

SECTION 16620

SURGE SUPPRESSION

PART 1 - GENERAL

1.1 SCOPE: This section outlines the quality, type, and installation of Transient Voltage Surge Suppression (TVSS).

1.2 QUALITY ASSURANCE

- A. Each complete suppression unit shall be Underwriters Laboratories (UL), Joint Canadian/Underwriters Laboratory (C-UL) listed and/or Canadian Standards Association approved, as stated in Section 2.02.
- B. Complete units shall bear the suppressed voltage rating issued by UL for all protected modes. Listing of modules, sub-assemblies, or components is not acceptable.
- C. The suppressor manufacturer (or supplier) shall make available experienced, qualified power quality application and field supervision engineering services, on an as-needed (reimbursable) basis.
- D. Each complete suppression unit shall be supplied by a manufacturer whose Quality System has been certified as compliant with ISO 9001:1994. The Certification Body must be accredited by the NAACB (UK National Accreditation Council for Certification Bodies).
- E. The manufacturer's test laboratory shall be certified under UL's Client Test Data Submittal Program to conduct testing in accordance with UL 1449 (Standard for Safety for Transient Voltage Surge Suppressors), UL 1363 (Standard for Safety for The Temporary Power Taps), UL 1283 (Standard for Safety for Electromagnetic Interference Filters) covering Transient voltage Suppression, Duty Cycle, Dielectric Voltage Withstand and Leakage Current Tests. In addition, the manufacturer's test laboratory shall be certified under UL's Client Test Data Submittal Program to conduct testing in accordance with the new UL Classification Program for evaluation of transient voltage surge suppressors in accordance with IEEE C62.41-1991 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.6.2.
- F. Submittals: For brand names specified, submit specification cut sheets. For brand names other than specified, submit manufacturer's qualifications as specified below:
 - 1. Only firms that have been regularly engaged in the development, design, testing, listing and manufacture of transient voltage surge suppressors for a period of ten years or more of the types and ratings required and whose products have been in satisfactory use in similar service are acceptable. Upon request, suppliers or manufacturers shall provide a list of not less than three customer references showing satisfactory operation.
 - 2. Prior to purchase of the suppression unit(s), catalog cuts and/or mechanical drawings shall be submitted for approval.
 - 3. Submittals shall contain the required published specifications and drawings to show conformance with all portions of this specification.
 - 4. Instructions for installation and connection shall be provided with the suppression unit(s).

5. All Let-Through voltage data will be measured on an "As Installed" lead length basis, simulating actual installation. Let-through voltage data at the module or at the bus "Zero lead length" is not acceptable. Testing will be conducted in accordance with UL- 1449, ANSI/IEEE C62.41-1991 and ANSI/IEEE C62.45-1992 standards. No testing will be done with "outside of the suppressor" lead lengths less than that specified for the product(s) specified in Section 2.02. The lead length parameter must be specified on test documentation and test graphs will be provided that list the type of test (dynamic or static), phase angle of test, current of test, voltage of test, wave forms used, and lead length of test. The test documentation will also list all test equipment used by brand name, model number and serial number with calibration requirements current and certified. The test equipment will also list all set up parameters of the test equipment to allow any certified test facility to recreate the exact test and reproduce the submitted specifications.
6. Copy of the ISO 9001-1994 Certificate of Registration will accompany the submittal.
7. Individual Product Requirements: Each individual product provided shall fully comply with all requirements shown for that size and type of TVSS unit. It is imperative that products submitted for approval meet or exceed the specified requirements and that reproduction of those requirements can be accomplished at a certified UL test facility. For brand names other than specified, the following product specifications must be submitted to comply with each voltage configuration and amperage rating of the AC power distribution panels or equipment to be protected. The submitted product specifications will not be accepted without the following criteria for each voltage configuration defined and listed in this specification.
 - a. Application Definition
 - b. Operating Voltage
 - c. Operating Frequency
 - d. Protection Modes
 - e. Maximum Surge Current Capacity
 - f. Pulse Life Test
 - g. UL1449 Performance Category
 - h. Life Expectancy
 - i. MCOV (Maximum Continuous Operating Voltage) Testing
 - j. Warranty
 - k. High-Frequency Tracking Filters
 - l. EMI/RFI (If Specified)
 - m. Field Connections
 - n. Field Installation
 - o. Status Indicators
 - p. NEMA Enclosure Listing
 - q. Fuses
 - r. Alarm Contacts (If Specified)
 - s. Conductor Size and Length
 - t. ANSI/IEEE C62.41-1991 UL 1449 LISTED on the label
 - u. Product Location Categories (A, B, C) of C62.41
 - v. Let Through Voltage Test Mode (L-G, L-L, L-N, N-G)
 - w. Let Through Voltage at each 90 degrees phase angle
 - x. Let Through Voltage at C62.41 Categories A3, B3, C3
 - y. Let Through Voltage Test Results using "as installed lead length"
 - z. Graphs of Let-Through Voltage Test Results
 - aa. Energy Loading Capability in Joules Stating the Time Basis of Test
 - bb. Surge Current Per Phase

- cc. Response Time
- dd. Size of Unit with Drawings
- ee. Weight of Unit
- ff. Manufacturer Qualification, ISO 9001, 1994
- gg. CFC Prohibited Compliance
- hh. Photograph of Unit
- ii. Circuit Description
- jj. Location of Mounting Methods
- kk. Wire Size and Type
- ll. Price

G. Equipment Certification: Items shall be listed by Underwriters' Laboratories, shall bear the UL seal, and be marked in accordance with referenced standard.

1.3 WARRANTY

- A. All TVSS devices shall be warranted to be free from defects in materials and workmanship under normal use in accordance with the instructions provided for a period of ten (10) years.
- B. Any TVSS device, which shows evidence of failure or incorrect operation during the warranty period, shall be replaced at no cost to the Owner. Warranty will provide for multiple exchanges of any inoperable devices at any time during the 10-year period.

1.4 MANUFACTURER

Authorized Distributor:
Lightning Protection Systems
P.O. Box 3994
Gulfport, MS 39503
(228) 832-8262, Fax (228) 832-5543

1.5 CODES AND STANDARDS

- A. All TVSS devices will be designed, tested, manufactured, listed and installed in accordance with the applicable publications, resources and standards shown below:
 - 1. ANSI/IEEE C84.1-1989, American National Standard for Electric Power Systems and Equipment - Voltage Ratings (60 Hertz)
 - 2. ANSI/IEEE C62.41-1991, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
 - 3. ANSI/IEEE C62.45-1992, IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits
 - 4. Underwriter Laboratories UL 1449 Standard for Safety - Transient Voltage Surge Suppressors, Revised edition July 2, 1987
 - 5. Underwriters Laboratories, UL 1283, Standard for Safety - Electromagnetic Interference Filters, August 23, 1993
 - 6. National Fire Protection Association, National Electrical Code 1996
 - 7. IEEE Standard 142-1991, IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems (IEEE Green Book)

8. ANSI/IEEE Standard 141-1986, IEEE Recommend Practice for Electric Power Distribution for Industrial Plants (IEEE Red Book)
9. IEEE Standard 1100-1992, IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (IEEE Emerald Book)
10. IPS Pub 94, Federal Information Processing Standards Publication - Guideline on Electrical Power for ADP Installations MIL Standard 220A Method of Insertion-loss Measurement
11. ISO 9001:1994, Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation and Servicing

PART 2 - PRODUCTS

2.1 SUPPRESSORS FOR ELECTRICAL SERVICE ENTRANCE PANELS, SECONDARY PANELS, OR BRANCH PANELS

- A. The circuit configuration of the suppression units shall be thermal stress reducing, custom parallel, solid state. (Series units or units equipped with "load carrying" components are expressly prohibited due to the possibility of single point series failures causing power interruption to protected loads.)
- B. Protection Modes: All modes shall be protected, i.e.. Normal (L-L, L-N) and Common (N-G, L-G).
- C. The suppressors shall conform in performance and design as described in Section 2.02 of this specification.
- D. No suppression units shall be supplied which require scheduled preventive maintenance or replacement parts (lights, fuses and relays, where applicable, excluded). Units requiring functional testing, special test equipment, or special training to monitor TVSS status are not acceptable.
- E. The suppression circuits shall be totally encapsulated by the suppressor manufacturer in a thermally conductive chemical compound to enhance transient energy dissipation; provide hermetic sealing; provide superior dielectric strength and superior protection against mechanical shock and vibration; provide protection against environmental factors including gases, industrial fumes, humidity, enhanced thermal stability, reduction of hot spots, and protection against thermal shock. Suppressor manufacturer shall have ten years continuous experience encapsulating suppressors.
- F. The manufacturer shall certify that all materials and processes used as a component of the suppression unit(s) and/or used in the process of manufacturing and/or packaging of the suppression unit(s) is in accordance with The Federal Clean Air Act Amendments of 1990, Sections 602 and 611, prohibiting the use of Class I or Class II ozone depleting chemicals.

2.2 SUPPRESSOR CRITERIA

- A. Suppressors shall meet or exceed the following criteria:
 1. For Protection of Service Entrances with ampacity rating up to 2000 Amperes.
 - a. Application: 3 phase, Wye 277/480 Vrms, 4 wire + ground

- b. Maximum Operating Voltage: 320Vrms (452 Vpk) L-N, L-G, N-G 550 Vrms (778Vpk) L-L
- c. Input Power Frequency: 50, 60, 420 Hz
- d. Peak Surge Current: 720,000 Amperes Total (8 X 20 μ s Waveform, Single Impulse) 240,000 Amperes per Phase; 60,000 Amperes N-G
- e. EMI/RFI Filter: Noise Rejection up to 38 dB Normal Mode; 34 dB Common Mode
- f. Response Time: <1 nanosecond
- g. Protection - All Modes: Normal Mode (L-N, L-L); Common Mode (L-G, N-G) Bi-directional, Positive and Negative Impulse Protection
- h. Let-Through Voltage: This is actual voltage level the equipment will see after the suppressor activates using an 8 microsecond by 20 micro second waveform. This is not clamping voltage at which the suppressor activates. Phase Angle Test Environment: Dynamic at 90E (D) or Static (S), Positive Polarity, All voltages are peak ($\pm 10\%$), Time base = 1ms. 90E phase angle voltages are measured from the positive peak of the sine wave to the positive peak of the surge.

Test Mode	Cat A3 Ring Wave 6,000V 200A 90_	Cat B3/C1 Impulse 6,000V 3,000A 90_	Cat C3 Impulse 20,000V 10,000A Static
L-N	408 (D)	538 (D)	950D
L-G	408 (D)	538 (D)	970D
N-G	800 (S)	930 (S)	1,400S
L-L	711 (D)	731 (D)	1020D

Note: Testing shall be done in accordance with ANSI/IEEE C62.41 - 1991 on the complete unit with 6 inches of lead length (outside of enclosure) The lead length parameter must be specified on test documentation and **shall be 6"**(as measured from outside of enclosure), **simulating typical installation.**

- i. Design: Suppressor to be fully encapsulated in thermally conductive material and shall. Consist of custom parallel circuitry.
- j. Listing/Certification: The entire unit shall bear UL 1449 and C-UL listing. Listing of modules, sub-assemblies, or components is not acceptable.
- k. Warranty: 10 years
- l. Size: Compact with dimensions no greater than 10.25" width x 10.25" height x 6.5" depth to allow close-to-the-load installation.
- m. Enclosure: NEMA 12, 13 (Hinged)
- n CFC Prohibited: The TVSS shall comply with Sections 602 and 611 of the Federal Clear Air Act of 1990.
- o. Installation: Trained representative must be available to witness installation of products and provide technical advice.
- p. Manufacturer Qualification: Quality system certification to ISO 9001

- q. Fuses: Surge suppressor shall include 20 amp replaceable Class FRN fuses.
- r. Status Indicator Lights: The TVSS shall be equipped with remote status indicator lights with 7' wire leads to permit remote mounting for easy viewing when the TVSS unit itself is not visible. When remote status indicator lights are used, indicator lights on the TVSS enclosure are not required.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPRESSORS

- A. Examine the areas and conditions under which the transient voltage surge suppressors are to be installed and advise the Architect in writing of conditions detrimental to the completion of work.
- B. Provide transient voltage surge suppression units with characteristics as described in Section 2.02 of this specification.
- C. Verify the proper application of the TVSS (i.e., voltage, phases, etc.) and coordinate with upstream and downstream transient suppression. Assure 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 TVSS.
- D. Furnish all labor, materials, equipment and services necessary for and incidental to the installation of the TVSS system components as specified herein. Only Licensed Electricians shall actually install TVSS units.
- E. Install the transient voltage surge suppressors as indicated in manufacturer's installation instructions and in accordance with the applicable portions of NEC and in accordance with recognized industry practices to ensure that product complies with requirements. NEC, State, and Local Codes will prevail.
- F. Coordinate with other electrical work as necessary to interface installation of the transient voltage surge suppression systems with other work on the site.

END OF SECTION