ESF SERIES

COMPACT 2-PORT SURGE FILTERS

FEATURES

- *Compact solution for Class II / Cat B,C & D, Point of Entry, distribution board and sub board surge protection*
- *2 mode protection L-N or L-E & N-E*
- *High kA rating per phase 100kA, Imax*
- *Exceptionally low let through voltage <600V @ 3kA / 8/20us, <800V @ 50kA / 8/20us, Inom*
- *50A to 80A single and three phase models*
- *Fully enclosed and gear tray versions to suit switch boards*
- *Can be configured for 3:1 phase bypass loads*
- *Available in TN & TT systems versions*
- *Eliminates RCD/ELCB tripping by being installed at the service bus UPSTREAM of RCD/ELCB's. (In accordance with latest wiring rules recommendations.)*
- *Cost effective solution where multiple 20A series filters cause cost over run and increased cabinet foot print.*

APPLICATIONS

- *Telecommunications systems*
- *Medical equipment*
- *Industrial equipment*
- *Data centres*
- *Control systems*
- *Switch boards*

FUNCTIONAL DESCRIPTION

The ESF series surge filters are Class II, single and three phase, 2 port SPDs, designed to provide complete site surge protection in a compact footprint. These models utilize UL1449 ed3 certified thermally-fused MOV devices in conjunction with air-wound inductors to provide a current-limited output, coordinated to surge levels below 3kA. This means that all downstream power circuits are protected to ANSI/IEEE C62.41 Category B level, the common level that medium power LV loads (UPS, rectifier, industrial machines) are designed to accept. The design results in an exceptionally low let through voltage. (<600V, 3kA, 8/20us).

In addition, the units also provide filtering of line harmonics, noise and RF transmitters with a cut off frequency of <10KHz and a nominal attenuation of 48dB above 1MHz.

The units can be supplied in gear-tray format for installation into a switchboard, or enclosed in an IP54 enclosure. When installed in compliance with the manufacturer's instructions and applicable standards, this unit provides a high degree of protection to connected loads.

Models are offered in 1 or 3 phase for TT or TN-based power systems in the range of 50A to 80A.

COMPLIANCE

The ESF series surge filters are designed in accordance with the requirements of AS/NZS3000:2007, AS/NZS3100, AS/NZS1768, IEC 61643-1 and EN610006.

PRINCIPLE OF OPERATION

Excess potentials are captured by the primary protection stage, resulting in a protection level of **<600V @ 3kA, (8/20us)** and **<800V @ 50kA, *Inom* (8/20us)**. The filter components reduce rise-time of the remaining surge and control current to the secondary MOVs. A 'Low Q' filter design is utilized to avoid resonance effects. When the secondary MOVs conduct, the unit's output is clamped and the inductor provides current-limiting of the surge into the externally-connected load circuits. TN models use Neutral as the primary and secondary surge return paths and provide Neutral-Earth protection via a high-energy gas arrestor. TT models use Earth as the primary surge return and Neutral as the secondary surge return path. TT models use MOV devices for Neutral-Earth protection. These units are applicable to TT, TN-C, TN-S and TNC-S power systems nominally rated between 380 and 440V.

FUSING

No fuses are fitted for line protection. It is assumed that the installation will include upstream provision for fusing and isolation (see section headed " Recommended Protection and Disconnect Devices "). This unit is intended to be connected before any RCD devices. Internal thermal fuses protect the individual circuit elements and their status is indicated on the escutcheon panel on the front of the unit.

INDICATORS

Each filter is provided with a 2 part led display.

The blue **"Power On"** led indicates when power is applied to the unit. When power is not present the led is extinguished. Normal operation is indicated when the led is blue.

The red **"Fault "** led indicates when any MOV has failed (reached end of life) OR when the input voltage has become too low. (<180vac on one phase). The led will stay latched on when a MOV failure has occurred. In this case consideration should be given to replace the unit at the next available PM window. In the event of a low mains condition, the led will extinguish when the mains returns to normal levels. Normal operation is for the led to be extinguished. Any condition that results in the fault led going red is input to the alarm monitoring circuit.

ALARMS

The alarm function provides a summary alarm output for protection failure and power failure. The summary alarm relay provides remote signalling to other equipment. The alarm provides a dry-contact relay output and is self-clearing. Contact rating is 240VAC/32VDC, 5A.

GUIDELINES FOR PLANNING YOUR SURGE PROTECTION

We recommend that the specifier and installer become familiar the standards applicable to the equipment and site, prior to any final product selection and placement. Correct product selection according to risk and location category is essential to a successful solution. This may also involve changing some aspects of existing electrical infrastructure to ensure an effective result.

- Pay particular attention to the positioning of any SPD in relation to the M.E.N. point or other effective earth termination position.
- It is imperative that input and output circuits be separated from each other to ensure that coupling of surges across cables does not occur. If this cannot be achieved, the use of shunt-only (single-port) SPD's should be considered.
- If applicable, ensure that appropriate approvals to connect are observed with your local energy authority.
- The output of any series SPD does not automatically confer a reclassification of the load side circuit category rating. This is due to the common neutral and earth shunt circuits. If sensitive, low power devices (i.e. ANSI/IEEEC62.41 Category A) are to be connected to the unit's output, we recommend investigating the fitting of further downstream SPDs at the sensitive equipment distribution board.

Further information on surge protection guidelines may be obtained through your local standards office. If in doubt, please contact your distributor.

INSTALLATION GUIDELINES

This Surge Protection Device (SPD), is intended to be installed and operated in accordance with the manufacturers instructions. Installation instructions are provided with the unit and should be read and understood prior to attempting the installation.

To make any SPD effective, there are a few simple principles that need to be considered:

CABLE LENGTHS AND SIZES

Under surge conditions, all cables exhibit voltage drop. For example, a 15kA surge current, depending on size and length of cable, can result in a voltage drop in excess of 2000v per metre. If this occurs in neutral or earth conductors, then the filter element would provide little protection. It is therefore important to install the SPD device as close as possible to the point of entry to the facility. Keep neutral and earth cables as short as possible, using the largest possible diameter cable practical. Wiring regulations can often stipulate much smaller cable sizes for earth and neutral, however, in surge applications the opposite is true. Using earth and neutral cables with the same cross-sectional area and size as the phase cables is more appropriate.

The better solution is to use 2 identical conductors in parallel for all primary cabling, each ½ of the area (i.e. instead of a 50mm^2 cable, use 2x 25mm^2 in parallel). This reduces the inductance of the cable run, reducing voltage drop under surge conditions. Cabling on the load side of the filter can be of conventional design and layout.

For TT applications, consider fitting small busbars (25 x 3mm) for earth connection from the SPD Primary earth to the earthing point. In TNC-S applications, consider using a busbar (insulated) as a neutral conductor back to the M.E.N. point. Flexible busbars are easy to form and install.

The unit may be inverted for bottom-entry/top exit if desired.

SINGLE POINT EARTHING

At the point of entry, the earth conductor is the common surge conductor. To prevent damage and minimize personal risk, it is imperative that all grounding systems are brought together at the supply connection point. As an example, the earth provided for equipment to be connected to this SPD must be connected to the same point as the SPD's earth, back at the source. **DO NOT** daisy chain earth from the SPD to the device that the SPD is protecting.

FAILURE TO OBSERVE THIS POINT WILL RESULT IN A MUCH LOWER PROTECTION LEVEL, ALLOWING DAMAGE TO CONNECTED EQUIPMENT. UNDER SURGE CONDITIONS, IT MAY ALSO REPRESENT A POTENTIAL SHOCK HAZARD.

Local regulations may require structural earth bonding under certain conditions. Always follow the appropriate regulations and consult with the factory or distributor if a conflict exists. We recommend the use of equipotential grounding devices between all services.

RECOMMENDED PROTECTION & DISCONNECTOR DEVICES

We recommend the use of HRC GL, 500V, >25KAIC rated fusing or rated in accordance with the supply connection on the line side of the filter. We do NOT recommend the use of circuit breakers as primary protection. HRC GL fuses are more appropriate for circuits subjected to surges as they are less prone to failure and provide a more effective path for high frequency energy. Under surge conditions, a circuit breaker's trip coils may cause large voltage drops, leading to internal arcing. These drops will reduce current flow and increase let-through voltage. Under some conditions, physical damage may occur to the breaker. This will result in increased unreliability and reduced safety where the breaker may not release in fault conditions.

If it is required to isolate the unit for servicing, there are 3 options:

1. Use three "BS88-style" (cylindrical) HRC fuses in combination with an isolation switch;

2. Use three 22x58mm HRC fuses in individual holders; or

3. Use three "NH-style" HRC fuses in a 3-pole pull-out drawer-type holder.

If there is no other primary SWB load other than this filter (i.e. every piece of equipment on the site runs through this filter, then an isolation switch may used alone, the main fuses providing line protection.

For load side protection, circuit breakers OR fuses are acceptable, due to reduced energy levels afforded by the SPD.

READ THE MANUAL!

Step by step installations instructions are provided with each unit to guide you through an effective installation practice. This will help to ensure the performance of the filter when followed correctly.

WARRANTY

Eaton warrants this unit against faulty parts and workmanship for a period of 5 years from the date of purchase. If this product fails to operate correctly, please contact your Eaton representative. This warranty doesn't cover neglect or intentional misuse. As this product is intended for use in electrically harsh environments no claim is made of suitability for purpose.

PHYSICAL AND ELECTRICAL SPECIFICATIONS

Models Model part numbering guide: **ESFWWX-YY-Z** **ESF** E model Surge Filter **WW** Current. 50, 63 or 80 Amp **X** Phases 1 or 3 **-YY** TN for TN based systems TT for TT based systems **-Z** E for enclosed units Blank for gear tray units	Available models : Enclosed versions : TN-S, TN C-S SYSTEMS. ESF501-TN-E, ESF503-TN-E, ESF631-TN-E, ESF633-TN-E, ESF801-TN-E, ESF803-TN-E Gear tray versions : TN-S, TN C-S SYSTEMS. ESF501-TN, ESF503-TN, ESF631-TN, ESF633-TN, ESF801-TN, ESF803-TN

Input voltage – Uc	220 – 250VAC 1∅, 380 – 440VAC 3∅	
Maximum continuous voltage – MCOV	320VAC L-N	
Service type	TN-S, TN C-S SYSTEMS	
Nominal discharge current	Class II I*n* L-N 50kA, N-E 50 kA	
Current rating – continuous	50, 63 or 80A	
Recommended maximum over current protection	HRC gL fuse rated according to the unit's rating.	
Residual current	<10 mA	
Short circuit withstand (1 sec)	29kA	
Primary protection modes – TN models	Line-Neutral, Neutral-Earth	
Primary protection modes – TT models	Line-Earth, Neutral-Earth	
In 8/20us (Line-Neutral or Line-Earth)	50kA	
In 8/20us (Neutral-Earth)	50kA	
Ismax 8/20us (Line – Neutral)	100kA	
Nominal surge lifetime	20 hits @ 50kA (8/20uS, each mode)	
Filter attenuation	48dB nominal above 1MHz	
Initial clamp voltage (Line-Neutral)	510V	
Initial clamp voltage (Line-earth – TT models)	680V	
Initial clamp voltage (Neutral-Earth)	TN = 255V, TT = XXXX	
Residual voltage (Vpl) Line-Neutral	<600V (3kA, 8/20uS)	
Residual voltage (Vpl) Neutral-Earth	<1000V (3kA, 8/20uS)	
Residual voltage (Vpl) Line-Neutral	<800V (50kA, 8/20uS)	
Residual voltage (Vpl) Neutral-Earth	<1100V (50kA, 8/20uS)	
Internal protection (fusing)	All surge diverter elements are thermally fused.	
External disconnector requirements	Line side:	1 or 3 pole, HRC gL fuse, 500v, 50KAIC.
	Load side:	10kAIC or better MCB.

PHYSICAL AND ELECTRICAL SPECIFICATIONS CONTINUED

Terminations	Bolted lug. 8mm bolts for phase and neutral connections. 6mm PE (earth) stud provided on gear tray. All connections identified on unit.
Alarms/indicators	Includes status indicators, dry contact alarm relay output (normally-closed with power applied and all SPD's at 100% capacity). Contact rating 250Vac/32Vdc, 5A, alarm under-voltage cut off 180Vac.
Location Category	Internal mounting location only. Must be installed within a suitable enclosed space, allowing for cooling airflow.
Thermal dissipation	Max 200W @ full load, 3 phase, 80A model.
Standards. Designed in accordance with :	IEC61643-1:2007, IEC610006-1,2,3,4 ANSI/IEEE C62.41, AS/NZS1768, AS/NZS3000:2007, AS3100
Installation instructions	Supplied with unit.
Dimensions – 1 phase including hinges	Enclosed models : 520H x 240W x 220D (mm) Gear tray models : 350H x 200W x 190D
Dimensions – 3 phase including hinges	Enclosed models :520H x 400W x 220D (mm) Gear tray models : 350H x 360W x 190D
Weight	6kg (single phase), 10kg (3 phase)
Environment	-10 to 65°C, 10 to 90%RH (non-condensing) IP42 Enclosed IP20 Gear tray
Warranty	5 years, workmanship and materials

NOTE:- Installation must be carried out by suitably qualified personnel. Please refer to installation instructions prior to proceeding with installation.