# SECTION 26 43 13
# TRANSIENT VOLTAGE SURGE SUPPRESSION

## PART 1 - GENERAL

### 1.1 DESCRIPTION

A. This Section describes the materials and installation requirements for Transient Voltage Surge Suppressors (TVSS), also referred to as a Surge Protective Devices (SPD). These devices are used to protect sensitive electronics from the effects of lightning-induced transients, substation switching transients and internally generated transients resulting from inductive and/or capacitive load switching.

### 1.2 QUALITY ASSURANCE

A. TVSS manufacturer shall be the same as the switchboards.

### 1.3 REFERENCE STANDARDS

A. The specified system shall be designed, manufactured, tested, and installed in compliance with:
   1. UL – Underwriters Laboratories Inc.
      a. UL 1449 Standard for Surge Protective Devices
      b. UL 1283 Standard for Electromagnetic Interference Filters
   2. IEEE – Institute of Electrical and Electronic Engineers
      a. IEEE C62.41.1-2002 Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits
      b. IEEE C62.41.2-2002 Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits
      c. IEEE C62.45-2002 Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and less) AC Power Circuits
   3. NEC – National Electrical Code
   4. NEMA – National Electrical Manufacturers Association
   5. NFPA – National Fire Protection Association
      a. NFPA 20 Standard for the Installation of Stationary Pumps for Fire Protection
      b. NFPA 70 National Electrical Code
      c. NFPA 75 Standard for the Fire Protection of Information Technology Equipment
      d. NFPA 780 Standard for the Installation of Lightning Protection Systems
   6. Federal Specifications
      a. Federal Information Processing Standards Publications (FIPS PUBS) 94
   7. The individual TVSS units shall be UL Listed under UL 1449 Second Edition (2007) Standard for Transient Voltage Surge Suppression (TVSS) and the surge ratings shall be permanently affixed to the TVSS. The unit shall also be complimentary listed to UL 1283 Standard for EMI/RFI Facility Filters.

### 1.4 SUBMITTALS

A. Product data and manufacturer's installation instructions shall be submitted concurrently with switchboard and panelboard submittals.

B. The submittals shall include:

C. Dimensional drawing of each TVSS type.
   1. Drawings illustrating mounting locations within switchboards and panelboards.

2. UL 1449 Second Edition Listing, Standard for Safety, Transient Voltage Surge Suppressors, documentation.
3. UL 1283 Listing, Electromagnetic Interference Filters, documentation.
4. ANSI/IEEE C62.41 and C62.45, Category C3 (20kV-1.2/50, 10kA-8/20□s waveform) clamping voltage test results.

D. Warranty
1. Provide a full ten-year warranty from date of acceptance by the Owner/Operator against any part failure when installed in compliance with manufacturer's written instructions, UL listing requirements, and any applicable national electrical codes. Make available local field engineering service support. Where direct factory-employed service engineers are not locally available, travel time from the factory or nearest dispatch center shall be indicated.

E. Factory Testing
1. The specified system shall be thoroughly factory tested before shipment.

## PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Eaton SPD Series, Square D/Schneider Electric Surgelogic IMA series, or equal by ABB or Siemens.

2.2 SERVICE ENTRANCE AND DISTRIBUTION EQUIPMENT

A. Internal TVSS
1. TVSS shall be listed in accordance with UL 1449 Second Edition 2007, and UL 1283 Electromagnetic Interference Filters.
2. Integrated surge protective devices (SPD) shall be Component Recognized in accordance with UL 1449 Second Edition, Revision 2/9/2007 Section 37.3 and 37.4 at the standard's highest short circuit current rating (SCCR) of 200 kA, including intermediate level of fault current testing that was effective 2/9/2007.
3. TVSS shall be tested with the ANSI/IEEE Category C High exposure waveform (20kV-1.2/50μs, 10kA-8/20μs).
4. TVSS shall provide suppression for all modes of protection: L-N, L-G, and N-G in WYE systems.
5. The manufacturer of the TVSS shall be the same as the manufacturer of the service entrance and distribution equipment in which the devices are installed and shipped. Also, this distribution equipment shall be fully tested and certified to the following UL standards:

| | | |
|---|---|---|
| UL 67 | = | Panelboards |
| UL 845 | = | Motor Control Centers |
| UL 891 | = | Switchboards |
| UL 1558 | = | Low Voltage Switchgear |

6. Recommended TVSS ratings:
   a. Minimum surge current rating shall be 160 kA per phase (80 kA per mode) for service entrance and 80 kA per phase (40 kA per mode) for distribution applications.
   b. UL 1449 clamping voltage must not exceed the following:

| VOLTAGE | L-N | L-G | N-G |
|---|---|---|---|
| 240/120 | 800/400V | 800/400V | 400V |
| 208Y/120 | 400V | 400V | 400V |
| 480Y/277 | 800V | 800V | 800V |

7. TVSS shall be designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115 percent of nominal RMS voltage.
8. TVSS shall be constructed of one self-contained suppression module per phase.

9. Visible indication of proper TVSS connection and operation shall be provided. The indicator lights shall indicate which phase as well as which module is fully operable. The status of each TVSS module shall be monitored on the front cover of the enclosure as well as on the module. A push-to-test button shall be provided to test each phase indicator. Push-to-test button shall activate a state change of dry contacts for testing purposes.
10. TVSS shall be equipped with an audible alarm which shall activate when any one of the surge current modules has reached an end-of-life condition. An alarm on/off switch shall be provided to silence the alarm. The switches and alarm shall be located on the front cover of the enclosure.
11. A connector shall be provided along with dry contacts (normally open or normally closed) to allow connection to a remote monitor or other system. The output of the dry contacts shall indicate an end-of-life condition for the complete TVSS or module.
12. Terminals shall be provided for necessary power and ground connections.
13. The TVSS shall be equipped the following optional items:
    a. A transient voltage surge counter shall be located on the diagnostic panel on the front cover of the enclosure. The counter shall be equipped with a manual reset and battery back-up to retain memory upon loss of AC power.
    b. A remote monitoring device shall be provided to directly connect to the TVSS with a dry contact connector for simple installation. The device will have indicator lights and an audible alarm to monitor for normal and fault conditions.

2.3 SURGE SUPPRESSION COMPONENTS

A. Each array shall be capable of withstanding over 1,250 pulses of the 10kA IEEE 62.41 Category C surge current without failure when tested per C62.11, C62.45, suggested wait times. The array shall consist of multiple gap-less metal oxide varistors, with each MOV individually fused.

B. The arrays shall be designed and constructed in a manner that ensures MOV surge current sharing. No gas tubes, silicon avalanche diodes or selenium plates/rectifiers shall be used. The status of each array shall be continuously monitored and a green LED shall be illuminated if the array is in full working order. All protection modes, including N-G, shall be monitored and internally fused, for compliance to NEC articles 110.9, 110.10 and 280.22.

2.4 CONNECTIONS

A. The unit shall be designed to be installed directly to the switchboard bus or to a meter breaker panel branch circuit breaker. All parallel connections to the TVSS shall be kept as short as possible. The connection to the TVSS shall be made using #10 AWG minimum.

2.5 ACCESSORIES

A. Unit Status Indicators: The unit shall have an integral status circuit that monitors 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.

B. Summary Alarm Relay Contacts: In addition to the LED indicators, the unit shall be equipped with a summary alarm relay with one set of Normally Open and Normally Closed (Form C) dry contacts rated for 125 VAC, 1 amp (minimum). The contacts will change state and indicate a failure of the unit, a phase loss condition or a full power loss condition.

**PART 3 - EXECUTION**

3.1 GENERAL

A. Manufacturer shall install TVSS in the power distribution equipment for use at the utility service

entrance to the facility and in each distribution panel to be protected, as indicated on the Drawings.

B. The TVSS shall be installed on the load side of a service disconnect overcurrent device per NEC.

C. Where the internal TVSS is connected to the power system with cables, keep the conductors as short as possible with no sharp bends.

D. The TVSS's ground shall be connected to the power system ground.

3.2 INSTALLATION

A. Where located in a switchboard, the manufacturer shall bus connect the TVSS in parallel to the power source. Where located in a meter/breaker panel, connect to a circuit breaker, keeping conductor length as short as practically possible.

B. The unit shall be bussed to the switchboard and be supplied by a 30-amp circuit breaker or 60-amp circuit breaker as required by the TVSS manufacturer.

C. Coordinate with the switchgear vendor and flush-mount user-interface panel integral into the switchgear front panel.

D. The Contractor shall follow the TVSS manufacturer's recommended installation practices and comply with all applicable codes.

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