MPE
Quality, Reliability, Performance

HEMP & IEMI PROTECTION FILTERS FOR AC OR DC CONTROL LINES TO MIL-STD-188-125-1 & -2 & DEF STAN 59-188-1 & -2

CONFORMS TO ELECTRICAL POINT-OF-ENTRY REQUIREMENTS FOR SHORT (E1) PULSES AND SHIELDING EFFECTIVENESS

HEMP & IEMI CONTROL LINE FILTERS

MPE Limited
Hammond Road,
Knowsley Industrial Park,
Liverpool
L33 7UL
UK

Description

Ranges of multi-line HEMP protection filters for control lines suitable for use in various HEMP protected installations. All lines are individually filtered and feature inductive input to offer both good continuous wave EMC performance and superior transient handling performance. All lines feature high-energy varistor transient suppressors at the input end. Two DC ranges rated at 28VDC and 48VDC, meet the PCI requirements of MIL-STD -188-125-1 & -2 for low voltage control lines working at <90V. Two AC ranges of filters are offered rated at 250VAC and 120VAC meeting the PCI requirements of MIL-STD -188-125-1 & -2 for high voltage control lines working at >90V.

Typical Applications

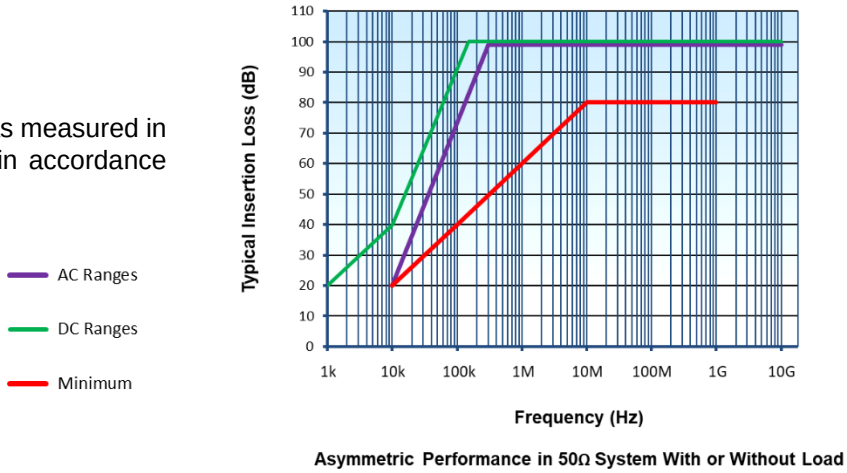
- Fixed ground-based C⁴I military facilities
- Transportable ground-based C⁴I military systems
- Proven to meet PCI and SE requirements of MIL-STD-188-125-1 & -2 and DEF STAN 59-188-1 & -2
- USACE 13.27.54.01
- UFGS 13.49.20.01
- UL 1283

Features

- Range for low-voltage DC and high-voltage AC control lines (28VDC, 48VDC, 120VAC & 250VAC)
- 2, 4, and 8 line versions
- 1, 2 and 5 Amp current ratings
- Individually filtered lines
- Utilises self-healing feedthrough capacitors
- UL 94 V-0 insulating materials
- RoHS compliant
- CE and UKCA compliant

Insertion Loss Performance

Typical asymmetric attenuation shown as measured in 50Ω system, at all loading conditions, in accordance with CISPR-17.



Asymmetric Performance in 50Ω System With or Without Load

Shielding Effectiveness

Frequency	10kHz	100kHz	1MHz	10MHz	100MHz	1GHz
Minimum Shielding Effectiveness to meet MIL-STD-188-125	20dB	40dB	60dB	80dB	80dB	80dB
Typical Filter Shielding Effectiveness	30dB	50dB	70dB	100dB	100dB	100dB

Web: www.mpe.co.uk
E-mail: sales@mpe.co.uk
Tel: +44 (0) 151 632 9100

Technical Specification

	28VDC Range	48VDC Range	120VAC Range	250VAC Range
Rated Voltage	28VDC	48VDC	120VAC 50/60Hz	250VAC 50/60Hz
Rated Current	1A to 5A	1A to 5A	1A to 5A	1A to 5A
Test Voltage (each line to case)*	300VDC	300VDC	2250VDC	2250VDC
Insulation Resistance*	>100MΩ	>100MΩ	>100MΩ	>100MΩ
Discharge Resistors (each line to case)	560kΩ	560kΩ	560kΩ	560kΩ
Discharge Time to Below 34V	N/A	N/A	<10s	<10s
Varistor Voltage Rating	38VDC	65VDC	150VAC	275VAC
Varistor Peak Surge Current	2kA (8/20μs)	6.5kA (8/20μs)	8kA (8/20μs)	8kA (8/20μs)

* test voltage and insulation resistance prior to fitting transient suppressors and discharge resistors

Maximum Volt Drop at Rated Current		See tables
Current Overload		10 x maximum rated current for 1 sec. 1.5 x max rated current for 10 minutes.
Temperature Range	Operating (Full Load)	-40ºC to +50ºC
	Reduced Load*	-40ºC to +85ºC
	Storage	-40ºC to +85ºC
Full Load Heat Dissipation		See tables
Maximum Temperature Rise on Full Load		25 ºC
Insertion Loss		See graph above

* Current derating between 50ºC and 85ºC, for operating temperature θ, the load current is given by $I_\theta = I_R\sqrt{(85-\theta)/35}$

Transient Suppression Performance

All the filters in this catalogue have passed acceptance pulse current injection (PCI) tests for the short (E1) pulse by an independent test laboratory in accordance with MIL-STD-188-125 and DEF STAN 59-188.

MIL STD 188-125-1 acceptance test, E1 short pulse current injection, wave shape 20/500ns Input pulse current injections of 250A, 500A, 1000A, 1800A, 2500A and 3535A			
	Norm	**Limit**	**Typical Response**
DC Ranges (referred to as low-voltage lines)	Peak Residual Current (28V Range)	100mA	<60mA
	Peak Residual Current (48V Range)	100mA	<80mA
	Peak Rate of Rise (di/dt)	$1x10^7$ A/s	$<1x10^7$ A/s
	Root Action	$1.6x10^{-3}$ Avs	$<1.6x10^{-3}$ Avs
AC Ranges (referred to as high-voltage lines)	Peak Residual Current (120V Range)	1A	<0.4A
	Peak Residual Current (250V Range)	1A	<0.4A
	Peak Rate of Rise (di/dt)	$1x10^7$ A/s	$<1x10^7$ A/s
	Root Action	$1.6x10^{-2}$ Avs	$1.6x10^{-2}$ Avs

MIL STD 188-125-1 acceptance test, E2 intermediate pulse current injection, wave shape 1.5/3000μs	
Input pulse amplitude	No requirement for Control Lines

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E-mail: sales@mpe.co.uk
Tel: +44 (0) 151 632 9100

Product Range (DC Ranges)

Part Number	Voltage Rating VDC	Current Rating (A) @50ºC	No. of Lines	DC Volt Drop per line (V)	Full Load Heat Dissipation per line (W)	Major Dimensions (see page 6 for full dimensions)			Weight (kg)
						Length (mm)	Width (mm)	Depth (mm)	
DS33590	28	1	2	0.2	0.2	360	90	90	2.5
DS33591	28	1	4	0.2	0.2	360	175	90	5
DS33592	28	1	8	0.2	0.2	360	340	90	10
DS33593	28	2	2	0.4	0.8	360	90	90	2.5
DS33594	28	2	4	0.4	0.8	360	175	90	5
DS33595	28	2	8	0.4	0.8	360	340	90	10
DS33596	28	5	2	0.6	3	360	90	90	2.5
DS33597	28	5	4	0.6	3	360	175	90	5
DS33598	28	5	8	0.6	3	360	340	90	10
DS33800	48	1	2	0.2	0.2	360	90	90	2.5
DS33801	48	1	4	0.2	0.2	360	175	90	5
DS33802	48	1	8	0.2	0.2	360	340	90	10
DS33803	48	2	2	0.4	0.8	360	90	90	2.5
DS33804	48	2	4	0.4	0.8	360	175	90	5
DS33805	48	2	8	0.4	0.8	360	340	90	10
DS33806	48	5	2	0.6	3	360	90	90	2.5
DS33807	48	5	4	0.6	3	360	175	90	5
DS33808	48	5	8	0.6	3	360	340	90	10

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Product Range (AC Ranges)

Part Number	Voltage Rating VAC (50/60Hz)	Current Rating (A) @50ºC	No. of Lines	DC Volt Drop per line (V)	Full Load Heat Dissipation per line (W)	Major Dimensions (see page 6 for full dimensions)			Weight (kg)
						Length (mm)	Width (mm)	Depth (mm)	
DS33690	120	1	2	0.3	0.3	360	90	90	2.5
DS33691	120	1	4	0.3	0.3	360	175	90	5
DS33692	120	1	8	0.3	0.3	360	340	90	10
DS33693	120	2	2	0.6	1.2	360	90	90	2.5
DS33694	120	2	4	0.6	1.2	360	175	90	5
DS33695	120	2	8	0.6	1.2	360	340	90	10
DS33696	120	5	2	0.9	4.5	360	90	90	2.5
DS33697	120	5	4	0.9	4.5	360	175	90	5
DS33698	120	5	8	0.9	4.5	360	340	90	10
DS33670	250	1	2	0.3	0.3	360	90	90	2.5
DS33671	250	1	4	0.3	0.3	360	175	90	5
DS33672	250	1	8	0.3	0.3	360	340	90	10
DS33673	250	2	2	0.6	1.2	360	90	90	2.5
DS33674	250	2	4	0.6	1.2	360	175	90	5
DS33675	250	2	8	0.6	1.2	360	340	90	10
DS33676	250	5	2	0.9	4.5	360	90	90	2.5
DS33677	250	5	4	0.9	4.5	360	175	90	5
DS33678	250	5	8	0.9	4.5	360	340	90	10

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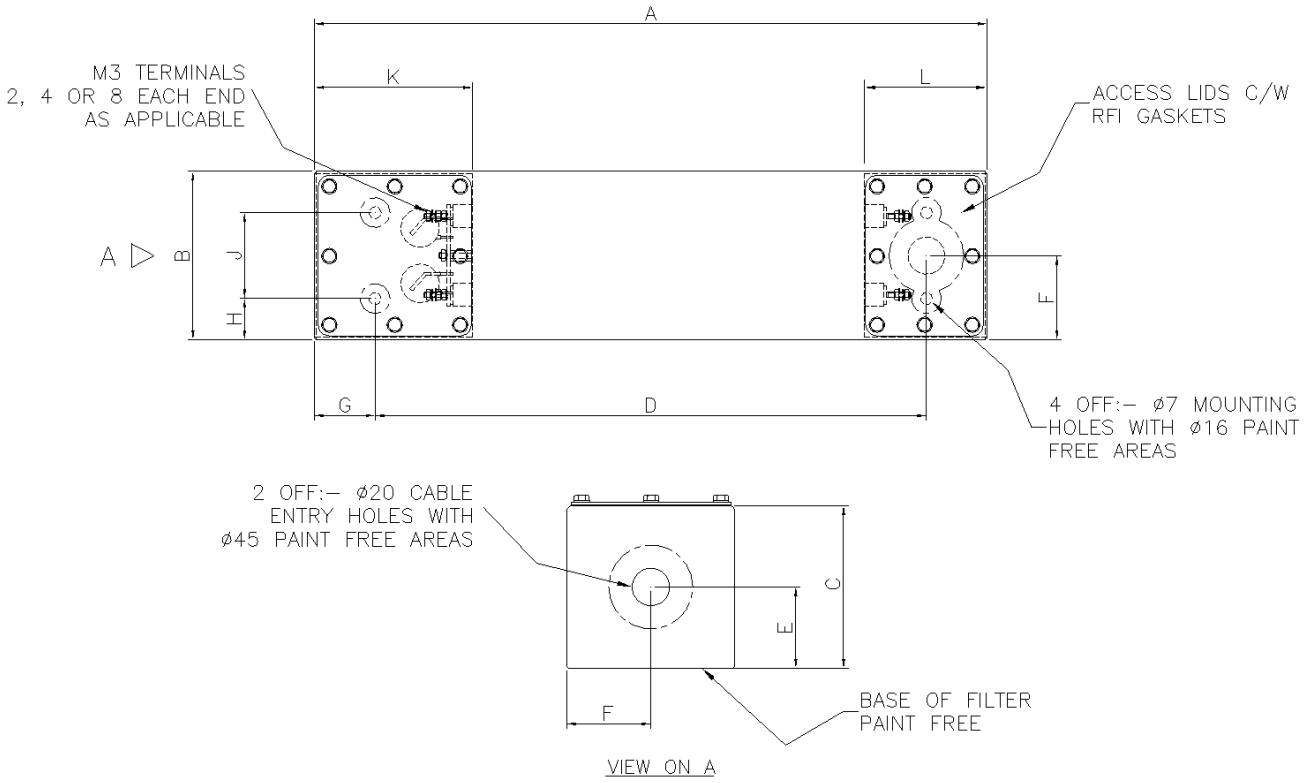
DIMENSIONS & MECHANICAL DETAILS

Dimensions



No. of Lines	Dimensions (mm)										
	A	B	C	D	E	F	G	H	J	K	L
2	360	90	90	295	42	45	32.5	22	46	85	65
4	360	175	90	295	42	87.5	32.5	37.5	100	85	65
8	360	340	90	295	42	170	32.5	45	250	85	65

Mechanical Details

Case material	Mild steel, dull tin plated
Terminals	M3 threaded brass spindles, bright nickel plated
Finish	Gloss epoxy paint to DEF-STAN 80-161
Colour	Light admiralty grey BS 381C 697
Enclosure Rating	IP 54
Potting Compound Flammability Rating	UL 94 V-0

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Installation Details

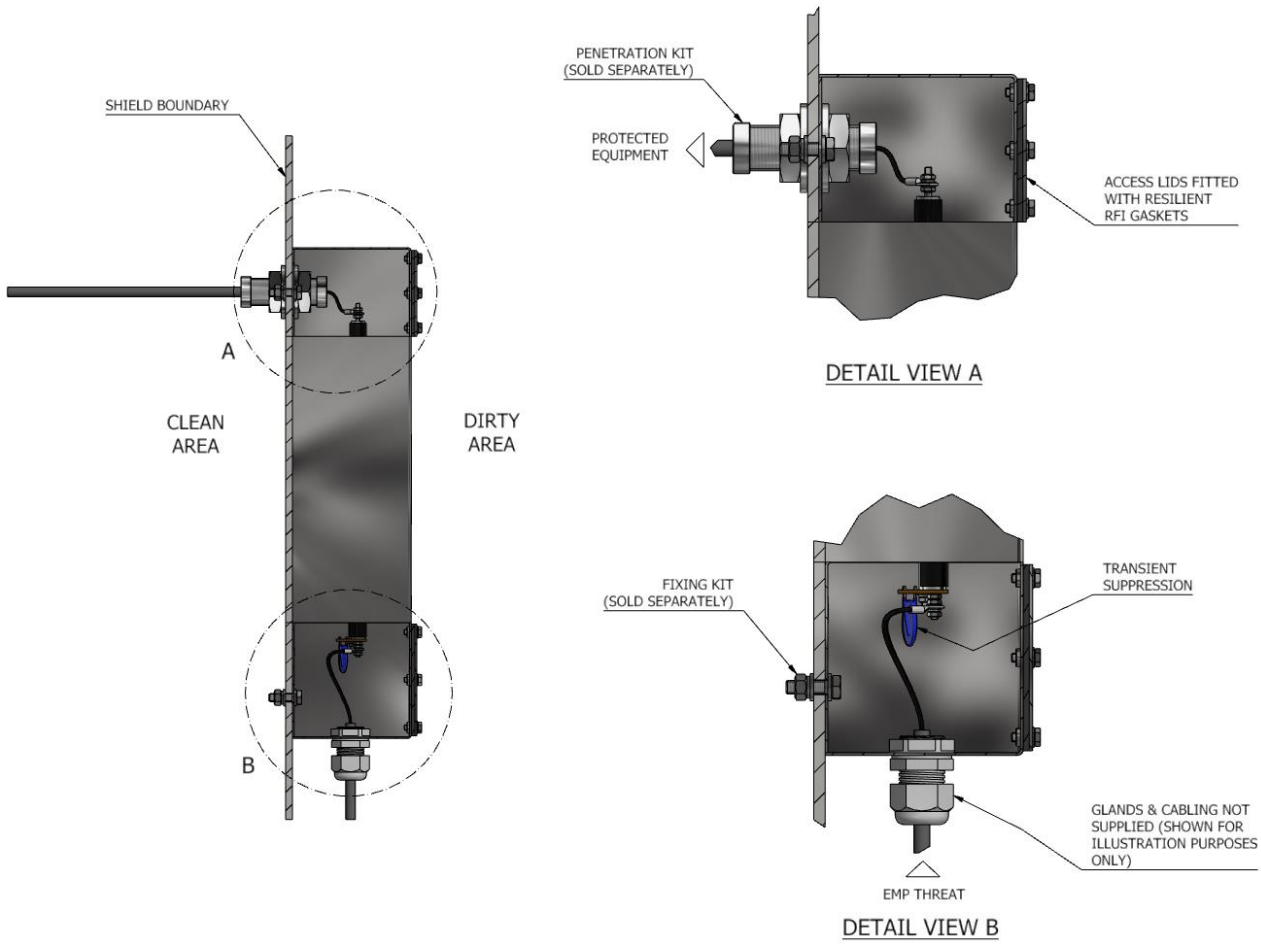
It is recommended that filters be mounted on a steel surface, which has been electroplated with tin or zinc. The mounting surface should be clean, flat and unpainted to ensure a low impedance bond to earth and good RF seal. This type of large area connection to the box ensures that at high frequencies, inductive and capacitive values are minimal, allowing a clear path to ground potential.

The filters are housed in a robust rectangular tin-plated steel case. To maintain shielding effectiveness, the enclosure is supplied complete with access lids, screws and EMI/environmental lid gaskets. The filters are not supplied with fixing hardware or bulkhead penetration tubes (can be purchased separately).

All HEMP & IEMI control filters are supplied with integrated transient suppression at the EMP INPUT of the filter. Leaded style metal oxide varistors (MOVs) are installed between each line and earth (the case) in the input wiring compartment. The design ensures these protection devices do not interfere with the filter wiring or mounting as much as possible, whilst still being accessible for servicing and in the event of failure, replacement. A good electrical connection is made by mounting the varistors on PCBs with short connections between the varistor and each terminal or the case. It is imperative that the filter is installed with the transient suppressor at the EMP INPUT of the filter facing the incoming EMP threat.

Fixing Type	Recommended Tightening Torque (N-m)
M3 Terminals	0.5
M4 Access Lid Screws	1

Typical Installation



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Earth Bonding for Safety

The installer must ensure the filter is permanently and solidly earthed both for safe operation and to achieve optimum EMC and pulse performance. This is essential for filters with direct capacitance from phase to metal enclosure. In the event of the earth connection to the enclosure becoming disconnected, the enclosure will rise in voltage to an unsafe level.

The user should ensure he is familiar with restrictions on capacitance value, earth leakage current, test voltage, and safety labelling requirements, which may be applicable to the particular installation.

Discharging after Isolation

All filters in this catalogue contain large values of capacitance. These capacitors can store a hazardous electrical charge long after the power has been removed. Therefore as a safety measure, all filters are fitted with internal discharge resistors intended to lower the stored voltage to a safe level after removal of the power. Even though discharge resistors are fitted to this range of filters, terminals should always be shorted to earth prior to touching to ensure the capacitors are fully discharged.

It is important to follow a safe disconnection procedure when working on cables and filters. Always ensure the voltage between phases, between phase and neutral, and between phase and ground are safe before working on any part of the cabling connected to a filter.

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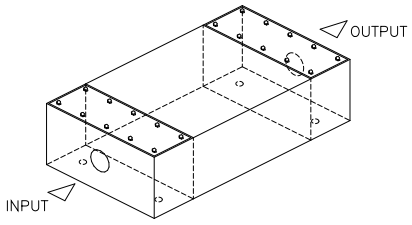
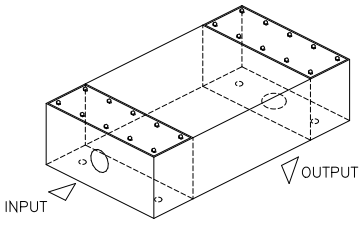
Cable Entry Options

Two different cable entry options are available as shown below. The most common configuration for mounting on shielded rooms is “C” i.e. end entry and exit through the base.



Configuration “A”
e.g. Part Number DS33590A
End Entry / End Exit



Configuration “C”
e.g. Part Number DS33590C
End Entry / Base Exit

Ordering Codes

The ordering code consists of the filter part number and the cable entry hole position suffix.

Step 1 Choose the voltage rating required (28VDC, 48VDC, 120VAC or 250VAC)

Step 2 Choose the current rating and the number of lines required

Step 3 Select part number from the product range tables

Step 4 Add preferred cable entry suffix A or C

DS33590#

Select the required filter part number from the range available (example shown)

Add suffix for cable conduit hole configuration
Suffix "C" supply enters on side face, load exits through base
Suffix "A" supply enters on side face, load exits on opposite face

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BULKHEAD & FIXING SCREW KITS

Bulkhead Penetration Kits

Optional bulkhead penetration kits can be provided for HEMP control line filters. All filter enclosures in this range have a 20mm diameter pierced hole in the OUTPUT end compartment for passing cables through the bulkhead.

These high quality bulkhead penetration kits have been designed to provide an RFI tight bulkhead penetration for cables to facilitate fixing of rectangular filters to bulkheads or walls of shielded enclosures. They make it easier to achieve a full RFI seal between filter case and bulkhead up to the highest frequencies, which is not usually achievable with standard electrical conduit fittings due to badly fitting threads.

The bulkhead penetration kits can be used with a bulkhead thickness up to 20mm. They comprise a penetration tube complete with nuts, heavy duty washers, RF gaskets, and end bushes for cable protection. The main components are made from electroplated steel and the RF gaskets are made from copper sheet.

Part Number (Kits for use with Bulkhead Thickness of up to 20mm)	Cable Entry Hole Diameter (mm)	Conduit Thread Size
30/807147	20	M20

Fixing Screw Kits

Optional fixing screw kits can be provided for HEMP control line filters. All filter enclosures in this range have 7mm diameter pierced holes in the base of the enclosure for mounting with M6 fasteners.

Fixing screw kits enable the filter to be securely fastened to the mounting surface. They can be used with a mounting surface thickness up to 20mm. They comprise a set of four screws each with washers, spring washers, nuts and lock nuts and are all made from electroplated steel with the exception of the spring washers which are stainless steel.

Part Number (Kits for use with Mounting Surface Thickness of up to 20mm)	Fixing Hole Diameter (mm)	Screw Thread Size
30/806952	7	M6

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Tel: +44 (0) 151 632 9100

OTHER PRODUCTS FROM MPE

MPE have designed and manufactured EMC solutions in the UK for over 95 years and have a proud reputation as one of the world's leading capacitor and filter specialists.

With a proven heritage of design, development and manufacture of high performance capacitors and filters, MPE are the first choice for companies who require the most cost effective EMC solution, quality products and technical support.

MPE's unrivalled capability and experience of many defence, telecoms, industrial and commercial applications enables MPE to supply capacitors and filters to satisfy the most exacting customer requirements from military vehicles, IT servers and telecoms base stations to EMP, NEMP, LEMP, HEMP and TEMPEST commercial and military installations.

MPE's comprehensive standard product range includes high performance feedthrough capacitors to high current power, telephone, data and control line filters with wide frequency spectrum characteristics in a choice of enclosure styles:

- Audio, Public Address & Building Management Services Filters
- Control Line Filters
- Data Line Filters
- Equipment Filters
- Feedthrough Capacitors & Filters
- High Voltage DC Power Line Filters – 1500VDC
- HEMP Control Line Filters
- HEMP Public Address Filters
- HEMP Power Line Filters
- HEMP Power Line Filters – Modular Option
- HEMP Telephone Line Filters
- Low Leakage TEMPEST EMI Filters
- Military Vehicle Filters
- Power Line Filters
- Specialist EMI Power Line Filters
- Telephone Line Filters
- TEMPEST Pluggable EURO Filters
- TEMPEST Pluggable UK Filters
- Ultra Low Leakage Power Line Filters

MPE Limited
Hammond Road,
Knowsley Industrial Park,
Liverpool
L33 7UL
UK

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