

## **SECTION 26 43 13 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS**

### **PART 1 - GENERAL**

#### **1.1 SUBMITTAL REQUIREMENTS**

- A. Product Data
  - 1. For each type include rated capacities, operating characteristics, electrical characteristics, maximum continuous operating voltage, weights and dimensions, wiring requirements, tested values, required OCPD and accessories, warranty, etc.

#### **1.2 RELATED DOCUMENTS**

- A. See Section 26 27 26.00 "Wiring Devices" for surge protection receptacles if applicable.

#### **1.3 DEFINITIONS:**

- A. SPD: Surge protective/protection device.
- B. SPD Type: Used to describe the intended application location of the SPD, either upstream or downstream of the main overcurrent protective device of the facility.
  - 1. 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.
  - 2. Type 2 SPD – Permanently connected SPDs intended for installation on the load side of the service equipment overcurrent device; including SPDs located at a branch panel.
  - 3. Type 4 SPD – Recognized Component SPDs, including discrete components as well as component assemblies, which bear specific conditions of acceptability.
- C. Enhanced EMI/RFI Filtering: 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 filtering 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 (2kV).
- D. VPR (Voltage Protection Rating): A rating selected from a list of preferred values as detailed in the latest edition of UL 1449 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 the latest edition of UL 1449 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. MCOV (Maximum Continuous Operating Voltage): 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.
- F. Nominal Discharge Current (In): Peak value of the current, selected by the manufacturer from a list of values specified in the latest edition of UL 1449, through the SPD having a current wave shape of 8/20 where the SPD remains functional after 15 surges using the test procedure described in the latest edition of UL 1449.
- G. Modes of Protection: Electrical paths where the SPD offers defense against transient overvoltages. e.g. Each Line to Neutral (L-N), Line to Ground (L-G), Line to Line (L-L) and Neutral to Ground (N-G).

- H. Per Phase Ratings: 'Per-Phase' ratings for a three-phase Wye-connected SPD is the total surge current capacity connected to a given phase (Line to Neutral mode plus Line to Ground mode).
- I. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

#### **1.4 COORDINATION**

- A. Coordinate location of field installed SPDs to allow adequate clearances for maintenance and proximity to electrical bus in protected power distribution equipment. SPDs shall be rated for the class and category of service necessary for the application.

#### **1.5 MANUFACTURER'S WARRANTY**

- A. Manufacturer agrees to repair or replace SPDs that fail in materials or workmanship within specified warranty period. Warranty Period: Minimum five (5) years from date of Substantial Completion.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Manufacturers: Provide all SPDs on this project by the same SPD manufacturer to ensure commonality and ease of Owner maintenance. Provide products manufactured by Surge Suppression Incorporated, Emerson Surge Protection or Current Technology (model numbers as specified further below). Subject to being equivalent and subject to compliance with requirements, provide product by one of the manufacturers listed below.
  - 1. Advanced Protection Technologies Inc. (APT)
  - 2. ASCO Power Technologies (APT)
  - 3. Current Technology
  - 4. Eaton Corporation
  - 5. Emerson Surge Protection
  - 6. General Electric
  - 7. LEA International
  - 8. Leviton Manufacturing Co., Inc.
  - 9. Siemens Industry, Inc.
  - 10. Square D
  - 11. Surge Suppression Incorporated

#### **2.2 GENERAL SPD REQUIREMENTS**

- A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. Comply with latest editions of NFPA 70 and UL 1449.

#### **2.3 SERVICE ENTRANCE SPD'S**

- A. Basis of Design:
  - 1. Surge Suppression Incorporated, Advantage Series
  - 2. Emerson Surge Protection, 400 Series
  - 3. Current Technology, Current Guard Plus Series
- B. SPDs: Listed and labeled UL acceptable to authorities having jurisdiction as complying with UL 1449 Type 1. Comply with UL 1283.

- C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per mode shall not be less than 200 kA. This value shall be independently tested by a 3rd party testing agency.
- D. SPD shall have a Nominal Discharge Current Rating of 20 kA per mode for all modes. The Maximum Continuous Operating Voltage (MCOV) shall be at a minimum as follows:
  - 1. 277/480 Wye shall be 320V
- E. The SPD shall have Voltage Protection Ratings (VPRs) for modes shown above as follows:
  - 1. 277/480 Wye
    - a. L-N: 1,200V
    - b. L-L: 2,000V
    - c. L-G: 1,200V
    - d. N-G: 1,000V
- F. SPDs shall be or have the following features and accessories:
  - 1. Indicator light display for power to device and protection status.
  - 2. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
  - 3. Surge counter.
  - 4. Permanently-mounted, parallel connected.
  - 5. 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.
  - 6. Capable of sustaining 115% of nominal RMS voltage continuously without degrading.
  - 7. The SPD shall be tested and listed by an UL 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 protected power distribution equipment, in accordance with NEC Article 285 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.
  - 8. SPD system shall provide protection for all modes for a three-phase Wye-connected SPD.

## **2.4 DISTRIBUTION PANEL SUPPRESSORS (400 AMP AND LARGER)**

- A. Basis of Design:
  - 1. Surge Suppression Incorporated, Advantage Series
  - 2. Emerson Surge Protection, 400 Series
  - 3. Current Technology, Current Guard Plus Series
- B. SPDs: Listed and labeled UL acceptable to authorities having jurisdiction as complying with UL 1449 Type 1 or Type 2. Comply with UL 1283.
- C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per mode shall not be less than 100 kA. This value shall be independently tested by a 3rd party testing agency.
- D. SPD shall have a Nominal Discharge Current Rating of 20 kA per mode for all modes. The Maximum Continuous Operating Voltage (MCOV) shall be at a minimum as follows:
  - 1. 120/208 Wye shall be 150V
  - 2. 277/480 Wye shall be 320V
- E. The SPD shall have Voltage Protection Ratings (VPRs) for modes shown above as follows:
  - 1. 120/208 Wye
    - a. L-N: 700V

- b. L-L: 1,200V
    - c. L-G: 700V
    - d. N-G: 700V
  - 2. 277/480 Wye
    - a. L-N: 1,200V
    - b. L-L: 2,000V
    - c. L-G: 1,200V
    - d. N-G: 1,000V
- F. SPDs shall be or have the following features and accessories:
- 1. Indicator light display for power to device and protection status.
  - 2. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
  - 3. Permanently-mounted, parallel connected.
  - 4. 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.
  - 5. Capable of sustaining 115% of nominal RMS voltage continuously without degrading.
  - 6. The SPD shall be tested and listed by an UL 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 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.
  - 7. SPD system shall provide protection for all modes for a three-phase Wye-connected SPD.

## 2.5 ENCLOSURES

- A. Indoor Enclosures: NEMA 1 or better; Outdoor Enclosures: NEMA 4 or better.
- B. Wire SPDs to a disconnecting switch or breaker, rated for minimum 30 amps (higher if/as recommended by equipment manufacturer), in the protected power distribution equipment per manufacturer’s installation instructions to ensure a means of disconnecting the SPD from the power source without de-energizing the protected power distribution equipment or the connected loads. Size circuit breaker rating so that breaker does not open prematurely when removing surge suppression from the circuit. The use of direct bus bar connected SPDs is expressly prohibited and will be rejected unless integral means is included to disconnect and remove SPD without having to de-energize respective protected equipment or upstream equipment.
- C. Service Entrance Equipment: Provide externally-mounted units or units integrated within equipment in separately-barriered compartments. Install SPD components to the service entrance equipment as near as possible to the interior connection points; position the related branch breakers accordingly. Provide dual shielded, triple insulated multi-core power conductor from connection lug to SPD to minimize cable impedance.
- D. New Power Distribution Equipment Other Than Service Entrance Equipment In Utility Rooms or Similar Unfinished Areas: Provide externally-mounted units or units fully integrated within equipment in separately-barriered or equivalent compartments, connected to power distribution equipment within the equipment protected. For fully integrated units, provide factory-installed integrated SPD units with collective assembly tested and UL Listed accordingly, and with the face of SPD unit (including LED’s, integral switches, etc. as applicable) visible and accessible from inside the door but outside of the dead front; size enclosure heights accordingly. Provide flush mounted enclosures where protecting flush mounted distribution equipment.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install SPDs in strict accordance with manufacturer's instructions and the NEC. Comply with NECA 1.
- B. Externally Mounted Units and Similar Applicable Installations: Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer in writing. In the case where the lead length exceeds 18 inches the installer must contact the SPD manufacturer for written installation assistance. Do not bond neutral and ground. Install conductors with direct paths to and from SPD devices avoiding sharp bends, loops and excessive lengths. Install externally mounted SPD components to the boxes of protected equipment as near as possible to the interior connection points; position or reposition the related branch breakers accordingly. Cut factory and field leads as required to minimize cable lengths for externally mounted units.
- C. Wiring:
  - 1. Install SPDs at service entrance on load side, with ground lead bonded to service entrance ground.
  - 2. Use crimped connectors and splices only. Wire nuts are unacceptable.
  - 3. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
  - 4. Controls: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
  - 5. Provide overcurrent protection (OCP) compliant with NFPA 70 for each SPD. Such OCP's that may be shown on drawings are shown for schematic purposes. Provide OCP's at ratings as recommended by SPD manufacturer for each application.
- D. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over. Energize SPDs after power system has been energized, stabilized, and tested.
- E. The SPD installation shall be certified by a licensed electrician that the installation is in accordance with the manufacturer's recommendations, NEC requirements and the requirements of the specification above. Any deficiencies noted shall be corrected by the Contractor. Provide written documentation of this inspection as part of the closeout documents/manual.

**END OF SECTION 26 43 13**