

# SERIES 500

## Model 560, Surge Protective Device

### Guide Specifications

#### 1.0 GENERAL

**1.1 Summary :** These specifications describe the electrical and mechanical requirements for a modular, high-energy surge protective device (SPD). The specified system shall provide effective, high-energy surge current diversion and be suitable for use as Type 1, 20kA device per ANSI/UL 1449 Fourth Edition.

**1.2 Standards :** The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

Underwriters Laboratories; ANSI/UL 1449 4<sup>th</sup> Edition 2014 Revision  
Underwriters Laboratories; UL 1283 6<sup>th</sup> Edition 2015 (complimentary listing for Type 2 locations)  
Canadian Underwriters Laboratories (cUL)  
American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.34, C62.41, C62.45)  
Institute of Electrical and Electronic Engineers 1100 Emerald Book  
Federal Information Processing Standards Publication 94 (FIPS PUB 94)  
National Fire Protection Association (NFPA 20, 70, 75 and 780)  
International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service  
Federal Communications Commission (FCC)

The system shall be UL listed and labeled under ANSI/UL 1449 Fourth Edition and the voltage protection ratings (VPRs) shall be permanently affixed to the SPD. Type 2 units of the product family shall be cUL listed and labeled to UL1283 Standard for Electromagnetic Interference Filters.

**1.3 System Description:** The system shall be constructed using multiple surge current diversion modules utilizing metal oxide varistors (MOV) computer matched to a variance of  $\pm 1$  volt and tested for manufacturing defects. The modules shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable unless documentation from a nationally recognized laboratory demonstrates current sharing of all dissimilar components at all surge current levels.

#### 1.4 Electrical Requirements (selection required)

##### 1.4.1 Nominal system operating voltage

\_\_\_\_\_ VAC  
\_\_\_\_\_ Configuration  
\_\_\_\_\_ Phase  
\_\_\_\_\_ Wires plus Ground

**1.4.2 Maximum Continuous Operating Voltage (MCOV):** The SPD and all components in the suppression path (including all current diversion components) maximum continuous operating voltage (MCOV) shall be greater than 115% of the nominal system operating voltage to ensure the ability of the system to withstand temporary RMS over-voltage (swell conditions).

**1.4.3 Operating Frequency:** The operating frequency range of the system shall be at least 47 - 63 Hz.

**1.5 Life Cycle Testing:** The SPD shall be duty life cycle tested to withstand 10kA (8x20µs), 20kV (1.2x50µs), IEEE C62.41 Category C surge current with less than 5% degradation of clamping voltage. The minimum numbers of surges the unit shall be able to protect against are:

Number of Life Cycle Surges: **(Selection Required)**

\_\_\_\_\_ Life Cycle Surges per Mode **(12,000), (15,000), (30,000), (45,000)**

\_\_\_\_\_ Life Cycle Surges per Phase **(12,000), (30,000), (60,000), (90,000)**

**1.6 Overcurrent Protection:** Fusing: All suppression components shall be individually fused and rated to allow maximum specified surge current capacity. For every 100k amps of surge current capacity, 120 amps RMS of internal, integral fusing shall be required. Devices that utilize a single fuse to protect two or more suppression paths are not excepted. Individual surge components shall be sand packed and shall be UL listed to be capable of interrupting up to 200 kA symmetrical fault current with 480 VAC applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable.

**1.7 Performance Ratings:**

Surge Current Capacity: **(Selection Required)**

\_\_\_\_\_ kA Surge Rating per Mode **(80), (125), (160), (200), (250), (375)**

\_\_\_\_\_ kA Surge Rating per Phase (L-N and L-G) **(160), (250), (320), (400), (500), (750)**

**1.8 Design Requirements**

**1.8.1 Noise Attenuation:** The filter shall provide an attenuation of 63 db max from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120-dB insertion loss from 100 kHz to 100 MHz when used in a coordinated facility system

**1.8.2 Protection Modes:** The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable). Note: L = Line, G = Ground, N = Neutral

**1.8.3 ANSI/UL 1449 Voltage Protection Ratings:** The maximum UL 1449 listed surge ratings for each and/or all of the specified protection modes shall not exceed the following:

System Voltage	ANSI/UL 1449 Fourth Edition VPR			
	L-N	N-G	L-G	L-L
120/208	700V	700V	700V	1000V
277/480	1000V	1000V	1200V	1800V
480			1800V	1800V

**1.8.4 ANSI/UL 1449 Nominal Discharge Current:** The ANSI/UL 1449 Nominal Discharge Current Rating shall be a minimum of 20kA.

**1.9 Submittals**

**1.9.1 Documentation:** These specifications are based on the ASCO Model 560. All other manufacturers shall submit for 10-day pre-approval, a detailed compliance or exception statements to all provisions of this specification to allow consideration. Additionally, manufacturers shall submit test data verifying the following: life cycle testing, overcurrent protection, UL1449 Fourth edition, noise attenuation and surge current capacity. Failure to do so will result in product disapproval. Any deviation from the published specification will result in an applicable deduct applied.

**1.9.2 Equipment Manual:** The manufacturer shall furnish an installation manual with installation, startup, and operating instructions for the specified system.

**1.9.3 Drawings:** Electrical and mechanical drawings shall be provided by the manufacturer that show unit dimensions, weights, component and connection locations, mounting provisions, connection details and wiring diagram.

**1.10 Quality Assurance:** The manufacturer shall be ISO 9001:2000 certified. The specified interconnect assembly shall be designed and manufactured in the USA by a qualified manufacturer of SPD products and line conditioning equipment. The manufacturer shall have been engaged in the design and manufacturer of such products for a minimum of 20 years.

### **1.11 Environmental Requirements**

<b>Storage Temperature:</b>	<b>-55 to +85°C (-67 to +185°F)</b>
<b>Operating Temperature:</b>	<b>-40 to +60°C (-40 to +140°F)</b>
<b>Relative Humidity:</b>	<b>0% to 95% (non-condensing)</b>
<b>Audible Noise:</b>	<b>less than 45dB at 5 feet (1.5m)</b>
<b>Operating Altitude:</b>	<b>0 to 18,000 feet (5,486m) above sea level</b>

**1.12 Warranty:** The manufacturer shall provide a full ten-year parts and five-year labor warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes. Direct factory trained, ISO 9001:2000 certified employees must be available for 48-hour assessment. A 24-hour 800 number must be available to support warranty.

## **2.0 PRODUCTS**

**2.1 Enclosure:** The specified system shall be provided in a heavy duty NEMA 4 dust-proof, drip-proof enclosure with no ventilation openings. The cover of the enclosure shall be hinged on the left side and require a tool for access to internal components. All monitoring indication must be visible without opening the door. The enclosure maximum dimensions shall be 20 in. (508 mm) high x 20 in. (508 mm) wide x 10 in. (254 mm) deep.

**2.2 Connections:** The terminals shall be provided to accommodate wire sizes up to #2/0 AWG.

**2.3 Internal Connections and Serviceability:** All surge current diversion module connections shall be by way of low-impedance copper plates. Surge current diversion modules shall use bolted connections to the plates for reliable, low-impedance connections. The system shall be designed for easy servicing by a qualified field electrician, providing simple change out of any or all SPD modules. Designs that require factory service are not acceptable. Any unit using "plug-in" type modules are not acceptable. All connections, conductors and terminals must be appropriately sized for specified surge current capacity.

### **2.4 Standard Features:**

**2.4.1 Unit Testing Capability**—The SPD monitoring circuitry must continually verify the protection status during operation and display this information on the front cover status panel. The SPD must also contain a built-in-test circuit that will verify the integrity of all fuse links and each associated MOV. The built-in-test circuit must cycle through all phase banks and the neutral-ground bank sending test signals to all modules. The integrity of all fuses in test must be indicated on the status panel. All testing must be able to be performed without disconnecting power to the SPD. Units that require external test sets or equipment are unacceptable.

**2.4.2 Unit Status Indicators**—SPD shall be equipped with red and green solid state indicators for each phase and N-G (where applicable). Indicators must be mounted within the enclosure and must be externally visible.

- 2.4.3 Dry Contacts for Remote Monitoring**—SPD must have a minimum of 2 sets of electrically isolated Form C dry contacts, one normally open and one normally closed.
- 2.4.4 Undervoltage Detection**—SPD shall be equipped with 70% undervoltage detection.
- 2.4.5 Phase Loss Monitoring**—SPD shall be equipped with phase loss monitoring.
- 2.4.6 Power Loss Monitoring**—SPD shall be equipped with power loss monitoring.
- 2.4.7 Audible alarm**—The specified system shall be equipped with an audible alarm that is activated during a fault condition. In conjunction with alarm, an alarm on/off switch shall be provided to silence the alarm, and an alarm push-to-test switch shall be provided to test the alarm's function. A visible LED will confirm whether alarm is on or disabled. Both switches shall be located on the unit's hinged front cover.

## **2.5 Optional Features**

- 2.5.1 Transient Counters**—Single or dual adjustable transient counters shall be available to tally Normal & Common mode transient voltage surges in both surge and swell conditions. The readout shall be at least a seven-digit LCD located on the unit's hinged front cover. The counter reset switches may be inhibited and must be remotely located. Counter must utilize lithium batteries with a 10-year nominal life to maintain accurate counts in the event of total power loss.
- 2.5.2 Remote Monitoring Panel**—The monitoring system display panel shall be capable of mounting remotely to the SPD enclosure. A [6-foot (183cm)] **[10-foot (305cm)] [20-foot (610cm)]** long harness shall be used to connect the remote monitoring panel assembly to the SPD assembly.
- 2.5.3 Rotary Disconnect Switch**—The specified system shall include a disconnect located in-line with the SPD system enclosure with an external manual operator. The switch shall disconnect all phase conductors, not including neutral, from the high-energy surge current diversion modules.
- 2.5.4 Active Surge Monitor** – The SPD shall be equipped with a power quality monitor including the following monitoring features:
- Communication via RS-485, Modbus TCP/RTU, Form C, Ethernet, SNMP, SMTP, with Embedded Webpage capable of generating charts, graphs, and downloadable reports.
  - Integral LCD Display providing real-time system RMS voltage, Average Voltage, VTDH, Crest Factor, Phase Imbalance, Voltage Harmonic Distortion, & Frequency.
  - Event Date/Time stamp with Duration/Magnitude for Surge, Sag, Swell, Temporary Overvoltage (TOV), Overvoltage, Phase Loss/Outage, Voltage Interruption/Dropout, Voltage Harmonics (VTDH), Over/Under Frequency, & Neutral Bond conditions. Event thresholds shall be capable of password-protected user modification at the system display and Embedded webpage.
  - System monitor shall verify the integrity of N-G Bond
  - System memory shall be capable of on-board storage & retrieval of a minimum of 2000 logged events.
  - Event diagnostics providing SPDs life cycle status with remaining surge protection percentage, and a resettable counter providing the number of Surge, Sag, and Swell events since last reset.
  - System monitoring shall incorporate user defined thresholds for multiple alarm conditions. Alarms must be configurable as audible, relay, or both.
- 2.5.5 Remote Monitor Unit**—A self-contained monitoring device shall be available to allow remote annunciation of the system status. Input power to the monitoring device shall be equipped with an 1828.8 mm (6-foot) long input power cord with a NEMA 5-15 plug. The monitoring device shall have an audible alarm, red and green LED's, an alarm on/off switch to silence and a push-to-test alarm switch.

## **2.6 Testing**

**2.6.1 Component Testing and Monitoring:** The proposed product shall be single pulsed surge current tested in all modes at the rated surge currents by an industry recognized independent test laboratory. The test shall include a surge impulse (6kV [1.2x50µs], 500 amp [8x20 µs] waveform) to benchmark the unit's suppression voltage. The applied impulse is followed by a single pulse surge of the maximum rated surge current magnitude, followed by a second 6kV [1.2x50µs], 500 amp [8x20 µs] impulse as a means of measuring clamping deviation (component degradation). Compliance is achieved if the two measured suppression voltage do not vary by more than 5%.

**Due to present industry test equipment single pulse surge current capacities over 200,000 amps are established via testing of individual modules in each mode.**

## **3.0 EXECUTION**

**3.1 Installation:** The installing contractor shall install the parallel SPD with short and straight conductors as practically possible. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes.

***These Guide Specifications comply with the outlines of the Construction Specification Institute per CSI MP-2-2-85 and MP-2-1-88***