4 Hz		1 m/s <sup>2</sup>	0.075 mm from 10 Hz	1 m/s <sup>2</sup>	
18.4 Hz to 57 Hz		1 m/s <sup>2</sup>	0.075 mm amplitude	0.075 mm amplitude	
57 Hz to 150 Hz		1 m/s <sup>2</sup>	9.81 m/s <sup>2</sup>	9.81 m/s <sup>2</sup>	
150 Hz to 200 Hz	1 m/s <sup>2</sup>		1 m/s <sup>2</sup>		
<b>Storage</b>	Temperature	-25 to +55°C (-13°F to 131°F)			
	Relative humidity	5 to 95% non-condensing			
	Altitude	Up to 3000 m (9842 ft.) above sea level			
Vibration	To IEC 61800-2 which specifies Class 2M1 of IEC 60721-3-2 when equipment is packed for transport: 2 to 9 Hz    3.5 mm amplitude 9 to 200 Hz    10 m/s <sup>2</sup> 200 to 500 Hz    15 m/s <sup>2</sup>				
<b>Transport</b>	Temperature	-25 to +70°C (-13°F to 158°F)			
	Relative humidity	≤ 95% non-condensing			
	Altitude	Will withstand air transport			
	Drop	To IEC 61800-2 which specifies Class 2M1 of IEC 60721-3-2 when equipment is packed for transport: mass < 100 kg    0.25 m			
	Vibration	Same as Storage			

## 10. Fusing

- Fuse selection depends on many external factors, including the current/time loading conditions, number of starts per hour/day etc., fuse cooling, ambient temperature, continuous running or intermittent running and fuse connection/mounting arrangements.
- The fuse information detailed here, is intended to provide a basic fusing arrangement for a single unit operating at rated current and voltage with an overload occurring for 60s once every 10 minutes and one stop/start per day.
  - 1.1 overload rating 600/690Vac :           Cooper Bussmann 170M6117
  - 1.5 overload rating 600/690Vac :           Cooper Bussmann 170M6118

## 11. AC Line Reactor/DC Link Inductor Details

AC Input Line Reactors :	Application Specific – contact Avid Controls
DC Link Inductor for 6- pulse applications :	<ul style="list-style-type: none"> <li>• 50Z0155/XX, for 1.1x O/Load applications. XX is the number of DELTA's connected in parallel.</li> <li>• 50Z0156/XX, for 1.5x O/Load applications. XX is the number of DELTA's connected in parallel.</li> </ul>
Inter Bridge Transformer for 12-pulse applications :	<ul style="list-style-type: none"> <li>• 50Z0157/XX, for 1.1x O/Load applications. XX is the number of DELTA's connected in parallel.</li> <li>• 50Z0158/XX, for 1.5x O/Load applications. XX is the number of DELTA's connected in parallel.</li> </ul>

## 12. Coolant

- Coolant must be compatible with materials used within the products and must provide suitable inhibitors against corrosion and freezing where applicable. Recommended coolant type is an Ethylene Glycol/Water mix.
- Coolant flow rate of 25 liters/minute (6.6 US Gallons/minute) required, with a maximum coolant inlet temperature of 60°C (140°F). Maximum working pressure is 3 bar (0.3 MPa/43 psi).
- For details of the coolant system arrangements, refer to T1693, MV DELTA Liquid Cooled Drive System.

**13. Document Revision History**

Rev.	Date	Author	Changes
00	Sep 14, 2017	Mark Woods	Document created from GE documents T2115EN and T1693EN