

Surge Protective Devices and UL 1449 3rd Edition

March 2011 / 9910-0001A

Since the 1970s, Transient Voltage Surge Suppressors (TVSSs) and secondary surge arresters have been used to protect sensitive electronics. From that time, suppressors have been designed and tested to specifications embodied in the Underwriters Laboratories® UL 1449 Standard. Intended to improve the overall safety of surge suppressors, the standard has been revised many times.

The most recent revision to UL 1449 is known as 3rd Edition. It was published in September 2006 with industry compliance required as of September 29, 2009 and has been accepted as an American National Standard (ANSI).

It is challenging for consulting engineers, specifying engineers, consumers, and others to keep up with rapidly changing standards. Additionally, the use of old and outdated terminology or parameters leads to ambiguity and confusion throughout the industry.

The purpose of this document is to summarize the major changes to surge protection standards and identify the key terms that should now be referenced when talking about or specifying any surge protective device.

The major UL 1449 3rd Edition updates:

- Standard's name change
- Surge protective device types
- Measured limiting voltage titles: SVR and VPR
- Nominal discharge current

Standard's Name Change: TVSS to SPD

Effective September 29th, 2009, the designations of Transient Voltage Surge Suppressor (TVSS) and Surge Arrester for use on AC systems 1,000 V and below changed to Surge Protective Device (SPD) and are covered within the same standard. Standards that referred to surge arresters, secondary surge arresters or TVSSs are now out of date and obsolete.

The new designation, Surge Protective Device (SPD), was chosen to better align the purpose of the devices

with the definition of transient surges as inclusive of energy, both voltage and current. The new edition has been renamed to UL 1449 *Standard for Surge Protective Devices*.

Surge Protective Device Types

UL 1449 3rd Edition classifies SPDs into five different Types. Types 1, 2, and 3 primarily refer to the location within the electrical distribution system where the SPD may be installed. Type 4 refers to recognized component assemblies, defined by UL as "An SPD intended solely for factory installation in another component, device or product."¹ Type 5 refers to discrete components such as MOVs. Neither Type 4 nor Type 5 SPDs may be installed in the field without being subjected to the same testing as its parent Listed SPD (Type 1, Type 2, or Type 3).

Type 1

"Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side or load side of the service equipment overcurrent device."²

Type 2

"Permanently connected SPDs intended for installation on the load side of the service equipment overcurrent device; including SPDs located at the branch panel."²

Type 3

"Point of utilization SPDs, installed at a minimum conductor length of 10 meters (30 feet) from the electrical service panel."²

Type 1, 2, and 3 Component SPDs

An SPD intended solely for factory installation in another piece of equipment such as a panelboard or switchboard. Type 1, 2 and 3 Component SPDs must pass all the same electrical safety tests as a listed external SPD.

Type 4 Component Assemblies

"Component assemblies consisting of one or more Type 5 components together with a disconnect

SPDs and UL 1449 3rd Edition

(integral or external) or a means of complying with the limited current tests.”²

Type 5

“Discrete component surge suppressors, such as MOVs that may be mounted on a PCB, connected by its leads or provided within an enclosure with mounting means and wiring terminations.”²

One of the most significant improvements to UL 1449 3rd Edition is the addition of Type 1, 2 and 3 Component Assemblies. A component assembly SPD is an SPD used solely for factory installation in another listed piece of equipment such as a panelboard or switchboard. The IEEE, NEC, UL, manufacturers, and consumers have long recognized that keeping the conductor lead length as short as possible is critical in maximizing SPD performance. For this reason, the popularity of installing SPDs inside electrical distribution equipment has greatly increased. This new category ensures that these integrated SPDs meet or exceed the performance of testing as externally mounted SPDs.

Measured Limiting Voltage: SVR and VPR

UL 1449 3rd Edition defines Measured Limiting Voltage (MLV) as the maximum voltage after the application of an impulse. To categorize different SPDs by the level of protection they provide, UL 1449 contains a measured limiting voltage test.

During the measured limiting voltage test, the SPD is subjected to a surge waveform and the resultant let-through voltage is measured. The measured limiting voltage test in UL 1449 2nd Edition required testing with a 6,000 Volt, 500 Amp surge waveform. The let-through voltage was referred to as the Suppressed Voltage Rating or SVR.

The measured limited voltage test in UL 1449 3rd Edition requires a 6,000 Volt, 3,000 Amp surge waveform. The new term that represents the let-through voltage of the device is the Voltage Protection Rating or VPR.

It is important to note that the magnitude of current used in testing has increased by a factor of six. With increased energy levels come higher MLV ratings. These new ratings present a distinct challenge when comparing one SPD to another. VPR values that are compared to SVR values are not valid comparisons as VPR ratings will be significantly greater than the SVR ratings.

Nominal Discharge Current

New to UL 1449 3rd Edition is the nominal discharge current test, commonly referred to as I(n). The results of this test are required to be placed on the label of the SPD. UL has defined specific nominal discharge current values, depending on the SPD Type. Type 1: 10 or 20 kA, Type 2: 3, 5, 10, or 20 kA. Type 3 SPDs normally do not have an I(n) rating.

The I(n) value claimed on any UL 1449 3rd Edition SPD confirms that the SPD has been subjected to 15 consecutive impulses at the specified I(n) value. During the testing, the SPD is to be connected with all intended fusing (internal or external) or other disconnecting means. The SPD is not allowed to create a shock or fire hazard and the SPD must continue operating throughout the entire test (no fuse or breaker allowed to open). The I(n) result is per mode (L-N, L-G, N-G, L-L) and the product is labeled with the lowest value for any mode of the SPD.

Note: UL 96A *Installation Requirements for Lightning Protection Systems* and NFPA 780 *Standard for the Installation of Lightning Protection Systems* both require that SPDs have a nominal discharge current rating, I(n), of 20 kA.

Conclusion

UL 1449 3rd Edition went into effect September 29, 2009 and includes many changes to the way surge protective devices are tested and rated. The term TVSS has now been replaced with SPD, and SVR with VPR. Nominal discharge current (I(n)) was introduced and surge arrestors have been included in one of the types of SPD that is determined by the location within the electrical distribution system.

These are the key changes that a consulting or specifying engineer should know and use to revise their specifications so they reflect current standards.

For questions or more clarification on any of the topics covered here, please contact a technical assistance expert at (800) 577-7353.

1. Underwriters Laboratories, *Standard for Surge Protective Devices* (Third edition, revised 8 Feb. 2011), p. 7.

2. Underwriters Laboratories, *Standard for Surge Protective Devices* (Third edition, revised 8 Feb. 2011), p. 6A.