

Changes Found in the Second Edition of UL 1449

Underwriters Laboratories has issued a Second Edition to the existing 1449 TVSS Safety Standard requiring every TVSS manufacturer to redesign and submit their products for re-evaluation. This new standard is effective February 16, 1998, with the second stage of this standard going into effect on August 17, 1998. Also, all previous listings were voided if they have not passed the new safety standards. This new safety standard incorporates failure mode testing which is summarized below.

Why issue a Second Edition of UL 1449?

Underwriters Laboratories wanted to provide a higher degree of safety for TVSS devices, and this was accomplished by integrating failure mode testing. These tests simulate failures that have been experienced in the field which include large surge events, loss of neutral conditions, and installation error due to either improper bonding or misapplication. Currently most TVSS device designs subjected to these new tests will cause the suppression elements to rupture resulting in either a fire hazard or expulsion of suppression element fragments. If not contained properly, either injury to personnel or damage to the facilities may occur.

The Significant New Tests – Summarized

1. Overvoltage Test

Accounting for normal fluctuations of the supply voltage from the utility, a TVSS must withstand 110% of the rated supply voltage for 7 hours without evidence of a risk of fire or electric shock.

2. Abnormal Overvoltage Test: Full Phase Voltage – High Current, Section 37 effective August 17, 1998

Ensuring proper overcurrent protection and fuse coordination for high fault currents, a TVSS device is subjected to a 25,000 Amps fault current while phase to phase voltage is applied line to neutral and line to ground. For example, 120 volt system would have 208 volts applied to the 120 volt leg while being subjected to a fault current of 25,000 Amps. This abnormal overvoltage is applied for either seven hours until the temperature has stabilized or until the surge protective device disconnects from the service. This test will cause the unit to fail, but it must fail without evidence of fire or electric shock.

3. Abnormal Overvoltage Test : Full Phase Voltage – Limited Current, Section 37 effective August 17, 1998

Ensuring proper overcurrent protection and fuse coordination for low fault currents, A TVSS device is subjected to multiple smaller fault current of 0.125, 0.5, 2.5 and 5 Amps while phase to phase voltage is applied line to neutral and line to ground. For example, 120 volt system would have 208 volts applied to the 120 volt leg while being subjected to fault currents of 0.125, 0.5, 2.5, and 5 Amps. This abnormal overvoltage is applied for either seven hours until the temperature has stabilized or until the surge protective device disconnects from the service. This test will cause the unit to fail, but it must fail without evidence of fire or electric shock.

4. Voltage Limiting Test and Duty Cycle Test: Let Through Voltage Classification, Section 34 effective August 17, 1998

In the previous edition, the let-through voltage test was performed by subjecting a TVSS device to IEEE Category C1/B3 combination waveform of 6000 Volts at 3000 Amps and measuring the corresponding let-through voltage. In addition, modular unit let-through voltage measurements were taken at the connection lugs inside the TVSS enclosure. Also, chase nipple device measurements were taken using six inches of lead length wire. This type of measurement criteria allowed for varying let-through ratings from similar modular products from the various TVSS manufacturers. In the Second Edition, Underwriters Laboratories has standardized testing by revising the test waveform and measurement location.

The Second Edition of UL 1449 requires the TVSS device to be injected with an initial 6000 Volt, 500 Amp IEEE impulse at each mode of protection, and a let-through voltage measurement is to be recorded per mode. The unit is then subjected to 10 consecutive 6000 Volt and 3000 Amp positive impulses at 60 second intervals and 10 consecutive 6000 Volt and 3000 Amp negative impulses at 60 second intervals. The TVSS device is then injected with another 6000 Volts and 500 Amps impulse and the output let-through voltage is measured and recorded.

The two measurements from the first and last impulse are averaged and the UL Suppression Voltage Rating is assigned. To make all measurements consistent for all vendors, all measurements are taken six inches outside the enclosure. This is to ensure that there will be no discrepancies in the let-through category ratings. Also, additional voltage rating categories were added to bridge the gap between ratings. For example, new categories include 600 Volt, 700 Volt, and 900 Volt. These tests are applied to each individual mode of protection which includes: L-N, L-G, L-L, and N-G.

5. Surge Test: Section 35 effective February 16, 1998

Ensuring proper operation during most common type of surge condition, the TVSS device must withstand two consecutive (one positive and one negative) 20,000 Volt and 10,000 Amp impulses (IEEE Category C3) and stay connected to the service at rated voltage for seven hours. This test must be conducted with the safety fusing in place.

There are other additional changes found in the Second Edition of UL 1449 compared to the previous edition, but those summarized above are the most strenuous and difficult to pass. In addition, these new tests are requiring virtually every surge protective device manufacturer to redesigning their entire product line.

What Design Changes are needed to have TVSS Devices pass UL 1449 Second Edition?

Designing a suppressor for UL 1449 Second Edition testing, requires the suppressor to clear both high and low fault current conditions while being subjected to a sustained overvoltage. Siemens opinion is that the safest protection scheme is one that removes only the failed modes of protection.

It is possible to contain the rupture within a metal enclosure, however during the failure process it is possible for the MOV to contaminate the box with conductive material resulting in a short circuit bypassing the entire suppression circuit, so it is important to completely remove the power from the circuit. This is accomplished by designing the surge protection circuit incorporating surge rated fuses and thermal cutouts coordinated to the MOV failure mode characteristics. The circuit operates by allowing the MOV's rated surge current to pass without taking the suppression module off line. If the surge current exceeds the MOV's surge current rating, the MOV will fail short causing the surge rated fuse to clear, taking the module off line.

During sustained overvoltage conditions, which could indicate a loss of neutral condition, the suppressor does not draw enough surge current to clear the surge rated fuse, but the thermal cutout will clear as heat is built up due to the MOV trying to clamp the sustained overvoltage. Some manufacturers may choose a less expensive method of handling the overvoltage conditions by doubling the maximum continuous operating voltage (MCOV) of the MOV; however, this increases the clamping level of the circuit significantly, providing inferior performance. Our products incorporate patented surge protection circuitry incorporating surge rated fuses with thermal cutouts.

Combining the Three Safety Features of Surge Rated Fuses, Thermal Cutouts, and Ceramgard[®] enabled Siemens Sentron TPS product line to be listed to UL 1449 Second Edition effective August 17, 1998.

How do you know if the TVSS device has passed the UL 1449 Second Edition Tests and is UL Listed?

This is not a straightforward process, and it may require some investigation. Unfortunately, UL is not requiring label changes to TVSS devices indicating *UL 1449 Second Edition*. This could leave the door open for vendors who have stockpiled units, which are listed under the previous edition of UL 1449, to sell TVSS units under the pretense that the units are listed by UL 1449 Second Edition. To ensure that your projects will have surge protective devices listed under UL 1449 Second Edition effective August 17, 1998, a specification requirement should request either a **UL compliance letter, or a copy of listing classification page from the UL engineering file**. A UL compliance letter will contain the model family, and statement that the listed model complies to UL 1449 Second Edition including sections 34 and 37, effective August 17, 1998. If a compliance letter is not available, a listing classification page from the UL engineering file should be provided which shows compliance to the August effective date.

If you have any questions or would like more information call us at 888-333-3545.