

SERIES 400

Model 445, Surge Protective Device

Guide Specifications

1.0 GENERAL

1.1 Summary : These specifications describe the electrical and mechanical requirements for a high-energy Discrete 10-Mode 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 4th Edition 2014 Revision
Underwriters Laboratories; UL 1283 5th 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

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.

International Electrotechnical Commission (IEC)

1.3 System Description: The system shall be constructed using multiple surge current diversion thermally protected metal oxide varistors (TPMOV). The surge current circuit 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.

2.0 PRODUCTS

2.1 Performance Ratings

2.1.1 Surge Current Capacity: (Selection Required)

_____ kA Surge Rating per Mode **(50) (100)**
_____ kA Surge Rating per Phase (L-N + L-G + L-L) **(150) (300)**

2.1.2 Noise Attenuation: The filter shall provide an attenuation of 40db max from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A.

2.1.3 Enhanced EMI/RFI Filtering: Up to 60db from 10 kHz to 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. (Type 2 devices only)

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

System Voltage	ANSI/UL 1449 Fourth Edition VPR's			
	L-N	N-G	L-G	L-L
120/240, 120/208	800V	800V	800V	1200V
240 Delta	NA	NA	1200V	2000V
277/480	1200V	1200V	1200V	2000V
347/600	1500V	1500V	1500V	2500V
480 Delta	NA	NA	1800V	2000V
600 Delta	NA	NA	2000V	3000V

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

2.1.6 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 Cycle Surges **(Selection Required)**

_____ Life Cycle Surges per Mode **(500) (3500)**
_____ Life Cycle Surges per Phase **(1500) (10,500)**

2.2 Design Requirements

2.2.1 Overcurrent Protection/Fusing: All suppression components shall be thermally protected and rated to allow maximum specified surge current capacity. Devices that utilize a single fuse to protect two or more suppression paths are not accepted. Individual surge components 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.

2.2.2 Protection Modes: The SPD shall provide Discrete 10-Mode protection as follows: All modes, L-N , L-G, N-G, and L-L. (Note: L = Line, G = Ground, N = Neutral) SPD's that do not provide discrete Line-to-Line protection do not meet the intent of this specification.

2.2.3 Enclosure: The specified system shall be provided in a heavy duty **NEMA 4X** enclosure rated UL94-5V, the best rating for resistance to flammability available.

2.2.4 Connections: Terminals/Compression lugs shall be provided to accommodate connection to phases, neutral, and ground where applicable. A three position terminal block with "NO", "NC", & "COM" indication shall be provided to accommodate relay alarm contact connection.

2.2.5 Internal Connections and Serviceability: The system shall be designed for simple change out of any SPD by a qualified electrician. Designs that require factory service are not acceptable. All connections, conductors and terminals must be appropriately sized for specified surge current capacity.

2.3 Standard Features:

- 2.3.1 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 integrity of all fuses must be indicated on the status panel.
- 2.3.2 Unit Status Indicators**—SPD shall have an integral status circuit that monitors the operational status of all modes of protection, including Line to Neutral, Line to Ground, Neutral to Ground, and Line to Line. No manual testing is required to confirm the integrity of the suppression and filter systems. The SPD shall be equipped with red and green solid state indicators mounted within the enclosure and be externally visible.
- 2.3.3 Dry Contacts for Remote Monitoring**—SPD must have a minimum of 1 set of electrically isolated Form C dry contacts, one normally open and one normally closed.
- 2.3.4 Power Loss Monitoring**—SPD shall be equipped with power loss monitoring.
- 2.3.5 Audible Alarm**—SPD shall be equipped with an audible alarm that is activated during a fault condition. In conjunction with alarm, an alarm on/off feature shall be provided to silence the alarm.

2.4 Optional Features:

- 2.4.1 Surge Counter**—A resettable transient counter shall be available to tally transient voltage surge conditions. The readout shall be at least a six-digit LCD located on the unit's front cover. Counter must maintain accurate counts for 10-years in the event of total power loss.
- 2.4.3 Surge Event LED**—The SPD shall include LED indication on the front cover that illuminates when the SPD's Nominal voltage is exceeded by 50%. Once activated, the Surge Event LED must remain illuminated until a reset function is manually activated.
- 2.3.4 N-G Overvoltage Detection**— The SPD shall include LED indication on the front cover that illuminates when the neutral to ground voltage exceeds 20VRMS.
- 2.4.5 NEMA 12 Metal Enclosure**—The SPD may be provided in NEMA 12 metal enclosure.
- 2.5.4 Active Surge Monitor** – The SPD shall be equipped with a power quality monitor including the following monitoring features:
- a. Communication via RS-485, Modbus TCP/RTU, Form C, Ethernet, SNMP, SMTP, with Embedded Webpage capable of generating charts, graphs, and downloadable reports.
 - b. Integral LCD Display providing real-time system RMS voltage, Average Voltage, VTDH, Crest Factor, Phase Imbalance, Voltage Harmonic Distortion, & Frequency.
 - c. 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.
 - d. System monitor shall verify the integrity of N-G Bond
 - e. System memory shall be capable of on-board storage & retrieval of a minimum of 2000 logged events.
 - f. 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.
 - g. System monitoring shall incorporate user defined thresholds for multiple alarm conditions. Alarms must be configurable as audible, relay, or both.
- 2.4.6 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.

2.5 Quality Assurance: The manufacturer shall be ISO 9001:2008 certified. The manufacturer shall have been engaged in the design and manufacturer of such products for a minimum of 20 years.

2.6 Warranty: The manufacturer shall provide a full ten year 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 or local electrical codes. Manufacturer shall make available (local, national) field engineering service support. Where direct factory employed service engineers are not locally available, travel time from the factory or nearest dispatch center shall be stated.

2.7 Environmental Requirements

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

2.8 Testing

2.8.1 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%.

3.0 EXECUTION

3.1 Submittals

3.1.1 Documentation: These specifications are based on the ASCO Series 445. All other manufacturers shall submit for 10-day pre-approval, a detailed compliance or exception statement to all provisions of this specification to allow consideration. Additionally, manufacturers shall submit test data verifying the following: life cycle testing, overcurrent protection, ANSI/UL 1449 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.

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

3.1.3 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.

3.2 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.