This specification is new in its entirety.

# GENERAL

## RELATED DOCUMENTS

### Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this Section. Division 26 “Basic Materials and Methods”, “Switchboards”, and “Panelboards”.

### LED light fixtures shall be provided with integral surge protection and additional external surge protection as applicable. Requirements of LED light fixture surge protection are provided in Division 26 “Interior Lighting” and Division 26 “Exterior Lighting”.

## DESCRIPTION OF WORK

### Surge protection devices (SPD) shall be provided at all service entrances and switchboards, distribution panels, and as require of the project. Devices shall be suitable for use as Type 1 or Type 2 devices per UL 1449 4th Edition, applied to the line or load side of the utility feed inside the building as specified on the project. All SPDs shall be tested and demonstrated for suitability for application within ANSI/IEEE C62.41 Category C, B, and A installation environments.

## QUALITY ASSURANCE

### The manufacturer of the unit must have been engaged in the design and manufacture of such products for a minimum of five years.

### The installer must have at least three years of successful installation experience on projects utilizing SPDs similar to those of this project.

### All SPDs shall come with a standard ten year warranty.

### The specified unit shall be designed, manufactured, tested and installed in compliance with the latest edition of the following standards:

#### ANSI/IEEE C62.41 (2002) Circuits, C62.45 (2002), C62.62 (2010)

#### NFPA 70, 75 and 78

#### UL 50, 67, 96A, 489, 943, 1283 and 1449 4th Edition.

### Environmental Requirements

#### Operating temperature range shall be -40 degrees to +65 degrees C.

#### Operation shall be reliable in an environment up to 95% non-condensing relative humidity.

#### The unit shall not generate audible noise greater than 35 dB at 3 feet from the unit.

#### No appreciable magnetic fields shall be generated. The unit shall be capable of use directly in computer rooms in any location without danger to data storage systems.

## SUBMITTALS AND DOCMENTATION

### Documentation and Testing

#### The manufacturer shall furnish an equipment manual with installation, operation and maintenance instructions for the specified unit.

#### Documentation of the unit’s UL 1449 suppression rating shall be included as required product data submittal information. Manufacturer shall make available upon request certified documentation of applicable Location Category Testing in full compliance with ANSI/IEEE C62.41-1991 and ANSI/IEEE C62.45-1987 guidelines.

#### Copies of documentation stating that the Surge Protective Device is listed by UL to UL1449 current edition, 20kA in Type 1 or Type 2 locations for use in UL 96A systems.

#### Copies of actual let through voltage data in the form of oscillography results for both ANSI/IEEE C62.41 Category C3 (combination wave) and B3 (Ring wave) tested in accordance with ANSI/IEEE C6245.

#### Copies of Noise Rejection testing as outlined in NEMA LS1-1992 (R2000) Section 3.11. Noise rejection is to be measured between 50 kHz and 100 MHz verifying the devices noise attenuation. Must show multiple attenuation levels over a range of frequencies.

#### Copies of test reports from a recognized independent testing laboratory, capable of producing 200kA surge current waveforms, verifying the suppressor components can survive published surge current rating on a per mode basis using the ANSI/IEEE C62.41 impulse waveform C3 (8 x 20 The unit shall be factory tested and burned in at the applicable MCOV for a minimum of one hour.

#### The unit shall be factory-tested before shipment. Testing of each unit shall include but shall not be limited to quality assurance, MCOV and clamping voltage verification tests.

#### Package must include shop drawings complete with all technical information, unit dimensions, detailed installation instructions, maintenance manual, recommended replacement parts list and wiring configuration.

#### Manufacturer’s catalog data, technical information & specifications on all SPDs used.

#### Documentation stating that the SPDs used are all listed by UL to UL1449 4th Edition.

#### Copies of actual let through voltage data in the form of oscillography for both ANSI/IEEE C62.41 Category C3 (combination wave) and B3 (Ring wave) tested in accordance with ANSI/IEEE C6245.

#### Copies of Noise Rejection testing as outlined in NEMA LS1-1992 (R2000) Section 3.11. Noise rejection is to be measured between 50 kHz and 100 MHz verifying the devices noise attenuation. Must show multiple attenuation levels over a range of frequencies.

#### Copies of test reports from a recognized independent testing laboratory, capable of producing 200kA surge current waveforms, verifying the suppressor components can survive published surge current ratings on a per mode basis using the ANSI/IEEE C62.41 impulse waveform C3 (8 x 20 microsecond, 20kV/10kA). Test data on an individual module is not acceptable.

#### Copy of warranty statement clearly establishing the terms and conditions.

# PRODUCTS

## GENERAL CONSTRUCTION

### Maintenance free design shall not require any user intervention throughout its life. SPDs containing such items as replaceable single-mode modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring regular maintenance of any sort, including periodic tightening of connections shall not be accepted. SPDs requiring user intervention via diagnostic test kits or similar devices are not allowed.

### SPDs shall feature balanced suppression platform that equally distributes surges 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.

### All of the SPDs components and diagnostics shall be contained within one discrete assembly. The use of plug in single-mode modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

### The SPD shall minimize potential arc flash hazards by containing no single-mode plug in user serviceable/replaceable parts and shall not require periodic maintenance

### 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.

### All SPDs shall have a 200kA Amps Interrupting Rating (AIC).

## ELECTRICAL REQUIREMENTS

### The nominal unit operating voltage and configuration shall be per the drawings.

### The maximum continuous operating voltage (MCOV) of all suppression components utilized in the unit shall not be less than 115% of nominal on 480/277 volt systems and 125% of nominal on 240-208/120 volt systems.

### The suppression system shall incorporate only thermally protected metal-oxide varistors (MOVs) as the core suppression component. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other such techniques. End of life mode to be open circuit, end of life short-circuit mode are not acceptable.

### Unit shall be operable without the need of an external overcurrent protection device; and shall be UL listed as such. This requirement is independent of the requirements for SPD overcurrent protection which may or may not exist on a given project.

### The operating frequency range of the unit shall be 47 to 63 Hertz.

### The unit’s primary mode of protection shall be line-to-neutral. The secondary modes of protection shall be line-to-ground and neutral-to-ground for a total of 10 modes.

### Based on ANSI/IEEE C62.41 standard 8 x 20 microsecond current waveform, the maximum repetitive surge current capacity, in amps, of the unit shall be no less than 100 KA per mode.

### Nominal discharge current (In) shall be 20kA rating regardless of the SPD Type (1 or 2), or operating voltage.

### Units shall have no more than 10% deterioration or degradation of the UL1449 4th Edition Voltage Protection Rating (VPR) when exposed to a minimum of 5,000 repeated category C3 (20kV/10kA) surges. The SPD manufacturer must provide a test report validating the repetitive surge test was performed.

### The UL1449 VPR shall be permanently affixed to the SPD unit.

### The unit’s published performance ratings shall be the UL 1449 Listed suppression ratings. The UL 1449 suppression rating shall be, for each mode of protection and system voltage as follows:

#### UL 1449 4th Edition Voltage Protection Ratings (VPR) as shown in the table below:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **SPD Voltage Rating** | **System Configuration** | **Mode L-N** | **Mode L-G** | **Mode N-G** | **Mode L-L** | **MCOV L-N, N-G, L-G** | **MCOV L-L** |
| 120/208, 120/240 | WYE (or) Single-Split Phase | 900 | 800 | 700 | 1200 | 150 | 300 |
| 277/480 | WYE | 1500 | 1200 | 1200 | 2000 | 320 | 552 |

### The minimum surge current capacity the device is capable of withstanding shall be per ANSI/IEEE C62.41 location categories.

#### Minimum surge current capacity as shown in the following table:

|  |  |  |  |
| --- | --- | --- | --- |
| **Category** | **Application** | **Per Phase  Surge Capacity** | **Per Mode  Surge Capacity** |
| C | Service entrance locations (SWBs, SWGs, MCCs, MDPs) | 250kA | 125kA |
| B | Distribution locations (SWBs, MCCs, large PBs) | 160kA | 80kA |
| A | Branch locations (PBs, MCCs, Busway) | 80kA | 40kA |

### Suppression/Filter System:

#### The unit shall include an engineered solid-state high-performance suppression system, utilizing arrays of fused non-linear voltage dependent metal oxide varistors with similar operating characteristics. The suppression system’s components shall optimally share surge currents in a seamless, low-stress manner assuring maximum performance and proven reliability. The suppression system shall not utilize gas tubes, spark gaps, silicon avalanche diodes or other components which might short or crowbar the line, thus leading to interruption of normal power flow to or system upset of connected loads. The suppression system shall not incorporate any other components which may degrade performance or reliability of the suppression system.

#### The fusing system shall be capable of allowing the rated maximum surge current to pass through without fuse operation. Systems utilizing a fusing system that opens below the maximum surge current level are unacceptable.

#### Each Type 2 unit shall include an EMI/RFI noise suppression filter capable of up to 50 dB attenuation from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Type 2 unit filtering shall conform to UL 1283 5th Edition. Ringwave let-through voltage shall be 160 volts or less (IEEE Category B3, 208V system L-N).

#### Any SPD unit mounted in a distribution panel shall have an integral disconnect or circuit breaker to be used as a means of disconnecting the suppression/filter system for maintenance and/or test purposes without interruption of power to the facility’s distribution system.

#### All internal wiring associated with the suppression/filter system and subject to surge currents shall utilize low-impedance copper bus bar and/or #8 AWG copper conductor or larger. All internal connections associated with the suppression/filter system and subject to surge currents shall be made with compression solderless-type lugs and shall be bolted to the bus bars in order to reduce overall system impedance. No plug-in component modules, quick-disconnect terminals or printed circuit boards shall be used in surge current-carrying paths.

## PANELBOARD SPD REQUIREMENTS

### 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.

#### The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.

#### 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.

#### The panelboard shall be capable of re-energizing upon removal of the SPD.

#### The SPD shall be integral to the panelboard and connected directly to the bus. Alternately, an integral SPD can be connected to a circuit breaker for disconnecting purposes, in case a disconnect is required.

#### The SPD shall be included and mounted within the panelboard by the manufacture of the panelboard.

#### The SPD shall be of the same manufacturer as the panelboard.

#### All monitoring and diagnostic features shall be visible from the front of the equipment.

#### The complete panelboard including the SPD shall be UL67 listed.

## SWITCHGEAR, SWITCHBOARD, MCC, AND BUSWAY SPD REQUIREMENTS

### 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 with ANSI/IEEE C62. 41 Category C environments.

#### The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, or busway.

#### The SPD shall be factory installed integral to the switchgear, switchboard, MCC, and/or bus plug at the assembly plant by the original equipment manufacturer.

#### 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.

#### 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 and as straight as possible.

#### All monitoring and diagnostic features shall be visible from the front of the equipment.

## SPD ACCESSORIES & ADVANCED FEATURES:

### The unit shall include Form C dry contacts (N.O. and N.C.) to facilitate connection to a building management system in order to monitor the on-line status of the unit. The contacts shall be normally open or normally closed and shall close or open upon failure of the suppression system and/or fuse. Both the NO and NC contacts shall change state under any fault condition.

### Provide unit with operational status indicating lights. Each SPD shall have a green/red solid-state indicator light that reports the status of the protection on each phase.

#### 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.

#### 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.

#### 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.

### Provide with audible alarm and alarm indicating lights. The audible alarm shall be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.

### Transient Voltage six-digit (nominal) digital surge event counter with battery backup. Counter shall feature an LCD display that indicates to the user how many surges have occurred at that location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 +/- 20 amps occurs. A reset button shall be standard, allowing the surge counter to be zeroed out. The reset button shall be configured to prevent an accidental resetting via a single, short-duration button press. The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is interrupted, the ongoing surge count will be stored in the memory and displayed upon power restoration. The surge counter’s memory shall not require a backup battery in order to achieve this functionality.

# EXECUTION

## FACTORY TESTING

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

## INSTALLATION

### The SPD shall be factory installed integral to the distribution equipment wheren applicable. The Contractor shall install all distribution equipment per the manufacturer’s recommendations, applicable electrical codes and the contract drawings.

## WARRANTY

### The manufacturer shall provide a ten (10) year warranty that covers replacement of the complete unit, including from lightning surges, starting from the date of shipment against any SPD part failure when installed in compliance with the manufacturer’s written instructions and any applicable national or local electrical code.

END OF SECTION 264313