

High Performance Output Filter (IP66)

Instruction Manual

AHP0236 to AHP1706

AHPL406, AHPL576

ZENER

VARIDRIVE SOLUTIONS

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.

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 filter 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 or rise above 70°C. 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.

Warnings



This manual should be read in conjunction with the ZENER 8000 Instruction Manual (IM00124).

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 of the Filter & the ZENER 8000. Damage to equipment may result and void equipment warranty.



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.

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.

Earthing Requirements



It is the installer's responsibility to assure that all earthing connections are properly made and meet all local rules and regulations.



All exposed conductive parts of the HIGH PERFORMANCE OUTPUT FILTER (HPOF), motor and associated electrical equipment must be earthed to ensure personal safety in all circumstances.



A protective earthing conductor shall be connected at all times when power is supplied to the HIGH PERFORMANCE OUTPUT FILTER or the associated variable speed drive.



Unless local wiring regulations state otherwise, the protective earthing conductor cross-sectional area shall be determined from the following table:

Cross-sectional area of Supply conductors S (mm ²)	Minimum cross-sectional area of corresponding protective earthing conductor S_p (mm ²)
$S \leq 4$	4
$4 < S \leq 16$	S
$16 < S \leq 35$	16
$35 < S$	$S/2$
The values in this table are valid only if the protective earthing conductor is made of the same metal as the phase conductors.	



The HIGH PERFORMANCE FILTER's touch current is greater than 3.5 mA ac. The standard IEC 62109-1 states that, one or more of the following measures shall be applied.

a) Permanently connected wiring, and:

- a cross-section of the protective earthing conductor of at least 10 mm² Cu or 16 mm² Al,
or
- automatic disconnection of the supply in case of discontinuity of the protective earthing conductor;
or
- Wiring a second protective earthing conductor of the same cross-sectional area as the original protective earthing conductor to a second protective earthing conductor terminal.

or

b) Connection with an industrial connector according to IEC 60309 and a minimum protective earthing conductor cross-section of 2,5 mm² as part of a multi-conductor power cable. Adequate strain relief shall be provided.

Performance

The following benefits can be realised with the **High Performance Output Filter** when connected between the ZENER 8000 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)
- Eliminate the need for installing screened motor cables.

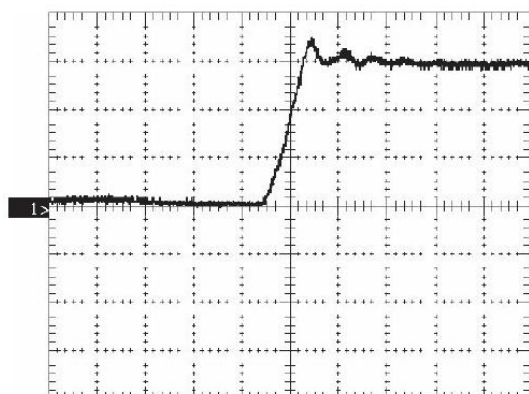
The permissible cable length¹ between filter and motor is 500m.

Categories as defined in AS61800.3 are:

- C1 limits apply to equipment in a domestic environment that does not require installation and commissioning by a professional.
- C2 limits apply to equipment in a domestic environment that does 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

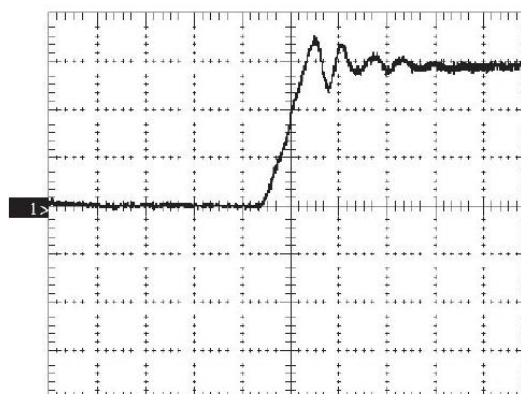
Maximum peak motor voltage with 100m of cable typically 120% of bus voltage



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

Figure 1

High Performance Output Filter voltage.



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

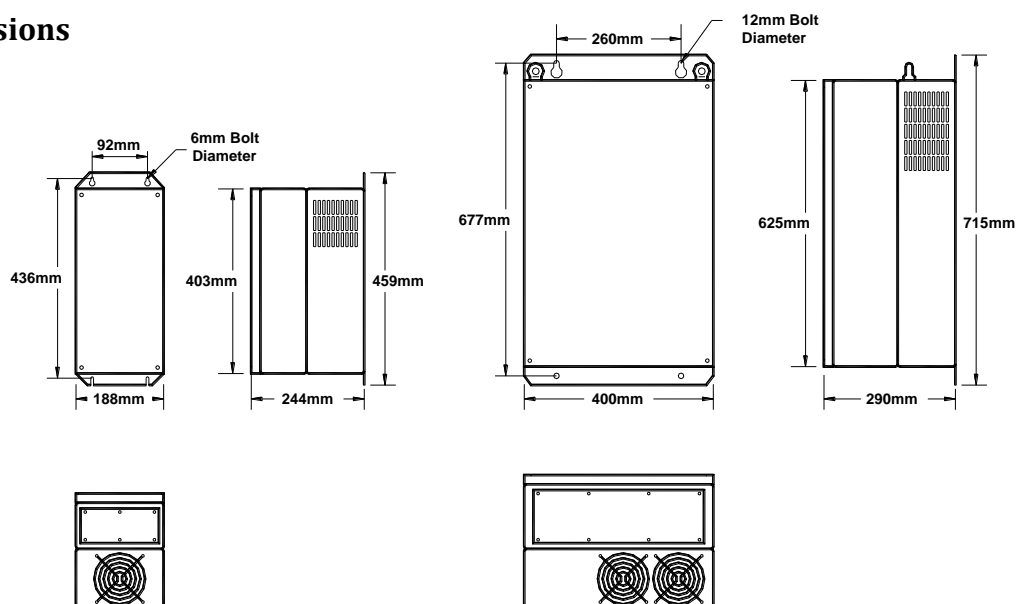
Figure 2

Motor terminal voltage with 100m of unscreened cable.

¹ Cable resistive voltage drop should be taken into consideration when long cable runs are used.

Mechanical Installation Information

Dimensions



Model	Chassis	Overall Dimensions (A x B x C)	Weight	Shipping Dimension (cm)	Shipping Weight (kg)
AHP0236	Small	459 x 188 x 244	25kg	54 x 36 x 40	28
AHP0306	Small	459 x 188 x 244	25kg	54 x 36 x 40	28
AHP0406 AHPL406	Small	459 x 188 x 244	25kg	54 x 36 x 40	28
AHP0576 AHPL576	Large	715 x 400 x 290	36kg	76 x 54 x 44	46
AHP0826	Large	715 x 400 x 290	57kg	76 x 54 x 44	47
AHP1096	Large	715 x 400 x 290	57kg	76 x 54 x 44	47
AHP1406	Large	715 x 400 x 290	76kg	76 x 54 x 44	47
AHP1706	Large	715 x 400 x 290	76kg	76 x 54 x 44	47

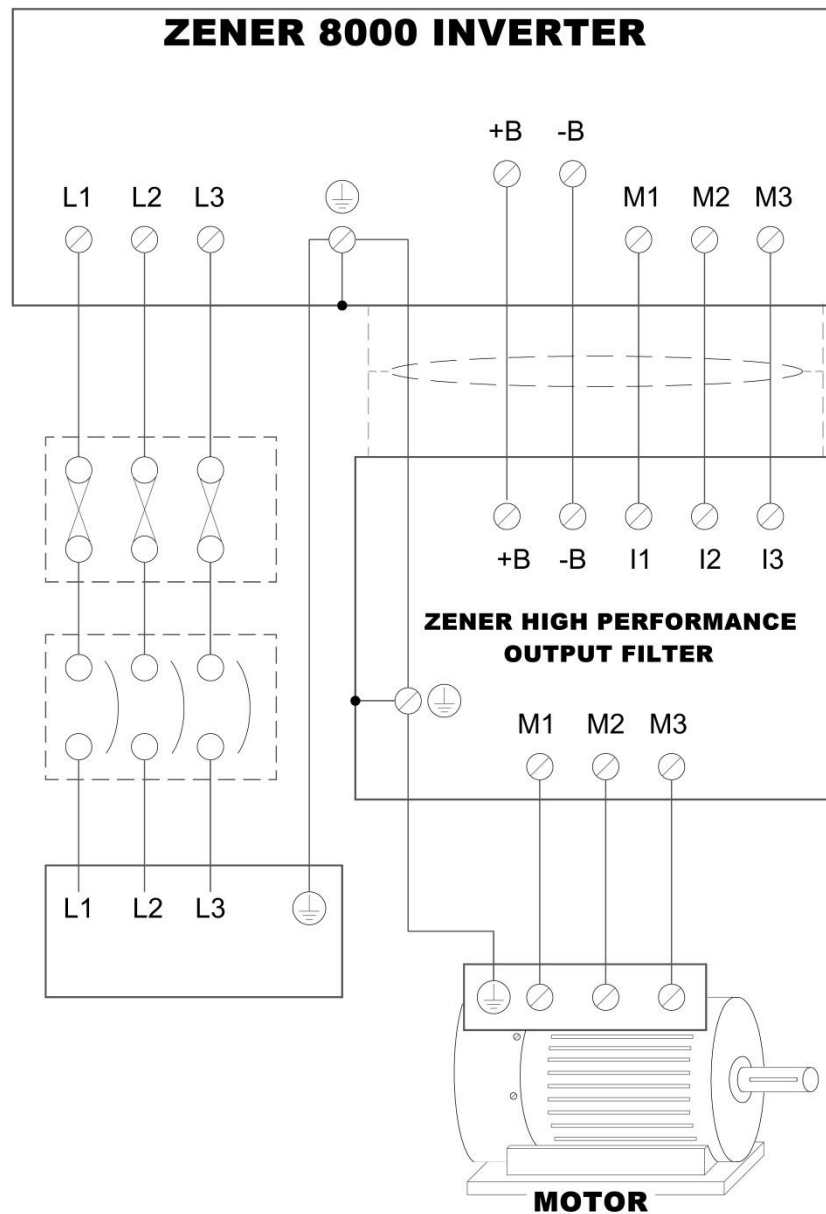
Installation Considerations



- The High Performance Output Filter must be mounted on a vibration free surface, away from heat radiating sources. Do not mount the High Performance Output Filter in direct sunlight or on a hot surface.
- If the High Performance Output Filter is mounted inside an enclosure with associated equipment, the total heat dissipation and resulting temperature rise in the enclosure must be considered.
- 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”²
- Do not drill holes in the High Performance Output Filter.
- Do not allow metal shavings or any other conductive material to enter the enclosure or damage may result.

² Confined spaces are generally defined in Workplace Health and Safety (WH&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.

Power Wiring Diagram



CAUTION

Do not operate the filter without connecting the filter +B & -B terminals to the ZENER 8000 inverter +B/BR and the -B terminals. Damage to equipment may result.

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* 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 ZENER 8000 Instruction Manual for EMC Installation practices.

*The wiring for +B & -B may be in a separate cable to the motor cables, but should also be screened.

Cable Size:

The minimum cable size used for the filter +B/-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 the ZENER 8000 Instruction Manual.

Chassis C and D: (ie. 82A model and above)

Chassis C & D includes a 30Amp fuse on the +B & -B terminals. This allows a smaller cable size to be used. The recommended minimum cable size is 6mm² (for UL508C compliance) or according to applicable wiring codes.

The fuse is designed to prevent damage to the ZENER 8000 in the event of a cable or Filter Fault condition.

ZENER 8000 +B/-B Terminals

The ZENER 8000 inverter's +B/-B terminals are supplied as an option fitted by the factory. The following table lists the part numbers corresponding to ZENER 8000 inverters from 15A to 170A.

Description	Models	Part Number	Internal Fuse
ZENER 8000 DC Bus Terminal Kit for Chassis A - fitted	R1 – R16	n/a	n/a
ZENER 8000 DC Bus Terminal Kit for Chassis B - fitted	R23-R57, L23-L57	AF08101	n/a
ZENER 8000 DC Bus Terminal Kit for ChC with Fuse - fitted	R82-R170	AF08107	30A

Fuse Data:

The fuse must be fast acting, 30A 600VDC rated, cartridge type 38.1 x 10.31mm.

Description	Part Number
Replacement Fuse, 30A 600VDC	AP18080



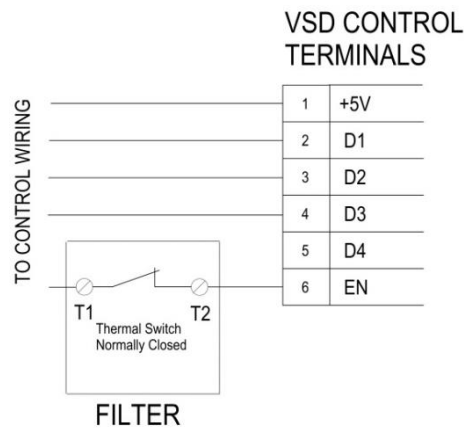
CAUTION

If the fuse is blown, do not operate the drive. The filter & drive must be inspected and tested by Zener before replacing the fuse & operating.

Temperature protection

Terminals T1 and T2 provide thermal protection for the high performance output filter. T1 and T2 is a normally closed contact that opens when it reaches its trip temperature.

Wire T1 & T2 terminals of the filter in series with the ZENER 8000 enable control signal (Terminal 6) as shown below. Alternatively, it may be connected into a digital input assigned as a custom alarm. Refer to the ZENER 8000 Reference manual for more information.



Operating the filter outside its rating such as a high ambient or high switching frequency or a faulty fan may result in high temperature.



CAUTION

Do not operate the equipment without the temperature protection connected. Failure to connect the protective thermal switch may void warranty.

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*When the filter is too hot the ZENER 8000 will display "NOT EN" on the second line of the display.

Operating Considerations

I^2T & current limit Setting:

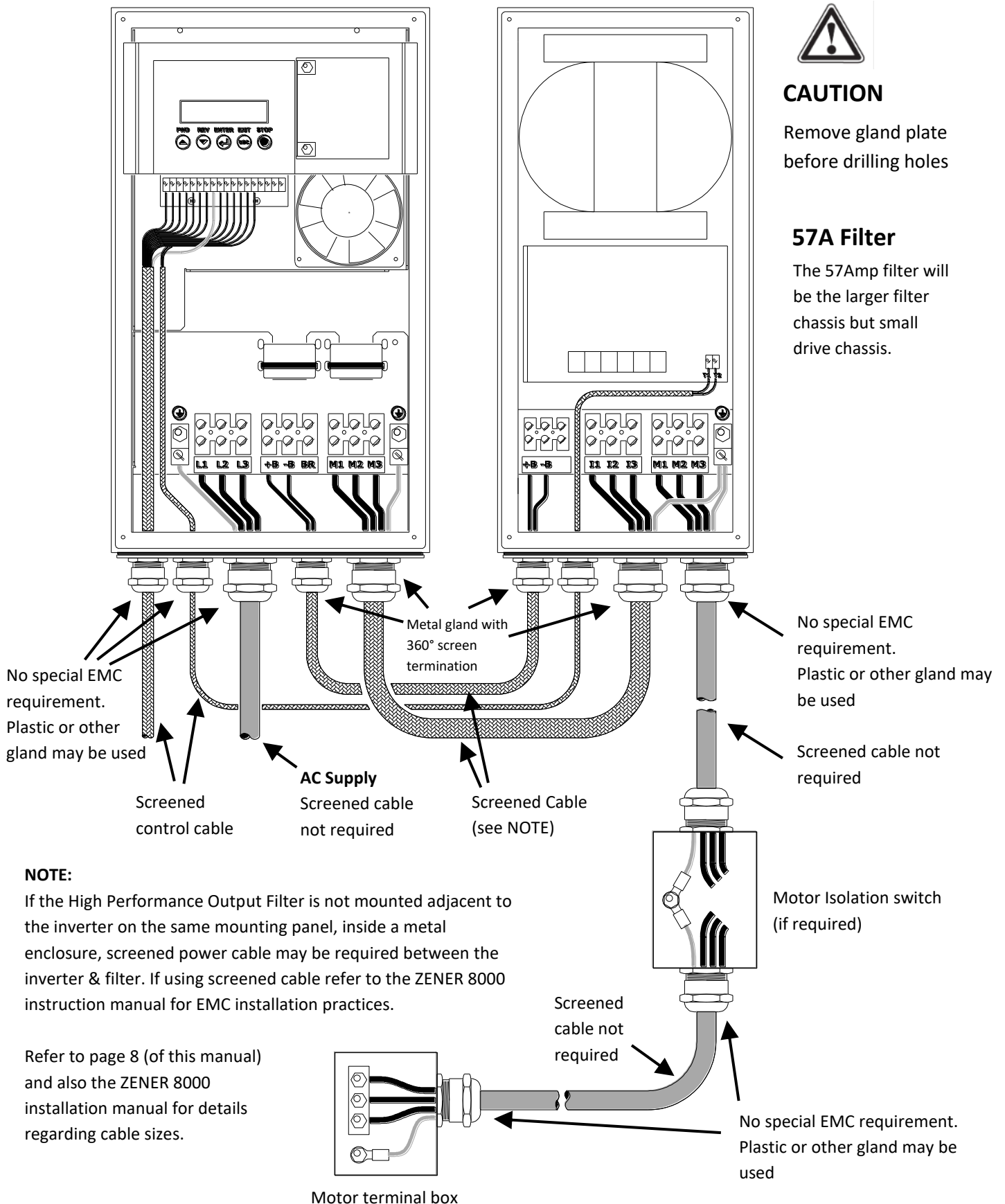
Set the ' I^2T ' setting of the ZENER 8000 to no more than the filter continuous rating, if the inverter has a higher current rating than the filter.

Set the 'current limit' of the ZENER 8000 to no more than the intermittent rating of the filter.

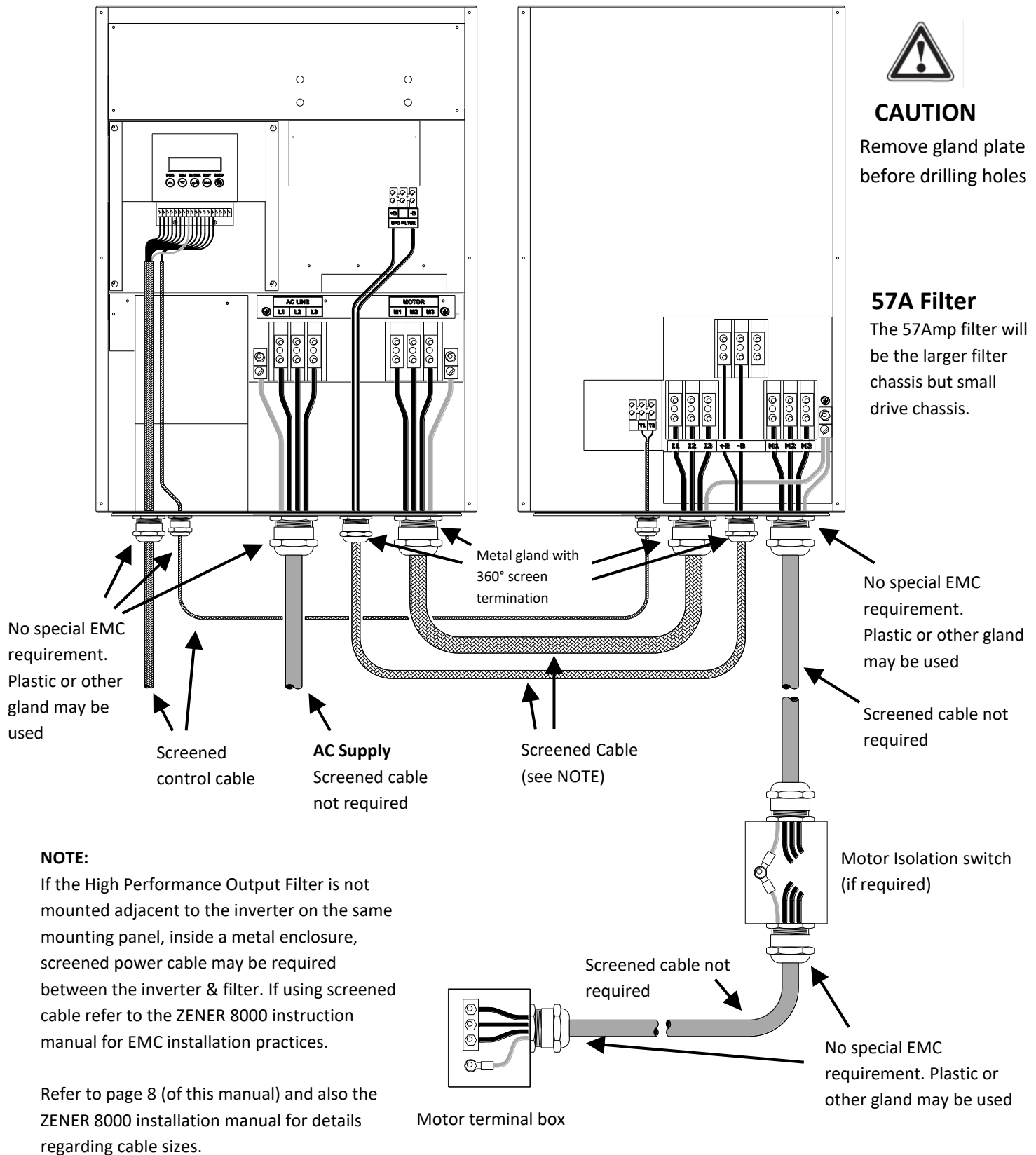
Audible (Switching) Frequency:

Zener recommends that the associated ZENER 8000 inverter be set for an audible switching frequency of 2kHz. Operating above this switching frequency may require de-rating of the filter & ZENER 8000. Contact Zener for details.

Small Chassis Wiring (23A to 57A)



Large Chassis Wiring (82A-170A)




Specification

Voltage Rating	AHPxxxx 380 to 480Vac, -15% +10%, 3 phase, 0-200Hz AHPLxxx 208 to 240Vac, -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	Typically 120% of peak mains voltage
Enclosure	IP66
Storage temperature	-20°C to 70°C
Operating environment temperature	0°C to 50°C as per drive rating / temperature (Consult Zener for higher ratings)
Relative Humidity	5 to 95% non-condensing
Altitude	0 to 1000m

Standards Compliance

When used with Zener 8000 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

Current Ratings

Model	Current Ratings			Heat Dissipation @ 2kHz Audible Frequency	Efficiency
	Continuous @ 40°C	Continuous @ 50°C	Intermittent 60s		
AHP0236	23A	18.8A	28.6A	88W	99.47%
AHP0306	30A	25.0A	38.4A	87W	99.60%
AHP0406*	40A	33.8A	51.1A	146W	99.49%
AHP0576*	57A	46.0A	72.5A	217W	99.45%
AHP0826	82A	68.9A	103.4A	291W	99.51%
AHP1096	109A	91.3A	138.0A	434W	99.45%
AHP1406	140A	118.9A	175.3A	437W	99.57%
AHP1706	170A	141.3A	189.9A	651W	99.47%

*These ratings are also available as 208-240VAC models. Change model number from AHP0xx6 to AHPLxx6

Operation at higher Audible Frequency may require derating. Operation at higher ambient temperatures than 40°C will require derating. Contact Zener with your requirements.

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