

**SECTION 26 43 13**  
**SURGE PROTECTIVE DEVICES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Provide the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as indicated on the contract documents (Drawings and Specifications). To maximize performance, reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment.
2. Surge Protective Devices SPD - C (high, medium, low) – Service entrance/Exterior exposure.
3. Surge Protective Devices SPD - B (high, medium, low) – Interior Equipment
4. Surge Protective Devices SPD – A – Point of use
5. Enclosures

B. Meet the following performance requirements:

1. Service Conditions: Rate surge protection devices for continuous operation under the following conditions unless otherwise indicated:
  - a. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
  - b. Operating Temperature: -40 to 122 deg F (-40 to 50 deg C).
  - c. Humidity: 5 to 95 percent, noncondensing.
  - d. Altitude: Less than 16,000 feet (5000m) above sea level.
2. NFPA 780 surge requirements – as a minimum comply with requirements for a NRTL Master Label for lightning protection systems.
  - a. Electrical Power Circuits.
    - 1) The SPD shall protect against a surge produced by a 1.2/50  $\mu$ s, 8/20  $\mu$ s combination waveform generator described in IEEE C62.41.2.
    - 2) SPDs at the service entrance shall have an  $I_n$  max rating of at least 40 kA 8/20  $\mu$ s per phase of a nominal discharge current ( $I_n$ ) rating of at least 20 kA 8/20  $\mu$ s per phase.
  - b. Signal, Data, and Communication Protection. SPDs shall be listed for the protection of signal, data, and communications systems and shall have a  $I_n$  max rating of at least 10 kA 8/20  $\mu$ s or greater when installed at the entrance.
3. Protection Modes – The SPD must protect all modes of the electrical system being utilized including L-N, L-G, L-L, N-G.
4. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

<b>MODES</b>	<b>208Y/120</b>	<b>400Y/230</b>	<b>480Y/277</b>	<b>600Y/347</b>
L-N; L-G; N-G	700	1200	1200	1500
L-L	1200	2000	2000	3000

5. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted. Noise attenuation for electrical noise shall be as follows using the MIL-STD-220A insertion loss test method:
  - a. 100 kHz at 44dB.
  - b. All other frequencies shall be 32dB or better.

C. System Description:

1. Surge Protection Devices (SPD) shall be provided to meet the requirements for a NRTL lightning protection Master Label complying with UL96A.
2. Provide multiple layers of surge protection throughout the facility in accordance with ANSI/IEEE C62.1 and 1100 – Emerald Book.
3. Devices shall be isolated so the SPD will not effect the operation of the electrical equipment if the SPD fails and have an isolating disconnect device so as to not require a shutdown to repair or replace SPD. Provide compartmentalization within equipment or mount on outside of equipment to be protected, with consideration of voltage rise, conductor size and accessibility.

## **1.2 RELATED WORK**

- A. Section 26 00 10 – Basic Electrical Requirements, is an integral part of this Section. Requirements and work indicated in 26 00 10 are not repeated in this Section.

## **1.3 COORDINATION**

- A. Coordinate work under provisions indicated in Section 26 00 10.
- B. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
1. Notify Construction Manager, Contractor and Owner no fewer than five days in advance of proposed electrical service interruptions.
  2. Do not proceed with interruption of electrical service without Contractor's and Owner's written permission.

## **1.4 QUALIFICATIONS / QUALITY ASSURANCE**

- A. Conform to requirements indicated in Section 26 00 10.

## **1.5 REGULATORY REQUIREMENTS AND STANDARDS**

- A. Conform to requirements indicated in Section 26 00 10 in addition to the latest edition of the following:
1. UL 1449 SPD safety standard (3<sup>rd</sup> edition or later)

2. UL 1283 EMI/RFI Filtering. Standard for Electromagnetic Interference Filters.
3. NFPA 70 National Electrical Code
4. NEMA LS1
5. ANSI/IEEE C62.41 recommended practice for surge voltages in low voltage ac power circuits.
6. C62.45 - guide for surge testing for equipment connected to low-voltage ac power circuits.
7. ANSI/IEEE C62.34 – Secondary Surge Arrestor. For UL 1449 type 1 applications.
8. ANSI/IEEE 1100 Emerald Book
9. UL 96A Installation Requirements for lightning protection systems
10. NFPA 780 Lightning protection standard.
11. MIL-STD-220A Compliance: Comply with military standard for measuring filter attenuation using the 50-ohm insertion loss method.
12. NRTL Listed for Lightning Protection Systems meeting requirements of UL96A and NFPA 780 equal to UL VZCA with a current rating of  $I_n = 20\text{kA}$ .
13. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

## **1.6 SUBMITTALS**

- A. Submit as required herein and under Section 26 00 10.
- B. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.
- C. Provide UL 1449, 3rd Edition test reports showing ratings and all “Engineering Considerations”.
- D. The SPD shall also be complementary listed to UL 1283. Submit noise filtering characteristics.
- E. Qualification Data: Provide the following:
  1. Provide test reports from a recognized independent testing laboratory verifying the COMPLETE SPD will survive the published and specified maximum surge current rating. Test reports will clearly show that all components that make up a COMPLETE system were included in these tests (including but not limited to all necessary fuses, thermal disconnects, integral disconnects and monitoring systems). Test data over individual module is not acceptable. Test data as individual module is not acceptable.
  2. Provide data confirming that the SPD will survive the published and specified repetitive surge current rating (longevity characteristic). Indicate percent degradation.
  3. Per the requirements of NEC Article 285, provide test data demonstrating that the SPD is capable of surviving the published and specified short circuit current capability (AIC rating) without the use of external fusing.
  4. Provide the nominal discharge current ( $I_n$ ) for each device.
  5. UL 1449 voltage protection rating (VPR) with and without disconnects.
  6. UL 96A compliance for SPD-1 devices with  $I_n = 20\text{ kA}$ .
  7. MCOV rating per UL 1449. MCOV values based on the component's value will not be acceptable.
  8. Submit on temporary overvoltage levels and protection method.
  9. Submit the NRTL Certificate for listing to UL VZCA.
- F. Operation and Maintenance Data: For SPD devices to include in emergency, operation, and maintenance manuals.

**1.7 EXTRA MATERIALS**

- A. Furnish under provisions indicated in Section 26 00 10
- B. Provide the following additional materials:
  - 1. One set of spare fuses of each type used.

**1.8 PROJECT RECORD DOCUMENTS**

- A. Submit under provisions indicated in Section 26 00 10.

**1.9 OPERATION AND MAINTENANCE DATA**

- A. Submit under provisions indicated in Section 26 00 10.

**1.10 WARRANTY**

- A. Provide under provisions indicated in Section 26 00 10.
  - 1. General Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within ten years from date of Substantial Completion.

**1.11 DEFINITIONS**

- A. UL 1449
  - 1. Type 1 – 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 – Permanently connected SPDs intended for installation on the load side of the service equipment overcurrent device, including SPDs located at the branch panel.
  - 3. Type 3 – Point-of-utilization SPDs, installed at a minimum conductor length of 30 ft from the electrical service panel to the point of utilization, e.g., cord connected, direct plug-in, receptacle type and SPDs installed at the utilization equipment being protected. The distance (30 ft) is exclusive to conductors provided with or used to attach SPDs.
  - 4. Type 4 – Component SPDs and component assemblies.
  - 5. SVR – 2<sup>nd</sup> edition UL 1449 surge voltage rating using a 6 kV/500A combination wave.
  - 6. VPR – 3<sup>rd</sup> edition UL 1449 voltage protection rating using a 6 kV/3kA combination wave surge.
  - 7.  $I_n$  – nominal discharge current
  - 8. Phase rating – two times mode rating
  - 9. MCOV – Maximum Continuous Operating Voltage
- B. ANSI/IEEE C62.41
  - 1. Category C – Service entrance
  - 2. Category B – Interior distribution equipment
    - a. Primary: first piece of distribution equipment after service entrance or after internal transformers or any equipment that connects to exterior equipment circuits.
    - b. Secondary: next piece of distribution equipment after the primary distribution equipment.

3. Category A – Point of use

## **PART 2 - PRODUCTS**

### **2.1 Modular**

- A. Modular Surge Protection Devices Shall have Field Replaceable Modules.

### **2.2 SURGE PROTECTIVE DEVICES SPD - C (HIGH, MEDIUM, LOW)**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Current Technology Inc.; Danaher Power Solutions. Modular – SEL Series
  2. LEA International. Modular – Dyna Systems Series
  3. Liebert Corporation; a division of Emerson Network Power. Modular – Interceptor II series
  4. Distribution Equipment Manufacturer SPD may be provided if it meets all specified requirements and is isolated from the equipment interior such that a failure will not effect the equipment from functioning and continue operating and complies with Part 1.
  5. Substitutions: under the provisions of Section 26 00 10.
- B. NRTL Listed for Lightning Protection Systems meeting requirements of UL96A and NFPA 780 equal to UL VZCA with a current rating of  $I_n = 20\text{kA}$ .
- C. Provide Surge Protection Devices with the following features and accessories:
1. Rated 20 kA nominal discharge current ( $I_n$ ). UL 1449 type 1 or 2.
  2. Repetitive Rating: SPD shall be capable of surviving at least 15,000 ANSI/IEEE C62.41 Category C3 impulses (20kA) without failure or less than 10% degradation of original performance characteristics.
  3. Fusing system to provide 200k AIC short circuit rating.
  4. Fabrication using bolted compression lugs for internal wiring.
  5. Integral disconnect switch (only when a breaker is NOT provided in distribution equipment). Rated to withstand the maximum surge current magnitude. Without failure or damage to the switch.
  6. Individually fused surge protection components (MOV, SAD, selenium, etc) to provide system redundancy.
  7. Built-in push-to-test feature that tests the integrity of each fuse/MOV pair. Manufacturers who accomplish by use of an external surge generator will provide the device with their quotation.
  8. Redundant replaceable modules.
  9. Arrangement with copper bus bars and for bolted connection to phase buses, neutral bus, and ground bus.
  10. Arrangement with wire connection to phase buses, neutral bus, and ground bus.
  11. LED indicator lights for power and protection status.
  12. Audible alarm, with silencing switch, to indicate when protection has failed.
  13. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
  14. Surge event operations counter.
  15. MCOV rating of 115% of nominal operating voltage.
  16. Unit shall be capable of being field tested while installed with no interruption to electrical service.

D. Peak Single-Impulse Surge Current Rating:

1. High exposure - 300 kA per mode/600 kA per phase
2. Medium exposure - 240 kA per mode/480 kA per phase
3. Low exposure -160 kA per mode/320 kA per phase.
4. Manufacturer to provide a higher maximum surge current rating if necessary to meet repetitive requirements listed above.

**2.3 SURGE PROTECTIVE DEVICES SPD - B (HIGH, MEDIUM, LOW)**

A. Manufacturers: Subject to compliance with requirements, provide products by one of the

1. Current Technology Inc.; Danaher Power Solutions, Field replaceable modular – EPGE Series.
2. LEA International Field Replaceable Modular – PEB Series.
3. Liebert Corporation; a division of Emerson Network Power. Field Replaceable Modular – LPGE Series.
4. Distribution Equipment. Manufacturer SPD may be provided if it meets all specified requirements and is isolated from the equipment interior such that a failure will not effect the equipment from functioning and continue operating and complies with Part 1.
5. Substitutions: under the provisions of Section 26 00 10.

B. Provide Surge Protection Devices with the following features and accessories:

1. Rated 10kA minimum nominal discharge current (In). UL 1449 type 2 minimum.
2. The SPD will be capable of surviving 12,000 ANSI/IEEE C62.41, Category C3 (10kA) impulses without failure or performance degradation of more than 5%.
3. The SPD will be integrally fused to pass the requirements of UL-1449 and provide a short circuit current rating of 200kAIC.
4. Individually fused MOVs to provide system redundancy.
5. Fabrication using bolted compression lugs for internal wiring.
6. Redundant suppression circuits. Each MOV shall be individually fused
7. Redundant replaceable module(s).
8. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
9. LED indicator lights for power and protection status.
10. Audible alarm, with silencing switch, to indicate when protection has failed.
11. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
12. Surge-event operations counter.
13. MCOV rating of 115% of nominal operating voltage.
14. Unit shall be capable of being field tested while installed with no interruption to electrical service.

C. Peak Single-Impulse Surge Current Rating:

1. High exposure - 150 kA per mode/300 kA per phase
2. Medium exposure - 100 kA per mode/200 kA
3. Low exposure - 50 kA per mode/160 kA] per phase. Manufacturer to provide a higher maximum surge current rating if necessary to meet the repetitive requirements listed above.

## **2.4 SURGE PROTECTIVE DEVICES SPD - A**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Current Technology Inc, Danaher Power Solutions.
  - 2. LEA International.
  - 3. Liebert Corporation, a division of Emerson Network Power.
  - 4. Receptacles per Section 26 27 26 – Wiring Devices.
  - 5. Substitutions: Under the provisions of Section 26 00 10.
- B. Device shall be listed under UL 1449 type 3 surge protective device to ANSI/IEEE C62.41 category A. Point of use.

## **2.5 TELEPHONE / DATA LINE SUPPRESSORS**

- A. Manufacturers of Telephone/Data Line Suppressors
  - 1. Subject to compliance with requirements, provide products by one of the following:
    - a. EDCO
    - b. NTE Electronics, Inc.
    - c. Telebyte Technology, Inc.
    - d. Substitutions: under provisions of Section 26 00 10.
- B. Manufacturers of Gas-Tube Suppressors:
  - 1. Subject to compliance with requirements, provide products by one of the following:
    - a. Sankosha U.S.A., Inc.
    - b. Substitutions: under provisions of Section 26 00 10.
- C. Device shall be listed under UL 1449 Type 2 surge protective device to ANSI/IEEE C62.41 category C – service entrance use. Device shall meet the requirements of UL96A and NFPA 780 for lightning protection systems. NRTL listed equivalent to UL VZCA with a current rating of  $I_n = 20kA$ .

## **2.6 ENCLOSURES**

- A. Indoor Enclosures: NEMA 250 Type 1.
- B. Outdoor Enclosures: NEMA 250 Type 4.
- C. NEMA 250, with type matching enclosure of panel or device being protected.

## **2.7 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS**

- A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.
  - 1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
  - 2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.

3. The panelboard shall be capable of re-energizing upon removal of the SPD.
  4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a circuit breaker for disconnecting purposes may be installed using short lengths of conductors twisted together as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the circuit breaker.
  5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
  6. The SPD shall be of the same manufacturer as the panelboard.
  7. The complete panelboard including the SPD shall be UL67 listed.
- B. Sidemount Mounting Applications Installation (SPD mounted external to electrical assembly)
1. Lead length between the breaker and suppressor shall be kept as short as possible and twisted together to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.
- C. Switchgear, Switchboard, MCC and Busway Requirements
1. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
  2. The SPD shall be factory installed inside the switchgear, switchboard, MCC, and/or bus plug at the assembly point by the original equipment manufacturer
  3. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
  4. The SPD shall be connected through a disconnect (circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
  5. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
  6. All monitoring and diagnostic features shall be visible from the front of the equipment.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Placing into service: Do not energize or connect equipment to their sources until the surge protective devices are installed and connected.
- B. Provide SPD as indicated on the one line diagram and under applications.
- C. Install SPD devices at service entrance on load side, with ground lead bonded to service entrance ground.
- D. SPD devices shall be compartmentalized so that a failure will not effect the operation of the equipment connected to the SPD.
- E. Install devices with conductors or buses between suppressor and points of attachment as short and straight as possible. Locate the externally mounted SPD as close as possible to the neutral lug. Locate the recommended breaker as close as possible to the SPD location. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground. Twist wires to minimize impedance.



1. Provide a 100A, multi-pole circuit breaker in the service entrance equipment and a 30A, multi-pole circuit breaker in branch panel equipment to serve as a dedicated disconnect for suppressor, unless otherwise required.
- F. Replacement or repair of the SPD shall not require de-energizing the equipment connected to the SPD.

### **3.2 APPLICATION**

- A. Provide device rated for the most stringent category indicated starting with SPD-CH. Review Drawings for additional requirements and ratings.
- B. SPD CH: "SW" Switchboards:
1. Provide secondary surge arrestor installed on the line side of the transformer source overcurrent protective device.
  2. Rated 20kA nominal discharge current ( $I_n$ ) on the label of the SPD certified for UL 96A usage. Installation on the secondary side of the overcurrent protective device.
  3. ANSI/IEEE C62.41 category C. – high exposure.
- C. SPD-CM: Distribution equipment, ATSS, panels and control circuits serving exterior and roof mounted equipment, generators and exterior switchboards:
1. SPD-CM type 2 rated 20 kA nominal discharge current ( $I_n$ ) on the label of the SPD
  2. ANSI/IEEE C62.41 category C. primary – medium exposure.
- D. Switchboards, panels or motor control centers serving interior loads only including UPS output switchboards:
1. SPD-BM rated 10 kA nominal discharge current ( $I_n$ ) on the label of the SPD.
  2. ANSI/IEEE C62.41 category B – Secondary-medium exposure
- E. Panels serving electronic or sensitive loads such as electronic systems. Fire alarm, BAS/ATS/BMS control systems, lighting control systems, etc.:
1. SPD – BL type 2 rated 5 kA nominal discharge current ( $I_n$ ) minimum.
  2. ANSI/IEEE C62.41 category B-secondary-low exposure.
- F. Install SPD on municipal alarm circuits or communication lines connected to equipment provided under this Section including fire alarm system, equipment modems, exterior control and monitoring circuits, etc.
1. Category C for any circuits with exterior exposure (under or above ground).
  2. Category B for interior only circuits.

### **3.3 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

- C. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
  - 2. After installing SPD devices but before electrical circuitry has been energized, test for compliance with requirements.
  - 3. Complete startup checks according to manufacturer's written instructions.
  - 4. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.19. Certify compliance with test parameters.
- E. Repair or replace malfunctioning units. Retest after repairs or replacements are made.
- F. SPD device will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

### **3.4 STARTUP SERVICE**

- A. Do not energize or connect service entrance equipment, panelboards, control terminals, data terminals to their sources until SPD devices are installed and connected.
- B. Do not perform insulation resistance tests of the distribution wiring equipment with the SPD installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

### **3.5 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to maintain SPD devices.

**END OF SECTION**