

**Part 1            General**

**1.1            Scope**

- .1    The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, busway (integrated within bus plug), or motor control centres.

**1.2            RELATED SECTIONS**

- .1    Section 26 05 00 Common Work Results FOR Electrical

**1.3            REFERENCES**

- .1    SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3<sup>rd</sup> Edition).

**1.4            SUBMITTALS – For Review/Approval**

- .1    The following information shall be submitted to the Engineer:
  - .1    Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (In).
  - .2    For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

- .2 Where applicable the following additional information shall be submitted to the engineer:

- .1 Descriptive bulletins
- .2 Product sheets

#### **1.5 Submittals – for Construction**

- .1 The following information shall be submitted for record purposes:
  - .1 Final as-built drawings and information for items listed in Section 1.04 and shall incorporate all changes made during the manufacturing process.

#### **1.6 QUALIFICATIONS**

- .1 The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- .2 For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- .3 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- .4 The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

#### **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

#### **1.8 OPERATION AND MAINTENANCE MANUALS**

- .1 Operation and maintenance manuals shall be provided with each SPD shipped.

**Part 2 PRODUCTS**

**2.1 VOLTAGE SURGE SUPPRESSION – GENERAL**

**.1 Electrical Requirements**

- .1 Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
- .2 Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 115% of the nominal system operating voltage.
- .3 The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
- .4 Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

- .5 Nominal Discharge Current ( $I_n$ ) – All SPDs applied to the distribution system shall have a 20kA  $I_n$  rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an  $I_n$  less than 20kA shall be rejected.

- .6 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:

MODES	208Y/120	480Y/347
L-N;	700	1000
L-L	1200	2500
N-G	700	1000
L-G;	800	1500

.2 SPD Design

- .1 Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
- .2 Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
- .3 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.
- .4 Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.

- .5 Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:
  - .1 Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
    - .1 For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.
    - .2 For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
    - .3 The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
  - .2 Remote Status Monitor – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
  - .3 Audible Alarm– The SPD shall contain an audible alarm that will be activated under any fault condition. .
- .3 Overcurrent Protection

- .1 The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
- .4 Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.
- .5 Short Circuit Current Rating:
  - .1 All SPD units for 480/277Vac distribution shall have a short circuit rating of 42kA minimum.
  - .2 All SPD units for 120/208 Vac distribution shall have a short circuit rating of 25kA minimum.
- .6 Safety Requirements
  - .1 The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
  - .2 SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.
  - .3 Sidemount SPDs shall be factory sealed in order to prevent access to the inside of the unit. Sidemount SPDs shall have factory installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

- .4 Where available, externally mounted Type 1 SPD units to be ordered with Integral Disconnect/Switch in order to facilitate maintenance without complete shutdown of associated power panel.

## 2.2 SYSTEM APPLICATION

- .1 The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.
- .2 Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category		
CATEGORY	Application	Per Phase
C (SPD1) on the drawings	Service Entrance Locations	120 kA
B (SPD2) on the drawings	Distribution Panel	80 kA
A (SPD3) on the drawings	Branch Locations	50 kA

- .3 SPD Type – all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

## **2.3 Lighting and Distribution Panelboard Requirements**

- .1 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 30A (or as recommended by the supplier) circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A 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.
- .2 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 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.
- .3 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 of the same manufacturer as the switchgear, switchboard, MCC, and busway
- .3 The SPD shall be factory installed inside the switchgear, switchboard, MCC, and/or bus plug at the assembly point by the original equipment manufacturer
- .4 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.
- .5 The SPD shall be connected through a disconnect (30A 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.
- .6 The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
- .7 All monitoring and diagnostic features shall be visible from the front of the equipment.

## **2.4 Enclosures**

- .1 All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:
  - .1 NEMA 1 – Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt). NEMA 4 – Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and

windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure.  
(sidemount units only)

- .2 NEMA 4X – Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection. (sidemount units only)

### **Part 3 EXECUTION**

#### **3.1 EXAMINATION**

#### **3.2 FACTORY TESTING**

- .1 Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

#### **3.3 INSTALLATION**

- .1 The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.
- .2 Any cutouts required in drywalls to install SPD units shall be professionally ceiled and painted.

#### **3.4 WARRANTY**

- .1 The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

**END OF SECTION**