

Damage from electrical transients, or surges, is one of the leading causes of electrical equipment failure. An electrical transient is a short duration, high energy impulse that is introduced into an electrical power system whenever there is a sudden change on the electrical circuit. It can originate from a variety of sources, both internal and external, to a facility, including lightning, utility switching and downed power lines. Surges may even come from such things as fax machines, copiers, air conditioners, elevators, motors/pumps or arc welders, to name a few. Surge protection that is properly sized and installed is highly successful in preventing damage, especially to sensitive electronic equipment.

Grounding

A surge protection device (SPD), also known as a transient voltage surge suppressor (TVSS), is designed to divert high-current surges to ground and bypass your equipment. That makes it critical that your facility have a good, low-resistance grounding system. The National Electric Code® 250.56 specifies that grounds should be less than 25 ohms. In facilities with sensitive equipment, it is recommended to be 5 ohms or less. Without proper grounding, there is no way to protect against surges.

Zones of Protection

One of the best means of protecting your electrical equipment from surges is to install SPDs strategically throughout your facility. Effective surge protection should be treated as a zoned system; each zone adds to the overall protection of the facility and helps to further reduce surges to exposed equipment. The selection process involves several steps:

Zone 1—This level of protection provides the first line of defense against the largest surge currents, such as lightning strikes and utility company power fluctuations. These devices divert much of the high-energy surges to ground and lower the energy level of the remaining portion of the surge entering the facility. These SPDs normally would be installed on the electrical service entrance equipment. SPDs installed at this level, however, will not protect against internally generated surges.



Zone 2—This level would provide protection to building branch circuits, distribution panels and lighting systems. By the time a surge gets to a Zone 2 SPD, it should have been significantly reduced by Zone 1 protection. Zone 2 SPDs are more likely to see surges generated by inductive switching within the building. Zone 2 SPDs should be installed on all distribution panels within a facility that supply power to critical or sensitive electronic equipment. Zone 2 devices typically have a lower ampere rating, but, according to John West, Sr., of Power Systems & Innovations, Inc., they should also have very good noise filtering to protect against internally generated surges.

Zone 3—The third zone of protection includes outlet and long branch circuits. The first two zones of protection should have reduced surges to the level that common surge protection outlet strips should handle. These SPDs should be installed at each piece of sensitive equipment to be protected, such as computers or computer-controlled devices. Communication and data lines should also be protected with SPDs that are specifically designed for that purpose.

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Carefully read manufacturers' literature and use devices that are appropriate and properly rated for your application. Zone 3 SPDs should be located as close as possible to equipment that may produce surges, as well as to equipment being protected.

SPD Ratings

Hartford Steam Boiler recommends that, when selecting a surge protection device for a given application, the following considerations be made:

- **Application**—Ensure that the SPD is designed for a specific zone of protection. For example, an SPD at the service entrance should be designed to handle larger surges that result from lightning or utility switching.
- **System voltage and configuration**—SPDs are designed for specific voltage levels and circuit configurations. Be certain that your devices are appropriate for the application.
- **Clamping voltage**—This is the voltage that the SPD will allow through to the protected equipment. Potential damage to equipment is dependent on how long it is exposed to this clamping voltage. Generally speaking, the lower the clamp voltage, the better the protection.
- **Surge current**—SPDs are rated by the amount of surge current that can be safely diverted without failing. When considering an SPD, a rating at 20 KA may be sufficient to protect against the average lightning strike and most internally generated surges; however, one that is rated 100 KA will be able to handle more of those surges without having to be repaired or replaced.

All SPDs should be tested in accordance with the American National Standards Institute (ANSI)/Institute of Electrical and Electronic Engineers (IEEE) Standard C62.41. They should be listed in Underwriters Laboratory (UL) 1449 second edition Standard for Safety.

SPD Selection

There are some SPDs in the marketplace with false or counterfeit UL and IEEE labeling. Ask for certified test results and buy SPDs manufactured by companies that have been making SPDs at least 10 years. When taking bids on SPDs, use written specifications that include performance ratings and manufacturer qualifications to be sure you get quality SPDs that will perform as the manufacturer claims.

Installation

For maximum protection, SPDs should be installed as close to the equipment being protected as possible. A solid connection to the system grounding conductor is essential for proper operation of SPDs. The surge protectors should be equipped with indicators that show if the circuit is grounded and operating properly, and units should be installed so these indicators can be easily inspected. All service entrance and distribution panel SPDs should be installed by a licensed electrician familiar with the equipment and its use. All installations should comply with the manufacturer's installation recommendations and article 285 of the National Electric Code®. It is recommended that a professional engineer experienced with surge suppression technology be retained to design the protection scheme for your facility to ensure all SPDs are properly sized and coordinated. For Additional Information

National Lightning Safety Institute:

www.lightningsafety.com

National Fire Prevention Association®:

www.nfpa.org

- Code 780 (Installation of Lightning Protection Systems)

EMC Insurance Companies: www.emcins.com

- Tech Sheets