1. GENERAL

1.01 SUMMARY

.1 Section Includes

.1 These specifications describe pertinent material requirements and installation practices for externally mounted, Low Voltage AC Power Panel Surge Protective Devices (SPDs). Furnish and install the SPDs equipment having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract drawings.

.2 The specifications in this section describe the electrical and mechanical requirements for a protection system provided by high-energy Surge Protective Devices. The specified system shall provide effective, high-energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Category A, B, and C environments (as tested by ANSI/IEEE C62).

.2 Applicability

.1 SPDs shall be fully applicable for the purpose of protecting all facility AC electrical circuits from the hazardous effects of transient voltages. These transients may be generated externally by lightning induced energies, utility load factor corrections, and substation switching, or they can be internally generated due to inductive and/or capacitive load switching.

.3 Suitability

.1 SPDs shall be suitable for all service entrance switchboards, panelboards and motor control centres as indicated on the electrical layouts and single line diagrams. Products are to be configured for parallel installation - no series designs shall be considered acceptable. Design products to allow installation as a stand-alone device allowing mounting adjacent to switchboards, panelboards, and motor control centres. Installation is to be accomplished by a qualified electrical contractor.

1.02 RELATED REQUIREMENTS

.1 Section 26 24 13 – Switchboards.

.2 Section 26 24 16 – Panelboards.

.3 Section 26 28 16.02 – Molded Case Circuit Breakers.

1.03 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 269.2-17 – Surge Protective Devices - Type 2 - Permanently Connected.

.2 Institute of Electrical and Electronics Engineers (IEEE):

.1 IEEE C62.41.1-2002 - IEEE Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits.

.2 IEEE C62.41.2-2002 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.

.3 IEEE C62.45-2002, Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.

.4 IEEE C62.62-2010, Standard Test Specifications for Surge Protective Devices.

.5 IEEE 142-2007, Recommended Practice for Grounding of Industrial and Commercial Power Systems - Green Book.

.6 IEEE 1100-2005, Recommended Practice for Powering and Grounding Electronic Equipment - Emerald Book.

.3 National Electrical Manufacturers Association (NEMA):

.1 NEMA LS-1. Document rescinded in entirety August 19, 2009. No replacement document has been issued.

.4 Ontario Building Code and its referenced standards.

.5 Underwriters Laboratories Inc. (UL):

.1 ANSI/UL 1449, (4th Edition), Standard for Safety, Surge Protective Devices.

.2 UL 1283 (4th Edition) - 2005, Standard for Electromagnetic Interference Filters.

.6 Other relevant standards:

.1 MIL-STD-220C, Method of Insertion-Loss Measurement.

1.04 DEFINITIONS

.1 Surge Protective Device: A device composed of at least one non-linear component and intended for limiting surge voltages on equipment by diverting or limiting surge current and is capable of repeating these functions as specified. SPDs were previously known as Transient Voltage Surge Suppressors (TVSS) or secondary surge arresters.

.2 SPD Types:

.1 Type 1 – Permanently connected device installed before or after the service disconnect overcurrent device and intended to be installed with no external overcurrent protective device.

.2 Type 2 – Permanently connected Type 2 SPDs are 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 use SPDs that are installed with a minimum of 30 feet of conductor length from the service panel. These 30 feet of conductor length does not include conductors used to attach the SPD. Some examples of Type 3 SPDs are cord connected, direct plug-in and receptacle type SPDs.

.4 Type 4 – component assemblies.

.5 Type 5 – components.

.3 L-G: measurements from phase to equipment grounding conductor as line terminals of utilization equipment.

.4 L-L: measurements from phase to phase in a polyphase system, or from one line to another line in a single-phase system.

.5 L-N: measurement from phase(s) to neutral for both single and three phase systems.

.6 N-G: measurements from neutral to equipment grounding conductor at line terminal of utilization equipment.

.7 Externally mounted SPD: Surge Protective Device (SPD) mounted outside of the power panel as a separate component.

1.05 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Shop Drawings:

.1 Line drawings or catalog sheets detailing dimensions and weight of enclosure, lifting and support points, and enclosure details.

.2 Internal wiring diagram illustrating all modes of protection in each type of SPD required.

.3 Wiring diagram showing all field connections and manufacturer's recommended wire size, recommended circuit breaker or fuse size, required overcurrent protection type, and maximum lead length.

.3 Provide the following product data:

.1 Voltage Protection Ratings (VPRs), I-nominal ratings, Short Circuit Current Ratings, SPD type designations, dimensions showing construction, per mode and per phase peak surge current, modes of discrete suppression circuitry, warranty period, and replacement terms.

.2 List and detail all protection systems such as fuses, disconnecting means, and protective features.

.4 Submit product data for all components and accessories.

.5 Manufacturer's Installation Instructions:

.1 Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

.2 Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

.6 Test reports:

.1 Submit cover sheet of test report from a recognized independent testing laboratory certifying compliance with CSA C22.2 No. 269.2.

.2 Provide verification that the SPD complies with CSA C22.2 No. 269.2.

.3 Provide spectrum analysis of each unit based on MIL-STD-220C test procedures between 10 kHz and 100 kHz verifying the devices noise attenuation equals or exceeds values indicated in this section.

.4 Documentation verifying Short Circuit Current Rating (SCCR).

.5 Proof of UL 1283 listing for EMI filters.

.7 Upon request, present unencapsulated but complete SPD for visual inspection; proprietary technology included. MOV type and quantity shall

reflect kA ratings on cut sheets, verification of monitoring, thermal, overcurrent protection, etc.

.8 Include the following information:

.1 Data for each suppressor type indicating conductor sizes, conductor types, and connection configuration and lead lengths.

.2 Manufacturer's certified test data indicating the ability of the product to meet or exceed requirements of this specification.

.3 Drawings, with dimensions, indicating SPD mounting arrangement and lead length configuration, and mounting arrangement of any optional remote diagnostic equipment and assemblies.

.4 List and detail all protection systems such as fuses, disconnecting means and protective materials.

.5 Indicate SPD wiring, bonding, and grounding connections on wiring diagrams for each system. Include installation details demonstrating mechanical and electrical connections to equipment to be protected.

.6 Wiring diagram of SPD diagnostic indicators.

1.06 CLOSEOUT SUBMITTALS

.1 Maintenance data: submit operation and maintenance data, and engineering data for incorporation into manual specified in Section 01 78 00.

.2 Warranty document.

1.07 ENVIRONMENTAL REQUIREMENTS

.1 Operating temperature range: -40 degrees C to 70 degrees C (-40 degrees F to 160 degrees F).

.2 Elevation: Operation up to 3 658 m (12 000 feet) above sea level.

.3 Generate no appreciable magnetic fields.

1.08 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle in accordance with Section 01 61 00.

.2 Store materials in dry, secure location and protect from weather.

.3 Protect from moisture and humidity.

.4 Store in accordance with manufacturer's written instructions.

.5 Waste management and disposal in accordance with Section 01 74 00.

1.09 MANUFACTURER WARRANTY

.1 Five-year warranty.

.2 Since "Acts of Nature" or similar statements typically include the threat of lightning to which the SPD shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this section. This is, the warranty shall cover the effects of lightning, single phasing, and all other electrical anomalies. The warranty shall cover the entire device, not just various components, such as modules only.

1.10 MANUFACTURER QUALIFICATIONS

.1 Manufacturer regularly engaged in the design, manufacturing and testing of SPD's of the types and ratings required for a period of not less than five years. Manufacturers requesting product approval must meet or exceed the written specification contained herein. Manufacturers requesting approval must receive written verification of product acceptance by the Consultant ten days prior to the bid date.

1.11 QUALITY ASSURANCE

.1 All SPDs manufactured by a single ISO 9001 registered company normally engaged in the design, development, and manufacture of such devices for electrical and electronic system equipment protection.

.2 Manufacturer regularly engaged in the manufacture of surge suppression products for the specified categories for minimum of ten years.

.3 Manufacturer shall offer repair or replacement service for all materials and components incorporated in the Surge Protective Devices.

.4 Technical assistance (no cost to customer) provided by manufacturer through a factory representative or a local distributor and a factory staffed toll-free technical hotline.

.5 Manufacturer shall provide a toll-free customer service phone number to facilitate all inquiries regarding product returns, warranty claims, purchasing requirements and payment or credit issues.

.6 Listed to most recent edition of CSA C22.2 No. 269.2.

.7 Products certified by a recognized testing agency accredited by the Standards Council of Canada, and bear a certification mark from that agency indicating acceptance to Canadian standards.

.1 Equipment certification by one of the following bodies:

.1 Listed by Underwriters Laboratories, Inc. and exhibit the cUL Listing Mark for the category "Surge Protective Devices" or SPD. Provide UL Listing Card under category VZCA7 (SPDs certified for Canada) to confirm compliance to CSA C22.2 No. 269.2, and assigned Voltage Protection Ratings.

.2 Listed by ETL.

.3 Certified by CSA Group.

.2 SPD to be labeled with no less than a 100 kA Short Circuit Current Rating (SCCR).

2. PRODUCTS

2.01 OUTDATED AND DEFUNCT SPECIFICATION CRITERIA

.1 Selection of SPD is not be made, solely, or in part, based upon any of the following ambiguous specifications, and obsolete terminology. These terms are no longer recognized by ANSI, NEMA, IEEE, or IEC standards as bonafide suppressor performance parameters. Submittals bearing reference to any of the following will be rejected.

.1 A1 ringwave: removed in 2002 revisions of IEEE C62 documents.

.2 Joule ratings: there is no recognized standard for SPD joule ratings.

.3 NEMA LS-1: document rescinded by NEMA.

.4 Response time: not endorsed by IEEE, NEMA, or UL as a valid SPD rating parameter.

.5 Suppressed Voltage Ratings (SVR): terminology deprecated with UL 1449 third and subsequent editions.

2.02 MANUFACTURERS

.1 Manufacturer List

.1 Asco.

.2 Citel.

.3 Current Technology.

.4 [Eaton.]

.5 Mersen.

.6 Raycap Electrical Protection Systems.

.7 [Siemens.]

.8 [Total Protection Solutions.]

.2 Substitution Limitations: No unit will be accepted as an "approved equal" unless it meets the warranty, strength, safety features, performance ratings, and all other requirements of this specification.

.3 Product Options:

.1 The inclusion of a manufacturer in the following list does not indicate the manufacturer meets all the requirements in this specification. Likewise, the omission of a manufacturer is not indicative of any lack of qualification. The manufacturer and product must meet all the requirements of this specification.

.2 The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Consultant ten (10) days prior to bid date.

2.03 SURGE PROTECTION DEVICES – GENERAL

.1 Obtain all surge suppression devices through one source from a single manufacturer.

.2 SPD separate from panelboards. Integral SPDs not acceptable.

.3 The SPD listed by recognized testing agency accredited by the Standards Council of Canada, and bear a certification mark from that agency indicating acceptance to Canadian standards, and to UL's 1283 and UL's 1449 standards (latest edition, latest revision), and not merely the components or modules. Label all SPDs as a Type 2 for use in Type 1 and Type 2 locations.

.4 Protect all modes L-G, L-N, L-L, and N-G, have discrete suppression circuitry in L-G, L-N, and N-G, and have bidirectional, positive, and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only four modes are not acceptable. In delta systems, line-to-ground-to-line protection is not acceptable where line-to-line is specified.

.5 If a disconnect switch is specified, the disconnect switch and the SPD as a system shall be capable of interrupting up to a minimum 100 kA symmetrical fault current with 600 VAC applied.

.6 Suppression Components:

.1 Metal Oxide Varistors (MOVs).

.2 Gas tubes, silicon avalanche diodes, or selenium cells: not permitted.

.3 Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls, such as through the use of Thermally Protected MOVs (TPMOVs).

.4 Where SPD is not equipped with overtemperature controls, pack all surge components, current carrying paths and fusing in fuse grade silica sand or epoxy potting for arc quenching capability, minimization of smoke and contaminates in the event of failure.

.7 Internal Fusing - Overcurrent Protection

.1 Individually fuse each suppression component for safety and performance.

.2 Fusing shall be present in every mode, including Neutral-to-Ground.

.3 All overcurrent protection must be included within the device, and not require external overcurrent protection.

.8 Surge Current Rating

.1 Service Entrance: 200 kA per phase.

.2 Distribution: 100 kA to 200 kA per phase.

.3 Point of Use: 100 kA per phase.

.9 Short Circuit Current Rating (SCCR), sometimes referred to as fault current rating: minimum 100 kA.

.10 Nominal Discharge Current (In, or I-nominal):

.1 UL labelled with a minimum 10 kA I-nominal.

.11 Maximum Continuous Operating Voltage (MCOV): The maximum continuous operating voltage (MCOV) of all components not less than 125 per cent for a 120 V system, 120 per cent for 220 and 240 V systems, and 115 per cent for 347 and 600 V systems.

.1 277 V systems: 320 V MCOV.

.2 480 V systems: 552 V MCOV.

.12 Voltage Protection Ratings (VPRs) to not exceed the following:

Voltage	L-N	L-G	N-G
208Y/120	800 V	800 V	800 V
480Y/277	1200 V	1200 V	1200 V
600Y/347	1500 V	1500 V	1500 V
Voltage	L-L	L-G	
480 Delta	1800 V	1800 V	
600 Delta	2500 V	2500 V	

.13 Minimum EMI/RFI filtering of -50 dB at 100 kHz.

.14 SPD enclosure:

.1 Minimum NEMA type 12 rating in indoor applications.

.2 Minimum NEMA type 4 in outdoor applications.

.15 Diagnostics and Monitoring:

.1 Visual LED diagnostics to indicate failure of a suppression component. Monitor every suppression component of every mode, including N-G.

.2 Form C dry contacts (NO or NC) for remote monitoring capability to indicate the failure of any MOV in the unit.

.3 Surge event counter with backup power source.

2.04 SERVICE ENTRANCE AND TRANSFER SWITCH SPDS

.1 CSA certified and labeled as a Type 2 device.

.2 SPDs relying on an external breaker or fuse as supplemental overcurrent protection do not meet the intent of this specification and will be rejected.

.3 CSA certified listed and labeled with a minimum I-nominal rating of 20 kA.

.4 An approved disconnect switch provided as a means of service disconnect if a 60 A breaker is not available.

.5 Connect SPD using the manufacturer's breaker/wire recommendations. If recommendations are not available, use a 60 amp breaker and 6 AWG cable with full size ground.

.6 Minimum Surge Current Rating: 200 kA per phase (100 kA per mode).

2.05 DISTRIBUTION PANELBOARD AND MOTOR CONTROL CENTRE SPDS

.1 CSA certified listed and labeled as a Type 2 device.

.2 SPDs relying on an external breaker or fuse as supplemental overcurrent protection do not meet the intent of this specification and will be rejected.

.3 CSA certified listed and labeled with a minimum I-nominal rating of 20 kA.

.4 SPD connected using the manufacturer's breaker/wire recommendations. If recommendations are not available a 60 A breaker and 6 AWG with full size ground will be used.

.5 Minimum Surge Current Rating: 100 kA per phase (50 kA per mode).

2.06 LIGHTING AND RECEPTACLE BRANCH CIRCUIT PANELBOARD SPDS

.1 CSA certified listed and labeled as a Type 2 device.

.2 SPDs relying on an external breaker or fuse as supplemental overcurrent protection do not meet the intent of this specification and will be rejected.

.3 CSA certified listed and labeled with a minimum I-nominal rating of 10 kA.

.4 SPD connected using the manufacturer's breaker/wire recommendations. If recommendations are not available a 60 A breaker and 6 AWG will be used.

.5 Minimum Surge Current Rating: 100 kA per phase (50 kA per mode).

3. EXECUTION

3.01 PRE-INSTALLATION MEETINGS

.1 Pre-installation meetings: conduct pre-installation meeting one week prior to commencing work of this Section and on-site installations to verify project requirements, substrate conditions and co-ordination with other building sub-trades, to review manufacturer's installation instructions and warranty requirements.

3.02 FIELD QUALITY CONTROL

.1 Have manufacturer of products supplied under this Section review Work involved in the handling, installation, application, protection, and cleaning of its products. Submit written reports in acceptable format to verify compliance of Work with Contract in accordance with Section 01 33 00 and Section 01 78 00.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits to review work at stages listed:

.1 After delivery and storage of products, and when preparatory work on which the work of this Section depends is complete, but before installation begins.

.2 Twice during progress of work at 66 per cent and 99 per cent complete.

.3 Upon completion of the work, after cleaning is carried out.

.4 Obtain reports within three (3) days of review and submit immediately to the Consultant.

3.03 EXAMINATION

.1 Verify service and separately derived system Neutral to Ground bonding jumpers.

3.04 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1, CSA C22.2 No. 0, ANSI/IEEE C62.41, and all other applicable codes.

.2 Manufacturer's instructions:

.1 Install SPD in accordance with manufacturer's installation instructions with lead lengths as short and as straight as practically possible. Lead lengths no greater than 600 mm (24 inches). Gently twist conductors together.

.2 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage, and installation instructions.

.3 Connect SPD to service panel being protected via a circuit breaker for each phase, based on the number of poles and the connecting wire size, with a 100 A maximum.

.4 Follow the SPD manufacturer's recommended installation practice as outlined in the equipment installation manual. Ensure that all neutral conductors are bonded to the system ground at the service entrance or the serving isolation transformer prior to installation of the associated SPD.

.5 Installation position of SPD:

.1 Locate SPD adjacent to the panelboard, in a position as close as possible to the neutral and ground lugs. Rearrange breaker positions for SPDs to minimize the length of the phase, neutral, and ground conductors.

.2 Mount SPD as close as possible to panel being protected in a position that will minimize lead lengths between suppressor and control breaker(s) to which suppressor connects. Utilize conduit, preferably metallic, to accomplish these connections with a recommended minimum wire size of 10 AWG, a maximum wire size of 4 AWG (for ease of dressing), or as noted on the single line diagram. Do not extend suppressor leads beyond manufacturer's recommended maximum length without specific engineering approval. The rationale for this is the longer connecting leads between the SPD and the power panel, the higher the residual transient voltage.

.3 Locate surge suppressors as indicated and mount securely, plumb, true, and square to adjoining surfaces.

.4 Install surface mounted surge suppressors on fire-retardant plywood backboards as recommended in manufacturer's written instructions. Where practical, group SPDs on common backboard with other equipment.

.5 Mount housings and enclosures on fire-retardant plywood backboard with top not higher than 1.8 m (6 feet) above finished floor.

.6 Wiring:

.1 Install units on a breaker, sized, where indicated, that meets or exceeds the fault current rating of the switchgear or panelboard.

.2 Connect SPD to service panel being protected via a circuit breaker for each phase, based on the number of poles and the connecting wire size. Connect SPD using the manufacturer’s breaker/wire recommendations.

.1 If recommendations are not available, a 60 A breaker and 6 AWG phase, neutral, and ground conductors will be used.

.2 If the SPD is supplied with lead wires, match the overcurrent protection to the 75 degree C ampacity of the wiring as described in Ontario Electrical Safety Code, Table 2; i.e. a 30 A breaker to suit 10 AWG lead wires.

.3 Install SPD in a neat, workmanlike manner. Dress leads as short and as straight as possible and be consistent with recommended

industry practices for the application on which these units are installed. Bind phase, neutral, and ground conductors tightly (one twist per 30 cm) over entire run, from suppressor to service panel, and always use the shortest length of connecting cable possible.

.4 If the SPD is supplied by the manufacturer with lead wires, cut excess lead length.

End of Section