ELECTRICAL SAFETY: SURGE PROTECTORS
2014

A **surge protector** (or **surge suppressor**) is an appliance designed to protect electrical devices from voltage spikes. A surge protector attempts to limit the voltage supplied to an electric device by either blocking or by shorting to ground any unwanted voltages above a safe threshold. This article primarily discusses specifications and components relevant to the type of protector that diverts (shorts) a voltage spike to ground; however, there is some coverage of other methods.

A power bar with built in surge protector and multiple outlets

The terms **surge protection device (SPD)**, or **transient voltage surge suppressor (TVSS)**, are used to describe electrical devices typically installed in power distribution panels, process control systems, communications systems, and other heavy-duty industrial systems, for the purpose of protecting against electrical surges and spikes, including those caused by lightning. Scaled-down versions of these devices are sometimes installed in residential service entrance electrical panels, to protect equipment in a household from similar hazards.

A surge protection device mounted on a residential circuit breaker panel

Many power strips have basic surge protection built in; these are typically clearly labeled as such. However, power strips that do *not* provide surge protection are sometimes erroneously referred to as "surge protectors".

IMPORTANT SPECIFICATIONS - These are some of the most prominently featured specifications which define a surge protector for AC mains, as well as for some data communications protection applications.

Clamping voltage: Also known as the let-through voltage. This specifies what spike voltage will cause the protective components inside a surge protector to divert unwanted energy from the protected line. A lower clamping voltage indicates better

protection, but can sometimes result in a shorter life expectancy for the overall protective system. The lowest three levels of protection defined in the UL rating are 330 V, 400 V and 500 V. The standard let-through voltage for 120 V AC devices is 330 volts. The theoretical lowest possible let-through voltage for 120 V power lines was 180 V. New technology, high quality surge suppressors can now clamp voltage at 130 V.

Underwriters Laboratories (UL), a global independent safety science company, defines how a protector may be used safely. UL 1449, 3rd edition became compliance mandatory in September 2009 to increase safety compared to products conforming to 2nd edition. A Measured Limiting Voltage test, using six times higher current (and energy), defines a Voltage Protection Rating (VPR). For a specific protector, this voltage may be higher compared to a Suppressed Voltage Ratings (SVR) in previous editions that measured let-through voltage with less current. Due to non-linear characteristics of protectors, let-through voltages defined by 2nd edition and 3rd edition testing are not comparable.

A protector may be larger to obtain a same let-through voltage during 3rd edition testing. Therefore, a 3rd edition protector should provide superior safety with increased life expectancy.

Response time: Surge protectors don't operate instantaneously; a slight delay exists. The longer the response time, the longer the connected equipment will be exposed to the surge. However, surges don't happen instantly either. Surges usually take around a few microseconds to reach their peak voltage, and a surge protector with a nanosecond response time would kick in fast enough to suppress the most damaging portion of the spike.

Therefore, response time under standard testing is not a useful measure of a surge protector's ability when comparing MOV devices. All MOVs have response times measured in nanoseconds, while test waveforms usually used to design and calibrate surge protectors are all based on modeled waveforms of surges measured in microseconds. As a result, MOV-based protectors have no trouble producing impressive response-time specs.