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An American National Standard

Standard Specification for Surge Suppressors for Shipboard Use[1]

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1. Scope

1.1 This specification establishes performance requirements of surge suppressors for use on shipboard ac power circuits.

1.2 Surge suppressor shall be a protective device for limiting voltage transients on equipment by discharging, dissipating internally, bypassing surge current, or a combination thereof and which prevents continued flow of follow current to ground and is capable of repeating these functions.

1.3 Surge suppressors covered by this specification may consist of a single circuit element or may be a hybrid device using several suppression devices.

2. Referenced Documents

2.1 The following documents of the issue in effect on the date of material purchase form a part of this specification to the extent referenced herein:

2.2 *American National Standards:*[2]

ANSI/IEEE Std 4 IEEE Standard Techniques for High Voltage Testing

ANSI/IEEE C62.41 Recommended Practice on Surge Voltage in Low-Voltage AC Power Circuits

ANSI/IEEE C62.45 Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits

ANSI/IEEE C84.1 Electrical Power Systems and Equipment—Voltage Ratings

2.3 *Military Standard:*[3]

MIL-STD-1399 Section 300; Military Standard Interface Standard for Shipboard Systems, Section 300, Electric Power, Alternating Current

2.4 *Underwriters Laboratories Standard:*[4]

UL 1449 Transient Voltage Surge Suppressors, 2nd Edition

3. Terminology

3.1 *Definitions:*

NOTE 1—These definitions other than specific to the standard are taken from UL 1449, ANSI/IEEE C62.41, and MIL-STD 1399 to provide for harmonization of terms.

3.2 *power interface*—The electrical points where the surge suppression device is electrically connected to the ac power system.

3.3 *combination wave*—A surge delivered by an instrument that has the inherent capability of applying a 1.2/50-μs voltage wave across an open circuit and delivering an 8/20-μs current wave into a short circuit. The exact wave that is delivered is determined by the instantaneous impedance to which the combination wave is applied. (Also called combination voltage/current surge or combination V/I surge.)

3.4 *crest (peak) value (of a wave, surge or impulse)*—The maximum value that a wave, surge, or impulse attains.

3.5 *electric power source*—The electric power that is supplied for testing.

3.6 *electric power system ground*—Ground is a plane or surface used by the electric power system as a common reference to establish zero potential. Usually, this surface is the metallic hull of the ship. On a nonmetallic hull ship, a special ground system is installed for this purpose.

3.7 *follow (power) current*—The current from the connected power source that flows through a surge protective device following the passage of discharge current.

3.8 *frequency tolerance*—Frequency tolerance is the maximum permitted departure from nominal frequency during normal operation, excluding transient and cyclic frequency variations. This includes variations such as those caused by load changes, switchboard frequency meter error, and drift. Unless specified otherwise, frequency tolerance shall be considered to be ±10 % of nominal frequency.

3.9 *inrush current*—The inrush current is a sudden change in line current that occurs during startup or as a result of a change to the operating mode. Inrush current is dependent on the type of load connected to the surge suppressor, and typically will rise to a maximum value in a few milliseconds and decay to rated value in several milliseconds to several seconds.

[1] This specification is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.10 on Electrical.

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[2] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[3] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://dodssp.daps.dla.mil.

[4] Available from Underwriters Laboratories (UL), 2600 N.W. Lake Rd., Camas, WA 98607-8542, http://www.ul.com.

3.10 *leakage current*—Line current drawn, either line-to-line or line-to-ground, by the suppressor when operated at the maximum continuous operating voltage.

3.11 *maximum continuous operating voltage*—Maximum sinusoidal rms voltage which may be continuously applied without degradation or deleterious effects.

3.12 *measured limiting voltage*—The crest (peak) value of the voltage measured at the leads, terminals, receptacle contacts and the like, intended for connection to the load(s) to be protected, and resulting from application of a specified surge.

3.13 *nominal frequency*—the nominal frequency is the designated frequency in Hz.

3.14 *nominal system voltage*—A nominal value assigned to designate a system of a given voltage class in accordance with ANSI/IEEE C84.1. For the purpose of this standard, nominal system voltages are 120, 208, 240, and 480 vac. All voltages in this standard are root-mean-square (rms) unless stated otherwise. All tolerances are expressed in percent of the nominal system voltage.

3.15 *one-port transient voltage surge suppressor*—A TVSS having one set of electrical connections (terminals, leads and the like) intended only for shunt-connection to the ac power circuit, such that load current in the ac power circuit bypasses the TVSS.

3.16 *peak overshoot voltage*—Maximum voltage above the voltage protection level (peak voltage minus suppression voltage rating) across the suppressor output terminals during initial response to a voltage spike.

3.17 *rated rms voltage (varistor)*—Maximum continuous sinusoidal rms voltage which may be applied to a varistor.

3.18 *response time (varistor)*—The time between the point at which the wave exceeds the voltage protection level (suppression voltage rating) and the peak of the voltage overshoot. For the purpose of this definition, voltage protection level is defined with an 8/20-μs current waveform of the peak current amplitude as the waveform used for this response time.

3.19 *secondary surge arrestor*—A surge protector device acceptable ahead of the service entrance equipment on circuits not exceeding 1000-V rms (location category C as described in ANSI/IEEE C62.41).

3.20 *surge*—A transient overvoltage superimposed on the ac power circuit. A voltage surge is generally one in which the superposition of the surge and normal power frequency voltage involves peak voltage levels of twice or more the normal voltage of the ac power system and generally lasting not more than one-half period of the nominal system voltage waveform.

3.21 *surge protective device (SPD)*—A protective device composed of any combination of linear or non-linear circuit elements and intended for limiting surge voltages on equipment by diverting or limiting surge current; it prevents continued flow of follow (power) current and is capable of repeating these functions as specified.

3.22 *temporary overvoltage (TOV)*—A voltage swell from a sudden change in voltage which goes outside the voltage tolerance limits but does not exceed 120 % of nominal system voltage and returns to and remains within these limits within 2 s after the initiation of the disturbance.

3.23 *transient voltage surge suppressor (TVSS)*—A surge protective device intended for connection electrically on the load side of the main overcurrent protection in circuits not exceeding 600 V. (Location Categories A and B as described in ANSI/IEEE C62.41.)

3.24 *two-port transient voltage surge suppressor*—A TVSS having one set of electrical connections (terminals, leads and the like) intended for connection to the ac power circuit and one or more separate sets of electrical connections (terminals, leads, outlet receptacles, and so forth) intended for connecting the load(s) to be protected. This device is series-connected such that load current will flow through the transient voltage surge suppressor.

3.25 *voltage drop*—Voltage differential measured from input terminals to output terminals under conditions of rated load current for two-port surge suppressors.

3.26 *voltage protection level*—A suppression rating (or ratings) in volts or kilovolts, selected by the manufacturer that is based on the measured limiting voltage determined during surge testing. Also referred to as the suppression voltage rating.

3.27 *voltage spike*—A voltage spike is a voltage change of very short duration (100 μs to ½ cycle). The standard 1.2/50-μs lightning impulse, as defined by ANSI/IEEE Std 4, is the characteristic voltage spike used for test purposes.

3.28 *voltage tolerance*—Voltage tolerance is the maximum permitted departure from nominal system voltage during normal operation, excluding transient voltage variations. Voltage tolerance includes variations such as those caused by load changes, switchboard meter error, and drift. Unless otherwise specified, voltage tolerance shall be considered to be ±10 % of nominal system voltage.

4. Classification

4.1 Surge suppressors covered in this specification shall be classified by class and type.

4.2 The two classes of surge suppressors covered in this specification are based on and reflect ANSI/IEEE C62.41 locations.

4.2.1 *Class A*—Surge suppressor associated with long circuit branch that being greater than 30-ft cable distance from the distribution panel and usually installed as a series-connected TVSS at the distribution system receptacle (wall outlet).

4.2.2 *Class B*—Surge suppressor for short branch circuit, either installed at loads within 30-ft cable distance from the circuit breaker distribution panel or within the distribution panel.

4.3 Type designations for surge suppressors covered in this specification are as follows:

4.3.1 *Type I; Permanent Connected Type*—A suppressor designed for hard-wired or panel-mount applications. This type surge suppressor is the only one-port-type TVSS.

4.3.2 *Type II; Plug-In Type*—A suppressor provided with blades for direct connection at a receptacle and with integral