

# MASTER GUIDEFORM SPECIFICATION

## SECTION 264 313 – SURGE PROTECTIVE DEVICE (SPD) FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 CODES AND REFERENCE

- A. Qualification Data: Products shall be tested and listed by a Third-Party testing lab or U.S. Department of Labor/OSHA approved NRTL

Agency Approval/Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a Nationally Recognized Testing Laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

- 1. All SPDs shall be tested and listed to ANSI/UL 1449 latest edition & Complimentary Listed to UL 1283 by a Nationally Recognized Testing Laboratory (NRTL) (i.e. CSA, UL, etc.)

- B. Applicable Documents:

- 1. ANSI/IEEE Std C62.41.1™-2002, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits
- 2. ANSI/IEEE Std C62.41.2™-2002, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
- 3. ANSI/IEEE Std C62.45™-2002, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
- 4. ANSI C84.1, American National Standard for Electric Power Systems and Equipment – Voltage Ratings (60 Hertz)
- 5. IEEE Standard 1100-2005, IEEE Recommended Practice for Power and Grounding Electronic Equipment - Clause 8.6.1
- 6. National Fire Protection Association (NFPA) 70 (N.E.C.) –2017 – Article 285
- 7. ANSI/UL 1449 latest edition Surge Protective Devices
- 8. IEEE Std C62.72-2016 - IEEE Guide for the Application of Surge-Protective Devices for Use on the Load Side of Service Equipment in Low-Voltage (1000 V or Less, 50 Hz or 60 Hz) AC Power Circuits
- 9. IEEE Std C62.62-2018, IEEE Standard Test Specifications for Surge-Protective Devices (SPDs) for Use on the Load Side of the Service Equipment in Low-Voltage (1000 V and Less) AC Power Circuits

#### 1.3 SUMMARY

- A. Section includes field installed SPDs for low-voltage power distribution equipment.

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## 1.4 GLOSSARY AND ACRONYMS

- A. **SPD:** Surge Protective Device(s), both singular and plural.
- B. **NEC/CEC:** National Electrical Code / Canadian Electrical Code
- C. **Frequency Responsive Circuitry (FRC):** Voltage independent, dedicated circuitry intended to mitigate the effects of switching or ringing surges that is specifically designed so that it can survive the surge environment. The performance of frequency responsive circuitry is defined by the level to which it mitigates Ring Wave transients and can be demonstrated in the test results of IEEE C62.41.2-2002, Category A Ring Wave (2 kV).
- D. **Voltage Protection Rating (VPR)** A rating selected from a list of preferred values as detailed in ANSI/UL 1449 latest edition and assigned to each mode of protection. The value of VPR is determined as the nearest highest value taken from a list of preferred values as detailed in ANSI/UL 1449 latest edition to the measured limiting voltage determined during the transient-voltage surge suppression test using the combination wave generator at a setting of 6 kV, 3 kA.
- E. **Maximum Continuous Operating Voltage (MCOV)** – The maximum designated root mean-square (rms) value of the power frequency voltage that may be continuously applied to the mode of protection of an SPD without the SPD degrading.
- F. **Nominal Discharge Current ( $I_n$ )** – Peak value of the current, selected by the manufacturer from a list of values specified in ANSI/UL 1449 latest edition, through the SPD having a short-circuit current waveshape of 8/20  $\mu$ s where the SPD remains functional after 15 surges using the test procedure described in ANSI/UL 1449 latest edition.
- G. **Type 1 SPD** – Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service equipment overcurrent device, as well as the load side, including watt-hour meter socket enclosures and intended to be installed without an external overcurrent protective device.
- H. **Type 2 SPD** – Permanently connected SPDs intended for installation on the load side of the service equipment overcurrent device; including SPDs located at the branch panel.
- I. **Type 2 Component Assemblies (CA)** – Consists of a Type 4 component assembly with internal or external short circuit protection.
- J. **Type 4 Component Assemblies** – Component assembly consisting of one or more Type 5 components together with a disconnect (integral or external) or a means of complying with the limited current tests in UL 1449 section 44.4.
- K. **Type 5** – Discrete component surge suppressors, such as MOVs that may be mounted on a PWB, connected by its leads or provided within an enclosure with mounting means and wiring terminations.
- L. **Modes of Protection:** Electrical paths where the SPD offers defense against transient overvoltage. e.g. Each Line to Neutral (L-N), Line to Ground (L-G), Line to Line (L-L) and Neutral to Ground (N-G).
- M. **Per Phase Ratings:** ‘Per-Phase’ ratings for a three-phase Wye-connected SPD are determined by multiplying the kA per mode times the number of **discrete modes of protection (directly connected surge protective components)**, minus the value for the Neutral to Ground mode, divided by the number of phases.

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1. Per-Phase = (((kA per mode) X (# of modes with discrete surge protection components))-(N-G mode kA)) / (# of phases)

### 1.5 SUBMITTALS FOR REVIEW

- A. Product Data: For each type of product indicated, include all required testing and pertinent manufacturer information described in section 1.6, as well as rated capacities, maximum continuous operating voltage, weights and dimensions, electrical characteristics, interconnecting wiring requirements, accessories, and ANSI/UL 1449 latest edition VPRs.
- B. Letter from manufacturer stating products are in strict compliance with the recommendations of IEEE Std 1100-2005, Clause 8.6.1. and **incorporate a minimum of 10 individual dedicated discrete modes of protection for three-phase Wye systems (3 x L-N, 3 x L-G, 1 x N-G, 3 x L-L), or 6 individual dedicated discrete modes of protection for three-phase Delta systems (3 x L-L, 3 x L-G), or 6 individual dedicated discrete modes of protection for Split-Phase systems (2 x L-N, 2 x L-G, 1 x N-G, 1 x L-L). (Reduced-Mode variations will not be accepted).**
- C. Warranty duration and replacement policy.
- D. Manufacturer’s installation instructions
- E. Provide a table indicating which panel/switchboard/equipment each SPD will serve. Table shall include project name, panel name, voltage/phase, and SPD model number to be provided, submittals will not be approved without this table.

| Project Name:          |              |                  |
|------------------------|--------------|------------------|
| Panel/Switchboard Name | Volts, Phase | SPD Model Number |
|                        |              |                  |
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### 1.6 SUBMITTALS FOR INFORMATION

- A. Product Data: For each type of product indicated. Include rated capacities; shipping, installed, and operating weights, furnished specialties; and accessories.
- B. Specification Compliance Review:
  - 1. Manufacturers and bidders must provide the consulting engineer with a Compliance Review of the Specifications and Addenda’s. The Compliance Review shall be a paragraph-by-paragraph review of the Specifications and schedule with the following

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information; “C”, “D”, or “E” marked in the margin of the original Specifications and any subsequent Addenda’s. If the manufacturer or bidder does not provide the Compliance Review to the engineer for review, with the submittal, the submittal will be subject to rejection as non-compliant.

- a. “C” Comply with no exceptions.
  - b. “D” Comply with deviations. For each deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the Specification can be satisfied.
  - c. “E” Exception, do not comply. For each exception, provide a numbered footnote with reasons and possible alternatives. Non-compliance with the specifications is grounds for rejection as unacceptable. A bid from any alternative or listed equipment manufacturer with any number of exceptions will be reason for rejection for non-compliance without further review.
  - d. Unless a deviation or exception is specifically noted in the Compliance Review, the manufacturer shall provide full compliance with the entire specification. Deviations or exceptions taken in letters or cover letters in a bid document, subsidiary documents, by omission or by contradiction do not release the manufacturer or bidder from being in complete compliance, unless the exception or deviation has been specifically noted in the Compliance Review and approved by the consulting engineer.
  - e. Equipment manufacturers or bidders that do not meet the specifications through the above process will be subject to rejection without further review.
- C. Independent, third party, certified, IEEE Std C62.41.2™-2002 test reports from a recognized testing facility (e.g., the National Electric Energy Testing, Research and Applications Center (NEETRAC) based within the School of Electrical and Computer Engineering at the Georgia Institute of Technology). Testing is to be supervised by a licensed Professional Engineer who is a recognized expert in surge protective device testing. Include complete let-through voltage/measured limiting voltage test data, for every mode, for each product submitted for Category’s C, B, A (including Cat A, 2 kV, 67 A, 100 kHz Ring Wave at both 90- & 270-degree electrical phase angles for frequency responsive, frequency responsive models). Testing shall be conducted as follows:
- Test Parameters:** Positive Polarity, Net voltages are peak ( $\pm 10\%$ ). All tests are static (un-powered) except 150 V MCOV modes. Let-through voltages on static tests calculated by subtracting sinewave peak from let-through measured from zero. 150 V MCOV mode let-through voltages measured from the insertion point on the sinewave. Each phase is the average of the 3 modes. In order to duplicate the results, the specified mode must be tested for all three phases (except N-G) and averaged together. (Individual mode or shot results may not vary by more than 10%. *Scope Settings: Time Base = 10 microseconds, Sampling Rate = 250 Megasamples/sec. These settings assure Let-through voltages test results are accurate*). **All tests performed with 6” lead length (external to the enclosure), simulating actual installed performance per the ANSI/UL 1449 standard.**
- D. Certificates of Conformity: For SPDs, certifying compliance with an NRTL listing/certification to the following standards:
1. ANSI/UL 1449 latest edition, listing and classification.)
  2. UL 1283 (Type 2 SPDs Only)

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### 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Closeout Submittal shall include operation, installation and specification data in closeout submittals.
- B. Certification: By Electrical Contractor (Installer) that installation complies with manufacturer's instructions (SEE FINAL INSPECTION SECTION OF THIS SPECIFICATION).
- C. Warranty duration and replacement policy
- D. All surge protection devices shall be sourced from the same company and current models.

### 1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain surge protective devices and accessories through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of surge protective device and are based on the specific system indicated. Other manufacturers' products complying with requirements may be considered. Refer to Division 1 Section "Substitutions."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
- D. IEEE Testing: Tested according to IEEE C62.41.1-2002, "IEEE Guide for Surge Environment in Low Voltage AC Power Circuits," IEEE C62.41.2-2002, "IEEE Recommended Practice on Characterization of Surges in Low Voltage AC Power Circuits" and test devices according to IEEE C62.45-2002, "IEEE Recommended Practice on Surge Testing for Equipment connected to Low Voltage AC Power Circuits."
- E. UL Compliance: Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449 latest edition, "Surge Protective Devices."
- F. Manufacturer's Qualifications: Manufacturer must have at least 10 years' experience in the engineering, design and manufacture of permanently connected SPDs. The manufacturer shall be certified and compliant to ISO 9001:2015.

### 1.9 PROJECT CONDITIONS

- A. Placing in Service: Do not energize or connect service entrance equipment, panelboards, control terminals, or data terminals to their sources until the installer verifies the service and separately derived system's Neutral to Ground bonding jumpers per NEC. After the system voltages have been verified and the system has been energized and is stable, follow the manufacturers instructions for installing the surge protective devices.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.

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- C. Service Conditions: Surge protective devices shall be rated for continuous operation under the following conditions, unless otherwise specified:
  - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage for 480Y/277V and not less than 125 percent of nominal voltage for 208Y/120V (Verifiable at UL.com).
  - 2. Operating Temperature: 30 to 120 deg F.
  - 3. Humidity: 0 to 85 percent, noncondensing.
  - 4. Altitude: Less than 20,000 feet above sea level.

### 1.10 COORDINATION

- A. Coordinate location of field installed SPDs to allow adequate clearances for maintenance.
- B. SPDs shall be rated for the class and category of service necessary for the application per the ANSI/IEEE Std C62.41.2™-2002 and IEEE Std C62.72™-2016 (Categories C, B, A)

### 1.11 FUSING

- A. Provide as a minimum, over-current, over temperature protection in the form of component-level thermal fusing to ensure safe failure and mitigate thermal runaway. This component-level fusing shall be an integral part of the MOV itself, and not silver wire (or other) independently laid across each MOV.
- B. Provide integral short circuit current fusing within each device. The fusing will be independent of the “component-level” fusing and specifically for over-current protection on each phase, and shall be constructed utilizing surge rated, cartridge fuses and not rated ‘silver-fuse-wire’ (or other).
- C. The use of any mechanical or electro-mechanical thermal/over-current protection (i.e. moving parts and/or springs and shutters), in combination with or for the protection of the suppression elements are expressly prohibited and will be rejected.
- D. Large-block rectangular or round thermally-protected MOVs (i.e. 34 to 40 mm rated at 40-60 kA) are expressly prohibited and will not be accepted.
- E. The fusing mechanisms employed must effectively coordinate their performance in conjunction with the high current abnormal over-voltage testing under ANSI/UL 1449 latest edition).

### 1.12 WARRANTY

- A. The manufacturer shall provide unlimited free replacement of the entire SPD (not just modules, components or sub-assemblies) for all inoperable SPDs during the warranty period. Acceptable manufacturers listed below that do not meet the warranty as standard shall submit a letter from an officer of the corporation extending the warranty with the product submittal.
  - 1. Warranty Period: Minimum warranty shall be Twenty-Five (25) years from date of purchase.
  - 2. Maintenance Restrictions: No SPD shall be supplied which requires scheduled preventative-maintenance or replaceable parts (other than replaceable LEDs for diagnostic circuits). Units requiring functional testing, special test equipment, or special training to monitor SPD status are not acceptable. SPDs shall require no

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routine maintenance. SPDs are considered non-repairable items and shall be fully replaced upon failure.

3. Warranty shall not be pro-rated and shall cover manufacturer defects and workmanship, plus any end-of-life electrical events including lightning.
- B. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

### PART 2 – PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Manufacturers of a Broad Line of Surge Protective Devices:
    - a. Current Technology, Inc.
    - b. Leviton Manufacturing Co., Inc.
    - c. Surge Suppression, LLC
  2. Manufacturers of Category A and Telephone/Data Line Surge Protective Devices:
    - a. Current Technology, Inc.
    - b. Leviton Manufacturing Co., Inc.
    - c. Surge Suppression, LLC.

#### 2.2 SERVICE ENTRANCE SURGE PROTECTIVE DEVICE

- A. Manufacturers: Subject to compliance with requirements, **provide specific model numbers listed by the following manufacturer, or comparable models from PreApproved Other Manufacturers meeting these specifications.**
- B. All SPDs on the entire project must be provided by the same SPD manufacturer to ensure commonality and ease of Owner maintenance.
- C. Peak Single-Impulse Surge Current Shall be **160 kA per mode, 480 kA per phase, minimum**
1. Basis of Design: Surge Suppression, LLC: Sales – 888-987-8877 – [www.surgesuppression.com](http://www.surgesuppression.com)

##### **SSI Advantage Model Numbers:**

**SHLB1S1AC11M (120/240 Vac Split-Phase) / SHLB3Y1AC11M (120/208 Vac Wye)  
/ SHLB3Y2AC11M (277/480 Vac Wye) / SHLB3N4AC11M (480 Vac Delta)**

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2. Let through voltage test results for service entrance surge protective devices must not exceed the following to be considered for approval, no exceptions:

| <b>IEEE Std. C62.41.2-2002 Category C High Current Driven Surge Test Results (10 kA)</b> |            |            |            |            |
|--|------------|------------|------------|------------|
|  | <b>L-N</b> | <b>L-L</b> | <b>L-G</b> | <b>N-G</b> |
| 120/240 V<br>Split-Phase   | 729 V      | 964 V      | 781 V      | 991 V      |
| 208Y/120 V<br>3 Ø  | 729 V      | 964 V      | 781 V      | 991 V      |
| 480Y/277 V<br>3 Ø  | 1374 V     | 1758 V     | 1414 V     | 1661 V     |
| 480 V 3 Ø Δ  | ---        | 1758 V     | 2071 V     | ---        |
| <b>IEEE Std. C62.41-2002 Category A 6 kV 200 A 100 kHz Ring Wave Surge Test Results</b>  |            |            |            |            |
|  | <b>L-N</b> | <b>L-L</b> | <b>L-G</b> | <b>N-G</b> |
| 120/240 V<br>Split-Phase   | 261 V      | 412 V      | 272 V      | 491 V      |
| 208Y/120 V<br>3 Ø  | 261 V      | 412 V      | 272 V      | 491 V      |
| 480Y/277 V<br>3 Ø  | 392 V      | 484 V      | 376 V      | 817 V      |
| 480 V 3 Ø Δ  | ---        | 505 V      | 505 V      | ---        |

- D. SPDs shall be:
1. Listed to ANSI/UL 1449 latest edition and Complimentary Listed to 1283
  2. SPD shall be UL labeled as Type 2 (verifiable at UL.com). Every suppression component of every mode, including N-G, shall be protected by internal component level thermal fusing, in addition to surge-rated, over-current protection fuses on each incoming phase lead prior to connection with the circuit board. Type 1 or Type 4 SPDs are not permitted.
  3. SPD shall be UL labeled with a Nominal Discharge Current Rating ( $I_{nominal}$  or  $I_n$ ) of 20 kA per mode for all modes, which is verifiable at UL.com for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
  4. The Maximum Continuous Operating Voltage (MCOV) shall be as follows:



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| Nominal System Voltage                 | Mode | MCOV      |
|--|------|-----------|
| 120/208 Wye and<br>120/240 Split-Phase | L-N  | 150 V     |
|  | L-L  | 300 V     |
|  | L-G  | 150 V     |
|  | N-G  | 150 V     |
| 277/480 Wye                            | L-N  | 320 V     |
|  | L-L  | 552-640 V |
|  | L-G  | 320 V     |
|  | N-G  | 320 V     |
| 480 Delta                              | L-L  | 552 V     |
|  | L-G  | 552 V     |

5. The SPD shall have UL 1449 latest edition, Voltage Protection Ratings (VPRs) as follows:

| Nominal System Voltage                 | Mode | VPR    |
|--|------|--------|
| 120/208 Wye and<br>120/240 Split-Phase | L-N  | 600 V  |
|  | L-L  | 1000 V |
|  | L-G  | 600 V  |
|  | N-G  | 600 V  |
| 277/480 Wye                            | L-N  | 900 V  |
|  | L-L  | 1800 V |
|  | L-G  | 1000 V |
|  | N-G  | 900 V  |
| 480 Delta                              | L-L  | 1800 V |
|  | L-G  | 1800 V |

6. Visual LED indicator lights for power and protection status including a minimum of one green LED indicator per phase, and one red service LED.
7. Permanently-mounted, parallel connected.
8. Solid-state clamping components to limit the surge voltage and divert the surge current. SPD components that “crowbar” (e.g. spark gaps, gas tubes, SCR's, etc.) are not allowed.
9. Self-restoring and fully automatic.
10. The SPD shall be tested and listed by a testing agency acceptable to authorities having jurisdiction, as a complete assembly to a symmetrical fault current rating greater than, or equal to, the available fault current at the location of installation at the connected panel, in accordance with NEC Article 285.6, and shall be marked with the short circuit current rating (SCCR). If the available fault current is unknown, then the SCCR of the SPD shall be 200 kAIC.
11. Bi-directional, encapsulated, custom parallel and solid-state circuit configuration.
12. SPD system shall **incorporate a minimum of 10 individual dedicated discrete modes of protection for three-phase Wye systems (3 x L-N, 3 x L-G, 1 x N-G, 3 X L-L), or 6 individual dedicated discrete modes of protection for three-phase Delta systems (3 x L-L, 3 x L-G), or 6 individual dedicated discrete modes of protection for Split-Phase systems (2 x L-N, 2 x L-G, 1 x N-G, 1 X L-L). Reduced-Mode variations will not be accepted.**
13. Audible alarm, with diagnostic test function and silencing switch, to indicate when protection has failed.
14. One set of dry contacts rated at a minimum of 60 W (from 30 VDC @ 2 A to 150 VDC @ 0.4 A) or 100 VA (from 50 VAC @ 2 A to 220 VAC @ 0.45 A).

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2.3 DISTRIBUTION PANEL SURGE PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, **provide specific model numbers listed by the following manufacturer, or comparable models from PreApproved Other Manufacturers meeting these specifications.**

B. All SPDs on the entire project must be provided by the same SPD manufacturer to ensure commonality and ease of Owner maintenance.

C. Peak Single-Impulse Surge Current Shall be **100 kA per mode, 300 kA per phase, minimum with Frequency Responsive Circuitry.**

1. Surge Suppression, LLC: Sales – 888-987-8877 – [www.surgesuppression.com](http://www.surgesuppression.com)

**SSI Advantage Model Numbers:**

**CMLB1S1AC11 (120/240 Vac Split-Phase) / CMLB3Y1AC11 (120/208 Vac Wye) / CMLB3Y2AC11 (277/480 Vac Wye) / CMLB3N4AC11 (480 Vac Delta)**

2. Let through voltage test results for service entrance surge protective devices must not exceed the following to be considered for approval, no exceptions:

| <b>IEEE Std. C62.41.2-2002 Category C High Current Driven Surge Test Results (10 kA)</b> |            |            |            |            |
|--|------------|------------|------------|------------|
|  | <b>L-N</b> | <b>L-L</b> | <b>L-G</b> | <b>N-G</b> |
| 120/240 V<br>Split-Phase   | 1068 V     | 1381 V     | 1048 V     | 1431 V     |
| 208Y/120 V<br>3 Ø  | 1068 V     | 1381V      | 1048 V     | 1431 V     |
| 480Y/277 V<br>3 Ø  | 1334 V     | 1981 V     | 1304 V     | 1721 V     |
| 480 V 3 Ø Δ  | ---        | 1981 V     | 2144 V     | ---        |
| <b>IEEE Std. C62.41-2002 Category A 2 kV 67 A 100 kHz Ring Wave Surge Test Results</b>   |            |            |            |            |
|  | <b>L-N</b> | <b>L-L</b> | <b>L-G</b> | <b>N-G</b> |
| 120/240 V<br>Split-Phase   | 45 V       | 51 V       | 80 V       | 69 V       |
| 208Y/120 V<br>3 Ø  | 45 V       | 51 V       | 80 V       | 69 V       |
| 480Y/277 V<br>3 Ø  | 50 V       | 55 V       | 70 V       | 58 V       |
| 480 V 3 Ø Δ  | ---        | 104 V      | 1559 V     | ---        |

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D. SPDs shall be:

1. Listed to ANSI/UL 1449 latest edition and Complimentary Listed to UL 1283.
2. SPD shall be UL labeled as Type 2 (verifiable at UL.com). Every suppression component of every mode, including N-G, shall be protected by internal component level thermal fusing, in addition to surge-rated, over-current protection fuses on each incoming phase lead prior to connection with the circuit board. Type 1 or Type 4 SPDs are not permitted.
3. SPD shall be UL labeled with a Nominal Discharge Current Rating ( $I_{\text{nominal}}$  or  $I_n$ ) of 20 kA per mode for all modes, which is verifiable at UL.com for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
4. The Maximum Continuous Operating Voltage (MCOV) shall be as follows:

| Nominal System Voltage                 | Mode | MCOV      |
|--|------|-----------|
| 120/208 Wye and<br>120/240 Split-Phase | L-N  | 150 V     |
|  | L-L  | 300 V     |
|  | L-G  | 150 V     |
|  | N-G  | 150 V     |
| 277/480 Wye                            | L-N  | 320 V     |
|  | L-L  | 552-640 V |
|  | L-G  | 320 V     |
|  | N-G  | 320 V     |
| 480 Delta                              | L-L  | 552 V     |
|  | L-N  | 552 V     |

5. The SPD shall have UL 1449 latest edition, Voltage Protection Ratings (VPRs) as follows:

| Nominal System Voltage                 | Mode | VPR    |
|--|------|--------|
| 120/208 Wye and<br>120/240 Split-Phase | L-N  | 600 V  |
|  | L-L  | 1000 V |
|  | L-G  | 600 V  |
|  | N-G  | 700 V  |
| 277/480 Wye                            | L-N  | 1200 V |
|  | L-L  | 1800 V |
|  | L-G  | 1200 V |
|  | N-G  | 1200 V |
| 480 Delta                              | L-L  | 1800 V |
|  | L-G  | 1800 V |

6. Visual LED indicator lights for power and protection status including a minimum of one green LED indicator per phase, and one red service LED.
7. Incorporate "True sine wave tracking or frequency responsive circuitry (FRC)" based on the results of the Category A (2 kV) Ring Wave Measured Limiting Voltages. Products utilizing basic EMI/RFI filter performance or tracking circuits in the L-N mode only are not allowed (see section 1.6 C and D of this specification for specific requirements).
8. Permanently-mounted, parallel connected.
9. Solid-state clamping components to limit the surge voltage and divert the surge current. SPD components that "crowbar" (e.g. spark gaps, gas tubes, SCR's, etc.) are not allowed.
10. Self-restoring and fully automatic.
11. The SPD shall be tested and listed by a testing agency acceptable to authorities having jurisdiction, as a complete assembly to a symmetrical fault current rating greater than,

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or equal to, the available fault current at the location of installation at the connected panel, in accordance with NEC Article 285.6, and shall be marked with the short circuit current rating (SCCR). If the available fault current is unknown, then the SCCR of the SPD shall be 200 kAIC.

12. Bi-directional, encapsulated, custom parallel and solid-state circuit configuration.
13. SPD system shall **incorporate a minimum of 10 individual dedicated discrete modes of protection for three-phase Wye systems (3 x L-N, 3 x L-G, 1 x N-G, 3 X L-L), or 6 individual dedicated discrete modes of protection for three-phase Delta systems (3 x L-L, 3 x L-G), or 6 individual dedicated discrete modes of protection for Split-Phase systems (2 x L-N, 2 x L-G, 1 x N-G, 1 X L-L). Reduced-Mode variations will not be accepted.**
14. Audible alarm, with diagnostic test function and silencing switch, to indicate when protection has failed.
15. One set of dry contacts rated at a minimum of 60 W (from 30 VDC @ 2 A to 150 VDC @ 0.4 A) or 100 VA (from 50 VAC @ 2 A to 220 VAC @ 0.45 A).

### 2.4 BRANCH PANEL SURGE PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, **provide specific model numbers listed by the following manufacturer, or comparable models from PreApproved Other Manufacturers meeting these specifications.**
- B. All SPDs on the entire project must be provided by the same SPD manufacturer to ensure commonality and ease of Owner maintenance.
- C. Peak Single-Impulse Surge Current Shall be **60 kA per mode, 180 kA per phase, minimum with Frequency Responsive Circuitry.**
  1. Surge Suppression, LLC: Sales – 888-987-8877 – [www.surgesuppression.com](http://www.surgesuppression.com)

#### **SSI Advantage Model Numbers:**

**CDLB1S1AC11 (120/240Vac Split-Phase) / CDLA3Y1AC11 (120/208Vac Wye) /  
CDLA3Y2SAC11 (277/480Vac Wye) / CDLA3N4AC11 (480 Vac Delta)**

2. Let through voltage test results for service entrance surge protective devices must not exceed the following to be considered for approval, no exceptions:

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| <b>IEEE Std. C62.41.2-2002 Category C High Current Driven Surge Test Results (10 kA)</b> |            |            |            |            |
|--|------------|------------|------------|------------|
|  | <b>L-N</b> | <b>L-L</b> | <b>L-G</b> | <b>N-G</b> |
| 120/240 V<br>Split-Phase   | 1068 V     | 1381 V     | 1048 V     | 1431 V     |
| 208Y/120 V<br>3 Ø  | 1068 V     | 1381V      | 1048 V     | 1431 V     |
| 480Y/277 V<br>3 Ø  | 1334 V     | 1981 V     | 1304 V     | 1721 V     |
| 480 V 3 Ø Δ  | ---        | 1981 V     | 2144 V     | ---        |
| <b>IEEE Std. C62.41-2002 Category A 26 kV 67 A 100 kHz Ring Wave Surge Test Results</b>  |            |            |            |            |
|  | <b>L-N</b> | <b>L-L</b> | <b>L-G</b> | <b>N-G</b> |
| 120/240 V<br>Split-Phase   | 45 V       | 51 V       | 80 V       | 69 V       |
| 208Y/120 V<br>3 Ø  | 45 V       | 51 V       | 80 V       | 69 V       |
| 480Y/277 V<br>3 Ø  | 50 V       | 55 V       | 70 V       | 58 V       |
| 480 V 3 Ø Δ  | ---        | 104 V      | 1559 V     | ---        |

D. SPDs shall be:

1. Listed to ANSI/UL 1449 latest edition and Complimentary Listed to UL 1283.
2. SPD shall be UL labeled as Type 2 (verifiable at UL.com). Every suppression component of every mode, including N-G, shall be protected by internal component level thermal fusing, in addition to surge-rated, over-current protection fuses on each incoming phase lead prior to connection with the circuit board. Type 1 or Type 4 SPDs are not permitted.
3. SPD shall be UL labeled with a Nominal Discharge Current Rating ( $I_{\text{nominal}}$  or  $I_n$ ) of 20 kA per mode for all modes, which is verifiable at UL.com for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
4. The Maximum Continuous Operating Voltage (MCOV) shall be as follows:

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| Nominal System Voltage                 | Mode | MCOV      |
|--|------|-----------|
| 120/208 Wye and<br>120/240 Split-Phase | L-N  | 150 V     |
|  | L-L  | 300 V     |
|  | L-G  | 150 V     |
|  | N-G  | 150 V     |
| 277/480 Wye                            | L-N  | 320 V     |
|  | L-L  | 552-640 V |
|  | L-G  | 320 V     |
|  | N-G  | 320 V     |
| 480 Delta                              | L-L  | 552 V     |
|  | L-G  | 552 V     |

5. The SPD shall have UL 1449 latest edition, Voltage Protection Ratings (VPRs) as follows:

| Nominal System Voltage                 | Mode | VPR    |
|--|------|--------|
| 120/208 Wye and<br>120/240 Split-Phase | L-N  | 600 V  |
|  | L-L  | 1000 V |
|  | L-G  | 600 V  |
|  | N-G  | 700 V  |
| 277/480 Wye                            | L-N  | 1200 V |
|  | L-L  | 1800 V |
|  | L-G  | 1200 V |
|  | N-G  | 1200 V |
| 480 Delta                              | L-L  | 1800 V |
|  | L-G  | 1800 V |

6. Visual LED indicator lights for power and protection status including a minimum of one green LED indicator per phase, and one red service LED.
7. Incorporate "True sine wave tracking or frequency responsive circuitry (FRC)" based on the results of the Category A (2 kV) Ring Wave Measured Limiting Voltages. Products utilizing basic EMI/RFI filter performance or tracking circuits in the L-N mode only are not allowed (see section 1.6 C and D of this specification for specific requirements).
8. Permanently-mounted, parallel connected.
9. Solid-state clamping components to limit the surge voltage and divert the surge current. SPD components that "crowbar" (e.g. spark gaps, gas tubes, SCR's, etc.) are not allowed.
10. Self-restoring and fully automatic.
11. The SPD shall be tested and listed by a testing agency acceptable to authorities having jurisdiction, as a complete assembly to a symmetrical fault current rating greater than or equal to the available fault current at the location of installation at the connected panel, in accordance with NEC Article 285.6 and shall be marked with the short circuit current rating (SCCR). If the available fault current is unknown, then the SCCR of the SPD shall be 200 kAIC.
12. Bi-directional, encapsulated, custom parallel and solid-state circuit configuration.
13. SPD system shall **incorporate a minimum of 10 individual dedicated discrete modes of protection for three-phase Wye systems (3 x L-N, 3 x L-G 1 x N-G, 3 X L-L), or 6 individual dedicated discrete modes of protection for three-phase Delta systems (3 x L-L, 3 x L-G), or 6 individual dedicated discrete modes of protection for Split-Phase systems (2 x L-N, 2 x L-G, 1 x N-G, 1 X L-L). Reduced-Mode variations will not be accepted.**
14. Audible alarm, with diagnostic test function and silencing switch, to indicate when protection has failed.
15. One set of dry contacts rated at a minimum of 60 W (from 30 VDC @ 2 A to 150 VDC @ 0.4 A) or 100 VA (from 50 VAC @ 2 A to 220 VAC @ 0.45 A).

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**\*HEALTHCARE FACILITY NOTE: SPD manufacturer is to remove the Frequency Responsive Circuitry in the N-G mode. The SPD itself however must still incorporate the standard threshold N-G mode circuitry within the device.**

## 2.5 SPECIAL SYSTEMS CONTROL AND DATA TERMINALS

- A. Protector for fire alarm, copper control, data, antenna, and telephone conductors entering the building from the outside shall be as recommended by the manufacturer for the type of line being protected.

## 2.6 ENCLOSURES

- A. Indoor Enclosures: NEMA 1 or better, with type matching the enclosure of panel or device being protected.
- B. Outdoor Enclosures: NEMA 4 or better for outdoor/wet locations.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF SURGE PROTECTIVE DEVICES

- A. Provide surge protective devices for the incoming service at the switchboard or service entrance equipment.
- B. Provide surge protective devices at the tele/data demark phone board or cabinet as close as possible to the incoming conduit and conductors. Provide surge suppression for all tele/data conductors that are run underground from one MDF/IDF to another.
- C. Provide surge protective devices at all fire alarm panels that connect to any fire alarm panel or device with underground conductors.
- D. Install surge protective devices at service entrance on load side, with ground lead bonded to service entrance ground.
- E. Install surge protective devices for panelboard and auxiliary panels per NEC 285.12 with conductors between surge protective device and points of attachment as short (less than 18") and straight as possible. Gently twist conductors together. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
- F. At Service Entrance or Transfer Switch, the surge protective device shall include an integral UL approved disconnect switch as a means of servicing disconnect if a 30 A breaker (or larger sized by manufacturer) is not available.
- G. Install surge protective devices for Distribution, MCC and Branch panelboards with conductors between suppressors and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral to ground.
- H. SPD shall have an independent means of servicing disconnect such that the protected panel remains energized. Provide a 30 Amp breaker (or larger sized by manufacturer) to serve this function.

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- I. Installer may reasonably rearrange breaker locations to ensure short and straightest possible leads to SPDs.
- J. Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per NEC.
- K. For surface mounted panel boards, associated surge protective device shall be surface mounted directly adjacent to the panel board with user access. For recessed mounted panel boards, associated surge protective devices shall be mounted recessed adjacent to the panel board with user access. Do not mount above 84 inches unless directed.
- L. Install the SPDs immediately adjacent to the switchboard or panelboard being protected.
- M. SPDs must be installed to a disconnecting switch or breaker rated for (minimum) 30-amps in the panel per manufacturer's installation instructions to ensure a means of disconnecting the SPD from the service without de-energizing the panel or the connected loads. The use of direct bus bar connected SPDs is expressly prohibited and will be rejected.
- N. Do not energize service entrance equipment or panelboards until SPDs are properly installed and connected.
- O. Do not perform insulation resistance tests of the distribution wiring equipment with the SPDs installed. Disconnect all SPDs (all Phase, Neutral and Ground connections) before conducting insulation resistance tests. Reconnect immediately after the testing is over.**

### 3.2 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.3 FIELD QUALITY CONTROL

- A. Field Service: Electrical Contractor shall inspect, test, and adjust components, assemblies, and equipment installations, including connections to strictly comply with this specification.
  - 1. After installing surge protective devices, verify for compliance with manufacturer's written installation requirements and NEC requirements
  - 2. Complete startup checks according to manufacturer's written instructions.
  - 3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.19, with the exclusion of Sections 7.19.1.B.2, 7.19.1.D.2, and 7.19.2. Certify compliance with test parameters.
  - 4. If the SPD status and power LEDs are not illuminated, check the status of the power and connections. For additional troubleshooting, contact the manufacturer.
- B. If an SPD has expired, replace the SPD with the same model from the same manufacturer. Verify the system operation after the SPD is replaced.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
  - 1. Verify that electrical wiring installation complies with manufacturer's installation requirements.

END OF SECTION