	Title: YALE OFFICE OF FACILITIES PROCEDURE MANUAL Chapter: 01 - Yale Design Standard Division: Electrical Standards	Section: 26 35.00 Transient Voltage Surge Suppression
		Date: 6/15/16
		Author: Office of Facilities
CC: Project Folder		

## Change History


Date	Description of Change	Pages / Sections Modified	Change Approver Initials
6/15/16	Updated division section from 16289 to 26 35 00, removed references to other section numbers	-	mgl44
10/14/14	Amend text in section B at various sub paragraphs to clarify existing conditions, intent and requirements.	14 – 16289, B. #1, #3.b, #5, #6, #7 & #8 (System Design and Performance Requirements)	SO
10/14/14	Amend text in paragraph 1 to clarify intent and requirements.	17 – 16289, I. #1. (Installation Guidelines)	SO

## A. Summary

This section contains design criteria for transient voltage surge suppression (TVSS) systems incorporated in unit substation switchboards, independent switchboards, or panels rated at 600 volts or less.

## B. System Design and Performance Requirements

1. The TVSS shall be integral or external with the panelboard or switchboard and shall be installed or shipped loose along with the switchboard or panelboard from the manufacturer's factory. These units shall be a solid state design, parallel-connected, sine-wave tracking suppress and filtering modules.
2. The TVSS shall be designed in accordance with NEMA Standard LS 1 and UL 1449 Second Edition.
3. The system shall provide protection in the following modes:
  - a. Main distribution boards or panels: Normal mode suppression line to line, line to neutral, common mode suppression line to ground and neutral to ground except ungrounded delta configuration.
  - b. Branch distribution panels or switchboards: Normal modes of protection in a 3 phase WYE system are L/N, L/G and N/G. These modes are prevalent throughout the Yale Facilities electrical system and each is a potential pathway for surge activity. Each shall be protected.
4. The system design shall be tested to withstand a minimum of 10,000 Category C3

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(10kA, 20 kV) Bi-wave surges.

5. The TVSS shall have a surge current rating based on exposure curves and not necessarily uniform throughout our buildings on campus. Where used at service entrances, consideration should also be given to protect against temporary overvoltage and power surge events.
6. The noise filtering shall reject a minimum of 41 dB at 100 kHz. The frequency bandwidth of all noise attenuation shall be from 10 kHz to 400 MHz.
7. Protection modes and UL1449SVR for Grounded WYE circuits should be as follows: L/N: 400V@208Y/120V and 900V @480Y/277V; L/G: 500V@208Y/120V and 1000V @480Y/277V; N/G: 500V @208Y/120V and 900V @480Y/277V.
8. The listed AIC rating of TVSS shall be no less than the system available short circuit rating at the point of TVSS installation per a Short Circuit Study.
9. An integral disconnect switch or circuit breaker is required for TVSS isolation.


## C. Submittals

### Warranty

Manufacturer shall warranty the entire system against defective materials and workmanship for a period of five (5) years from date of Substantial Completion including the field service to repair or replace components at no cost to the owner.

### Construction Documents

1. Submit the following construction documents:
  - a. Shop drawings and product data
  - b. Operation and maintenance instructions.
2. Material Certified Test Reports Signed by Manufacturer
  - a. Maximum Surge Current Test Reports demonstrating that the TVSS has been tested to the specified rating. Reports shall clearly demonstrate that the tests have been performed on a complete system including fusing and monitoring.
  - b. Provide test data demonstrating that the TVSS is capable of surviving the

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minimum specified repetitive rating.

- c. Provide test reports demonstrating that the TVSS has been tested to the specified AIC rating.

## D. Product Standards

Products shall conform to the following standards:

1. Refer to Section 01064 Electrical Regulatory and Directive Standards.U
2. L 1449 2<sup>nd</sup> edition Transient Voltage Surge Suppressors and UL 1283 Electromagnetic Interference Filters.
3. NEMA LS 1, “Low Voltage Surge Protection Devices”.
4. NEMA Military Standards (MIL-STD 220A).
5. ISO 9001 certified manufacturer.
6. IEEE C62.41, “Guide for Surge Voltage in Low Voltage AC Power Circuits” and test according to IEEE C62.45, “Guide on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits”.

## E. Manufacturers


Subject to compliance with the design requirements, provide products by one of the following manufacturers:

1. General Electric
2. Square D
3. Eaton
4. Libert
5. Current Technology

## F. Equipment

TVSS shall include the following provisions:

1. LED indication lights for phase and protection status.
2. Audible alarm, with silencing button, to indicate when the protection has

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failed.

3. A surge event six –digit counter with reset push button.
4. One set of normally closed or normally open dry contact rated 5 A and 250 VAC for remote monitoring of protection status. Coordinate the communication protocol with power monitoring system or building monitoring system.

## G. Extra Materials

1. If the TVSS is a modular construction, provide one of each type and size spare module.

## H. Quality Control Testing


1. Test TVSS per above mentioned product standards.
2. Perform completely quality control checks before shipment.
3. Test TVSS to verify the surge current rating of 250 kA per phase.
4. Test TVSS to prove that it has the capability of surviving 10,000 Category C3 bi-wave impulses without failure per IEEE C62.41 Standard.
5. Provide test data to demonstrate that the TVSS have a short circuit rating of 250 kAIC.

## I. Installation Guidelines

1. The leads length between the TVSS and the protected load shall be kept as close (short) as possible. In applications that exceed 6 feet in termination length, use of a low impedance cable is required. One example of this type of cable is HPI cable, manufactured by Current Technology.
2. Install TVSS at service entrance on load side for all 480V systems, with ground lead bonded to service entrance ground. TVSS shall be installed for all services that have 200 amps or above.
3. Install TVSS for panelboard or auxiliary panels, do not bond neutral and ground.

## J. Field Quality Control

1. After installing TVSS, but before electrical circuitry has been energized, test

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for compliance with requirements.

2. Complete startup check 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.
4. Remove and replace malfunctioning units or components and retest as specified above.

**End of Section**