

High Performance Output Filter

Instruction Manual



ZENER TECHNOLOGY AND QUALITY ASSURANCE

Since 1976 Zener Electric has supplied many thousands of drives to industry. These drives have been installed into numerous applications resulting in a wealth of in house experience. The Zener **High Performance Output Filter** is the culmination of this experience, modern technology and industrial application requirements. The Zener Quality Assurance program ensures that every **High Performance Output Filter** manufactured has been proven to operate correctly in the production test bay before dispatch.

SAFETY

Your **High Performance Output Filter** must be applied, installed and operated in a safe manner. It is the responsibility of the user to ensure compliance with all regulations and practices covering the installation and wiring of your **High Performance Output Filter**. The instruction manual should be completely read and understood before attempting to connect or operate the **High Performance Output Filter**. Only skilled personnel should install this equipment.

This equipment contains a number of components that are designated by their various manufacturers as "not for use in life support appliances, devices or systems where malfunction of the components can reasonably be expected to result in personal injury or death". Customers using or selling Zener products for use in such applications do so at their own risk and agree to indemnify Zener for any damage resulting from improper use or sale.

THE CONTENTS OF THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE

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Explanation of symbols



WARNING

Indicates a condition or practice that, if the warning is not strictly observed, could result in personal injury or death.



CAUTION

Indicates a condition or practice, if the caution is not strictly observed, could lead to damage or destruction of equipment or a significant impairment of proper operation.



WARNING

This symbol is used to highlight an electrical hazard. Failure to strictly observe the warning could result in electrocution.



This symbol is used to highlight additional information on the product's capabilities or a common error in installation, commissioning or operation.

Warnings



This manual should be read in conjunction with the MSC-3 Instruction Manual (IM00092).

Read all operating instructions before installing, wiring, operating, servicing or inspecting the **High Performance Output Filter**.

Ensure that the instruction manual is made available to the final user of the product as well as all personnel involved in any aspect of installation, adjustment or maintenance.

Your **High Performance Output Filter** must be applied and installed by a suitably qualified and experienced electrical tradesperson in accordance with this manual, good engineering practice and all local rules and regulations



Do not operate the high performance output filter without connections to +B and -B terminals. Damage to equipment may result.



There are hazardous voltages inside the **High Performance Output Filter** whenever it is connected to an electrical supply and for some time after it is disconnected.

Before touching anything inside the High Performance Output Filter enclosure or other equipment connected to the **High Performance Output Filter** terminals, disconnect all sources of electrical power, wait at least 11 minutes for capacitors within the **High Performance Output Filter** to discharge to less than 50VDC and then ensure, by measurement, that there is no hazardous AC or DC voltage present at any terminal.

The **High Performance Output Filter** contains high energy circuits that may be hazardous. Do not operate the **High Performance Output Filter** with the door open or any part of the enclosure removed.

Do not touch the terminals of the **High Performance Output Filter** or any associated motor and wiring when it is energised, even if the **High Performance Output Filter** and motor are stopped. Electric shock may result.

Do not modify this equipment electrically, mechanically or otherwise. Modification may create safety hazards.

The **High Performance Output Filter** is designed to operate in series with an appropriately rated and otherwise suitable 3 phase induction motor. It is not suitable for single phase motors or other types of motor or non-motor load. Use with inappropriate load types may create a safety hazard.



Where the **High Performance Output Filter** is used as a component part of another product, it is the purchaser's responsibility to ensure that the final product meets all of the necessary safety, EMC, regulatory, operational and other requirements for that product. Requirements for the purchaser's final product may be substantially different to the requirements for stand-alone filters.

The **High Performance Output Filter** is intended for use only in fixed wiring applications. It is not intended for use on a flexible supply cable.

Mount the **High Performance Output Filter** on a vertical, incombustible surface such as metal or masonry. Do not place combustible or flammable material near the **High Performance Output Filter**. Failure to observe these precautions may create a fire hazard.

The **High Performance Output Filter** is manufactured under strict quality control arrangements, however additional and independent safety equipment must be installed if the application is such that failure of the product may result in personal injury or property damage.

Ensure that electrical noise generated by the product and any associated equipment does not adversely affect the proper operation of other equipment or systems, particularly those that have a safety function.

Do not install this equipment in locations where mechanical damage to the enclosure is possible. In particular, consider vehicles, vandalism and attack by insects or animals. Severe equipment damage and safety hazards may result.

Receiving

Inspect the **High Performance Output Filter** for any shipping damage. If any damage is found, report it to the carrier immediately. Access the inside of the controller and visually check for any damage.

Do not attempt to operate the **High Performance Output Filter** if any obvious damage exists.

After the initial inspection, the **High Performance Output Filter** can be repacked and stored in a clean, dry location until it is required for use.

DO NOT store this equipment in an area where the ambient temperature will fall below -20°C (-4°F) or rise above 70°C (158°F). DO NOT store this equipment in areas that are subject to condensation or corrosive atmosphere. Proper storage is necessary to ensure satisfactory **High Performance Output Filter** start up and performance.

Performance

The following benefits can be realised with the **High Performance Output Filter** when connected between the MSC-3 inverter and a motor.

- ✓ Significant reduction of RF voltages and currents achieving 40dB to 45dB attenuation.
- ✓ Complies with AS61800.3 (Adjustable speed electrical power drive systems, Part 3: EMC requirements and specific test methods) category C3 limits, category C2 limits and category C1 limits (0.2 to 30MHz) (see below for definitions) in a typical installation with 100m of either unscreened or screened motor cable.
- ✓ Ideal solution for eliminating AM radio frequency interference
- ✓ Maximum reduction of potential RF voltages and currents achieving 45dB to 50dB attenuation with screened motor cable.
- ✓ High efficiency, greater than 99.4%; low loss – far less than conventional iron core filters.
- ✓ Regenerative clamping to control peak voltage with long cable runs.
- ✓ Eliminate the need for installing screened motor cables.

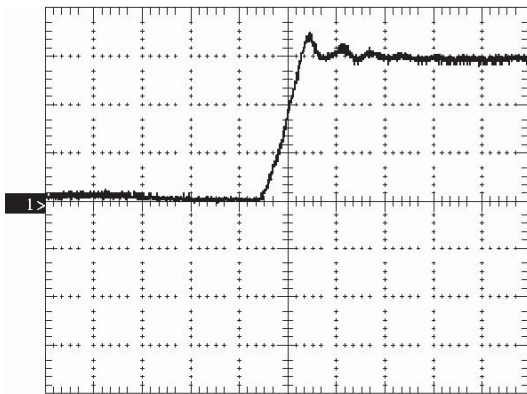
The permissible cable length² between filter and motor is 500m.

Categories as defined in AS61800.3 are:

- C1 limits apply to equipment in a domestic environment that do not require installation and commissioning by a professional.
- C2 limits apply to equipment in a domestic environment that do require installation and commissioning by a professional.
- C3 limits apply to equipment in a non-domestic environment.
- C4 limits apply to equipment with currents above 400A and special cases.

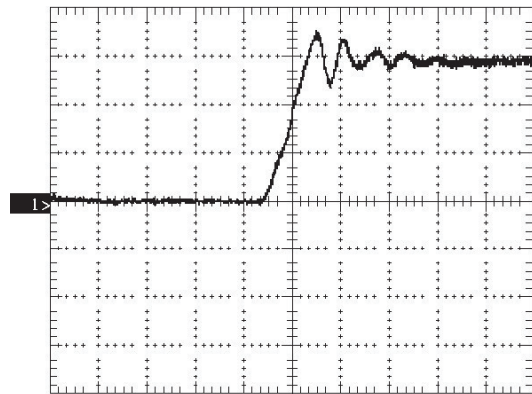
Maximum rate of change of voltage (dv/dt) = 150V/μs

Maximum peak motor voltage with 100m of cable = 120% of bus voltage



Vertical: 200V / div, Horizontal: 5μs / div.

Figure 1 – High Performance Output Filter voltage.

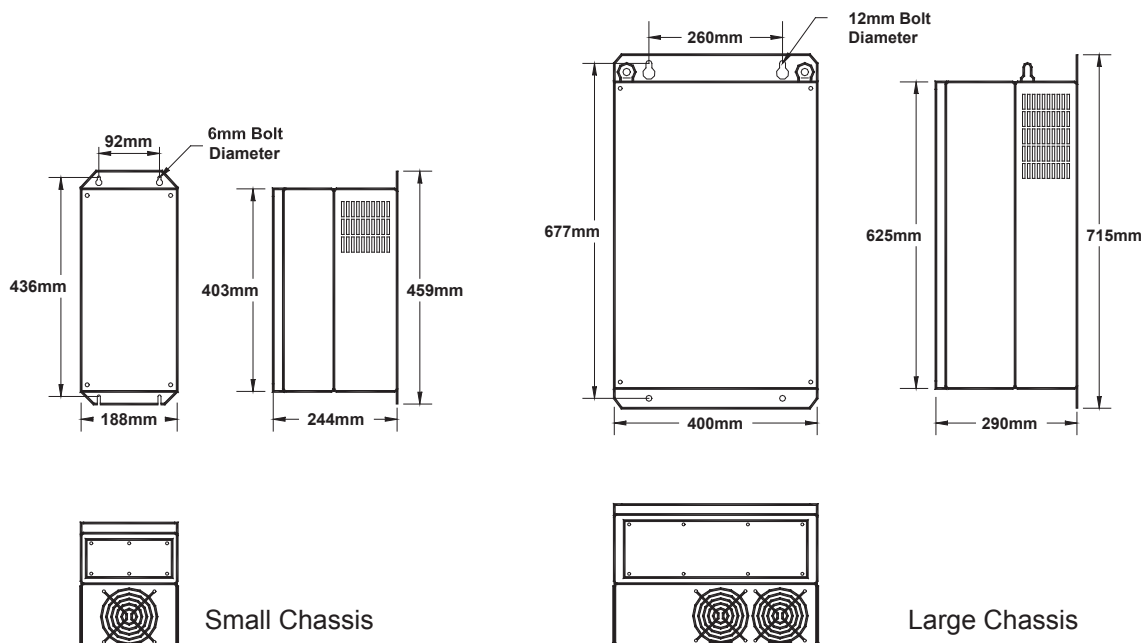


Vertical: 200V / div, Horizontal: 5μs / div.

Figure 2 – Motor terminal voltage with 100m of unscreened cable.

² Cable resistive voltage drop should be taken into consideration when long cable runs are used.

High Performance Output Filter Mechanical Installation Information



Model	Weight		Enclosure Rating	Enclosure Diagram
AHP0156	24 kg	53lb	IP66	Small chassis
AHP0236	24 kg	53lb	IP66	Small chassis
AHP0306	25 kg	55lb	IP66	Small chassis
AHP0406	25 kg	55lb	IP66	Small chassis
AHP0556	36 kg	79lb	IP66	Large chassis
AHP0826	57 kg	126lb	IP66	Large chassis
AHP1096	57 kg	126lb	IP66	Large chassis
AHP1406	76 kg	168lb	IP66	Large chassis
AHP1706	76 kg	168lb	IP66	Large chassis



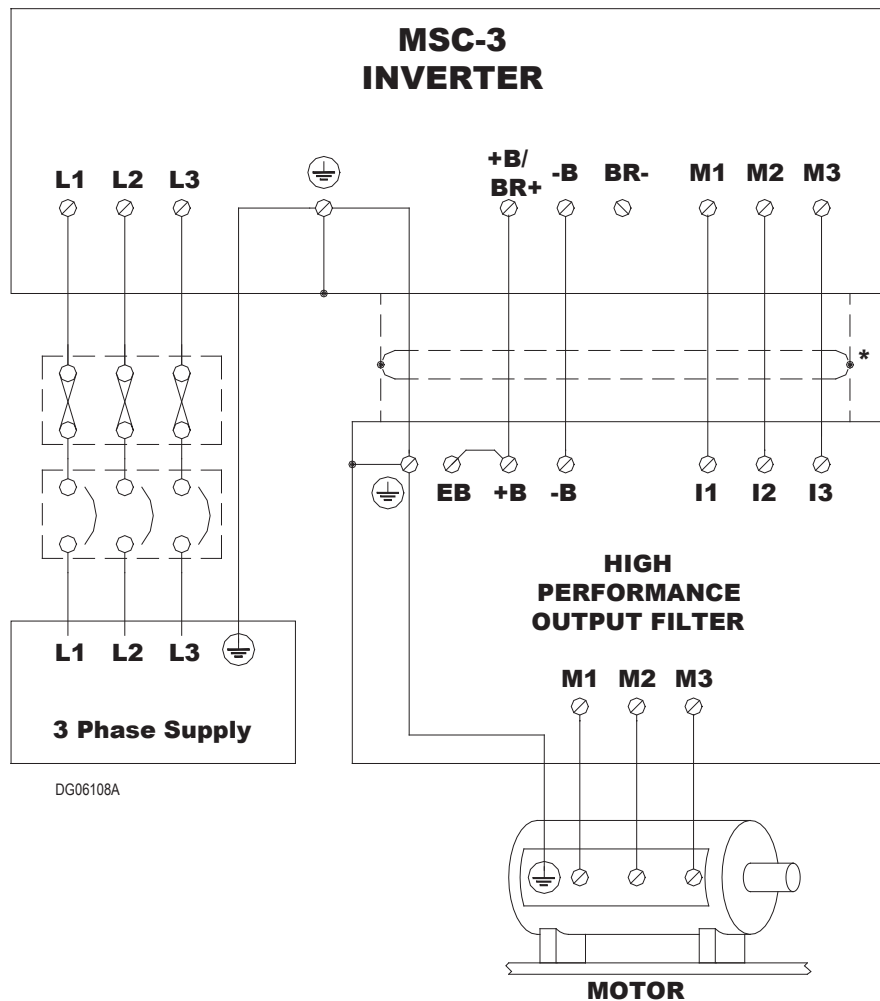
CAUTION Installation Information

- The **High Performance Output Filter** must be mounted on a vibration free vertical surface, away from heat radiating sources. Do not mount the High Performance Output Filter in direct sunlight or on a hot surface.
- The **High Performance Output Filter** must be mounted vertically. No other mounting orientation is acceptable.
- If the **High Performance Output Filter** is mounted inside another enclosure, the total heat dissipation and resulting temperature rise in the enclosure must be allowed for.
- Attention is drawn to the potential for condensation in vulnerable environments. Additional precautions may be required for all enclosure types.
- The installation location and environment should provide for safe access and working conditions for service personnel. Do not mount the **High Performance Output Filter** in “confined spaces” ¹
- Do not drill holes in the enclosure except in the gland plate.
- Remove the gland plate before drilling cable holes.
- Do not allow metal shavings or any other conductive material to enter the enclosure or damage may result.

¹ Confined spaces are generally defined in Occupational Health and Safety (OH&S) regulations to mean spaces where special precautions are necessary to ensure a safe breathing atmosphere, or there is limited access for escape/rescue in case of emergency.

High Performance Output Filter Wiring for 3 Phase Supply

Basic Power Wiring Diagram



Caution!

Do not operate the filter without connecting the filter +B and –B terminals to the MSC-3 inverter +B/BR+ and –B terminals. Damage to equipment may result.

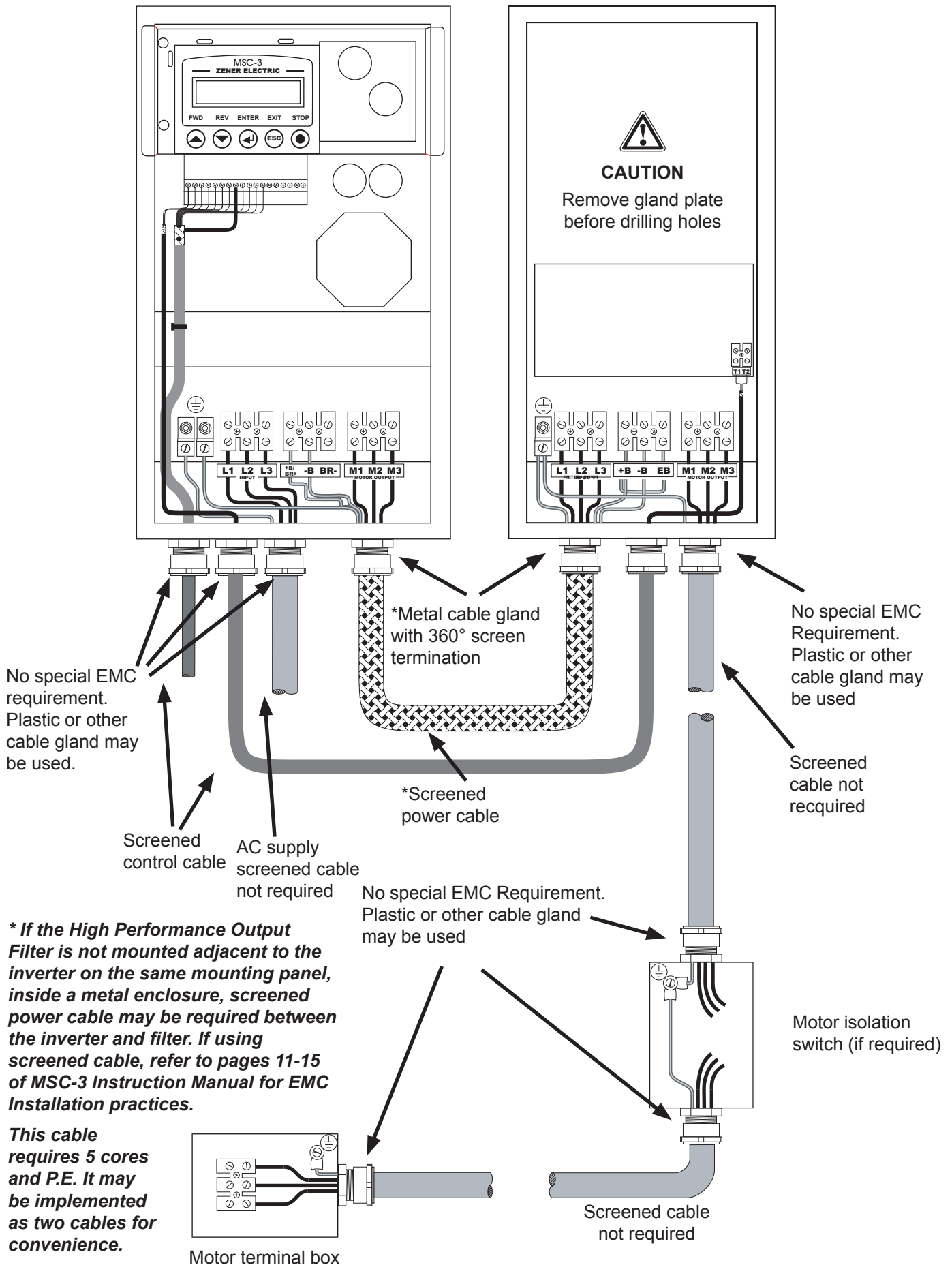
The minimum cable size used for the filter +B and –B should be no less than the size required for the protective earth conductor in the inverter installation. For supply protection, cable size and electrical isolation information, refer to pages 7-10 of the MSC-3 Instruction Manual.

The MSC-3 inverter's +B/BR+ and –B terminals are supplied as an option either factory fitted or loose for field installation. The following table lists the part numbers corresponding to MSC-3 inverters from 15A to 170A.

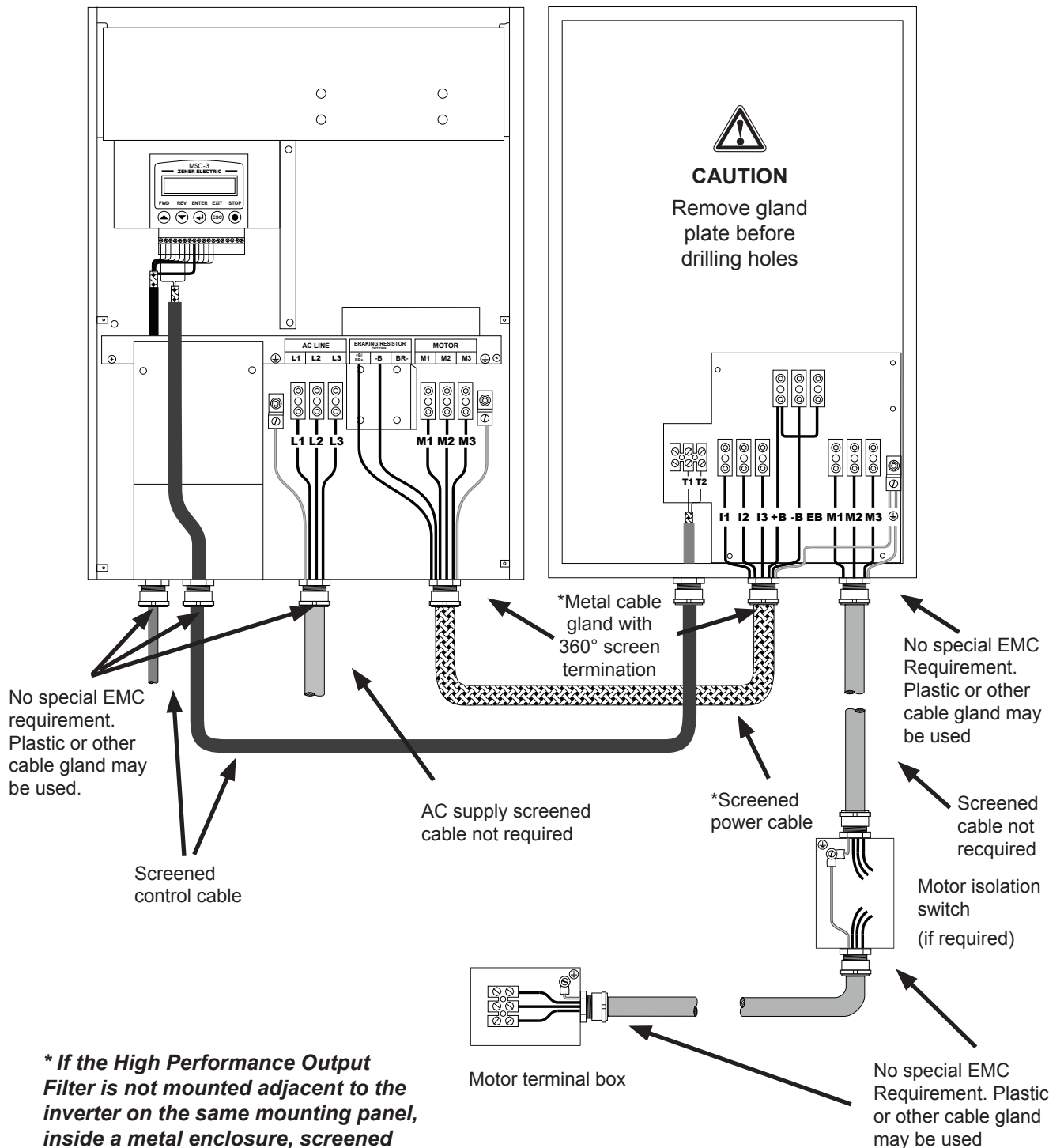
Description	Part Number	MSC-3 Models
MSC-3 DC Bus Terminal Kit for Chassis B – fitted	AF03101	3R15, 3R23, 3R30, 3R40.
MSC-3 DC Bus Terminal Kit for Chassis B – supplied loose	AQ03101	
MSC-3 DC Bus Terminal Kit for Chassis C – fitted	AF03102	3R55, 3R82, 3R109, 3R140, 3R170.
MSC-3 DC Bus Terminal Kit for Chassis C – supplied loose	AQ03102	

* If the High Performance Output Filter is not mounted adjacent to the inverter on the same mounting panel, inside a metal enclosure, screened power cable may be required between the inverter and filter. If using screened cable, refer to pages 11-15 of MSC-3 Instruction Manual for EMC Installation practices.

Small Chassis



Large Chassis



*** If the High Performance Output Filter is not mounted adjacent to the inverter on the same mounting panel, inside a metal enclosure, screened power cable may be required between the inverter and filter. If using screened cable, refer to pages 11-15 of MSC-3 Instruction Manual for EMC Installation practices.**

This cable requires 5 cores and P.E. It may be implemented as two cables for convenience.

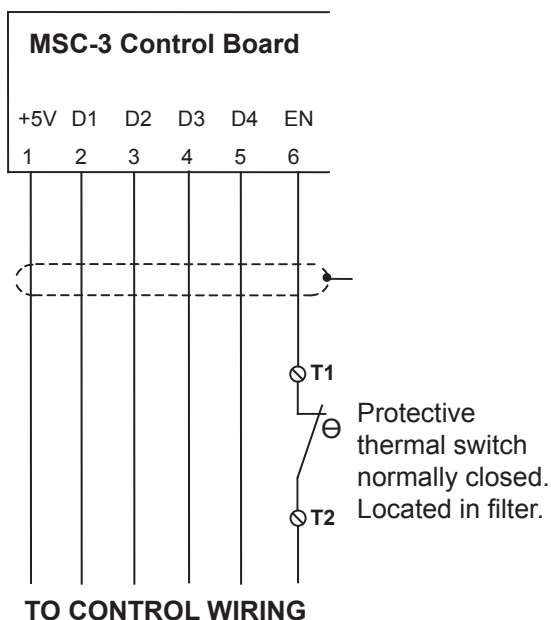


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Control connections and configuration

Wire the T1 and T2 terminals in series with the MSC-3 enable control signal (terminal 6). Excessive filter temperature will disable the MSC-3. When the temperature has fallen sufficiently, the inverter will become enabled.

Control Connections



Refer to MSC-3 Instruction Manual for control wiring



WARNING

Ensure that adequate safety measures are in place to prevent injury to personnel due to unexpected motor starting.



CAUTION

Failure to connect Protective Thermal Switch may void warranty.



When the filter is too hot the MSC-3 will display "NOT EN" on the second line of the display.


Set inverter I_{2t} to no more than filter continuous rating, if the inverter has a higher current rating than the filter. Refer to pages 45 and 46 of the MSC- 3 Instruction Manual.



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Specifications and Ratings

General Specification	
Voltage Rating	380 to 480Vac, -15% +10% 3 phase 0-200Hz
Phase to Phase voltage drop at output terminals	4.7Vac
Maximum rate of change of voltage dv/dt	150V/μs
Peak motor terminal voltage with 100m of motor cable	120% of peak mains voltage
Enclosure	IP66
Storage temperature	-20°C to +70°C -4°F to +158°F
Operating temperature	0°C to +40°C 32°F to +104°F (Consult Zener for higher ratings)
Relative Humidity	5 to 95% non-condensing
Altitude	0 to 1000m 0 to 3281ft

Standards compliance	
When used with Zener MSC-3 inverter	
Complies with the Australian EMC framework requirements	
Adjustable speed electrical power drive systems Part 3: EMC requirements and specific test methods	IEC 61800.3 AS 61800.3

Model	Current Rating			Heat Dissipation	Efficiency	Chassis Size
	Continuous @ 40°C	Intermittent 60s	Intermittent 10s			
AHP0156	15A	22.5A	30A	48W	99.55%	Small
AHP0236	23A	34.5A	46A	88W	99.47%	Small
AHP0306	30A	45.0A	60A	87W	99.60%	Small
AHP0406	41A	61.5A	82A	146W	99.49%	Small
AHP0556	57A	85.5A	114A	217W	99.45%	Large
AHP0826	82A	123A	164A	291W	99.51%	Large
AHP1096	114A	171A	228A	434W	99.45%	Large
AHP1406	140A	210A	280A	437W	99.57%	Large
AHP1706	170A	255A	340A	651W	99.47%	Large

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