

Guide Specifications

Select[®]2 3/25/04



Select[®]2

Selenium-Enhanced
Suppression and
Secondary Arrester
Filter System

A member of the MasterPlan™ family of products

TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) SPECIFICATION

1.0 GENERAL

1.1 Summary. The specified unit shall provide effective high energy transient voltage surge suppression and high frequency noise attenuation in all electrical modes for exposure locations as defined in IEEE C62.41.1-2002 and C62.11. The unit shall be connected in parallel with the facility's wiring system and have dual UL listings as both a TVSS device and as a Secondary Surge Arrester to allow installation at service entrance locations upstream of the facility's main circuit breaker. Products that do not allow installation upstream of the main circuit breaker or solutions that require the use of separate suppressors and arresters are unacceptable.

1.2 Standards. The specified unit shall be designed, manufactured, tested and installed in compliance with the following standards:

- 1.2.1 Underwriters Laboratories UL 1449 Second Edition and UL 1283;
- 1.2.2 Underwriters Laboratories UL 96
- 1.2.3 National Electrical Manufacturers Assoc. (NEMA LS1-1992 (R2000) Guidelines);
- 1.2.4 IEEE C62.41.1-2002, C62.41.2-2002 and C62.45-1992;
- 1.2.5 IEEE C62.1, C62.11 and C62.34;
- 1.2.6 Canadian Standards (CUL);
- 1.2.7 Federal Information Processing Standards Publication 94 (FIPS PUB 94);
- 1.2.8 National Fire Protection Association (NFPA 70 [NEC], 75, and 78);

1.3 UL Listings. The unit shall have the following UL listings:

- 1.3.1 **UL listed as category XUHT (UL 1449 Second Edition) and CUL Approved** as a TVSS
- 1.3.2 **UL listed as category OWHX (UL 96)** as a Secondary Surge Arrester
- 1.3.3 **UL listed as category FOKY (UL 1283)** as an Electromagnetic Interference Filter.

1.3 Approved Vendors. This specification is based on Current Technology's selenium-enhanced™ Select®2 suppression filter systems. Other manufacturers shall provide detailed compliance or exception statements, along with required test documentation, to all provisions of this specification fourteen (14) days prior to bid.

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2.0 ELECTRICAL REQUIREMENTS

2.1 Maximum Continuous Operating Voltage (MCOV). The MCOV of the TVSS shall be greater than 115% of nominal voltage. The system's maximum continuous operating voltages shall be in compliance with test and evaluation procedures outlined in NEMA LS 1-1992 (R2000), paragraphs 2.2.6 and 3.6.

2.2 Protection Modes. The unit shall provide protection in all modes. WYE systems: Line-Neutral, Line-Ground, Line-Line and Neutral-Ground; Delta systems: Line-Line and Line-Ground

2.3 Operating Frequency. Operating frequency range shall be 47 to 63 Hertz.

3.0 PRODUCT

3.1 Tested Single Pulse Surge Current Capacity. The maximum single-pulse surge current capacity per mode shall be verified through testing at an independent third party testing facility and shall be conducted per NEMA LS-1-1992 (R2000), paragraphs 2.2.9 and 3.9. The unit shall be tested in all modes at rated surge currents and all tested modes shall be from the same test sample. This test shall include all components of the system, including disconnects (if applicable) and fusing as a completed assembly.

Individual component testing, module testing only, or subsystem testing of the unit for compliance with this section will not be acceptable. Testing that causes damage to the device, fuse operation, or voltage clamping performance degradation by more than 10% is not acceptable. The rated single pulse surge current capacity shall be as follows:

Note: Due to current industry test equipment limitations, ratings above 200kA (per mode) will be independently tested to 200kA.

(Choose appropriate product rating from below)

- 100kA per mode
- 150kA per mode
- 200kA per mode
- 250kA per mode
- 300kA per mode

- 3.2 Minimum Repetitive Surge Current Capacity.** Per IEEE C62.41-1991 and C62.45-2002, the product shall be repetitive surge current capacity tested in every mode utilizing a 1.2 x 50 µsec, 20 KV open circuit voltage, 8 x 20 µsec, 10 KA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than ±10% deviation of clamping voltage at the specified surge current.

(Choose appropriate product rating from below)

- 100kA (per mode) rated product – 11,000 repetitive C3 strikes per mode
- 150kA (per mode) rated product – 12,000 repetitive C3 strikes per mode
- 200kA (per mode) rated product – 13,000 repetitive C3 strikes per mode
- 250kA (per mode) rated product – 14,000 repetitive C3 strikes per mode
- 300kA (per mode) rated product – 15,000 repetitive C3 strikes per mode

- 3.3 NEMA LS-1-1992 (R2000) Clamping Voltage Data.** The unit's clamping voltages shall be in compliance with test and evaluation procedures outlined in NEMA LS-1-1992 (R2000), paragraphs 2.2.10 and 3.10. Maximum clamping voltages for the unit are as shown in tables following section 3.4.

- 3.4 Unit UL1449 Second Edition Suppressed Voltage Ratings.** The UL 1449 Second Edition listed suppressed voltage ratings are listed in the following tables as assigned by Underwriters Laboratories utilizing the test procedure described in section 4.3 of this document titled UL 1449 Second Edition Suppression Voltage Performance Testing.

(Choose appropriate table from below)

SL2-200, SL2-250 and SL2-300					
System Voltage	Mode	B3 Ringwave	B3/C1 Comb. Wave	C3 Comb. Wave	UL 1449 Second Edition
120/240	L-N	300 / 350	400/425	625/750	400/400
120/208	L-G	375 / 425	400/475	625/800	500/500
	N-G	325 / 325	450/450	725/725	500/500
	L-L	375 / 475	750/825	925/1225	700/700
277/480	L-N	525 / 575	850/875	1100/1200	800/800
	L-G	825 / 850	825/875	1050/1200	1000/1000
	N-G	675 / 675	875/875	1200/1200	900/900
	L-L	625 / 725	1625/1700	1925/2175	1500/1500

SL2-100 and SL2-150					
System Voltage	Mode	B3 Ringwave	B3/C1 Comb. Wave	C3 Comb. Wave	UL1449 Second Edition
120/240 120/208	L-N	300 / 325	400/425	600/700	400/400
	L-G	375 / 425	400/450	600/725	500/500
	N-G	350 / 350	450/450	725/725	500/500
	L-L	350 / 450	750/825	950/1175	700/700
277/480	L-N	500 / 525	850/900	1125/1175	900/900
	L-G	825 / 850	825/850	1050/1150	1000/1000
	N-G	675 / 700	875/875	1175/1175	800/800
	L-L	650 / 700	1650/1700	1925/2150	1500/1500

NOTE: Clamping voltage values shown without / and with integral disconnect. Consult factory for voltage configurations not shown.

- 3.5 High Frequency Extended Range Power Filter.** The unit shall include a high frequency filter and shall be UL 1283 listed as an Electromagnetic Interference Filter. The unit's EMI-RFI noise rejection or attenuation values shall be in compliance with test and evaluation procedures outlined in NEMA LS-1-1992 (R2000), paragraphs 2.2.11 and 3.11.

Attenuation Frequency	50KHz	100KHz	500KHz	1MHz	5MHz	10MHz	50MHz	100MHz
SL-200, SL-250 and SL-300	53dB	41dB	32dB	31dB	32dB	35dB	47dB	53dB
SL-100 and SL-150	50dB	44dB	34dB	33dB	34dB	36dB	47dB	53dB

NOTE: Standardized insertion loss data obtained utilizing MIL-STD-220B 50 ohm insertion loss methodology. Noise source path = 100' to model maximum average circuit distance, filter connection distance = 6".

The Select[®]2 system shall function in conjunction with other suppression filter devices of the same manufacturer within the facility-wide MasterPLAN[®] system providing the following noise attenuation:

Attenuation Frequency	50KHz	100KHz	500KHz	1MHz	5MHz	10MHz	50MHz	100MHz
MasterPLAN [®]	85dB	83dB	68dB	68dB	68dB	67dB	78dB	84dB

NOTE: Standardized insertion loss data obtained utilizing MIL-STD-220B 50 ohm insertion loss methodology, based on a minimum of 100 ft. of #4 AWG conductor between the two devices. Noise source = 100' to model maximum average circuit distance, filter connection distance = 6".

- 3.6 Redundant Suppression Elements.** The unit shall provide an additional set of parallel connected, individually fused selenium cells, internal to the unit, which shall provide backup protection to the primary suppression devices. If subjected to an overvoltage within the parameters in section 3.7 below, there shall be no failure or degradation of the primary suppression elements. The suppression system shall not utilize gas tubes, spark gaps, silicon avalanche diodes or other components which might short or crowbar the line, thus leading to interruption of normal power flow to or system upset of connected loads.
- 3.7 Excessive MCOV Withstand (Swell Voltage Rating).** The unit shall be capable of withstanding temporary overvoltage events that may be encountered within the distribution system, without damaging any of the components within the TVSS, especially MOVs and other non-MOV parallel connected elements, in accordance with NEMA LS-1-1992 (R2000), section 2.2.6. The unit shall provide overvoltage protection as follows:

SL2-300, SL2-250						
% Overvoltage	160%	170%	180%	190%	195%	200%
Line impedance of power system = 0.1 ohms						
# of cycles	>3600	200	40	8	5	4
Line impedance of power system = 0.3 ohms						
# of cycles	>3600	>3600	700	125	80	30
Line impedance of power system = 0.7 ohms						
# of cycles	>3600	>3600	>3600	>3600	>3600	>3600

SL2-200, SL2-150, SL2-100						
% Overvoltage	160%	170%	180%	190%	195%	200%
Line impedance of power system = 0.1 ohms						
# of cycles	1000	60	12	5	4	3.5
Line impedance of power system = 0.3 ohms						
# of cycles	>3600	300	60	20	15	11
Line impedance of power system = 0.7 ohms						
# of cycles	>3600	>3600	500	200	80	60

- 3.8 Internal Connections.** All full magnitude transient current shall be conducted utilizing low-impedance copper bus bar. No plug-in component modules or quick-disconnect terminals shall be used in surge current-carrying paths.
- 3.9 Overcurrent Protection**
- 3.9.1** Each MOV shall be fused such that the failure of a single MOV or the operation of a single fuse element remains isolated and does not render the entire mode, or product, deficient by more than the following percentages:
- | | |
|------------------------------------|------|
| 200-300kA (per mode) rated product | < 5% |
| 100-150kA (per mode) rated product | <10% |
- 3.9.2** All fusing must be UL-Recognized as a stand-alone fuse and shall be 200kAIC rated.
- 3.9.3** Each fuse shall be individually sealed in a manner that eliminates cross arcing.
- 3.9.4** All fusing shall be required to meet the single pulse surge current testing requirements of Section 3.1. It is necessary that the fuse be capable of withstanding a surge greater than the surge capacity of the element it is protecting. In no case should the fuse limit the surge capacity of the unit.
- 3.10 Warranty.** The manufacturer shall provide a Ten-Year Limited Warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.
- 3.11 Enclosure and Mounting.** The unit shall be supplied in a NEMA 4 metallic enclosure for mounting external to switchgear. Products required to be mounted integral to switchgear will not be accepted.
- 4.0 FEATURES / OPTIONS.**
- 4.1 Integral Disconnect Switch.**
- 4.1.1** The device shall have an optional NEMA compliant safety interlocked integral disconnect switch with an externally mounted metal manual operator.
- 4.1.2** The switch shall disconnect all ungrounded circuit conductors from the distribution system to enable testing and maintenance without interruption to the facility's distribution system.
- 4.1.3** The switch shall be rated for 600Vac.

- 4.1.4 The TVSS device shall be UL1449 Second Edition listed with the integral disconnect switch and the UL1449 Second Edition Suppression Voltage Ratings shall be provided.
- 4.1.5 The integral disconnect switch shall be capable of withstanding, without failure, the published maximum surge current magnitude without failure or damage to the switch (per Section 3.1).
- 4.2 **On-Line Diagnostic Monitoring:** *(Choose appropriate monitoring system from below)*
- 4.2.1 **BASIC Monitoring**
- 4.2.1.1 **Status Indicator Lights.** This monitoring shall include one set of status monitoring lights that will provide visual indication of voltage present to the TVSS for each phase of protection. The lights shall also indicate when suppressor protection has degraded to any value of less than 50%. Status indicator lights that simply indicate the presence of voltage, and provide no indication of performance will be unacceptable.
- 4.2.2 **PRIMARY Monitoring Option.**
- 4.2.2.1 **Status Indicator Lights.** This monitoring shall include one set of status monitoring lights that will provide visual indication of voltage present to the TVSS for each phase of protection. The lights shall also indicate when suppressor protection has degraded to any value of less than 50%. Status indicator lights that simply indicate the presence of voltage, and provide no indication of performance will be unacceptable.
- 4.2.2.2 **Dual Form “C” Dry Contacts.** The unit shall include 2 sets of form “C” dry contacts.
- 4.2.3 **ADVANCED Monitoring Option.**
- 4.2.3.1 **Status Indicator Lights.** This monitoring shall include one set of status monitoring lights that will provide visual indication of voltage present to the TVSS for each phase of protection. The lights shall also indicate when suppressor protection has degraded to any value of less than 50%. Status indicator lights that simply indicate the presence of voltage, and provide no indication of performance will be unacceptable.
- 4.2.3.2 **Dual Form “C” Dry Contacts.** The unit shall include 2 sets of form “C” dry contacts.
- 4.2.3.3 **Event Display Counter.** The unit shall include a counter that displays the cumulative number of transients that the device has encountered.
- 4.2.3.4 **Battery Powered Audible Alarm and LED Indicators.** The unit shall be provided with a battery powered audible alarm that detects and provides notification of single or multiple phase failure of the suppression filter system.
- 4.2.4 **MasterMIND® Monitoring Option.**
- 4.2.4.1 **Status Indicator Lights.** This monitoring shall include one set of status monitoring lights that will provide visual indication of voltage present to the TVSS for each phase of protection. The lights shall also indicate when suppressor protection has degraded to any value of less than 50%. Status indicator lights that simply indicate the presence of voltage, and provide no indication of performance will be unacceptable.
- 4.2.4.2 **Enhanced Status Indicators.** The unit shall include status indicators that show the online status of all hybrid elements (for each phase): selenium, MOVs, and capacitors.
- 4.2.4.3 **Dual Form “C” Dry Contacts.** The unit shall include 2 sets of form “C” dry contacts.
- 4.2.4.4 **Event Display Counter.** The unit shall include a counter that displays the cumulative number of transients that the device has encountered.
- 4.2.4.5 **Battery Powered Audible Alarm and LED Indicators.** The unit shall include a battery powered audible alarm that detects and provides notification of single or multiple phase failure of the suppression filter system.
- 4.2.4.6 **% Protection Available.** The unit shall provide numeric display of suppression protection available, shown in a percentage from 0% to 100%.
- 4.2.4.7 **Neutral-to-Ground Current and Voltage Sensing.** The unit shall detect and digitally indicate current flowing in the neutral-to-ground protection path within the device (WYE, split phase, and high leg delta systems only). The unit shall provide digital display of the voltage across the neutral and ground.

- 4.2.4.8 True RMS Voltage Monitor.** The unit shall provide true RMS voltage monitoring for all phases along with neutral-to-ground.
- 4.2.4.9 Power Quality Event Detection.** The unit shall provide visual indication and count of all voltage sags < 90% of nominal, all voltage swells > 110% of nominal, all power dropouts < 1 cycle, and all power outages > 1 cycle.

5.0 DOCUMENTATION.

- 5.1 Equipment Manual.** The manufacturer shall furnish with the submittal and with each unit delivered an equipment manual that details the installation, operation and maintenance instructions for the specified unit.
- 5.2 Drawings.** Electrical and mechanical drawings shall be provided by the manufacturer with the submittal and with each unit delivered that show unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.
- 5.3 UL1449 Second Edition Listing / Clamping Voltages.** The manufacturer shall provide data showing UL 1449 Second Edition product listing. The manufacturer shall also submit documentation showing clamping voltage data per NEMA LS 1-1992 (R2000), paragraphs 2.2.10 and 3.10.
- 5.4 Single Pulse Surge Current Capacity Testing.** Documentation from an independent test laboratory of the unit's Single Pulse Surge Current Capacity Testing shall be included in the submittal.
- 5.5 Minimum Repetitive Surge Current Capacity Testing.** Documentation of the unit's Minimum Repetitive Surge Current Capacity Testing shall be included in the submittal.
- 5.6 Diagnostic Signature Card.** A copy of the start-up test results and the factory benchmark testing results shall be supplied to the engineer and the owner for confirmation of proper system function. These results shall also clarify that the integrity of all neutral-to-ground bonds were verified through testing and visual inspection, and that all grounding bonds were observed to be in place.

End of Specification

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