



## **UL 1449 Third Edition**

**- Published Oct 2, 2006, Effective Sept 28, 2009**

### **Major Revisions:**

- a.) **Change terminology from Transient Voltage Surge Suppressor (TVSS) to Surge Protective Device (SPD)**
- b.) **Add Type Designations (1, 2, 3 and 4) for SPDs based on the installation location within the electrical system**
- c.) **Testing revised to include Nominal Discharge Current ( $I_n$ )**
- d.) **Change Measured Limiting Voltage testing from Suppressed Voltage Rating at 6kV/0.5kA to Voltage Protection Rating at 6kV/3kA**
- e.) **First time approval of UL 1449 as an American National Standard (ANSI)**

**Full file review – Every product must be completely retested**

**36-month phase-in window**

**Includes Intermediate Fault Current Testing from Second Edition Revision published Feb 9, 2005, effective Feb 2007.**

### ***Details:***

- Term Transient Voltage Surge Suppressor (TVSS) changing to Surge Protective Device (SPD)
- Create SPD Types 1-4:

Type 1 – Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service entrance disconnect overcurrent device, as well as the load side, including watt-hour meter socket enclosures. This brings old-style Secondary Arrestors under UL 1449 and clarifies appropriate use for UL 96A Master Label. Type 1 SPDs must include any safety protective equipment within device – cannot use external breakers or fuses.

Type 2 – Permanently connected SPDs intended for installation on the load side of the service entrance disconnect overcurrent device; including SPDs located at the branch panel. External breakers or fuses as safety disconnectors are allowable.

Type 3 – Point of utilization SPDs, installed at a minimum of 10 meters (30 feet) from the electrical service entrance, for example cord connected, direct plug-in, receptacle type and SPDs installation the utilization equipment being protected.

Type 4 – Component SPD, including discrete components as well as component assemblies

## Suppressed Voltage Rating (SVR) changed to Voltage Protection Rating (VPR)

UL is changing clamp voltage testing from 6kV, 500A to 6kV, 3,000A; I.e., 6 times more surge current. This will be renamed to Voltage Protection Rating (VPR) to distinguish from Suppressed Voltage Rating (SVR). Test format is still 6" leads outside the enclosure with UL prescribed test setup.

VPR is the average of measured limiting voltage before and after Nominal Discharge Testing ( $I_n$ ), rounded up to one of UL's VPR categories 330V, 400V, 500V, etc. VPR is posted on device UL label. (Procedure shown in outline form below).

Nominal Discharge Current ( $I_n$  or  $I_n$  or  $I_{nominal}$ ): Peak value of surge current, selected by the manufacturer, through the SPD having current waveshape of 8/20 where the SPD remains functional after 15 surges.  $I_n$  is posted on device UL label

Three sample Type 1 and 2 SPDs are subjected to 15 8/20 surge currents per mode (includes Type 4 SPDs used in Type 1 and 2 applications).

Current through SPD – different than short circuit current. For example, 6kA short circuit current is measured as a *short circuit* – not the current through the SPD. The SPD's impedance would reduce 6kA short circuit current to about 5.4kA. Thus 'current through SPD' is more severe than 'short circuit current'.

- For Type 1 SPDs, the manufacturer selects 10kA or 20kA (per mode). Device must include any & all safety disconnectors like breakers or fuses, because no external disconnectors are allowed. We understand that UL 96A Master Label compliance will require  $I_n$  of 20kA.
- For Type 2 SPDs, the manufacturer can select 3kA, 5kA, 10kA, or 20kA (per mode).
- 15 surges are applied in three groups of five at 90° point of applied AC voltage. Within one second of surge, MCOV is applied for 60 seconds +/- 15 seconds. After each group of five surges, sample shall rest for 30 minutes, +/- 5 minutes. After 15<sup>th</sup> surge, MCOV shall be re-applied for at least 15 minutes.

Following VLP testing, SPD is subjected to 115% overvoltage for 30 minutes. (This is an increase over former 110%. We believe this prevents cheating with golden units having low-clamp MOVs.)

**Summary Outline** of Voltage Protection Rating (VPR) using Nominal Discharge Current ( $I_n$ ) testing as Duty Cycle:

- ❖ Record clamp voltage at 6kV, 3000A (1.)
  - Begin  $I_n$  & Duty Cycle testing
    - Manufacturer declares Type 1 or Type 2 SPD
      - If Type 1:
        - ◆ Manufacturer selects  $I_n$  of 10kA or 20kA
          - If 10kA:
            - 15 10kA hits
          - If 20kA:
            - 15 15kA hits
      - If Type 2:
        - ◆ Manufacturer selects  $I_n$  of 3kA, 5kA, 10kA, or 20kA
          - If 3-20kA:
            - 15  $I_n$  hits
- ❖ Record clamp voltage at 6kV, 3000A (2.)
- ❖ Average clamp voltage from (1.) and (2.)
- ❖ Assign Voltage Protection Rating – VPR

**Ungrounded system SPDs:** SPDs for use on ungrounded system shall have surge protective elements that are connected form L-G rated for maximum Line to Line voltage. Instruction shall include the following cautionary marking: *“Caution – Ungrounded power systems are inherently unstable and can produce excessively high line-to-ground voltages during certain fault conditions. During these fault conditions any electrical equipment, including an SPD, may be subjected to voltages which exceed their design ratings. This information is being provided to the user so that an informed decision can be made before installing any electrical equipment on an ungrounded power system”.*

**Second Edition Revision – may be incorrectly called Third Edition - Important:**

UL 1449 Second Edition received late changes shortly before Third Edition. Some in the industry may be calling these 'Third Edition' changes, so we include them for completeness. This is a very Big Deal due to difficulty and impact to existing products (most require redesign).

These were major changes to Second Edition, as a precursor to Third Edition.

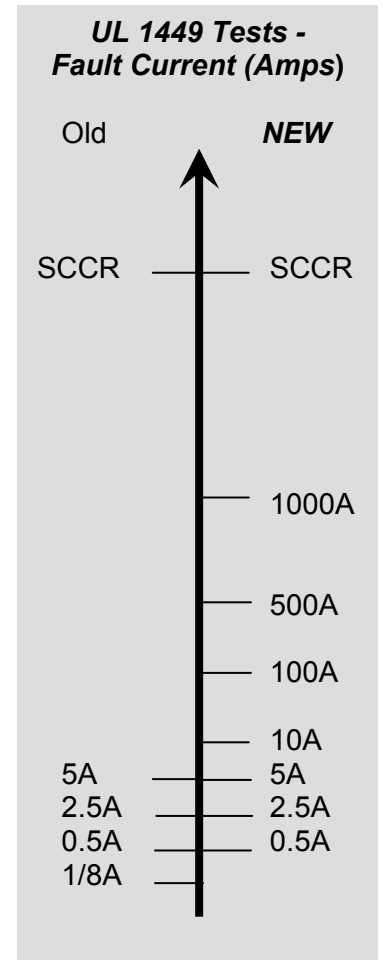
Change adds 10A, 100A, 500A and 1000A fault current withstand testing to previous tests of 0.5A, 2.5A, 5A and manufacturer-selected Short Circuit Current Rating (SCCR). Old & new current levels shown below; 1/8A test is now deleted. The purpose of this testing is to better simulate failure modes caused by sustained overvoltages at various currents. This change closes a former blind spot between 5A and SCCR. Does not apply to N-G mode on Type 1 or Type 2.

Suppression components must now conduct during failure mode testing. Previously, certain applications and/or technologies would not fail within UL's precisely worded procedures. For example, 'raised MCOV' technology, certain L-L applications and gas discharge tubes evaded UL's intent. Manufacturers must demonstrate failure by either:

- 1.) Shorting out switching components with solid wire (i.e., short out gas discharge tubes used in series with MOVs),
- 2.) Increase test voltage until conduction occurs, or
- 3.) Lower MCOV using similar MOVs such that conduction occurs.

**What this means to you & surge industry:**

- ✓ UL has closed loopholes
  - 'Raised MCOV' technology & directly connected L-L modes can no longer sidestep UL's failure mode testing.
- ✓ Intermediate fault current testing will be hard to pass!
  - Fuses sized to pass large surge currents will have problems with low fault currents. Fuse won't clear at 100A if sized to pass a 200,000A surge!
  - Test is seven hours – almost certainly requires disconnect to clear from circuit – unit unlikely to withstand 100A for 7 hours
  - 10A almost certainly requires a thermal disconnect because current too low for fuse and containment unlikely to withstand heat
  - Historical containment-based safety (without disconnectors) unlikely to work because too much energy for 7 hours
  - All products must be tested, including existing Listed devices
  - Most existing products will require redesign, fusing changes or become obsolete
  - Be aware that supplemental overcurrent protection may be required by TVSS manufacturer
- ✓ Expect marketing 'backtracking' - manufacturers chasing excessive surge currents for marketing reasons tended to skew fusing that resulted in unsafe TVSS



APT has performed 500A testing since 1998. Expect little or no change to existing APT products.

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