

CPS Control Rev: 1_02/28/06
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SECTION 16289 - TRANSIENT VOLTAGE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. All Sections of Division 15 and 16 apply to this Section.

1.2 SUMMARY

- A. This Section includes TVSSs for low-voltage power, control, and communication equipment.

1.3 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. SVR: Suppressed voltage rating.
- C. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.
- B. Product Certificates: For transient voltage suppression devices, signed by product manufacturer certifying compliance with the following standards:
 - 1. UL 1283.
 - 2. UL 1449.
- C. Field quality-control test reports, including the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Failed test results and corrective action taken to achieve requirements.

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- D. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals.
- E. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in City of Chicago Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with City of Chicago Electrical Code.
- E. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."
- F. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."
- G. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449, "Transient Voltage Surge Suppressors."
- H. Permanently affix surge ratings to the unit.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver TVSS devices in original factory shipping cartons.
- B. Handle TVSS devices to avoid damage.
- C. Store TVSS devices indoors in clean, dry space with uniform temperature to prevent condensation. Protect TVSS devices from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- D. Do not store TVSS devices in areas subject to weather. Remove loose packing and flammable materials; install electric heating of sufficient wattage to prevent condensation.

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1.7 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect and Owner's representative not less than seven days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's and Owner's representative written permission.
- B. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 - 2. Operating Temperature: 30 to 120 deg F .
 - 3. Humidity: 0 to 85 percent, non-condensing.
 - 4. Altitude: Less than 20,000 feet above sea level.

1.8 COORDINATION

- A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

1.9 EXTRA MATERIALS

- A. Replaceable Protection Modules: One of each size and type installed.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within five years from date of Substantial Completion.
- B. Special Warranty for Cord-Connected, Plug-in Surge Suppressors: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic equipment connected to circuits protected by surge suppressors.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
1. Current Technology, Inc.
 2. Cutler-Hammer, Inc.; Eaton Corporation.
 3. General Electric, Inc.
 4. Liebert Corporation; a division of Emerson.
 5. Square D; Schneider Electric.

2.2 GENERAL

- A. Environmental Conditions:
1. Operating Temperature: -40 to +50C.
 2. Relative Humidity: 0% to 95% non-condensing relative humidity.
 3. Altitude: Up to 14,000 feet above sea level.
- B. Maximum Continuous Operating Voltage (MCOV): Greater than 115% of the nominal system operating voltage to ensure the ability of the system to withstand temporary RMS overvoltage (swell) conditions.
- C. Operating Frequency: 47 to 63 Hertz.
- D. Overcurrent Protection (Fusing): All protection modes (including Neutral to Ground) of the TVSS shall be internally fused at the component level with the fuses I²T capability to allow the suppressor's maximum rated transient current to pass through the suppressor without fuse operation. If the rated I²T characteristic of the fusing is exceeded, the fusing shall be capable of opening in less than one millisecond and clear both high and low impedance fault conditions. This overcurrent protection circuit shall be monitored and provide indication of suppression failure/operability. Conductor level fuses or circuit breaker internal or external to the TVSS shall not be acceptable.
- E. Accessories:
1. Status Indicators. Integral status circuit to monitor the operational status of all modes of protection, including Line to Neutral, Line to Ground and Neutral to Ground. No manual testing is required to confirm the integrity of the suppression and filter systems. If the unit does fail, the green LED will go out and the red LED will be lit.
 2. Dry Contacts for remote monitoring. Electrically isolated Form C dry contacts, one normally open and one normally closed set standard on all units for remote monitoring.
 3. Under voltage detection: Seventy percent (70%) under voltage detection capability.

4. Phase Loss Monitoring. Unit shall be equipped with power loss monitoring.
5. Audible Alarm. Activated when any one or more of the surge current diversion components has failed. An alarm enable/disable/test switch shall be provided. The audible alarm and switch shall be located on the unit's hinged front cover.

2.3 SERVICE ENTRANCE SUPPRESSORS

- A. Surge Protection Device Description: Solid state metal oxide varistor suppression modules. No series connected suppression components are allowed.
- B. Modular design with field-replaceable individually fused modules, sine-wave-tracking type with the following features and accessories:
 1. Fuses, rated at 200-kA interrupting capacity.
 2. Fabrication using bolted compression lugs for internal wiring.
 3. Integral disconnect switch.
 4. Redundant suppression circuits.
 5. Redundant replaceable modules.
 6. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
 7. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 8. LED indicator lights for power and protection status.
 9. Audible alarm, with silencing switch, to indicate when protection has failed.
 10. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
 11. Surge-event operations counter.
- C. Peak Single-Impulse Surge Current Rating 320 kA per mode minimum.
- D. All primary transient path wiring shall be of copper minimum size as required by the manufacturer but not less than #2AWG, or via bus bar of equivalent capacity to provide equal impedance interconnection between phases. No plug-in modules, components or printed circuit boards shall be used in surge carrying path. Primary transient path wiring shall be sized per manufacturer's requirements.
- E. Connection Means: Permanently wired.
- F. For distribution panels 400 Amps and larger:
 1. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of **[480Y/277] [208Y/120]** , 3-phase, 4-wire circuits shall be as follows:
 - a. Line to Neutral: **[800 V for 480Y/277] [400 V for 208Y/120]** .
 - b. Line to Ground: **[800 V for 480Y/277] [400 V for 208Y/120]**.
 - c. Neutral to Ground: **[800 V for 480Y/277] [400 V for 208Y/120]**.

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2. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
 - a. Line to Neutral: 400 V.
 - b. Line to Ground: 400 V.
 - c. Neutral to Ground: 400 V.
3. Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
 - a. Line to Neutral: 400 V, 800 V from high leg.
 - b. Line to Ground: 400 V.
 - c. Neutral to Ground: 400 V.
4. Protection modes and UL 1449 SVR for voltages of 240, 480, or 600, 3-phase, 3-wire, delta circuits shall be as follows:
 - a. Line to Line: **[2000 V for 480 V] [1000 V for 240 V]**.
 - b. Line to Ground: **[2000 V for 480 V] [1000 V for 240 V]**.

2.4 PANELBOARD SUPPRESSORS

- A. Surge Protection Device Description: Modular design with field-replaceable modules, sign-wave-tracking type with the following features and accessories:
 1. Fuses, rated at 200-kA interrupting capacity.
 2. Fabrication using bolted compression lugs for internal wiring.
 3. Integral disconnect switch.
 4. Redundant suppression circuits.
 5. Redundant replaceable modules.
 6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 7. LED indicator lights for power and protection status.
 8. Audible alarm, with silencing switch, to indicate when protection has failed.
 9. One set of dry contacts rated at 5 A and 250-V, ac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
 10. Surge-event operations counter.
- B. Provide externally mounted TVSS devices.
- C. Peak Single-Impulse Surge Current Rating: 160 kA per phase.
- D. For panels less than 400A:
 1. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of **[480Y/277] [208Y/120]**, 3-phase, 4-wire circuits shall be as follows:
 - a. Line to Neutral: **[800 V for 480Y/277] [400 V for 208Y/120]**.
 - b. Line to Ground: **[800 V for 480Y/277] [400 V for 208Y/120]**.
 - c. Neutral to Ground: **[800 V for 480Y/277] [400 V for 208Y/120]**.

2. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
 - a. Line to Neutral: 400 V.
 - b. Line to Ground: 400 V.
 - c. Neutral to Ground: 400 V.
 3. Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
 - a. Line to Neutral: 400 V, 800 V from high leg.
 - b. Line to Ground: 400 V.
 - c. Neutral to Ground: 400 V.
 4. Protection modes and UL 1449 SVR for voltages of 240, or 480, , 3-phase, 3-wire, delta circuits shall be as follows:
 - a. Line to Line: **[2000 V for 480 V] [1000 V for 240 V]**
 - b. Line to Ground: **[1500 V for 480 V] [800 V for 240 V]**
- E. Equipment shall be multi-stage parallel protector rated for noted VAC. Minimum surge capacity shall be 200 kA per phase.
- F. The system protection modules shall contain an array of metal oxide varistors (MOV). The TVSS shall be listed in accordance with UL 1449 Second Edition to include Section 37.3 highest Short Circuit Current rating (SCCR) of 200 kA.
- G. Each protection mode shall have a minimum surge current rating of 80kA per mode.
- H. All primary transient path wiring shall be of a #6 AWG copper minimum or via bus bar of equivalent capacity to provide equal impedance interconnection between phased. No plug-in modules, components, or printed circuit boards shall be in use in surge carrying paths.
- I. Provide visible status indicator mounted on the front of the panel or a glass window shall be installed on the enclosing cabinet to make indicators on the modules visible.

2.5 PLUG-IN SURGE SUPPRESSORS

- A. Description: Non-modular, plug-in suppressors with at least four 15-A, 120-V ac, NEMA WD 6, Configuration 15-15R receptacles, suitable to plug into a NEMA WD 6, Configuration 15-15R receptacle; with the following features and accessories:
1. LED indicator lights for power and protection status.
 2. LED indicator lights for reverse polarity and open outlet ground.
 3. Circuit breaker and thermal fusing. When protection is lost, circuit opens and cannot be reset.
 4. Close-coupled direct plug-in.
 5. Rocker-type on-off switch, illuminated when in the on position.

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6. One RJ11/12C telephone line protector, suitable for modem connection. Maximum clamping voltage 220 peak on pins No. 3 and No. 4.
- B. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
- C. Protection modes and UL 1449 SVR shall be as follows:
 1. Line to Neutral: 475 V.
 2. Line to Ground: 475 V.
 3. Neutral to Ground: 475 V.

2.6 ENCLOSURES

- A. NEMA 250, with type matching the enclosure of panel or device being protected.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

- A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.
- B. Install devices for panel board and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
- C. Examine conditions for compliance with requirements for installation tolerances, power characteristics and other conditions affecting performance of the TVSS device. Do not proceed until unsatisfactory conditions have been corrected.
 1. Provide multipole, [30] [60] [100]-A circuit breaker as a dedicated disconnect for suppressor, unless otherwise indicated.

3.2 CONNECTIONS

- A. Device shall be installed without extending manufacturer's wire lengths.
- B. External mount TVSS shall be installed with less than 18" of lead length from the panels. Installation of leads shall avoid sharp and unnecessary bends. Where TVSS cannot be mounted within 18" of the panel, an internal TVSS mounting shall be utilized. Terminals shall be provided for all necessary power and ground connections.
- C. Installation shall be in accordance with the NEC (280 & 285) and City of Chicago Electrical Code.

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- D. System shall not require removal and replacement for warranty and/or other repairs. All internal component replacements shall be capable of being completed by a licensed electrician.
- E. Ground each transient voltage surge suppressor enclosure.
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 PLACING SYSTEM INTO SERVICE

- A. Do not energize or connect service entrance equipment, panel boards, control terminals or data terminals to their sources until surge protection devices are installed and connected.

3.4 CLEANING

- A. Remove paint splatters and other spots, dirt and debris. Touch up scratches and mars of finish to match original finish.
- B. Clean devices internally using methods and materials recommended by the manufacturer.
- C. Do not use compressed air for cleaning.

3.5 CONTRACTOR START UP AND REPORTING

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect equipment installation, including connections, and to assist in field testing. Report results in writing.
 - 1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. Testing: Perform the following field tests and inspections and prepare test reports:
 - 1. After installing surge protection devices, but before electrical circuitry has been energized, test for compliance with requirements.
 - 2. Complete startup checks according to manufacturer's written instructions.
 - 3. 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.
- C. Remove and replace malfunctioning units and retest as specified above.

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- D. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage suppression devices. Refer to Division 1 Sections "Closeout Procedures" and "Demonstration and Training."

3.6 COMMISSIONING AND DEMONSTRATION – NOT APPLICABLE

END OF SECTION 16289