

# Specification Section 16289 Surge-Protection Devices

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**This document has undergone formal review and approval and been reviewed by a Derivative Classifier, and its contents have been deemed unclassified/unlimited release.**



**Sandia  
National  
Laboratories**



U.S. DEPARTMENT OF  
**ENERGY**





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# Change Log

Rev. No.	Changed By	Date	Type	Change Description	Pages Changed
0	KLB RLL	9/23/10	Subst	Applied FMOC branding. Edited document for spelling, punctuation, grammar, and general writing improvements. Revised the conditions and service entrances for which a SPD is required.	All 2.01A, 3.01F
1	VNL/EB	3/23/12	Subst	In 1.02, corrected specification number for Electrical Panelboards; in 2.01 and 2.02, specified that units are service entrance units; in 2.04A, specified that exterior-installed units must be UV or all-weather rated and labeled as such, in 3.01E, specified that SPDs integral to service entrance equipment must be accessible for servicing; in 3.01E, specified that SPD must be labeled and barricaded from energized service entrance equipment; and in 3.01F clarified in which cases SPDs integral to a lightning protection system must be installed.	1, 3, 4

## Part 1 - General

### 1.01 Summary

This section defines the requirements of surge-protection devices (SPDs) for low-voltage power systems. It addresses SPDs intended for service entrance equipment installation, and describes how they must comply with the Institute of Electrical and Electronic Engineers (IEEE) C62.41 Category C3 Waveforms.

### 1.02 References

The current editions of the following standards are part of this specification:

#### A. SNL Construction Standard Specifications

Number	Title
Section 01330	Submittal Procedures
Section 13100	Lightning Protection
Section 16001	Electrical Work
Section 16440	Electrical Panelboards

#### B. National Fire Protection Association (NFPA)

Number	Title
NFPA 70	National Electric Code
NFPA 780	Standard for the Installation of Lightning Protection Systems

#### C. Institute of Electrical and Electronic Engineers (IEEE)

Number	Title
IEEE C62.41	Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power
IEEE C62.45	Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
IEEE 1100	The Emerald Book

#### D. National Electrical Manufacturers Association

- NEMA LS-1, Low-Voltage Surge-Protective Devices

#### E. Underwriters Laboratory (UL) Safety Standards

Number	Title
UL 1449	Standard for Safety of Surge Protective Devices
UL 1283	Standard for Safety of Electromagnetic Interference Filters

### 1.03 Submittals

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#### A. Product Submittal Data Required

1. Physical Characteristics
2. Peak Surge Current Ratings per mode and per phase

#### B. Product Certificates must be signed by manufacturers of surge-protection devices, certifying that products furnished comply with the following:

1. UL 1283 certification
2. UL 1449 listing and classification

#### C. Warranties: Special warranties specified in this Section

#### D. Operations and Maintenance Data

- Provide 3 copies of instruction books, operating manuals, comprehensive troubleshooting guides, spare parts lists, and special bulletins covering onsite storage.

#### E. Furnish independent certified test results.

#### F. Submit formal report of factory tests within 10 days of factory tests, stating tests conducted, acceptable limits of such tests, actual test results, and original test data sheet with legible signatures of those conducting, witnessing, and approving such tests.

### 1.04 Quality Assurance

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#### A. Surge-protection devices must be tested per ANSI/IEEE C62.45, to comply with ANSI/IEEE C62.41. The test surge for Category C3 is a Biwave; 8 x 20 microseconds at 10,000 amperes short-circuit; and 1.2 x 50 microseconds at 20,000 volts open-circuit.

#### B. The system must be life-cycle tested to 5,000 sequential Category C3 waveforms, without failing or degrading the UL 1449 suppression rating by more than 10%.

#### C. Device must meet NEMA LS-1 requirements. Each suppression path must be individually fused. All fuses must be capable of allowing the suppressor's maximum rated transient current to pass without fuse operation. Fuses must be able to handle 200,000 AIC.

#### D. The system must be tested to Military Standard (MIL-STD) 220A for electrical line noise attenuation per 50-ohm insertion loss measurement method of radio frequencies up to 100 MHz.

## Part 2 - Products

### 2.01 Manufacturers

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- A. Service entrance SPDs can be an integral part of the service entrance switchboard/switchgear or service entrance power panel, or a separate unit subject to compliance with requirements; however, if an integral unit, it must have a disconnect or circuit breaker allocated so that power can be removed for servicing, and must be accessible for servicing without an outage to the switchboard or panel and labeled as so. Manufacturers offering products that can be incorporated in the work include the following:
- Square D Model XTE/XG
  - General Electric Tranquell HE
  - Siemens TPS 6
  - Cutler Hammer CPS H2
  - Lightning Protection Corporation (LPC)

### 2.02 System Requirements Description

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- A. The SPD must have replaceable metal oxide varistor (MOV) modules.
- B. Service entrance units must have a minimum Peak Surge Current rating as follows:
1. Per mode: 150,000 Amps
  2. Per phase: 300,000 Amps
- C. The Maximum Continuous Operating Voltage (MCOV), of all suppression components used in the unit must not be less than 115% of the facility's normal line-line operating root mean square (RMS) voltage.
- D. Minimum Protection Modes (4): The SPD must provide line-to-neutral (L-N), line-to-line (L-L), line-to-ground (L-G), and neutral-to-ground (N-G) protection.
- E. The unit must include solid-state externally mounted visual status indicators that monitor the functional status of each phase of the unit. For exterior installations, the display shall be UV or all-weather rated so as not to deteriorate with extended exposure to direct sunlight.
- F. All overcurrent protection devices must be monitored and provide indication of operability or failure of suppression path.
- G. The unit must have a Surge Counter that displays the combined total number of transient voltage surges detected from L-G, L-L, L-N, and N-G, with reset button.
- H. The unit must be provided with a written warranty, executed by the manufacturer agreeing to repair or replace components of surge suppressors that fail in materials or workmanship within 5 years from date of substantial completion.

## Part 3 - Execution

### 3.01 Installation

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Install SPDs according to the manufacturer's written instructions. The following instructions also apply:

- A. SPDs must be installed as close as possible to their respective panels. Lead length must not exceed 36" between bus and unit.
- B. Avoid short-radius bends in leads connecting the SPD and the bus of the protected equipment.
- C. Cable connection between bus and SPD must be a minimum #8 American Wire Gauge (AWG).
- D. Connecting wires must be twisted to reduce magnetic inductance.
- E. SPD must be connected to a dedicated circuit breaker at the main service entrance so power can be removed for servicing. If the SPD is integral to the service entrance equipment, it shall be accessible for servicing without an outage to the switchboard or panel. Install labeling indicating SPD is barricaded from energized portions of the service entrance equipment and is serviceable without an outage to service entrance main breaker.
- F. SPDs installed as an integral part of a lightning protection system must be installed on these services and equipment, as a minimum:
  - SPDs must be installed at the service entrance of each metallic power line, signal line, and communications line conductor entering the structure.
  - SPDs must be installed at all points where a conductor leaves the protected structure to supply an unprotected structure, if the length of the conductor is over 100 ft. If less than 100 ft, protection is assumed to be provided by the service entrance SPD.
  - SPDs must be installed at all points where a conductor leaves the protected structure to supply an unprotected exterior pole-mounted device (including but not limited to lighting fixtures, cameras, warning beacons, and antennae).
  - SPDs for data and telephone communication service entrances, and their installation, must comply with Sandia Standard Construction Specification 16742.
  - SPDs for data system facility entrances, including cable television (CATV), alarm, and antenna systems, and their installation, must comply with NFPA 780.

### 3.02 Field Testing

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Perform the following field quality-control measures:

- A. After installing surge-protective devices, but before electrical circuitry has been energized, verify compliance with installation requirements described in section 3.01 of this document.
- B. During the time of energization, complete start-up checks according to manufacturer's written instructions.
- C. Repair or replace malfunctioning units. Retest after repairs or replacements are made.