Innovative Technology
TVSS Products

Technical Document

UL1449 SAFETY STANDARD FOR TRANSIENT VOLTAGE SURGE SUPPRESSORS

NEW UL1449 SAFETY STANDARD FOR TRANSIENT VOLTAGE SURGE SUPPRESSORS

The Second Edition of UL1449 became effective August 17, 1998. This standard includes some important changes affecting the safety and performance of Transient Voltage Surge Suppression products. These products are also known as Surge Protection Devices (SPDs).

Introduction

UL1449 is the standard that describes the requirements a Transient Voltage Surge Suppressor (TVSS) must meet in order to have the UL mark applied to the product. The standard applies to products connected to 50 or 60 Hz power, not to exceed 600 Vac. These requirements do not cover Secondary Surge Arrestors intended for use on the line side of any main overcurrent protection.

The first edition of UL1449 was released in August of 1986. The primary objective of UL was to determine if a safety risk existed. In the ten years that followed, a number of changes occurred in the implementation of the standard and the understanding behind the testing procedures. It also became apparent that additional safety tests were required as well as the requirement to retest older products that may not have had the most modern tests applied.

The second edition of UL1449 was released in August of 1996 with an effective date of February 16, 1998. This required every surge suppressor manufacturer to submit their products for re-testing. Due to the number of manufacturers, products and limited resources at UL, this date was pushed back to August 17, 1998. Because of this, all units manufactured after August 17, 1998 must pass all test procedures outlined in the second edition of UL1449 to continue to be listed and labeled as UL1449.

TVSS Categories

The second edition of UL1449 categorizes TVSSdevices as one of the following three types:

Direct Plug-in
These devices incorporate integral blades for connection directly to electrical outlets where point-of-use surge protection is desired.

Cord-connected
These devices incorporate a power supply cord terminating in an attachment plug for connection to electrical outlets where point-of-use surge protection is desired.

Permanently Connected
These devices utilize terminals or leads that are then "hard wired" into the electrical distribution system. These products include switchboard and panelboard mounted devices and receptacle-type products.

This paper will focus on the permanently connected type of products.

The standard tests *Listed* products differently than *Recognized* products (components). An example of a *Recognized* product is a "TVSS Module" used in an enclosure to complete an assembled product. *Recognized* products do not have enclosures or are housed in an enclosure that is incomplete or unsuitable for field installation or direct connection to a branch circuit or have exposed terminals. Recognized products are suitable for use within enclosures.

Note: When evaluating TVSS devices, ask manufacturers utilizing replaceable modules or *Recognized* components for data relating to their entire assembly, not their component (module) rating.

UL Mark for Listed Products

UL Recognized Component

Testing Overview

UL1449 has basic
safety tests similar to other types of electrical products. These tests include leakage current, dielectric withstand, insulation resistance and temperature rise. There are also a series of mechanical integrity tests.

Measured Limiting Voltage (MLV) and Duty CycleTest

This test is performed to measure the let-through voltage of a product under test and is used to assign a Measured Limiting Voltage Rating (MLVR). Part of the UL labeling requirement is to publish this value on the product nameplate.

The second edition of UL1449 has clarified the test method, its details, and step by step procedures. The purpose is to test the ability of the TVSS to suppress or limit a specific surge while the duty cycle portion tests the ability of the TVSS to function repeatedly. Products are tested using the ANSI/IEEE 1.2/50 μs open voltage, and 8 x 20 μs short circuit current combination waveforms. Table 1 lists the changes to the peak voltage and current values.

Table 1

Product Type	First Edition Voltage/Current Impulse	Second Edition Voltage/Current Impulse
Permanently Connected	6,000 V, 3000 A	6,000 V, 500 A
Cord Connected & Direct Plug-In	6,000 V, 500 A	6,000 V, 500 A

Under the first edition, permanently connected products were tested and measured at different points. On a TVSS supplied with wire leads, the device was tested and measured at the end of the leads. If terminals were supplied, the device was tested at the terminals. If the product was a component (replaceable module), it was tested at the connection point.

The second edition UL1449 MLV test uses 6 inches (15cm) of wire measured from the outside of the enclosure. In the case of products supplied with wire leads, the leads are cut back to 6 inches. For products with terminal connections, wire is attached to the terminals and cut back so that 6 inches extends from the enclosure. This 6 inches of wire is used to simulate an installed product.

The testing begins by subjecting the TVSS to a single 6 kV, 500 A surge impulse. The measured limiting voltage is measured and recorded. The TVSS is then duty cycle tested using ten consecutive 6 kV, 3 kA positive impulses and 10 consecutive 6 kV, 3 kA negative impulses at 60 second intervals. The test is completed by subjecting the TVSS to a final 6 kV, 500 A impulse that is measured and recorded. This second measured limiting voltage must not deviate ± 10% from the initial measured limiting voltage.

Table 2

Number of Impulses	Voltage (1.25 x 50 µs)	Amperage (8 x 20 µs)	Remarks
1	6,000 V	500 A	MLV measured & recorded
2 - 21	6,000 V	3,000 A	Duty Cycle Testing
22	6,000 V	500 A	MLV must not deviate by ±10% when compared to Impulse

Once the MLV and duty cycle testing is completed, the TVSS is assigned a rating. Ratings are assigned based on a performance range. For example if the MLV is between 0 V and 330 V, it will be assigned a 330 V rating. If the MLV is between 331 V and 400 V it will receive a 400 V rating. Etc.

Table 3

UL 1449 Second Edition Suppressed Voltage Rating (SVR)		
300 V	900 V*	2500 V
400 V	1000 V	3000 V
500 V	1200 V	4000 V
600 V	1500 V	5000 V
700 V*	1800 V*	6000 V
800 V	2000 V	

* New in UL 1449 Second Edition

Surge Current Test

This test is performed to determine the ability of the device to safely withstand a high energy surge. The TVSS is connected to ac power and subjected to two surge impulses (one positive and one negative) 20 kV/10 kA at the peak of the voltage waveform.

Abnormal Overvoltage Test

These tests are performed to determine that the TVSS can withstand or fail safely the rated L-L voltage on the L-N mode (e.g. 208 Vac on a 120 Vac product). This is a severe test and is likely to damage the internal components and cause a short circuit from line to neutral.

The High Current Test applies a fault current up to 25 kA, while the Low Current Test applies fault current of 0.125, 0.5, 2.5, and 5 A. These tests are applied for seven hours and are often referred to as the “slow cook” or “slow burn” tests. In both tests, it is acceptable for the unit to fail, but the product must do so without evidence of fire or electrical shock hazard.

Conclusion

The second edition of UL1449 is an improvement because testing procedures are now defined and additional safety tests have been added to reduce the risk of fire and electrical hazard to the end user. The enhanced safety tests required some manufacturers to change their designs in order to meet the new standard. All Innovative Technology products have been tested by UL and all permanently connected units passed second edition testing without modifications. Should you have any questions or comments regarding UL1449 second edition or TVSS products in general, please contact your local Innovative Technology sales engineer.

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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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