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TVSS Products

Technical Document

Surge Arrestor vs. Surge Suppressor

SURGE ARRESTOR VS SURGE SUPPRESSOR

The use of surge protection devices (surge suppressors) is growing at over 20% per year. Suppressors are now routinely installed at the service entrance and key downstream panelboard or MCC locations to provide clean power to solid state loads. Currently, there is some confusion between the application of *surge arrestors* and *surge suppressors* - especially in industrial facilities, water treatment plants and other areas where arrestors were predominately used. This Tech Note explains the differences in performance and application between the two technologies.

The Evolution of Surge/Lightning Arrestors

In the past, when non-linear or solid state devices such as computers, PLCs and drives were not yet in use, relays, coils, step switches, motors, resistors and other linear loads were the standard. Utility companies and end users were concerned with how to protect electrical distribution systems from lightning surges. Their objective was to ensure that voltage surges did not exceed the basic insulation level (BIL) of the conductor wires, transformers and other equipment. Consequently, arrestors were developed for use in low, medium and high voltage applications at various points in the transmission and distribution system. The fact that these devices created a "crowbar" between the phase conductor and ground did not matter to these loads if it cleared within a few cycles.

Arrestors are still used in the electrical industry primarily along the transmission lines and upstream of a facility's service entrance. Arrestors are available in various classes depending upon their withstand capability (e.g. station vs distribution class). At the service entrance location on low voltage systems (600 Volts and below), surge suppressors are now replacing the use of arrestors.

The Evolution of Surge Protection Devices (also called TVSS)

In today's computer age, the use of solid state (nonlinear) loads is increasing dramatically. Research by Utilities and other groups estimated that in 2000 70% of utility loads are consumed by electronic equipment such as drives, PLCs, computers, electronic ballasts, telecommunication equipment, etc.

Modern day electronic equipment is getting faster, smaller, more efficient and very complex. These improvements have been made in all microprocessor based equipment over the years, and this progress will continue. The tradeoff in faster speed and lower cost is that the microprocessor loads are becoming increasingly more susceptible to the effects of transients and surges.

As a design objective, the IEEE Emerald Book (and the ITIC curve) recommend reducing 20,000 Volts induced lightning surge disturbances down to two times nominal voltage (< 330 Volts peak). To achieve this level of performance, surge suppressors were developed. Since the mid-1980s, these devices have become the preferred choice for protecting loads within any facility.

Lightning arrestors were designed to protect the electrical distribution system and not sensitive solid state equipment from the effects of lightning.

As Table 1 shows, lightning arrestors have a high let-through voltage, the key performance factor for protecting electronic loads. Under the IEEE Category C3 test wave (20 kV, 10 kA), the let-through voltage is typically over 1200 Volts (on a 120 Vac system).

This is satisfactory for insulation protection on transformers, panelboards and wiring. For VFDs, computers, PLCs and other sensitive equipment, however, the solid state components will be damaged or "upset" by these surges. Using suppressors at the service entrance and key branch panels, the surge will be effectively reduced to harmless levels.

Note: if a TVSS and lightning arrestor are both used at a service entrance switchboard, the TVSS will do all of the work. It will "turn on" earlier and shunt most of the surge current.

Many water treatment plants, telecommunication facilities, hospitals, schools and heavy industrial plants utilize TVSS instead of surge arrestors to provide protection against the effects of lightning, utility switching, switching electric motors, etc. When selecting a suppressor, look for a quality device having the following features:

- Low let-through under IEEE Category B3, C1and C3 test waves.
- Independently tested to the published surge current ratings (per phase).
- Includes internal monitoring features.
- Includes electrical noise filtering (≥40 dB @ 100 kHz).
- Small footprint design for more effective installation.
- Listed under UL 1449, UL 1283.

Table 1: Difference Between Arrestors and Suppressors

	Surge Arrestor		Surge Suppressor	
Let Through Voltages (based IEEE test waves):	480 V (277 V L-N)	208 V (120 V L-N)	480 V (277 V L-N)	208 V (120 V L-N)
- Cat. C3 (20 kV, 10 kA)	>1500 V	>1000 V	>1500 V	>1000 V
- Cat. C1 (6 kV, 3 kA)	>1500 V	>1000 V	>1000 V	400 V
- Cat. A1 (6 kV, 67 A, 100 kHz)	>1500 V	>1000 V	>100 V	<100 V
Internal Monitoring Capabilities (identify internal failure and activate remote alarm or lights)	NO		Yes (most quality devices)	
EMI/RFI Filtering	NO		Yes (most quality devices)	
Fusing (overcurrent protection)	NO		Yes (most quality devices)	
Design	Gapped MOV		MOV / Filter (hybrid)	
Interrupts Power (crowbar)	Yes (typical 1/2 cycle)		No	
Failure	Explosive		Trips Breaker / Fuse	
Warranty	Limited		10 years or more (most quality devices)	
Life Expectancy	Limited (throw away devices)		>20 years (if sized appropriately)	

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Eaton Corporation
1000 Cherrington Parkway
Moon Township, PA 15108-4312
United States
tel: 1-800-525-2000
www.eatonelectrical.com

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