

**READ THIS FIRST**

Notice to the Design Engineer, this document is part of Facilities and Infrastructure standards for Electrical Systems. Designers are advised to NOT use this template (\*.doc) document as part of any project contract documents. Designers shall use the Port of Seattle MasterSpec specifications from the following link:

**<https://www.portseattle.org/page/guide-specifications>.**

Designers shall edit the corresponding Port's MasterSpec specification to meet the F&I Electrical Standard outlined in this specification. Note that Port's MasterSpec specifications contain specifications and languages for both Aviation and Maritime Divisions. F&I Standards are strictly for Aviation Division, and any Maritime related specs or languages should be removed from the project specifications.

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY AND NOTES TO DESIGNER**

- A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment, specifically designed and manufactured to protect sensitive equipment from harmful transient voltages which may cause failure of solid-state components or corruption of digital data.
- B. This equipment shall be installed between all probable voltage transient sources and voltage sensitive equipment such as computers, microprocessor based and other electronic equipment. In general, this applies to service equipment and branch circuit distribution equipment including panelboards. Motor control centers require SPD protection when they contain voltage sensitive equipment such as Programmable Logic Controllers and Variable Frequency Drives.
- C. Two stage coordinated SPD protection is acceptable when the same manufacturer provides all SPD equipment and sufficient technical data is available to determine effectiveness of the installed system.
- D. Surge current ratings for SPDs listed in Part 2 are standard, but higher surge current ratings may be required based on engineering considerations.
- E. Related Requirements:
  - 1. Section 262413 "Switchboards" for factory-installed SPDs.
  - 2. Section 262416 "Panelboards" for factory-installed SPDs.

**1.3 DEFINITIONS**

- A. Inominal: Nominal discharge current.
- B. MCOV: Maximum continuous operating voltage.
- C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.
- D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.
- E. OCPD: Overcurrent protective device.
- F. SCCR: Short-circuit current rating.
- G. SPD: Surge protective device.
- H. VPR: Voltage protection rating.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  - 2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.
- B. Sample Warranty: For manufacturer's special warranty.

**1.6 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For SPDs to include in maintenance manuals.

**1.7 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

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**PART 2 - PRODUCTS**

**2.1 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.
- B. Comply with NFPA 70.
- C. Comply with NFPA 75.
- D. Comply with UL 1449 "Surge Protective Devices".
- E. Comply with UL 1283 "Electromagnetic Interference Filters".
- F. ANSI/IEEE Standard C62.41 and C62.45.
- G. MCOV of the SPD shall be the nominal system voltage.
- H. Surge Suppressors shall comply with the following:
  - 1. Parallel configuration.
  - 2. Electrochemical heat sink encapsulated.
  - 3. Provide LED indicator lights
  - 4. Provide alarm contacts for remote indication.
  - 5. Enclosure shall be steel.
  - 6. Type 2 or better, sized appropriately for MCOV.
  - 7. For Distribution and Main Service Panels: Provide threshold suppression network filtering, and voltage envelope clamping.
  - 8. For Branch Panels and Sub-Panels feeding Electronics: Provide active tracking on ringwave transients.
  - 9. Visual annunciators shall continuously indicate normal and abnormal operation of TVSS equipment.
  - 10. A means shall be provided to electrically disconnect the SPD from the equipment being protected for service and repair. Fuses or circuit breakers may be used to accomplish this.
  - 11. Where possible, SPD units shall be integrated inside equipment. Integration is particularly desirable in distribution panels and main service switchboards.

**2.2 SERVICE ENTRANCE SUPPRESSOR**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
  - 1. EATON/Innovative Technology.
  - 2. Thomas and Betts/Current Technology.
  - 3. Square D.
  - 4. Morris Tech.

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- B. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 2 or better.
  - 1. SPDs with the following features and accessories:
    - a. Indicator light display for protection status.
    - b. Reversible Form-C contacts, one normally open and one normally closed, for remote monitoring of protection status. Provide at main breakers and tie breakers.
    - c. Surge counter.
- C. Comply with UL 1283.
- D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 160 kA minimum for first stage of protection, 80kA minimum for second stage of protection. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:
  - 1. Line to Neutral: 1000 V for 480Y/277 V.
  - 2. Line to Ground: 1000 V for 480Y/277 V.
  - 3. Line to Line: 1800 V for 480Y/277 V.
- F. Dedicated components are required for each mode. Reduced or partial mode designs are not acceptable.
- G. SCCR: Equal or exceed 200 kA.
- H. Inominal Rating: 20 kA.

**2.3 DISTRIBUTION SUPPRESSOR**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
  - 1. EATON/Innovative Technology.
  - 2. Thomas and Betts/Current Technology.
  - 3. Square D.
  - 4. Morris Tech.
- B. SPDs: Comply with UL 1449, Type 2 or better.
  - 1. SPDs with the following features and accessories:
    - a. Include LED indicator lights for power and protection status.
    - b. Reversible Form-C contacts, one normally open and one normally closed, for remote monitoring of protection status. Provide at main breaker.
- C. Comply with UL 1283.

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- D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA minimum for first stage of protection, 80kA minimum for second stage of protection. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:
  - 1. Line to Neutral: 1000 V for 480Y/277 V.
  - 2. Line to Ground: 1000 V for 480Y/277 V.
  - 3. Line to Line: 1800 V for 480Y/277 V.
- F. Dedicated components are required for each mode. Reduced or partial mode designs are not acceptable.
- G. SCCR: Equal or exceed 200 kA.
- H. Inominal Rating: 20 kA.

**2.4 PANEL SUPPRESSORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. EATON Innovative Technology.
  - 2. Thomas and Betts/Current Technology.
  - 3. Square D.
  - 4. Morris Tech
- B. SPDs: Comply with UL 1449, Type 2 or better.
  - 1. SPDs with the following features and accessories:
    - a. Include LED indicator lights for power and protection status.
    - b. Reversible Form-C contacts, one normally open and one normally closed, for remote monitoring of protection status. Provide at main breaker.
- C. Comply with UL 1283.
- D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V and 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
  - 1. Line to Neutral: 1000 V for 480Y/277 V, 700 V for 208Y/120 V.
  - 2. Line to Ground: 1000 V for 480Y/277 V, 700 V for 208Y/120 V.
  - 3. Neutral to Ground: 1000 V for 480Y/277 V, 700 V for 208Y/120 V.
  - 4. Line to Line: 1800 V for 480Y/277 V, 1200 V for 208Y/120 V

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- F. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:
  - 1. Line to Neutral: 700 V.
  - 2. Line to Ground: 700 V.
  - 3. Neutral to Ground: 700 V.
  - 4. Line to Line: 1200 V.
- G. Dedicated components are required for each mode. Reduced or partial mode designs are not acceptable.
- H. SCCR: Equal or exceed 100 kA.
- I. Inominal Rating: 20 kA.

**2.5 ENCLOSURES**

- A. NEMA 250, Type 1 OR 12.

**2.6 CONDUCTORS AND CABLES**

- A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

**PART 3 - INSTALLATION**

**3.1 TVSS INSTALLATION**

- A. Comply with NECA 1.
- B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.
- C. Preferred method is to provide factory installed SPD equipment integral with switchboards, distribution panelboards and motor control centers where practical.
- D. 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

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manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground. Lead lengths shall be limited as follows:

1. Branch circuit panels: 12 inches maximum.
  2. Distribution Panels: 24 inches maximum.
  3. Main Service Panels: 36 inches maximum.
  4. Where manufacturer's recommended lead lengths are shorter than those listed above, manufacturers recommendations shall be followed.
- E. Surge arrestor grounds shall be connected as close as possible to the ground terminals of the apparatus to be protected and have as short and direct path to earth as practical. Arrestor leads shall be free of sharp bends.
- F. Use crimped connectors and splices only. Wire nuts are unacceptable.
- G. Wiring:
1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
  2. Controls: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

**3.2 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
1. Compare equipment nameplate data for compliance with Drawings and Specifications.
  2. Inspect anchorage, alignment, grounding, and clearances.
  3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
  4. Verify low impedance ground path consistent with principles set forth in IEEE Standard 1100 (Emerald Book).
- B. An SPD will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

**3.3 STARTUP SERVICE**

- A. Complete startup checks according to manufacturer's written instructions.
- B. 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.
- C. Energize SPDs after power system has been energized, stabilized, and tested.

**3.4 DEMONSTRATION**

- A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 264313