Guide Specifications

TransGuard 7/27/02

TransGuard®

Electrical Transient Suppression Filter Systems

TransGuard

CURRENT TECHNOLOGY®

1.0 GENERAL

1.1 SUMMARY. These specifications describe the electrical and mechanical requirements for a hybrid electrical transient surge suppression filter system integrating both transient voltage surge suppression (TVSS) and electrical high frequency noise filtering for exposure locations as defined in ANSI/IEEE C62.41-1991.

The unit shall be designed for parallel connection to the facility's wiring system. The suppression filter system shall be designed and manufactured in the USA by a qualified manufacturer of suppression filter system equipment. The qualified manufacturer shall have been engaged in the commercial design and manufacture of such products for a minimum of five (5) years.

These specifications are based on Current Technology's TransGuard® 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.

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

ANSI/IEEE C62.41-1991 and C62.45-1992;
ANSI/IEEE C62.1 and C62.11;
Canadian Standards; (CUL);
Federal Information Processing Standards Publication 94 (FIPS PUB 94);
National Electrical Manufacturers Association (NEMA LS1-1992 Guidelines);
National Fire Protection Association (NFPA 70 [NEC], 75, and 78);
Underwriters Laboratories UL 1449 Second Edition and 1283;
Underwriters Laboratories UL 489 and UL 198

The unit shall be **UL 1449 Second Edition Listed** and **CUL Approved** as a Transient Voltage Surge Suppressor and **UL 1283 Listed** as an Electromagnetic Interference Filter.

1.3 ENVIRONMENTAL REQUIREMENTS.

1.3.1 Storage Temperature. Storage temperature range: -40° to +85° C (-40° to +185° F).

1.3.2 Operating Temperature. Operating temperature range: -40° to +60° C (-40° to +140° F).

1.3.3 Relative Humidity. Reliable operation with 5% to 95% non-condensing relative humidity.

1.3.4 Operating Altitude. Capable operation up to 13,000 feet above sea level.

1.3.5 Audible Noise. The unit shall not generate any audible noise.

1.3.6 Magnetic Fields. No appreciable magnetic fields shall be generated. Unit shall be capable of use in computer rooms without danger to data storage systems or devices.

2.0 ELECTRICAL REQUIREMENTS

2.1 Unit Operating Voltage. The nominal unit operating voltage and configuration shall be as indicated on the drawings. For voltage configurations not listed, contact factory.

Model Number	Voltage	Poles	Configuration
TGxxx-120/240-2G	120/240	2	Grounded Neutral
TGxxx-120/208-3GY	120/208	3	Grounded WYE
TGxxx-220/380-3GY	220/380	3	Grounded WYE
TGxxx-277/480-3GY	277/480	3	Grounded WYE
TGxxx-347/600-3GY	347/600	3	Grounded WYE
TGxxx-120/240-3GHD	120/240 x 208	3	Grounded "High-Leg" DELTA
TGxxx-240-3DG	240	3	DELTA
TGxxx-480-3DG	480	3	DELTA
TGxxx-600-3DG	600	3	DELTA

2.2 Maximum Continuous Operating Voltage (MCOV). The MCOV shall be greater than 115% of nominal voltage for all TransGuard products. All Current Technology suppression filter systems maximum continuous operating voltages are in compliance with test and evaluation procedures outlined in NEMA LS 1-1992, paragraphs 2.2.6 and 3.6.

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

2.4 Protection Modes. All protected modes are defined per NEMA LS-1-1992, paragraph 2.2.7. Following IEEE Standard 1100-1992, section 9.11.2 recommendations, TransGuard units shall provide protection in all modes. WYE configured systems shall provide Line-to-Neutral, Line-to-Ground, Line-to-Line and Neutral-to-Ground protection. DELTA configured systems shall provide Line-to-Line protection and Line-to-Ground protection.

2.5 Rated Single Pulse Surge Current Capacity. The rated single pulse surge current capacity, in amps, for each mode of protection of the unit shall be no less than as follows:

Rated Single Pulse Surge Current Capacity					
Model	L-N	L-G	N-G	L-L	Per Phase
TG300*	300,000 A	300,000 A	300,000 A	300,000 A	600,000 A
TG250*	250,000 A	250,000 A	250,000 A	250,000 A	500,000 A
TG200	200,000 A	200,000 A	200,000 A	200,000 A	400,000 A
TG150	150,000 A	150,000 A	150,000 A	150,000 A	300,000 A
TG125	125,000 A	125,000 A	125,000 A	125,000 A	250,000 A
TG100	100,000 A	100,000 A	100,000 A	100,000 A	200,000 A
TG80	80,000 A	80,000 A	80,000 A	80,000 A	160,000 A
TG60	60,000 A	60,000 A	60,000 A	60,000 A	120,000 A

* NOTE: See section 2.6 below

2.6 Tested Single Pulse Surge Current Capacity. In compliance with NEMA LS-1-1992, paragraphs 2.2.9 and 3.9, Current Technology suppression filter systems are single pulse surge current tested in all modes at rated surge currents by an industry-recognized independent test laboratory. Single pulse surge current capacities of 200,000 amps or less are established by single-unit testing of all components within each mode. Due to present industry test equipment limitations, single pulse surge current capacities over 200,000 amps are established via testing of individual components or sub-assemblies within a mode. The test shall include a UL1449 Second Edition surge defined as a 1.2 X 50 μsec, 6000V open circuit voltage waveform and an 8 X 20 μsec, 500A short circuit current waveform to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current (for units rated over 200,000A per mode, components or sub-assemblies are tested) magnitude with an approximated 8 X 20 μsec waveform. To complete the test, another UL1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL1449 surges does not vary by more than ±10%.

2.7 Minimum Repetitive Surge Current Capacity. Per ANSI/IEEE C62.41-1991 and ANSI/IEEE C62.45-1992, all Current Technology suppression filter systems are 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.

Repetitive Surge Current Capacity-Number of Impulses	
Model	**# of Impulses**
TG300	> 7,500
TG250	> 7,000
TG200	> 6,500
TG150	> 5,500
TG125	> 5,000
TG100	> 4,500
TG80	> 4,000
TG60	> 3,500

2.8 NEMA LS-1-1992 Clamping Voltage Data. All Current Technology suppression filter system clamping voltages are in compliance with test and evaluation procedures outlined in NEMA LS-1-1992, paragraphs 2.2.10 and 3.10. Maximum clamping voltages for TransGuard units without and with an integral disconnect are as follows in tables following 2.9.

2.9 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.

TG300, TG250, TG200					
System Voltage	**Mode**	**B3 Ringwave**	**B3/C1 Comb. Wave**	**C3 Comb. Wave**	**UL 1449 Second Edition**
120/240	L-N	325 / 375	425/450	650 / 775	400/400
120/208	L-G	400 / 450	425/450	650 / 825	500/500
	N-G	350 / 350	475 / 475	750 / 750	500/500
	L-L	400 / 500	775 / 850	950 / 1250	700/700
277/480	L-N	550 / 600	875 / 900	1125 / 1225	800/800
	L-G	850 / 875	850 / 900	1075 / 1225	1000/1000
	N-G	700 / 700	900 / 900	1225 / 1225	800/900
	L-L	650 / 750	1650 / 1725	1950 / 2200	1500/1500

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

TG150, TG125, TG100					
System Voltage	**Mode**	**B3 Ringwave**	**B3/C1 Comb. Wave**	**C3 Comb. Wave**	**UL 1449 Second Edition**
120/240	L-N	325 / 350	425 / 450	625 / 725	400/400
120/208	L-G	400 / 450	425 / 475	625 / 750	500/500
	N-G	375 / 375	475 / 475	750 / 750	400/500
	L-L	375 / 475	775 / 850	975 / 1200	700/700
277/480	L-N	525 / 550	875 / 925	1150 / 1200	900/900
	L-G	850 / 875	850 / 875	1075 / 1175	1000/1000
	N-G	700 / 725	900 / 900	1200 / 1200	800/800
	L-L	675 / 725	1675 / 1725	1950 / 2175	1800/1500

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

TG80, TG60					
System Voltage	**Mode**	**B3 Ringwave**	**B3/C1 Comb. Wave**	**C3 Comb. Wave**	**UL 1449 Second Edition**
120/240	L-N	300 / 325	400 / 425	550 / 700	400/400
120/208	L-G	400 / 425	400 / 450	600 / 750	500/500
	N-G	325 / 350	475 / 475	800 / 800	500/500
	L-L	425 / 475	725 / 800	900 / 1125	700/700
277/480	L-N	500 / 525	875 / 900	1050 / 1175	900/900
	L-G	825 / 875	825 / 875	1025 / 1150	1000/1000
	N-G	650 / 650	875 / 900	1200 / 1225	800/900
	L-L	700 / 775	1625 / 1675	1825 / 2025	1800/1800

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

2.10 High Frequency Extended Range Power Filter. All Current Technology TransGuard suppression filter systems EMI-RFI noise rejection, or attenuation, values are in compliance with test and evaluation procedures outlined in NEMA LS-1-1992, paragraphs 2.2.11 and 3.11.

Attenuation Frequency	50KHz	100KHz	500KHz	1MHz	5MHz	10MHz	50MHz	100MHz
TG300, 250, 200	53dB	41dB	32dB	31dB	32dB	35dB	47dB	53dB
TG150, 125, 100	50dB	44dB	34dB	33dB	34dB	36dB	47dB	53dB
TG80, 60	47dB	50dB	37dB	37dB	37dB	38dB	47dB	53dB

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

The TransGuard suppression filter system shall function in conjunction with other suppression filter devices of the same manufacturer via coordinated filters within the facility-wide MasterPLAN® suppression filter system that provide minimum noise attenuation as follows:

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-220A 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".

2.11 Overcurrent Protection

2.11.1 Each suppression element shall be fused to ensure that the failure of a single component 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:

Model	Maximum Deficiency Percentage
TG300, TG250, TG200	< 5%
TG150, TG100	<10%
TG80, TG60	<17%

2.11.2 For systems utilizing a hybrid technology, each element type shall be fused.

2.11.3 Every current carrying conductor associated with a component shall be fused to ensure that every fault is isolated at the point of the fault or at the component level.

2.11.4 Fusing shall be present in all modes, including Neutral-to-Ground.

2.11.5 All overcurrent / fault current protection shall be UL-Recognized as a stand-alone fuse.

2.11.6 All fusing must be UL-Recognized and tested at 200kAIC. Testing shall be inclusive of all available product voltages.

2.11.7 All fuses and overcurrent / fault current protection devices shall consist of self-arc-quenching, sand-encapsulated UL-Recognized fuse arrays. Each fuse shall be individually sealed in a manner that eliminates cross arcing.

2.11.8 The device shall be capable of withstanding the full single pulse surge current capacity for every mode without the operation or failure of overcurrent / fault current protection or fuses.

2.11.9 Transient Conduction Path. All full magnitude transient current shall be conducted on low-impedance solid copper bussing. If printed circuit boards are utilized in surge current paths,

no single trace shall be allowed to conduct more than the proportional current share of the connected TVSS component.

3.0 DOCUMENTATION

3.1 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.

3.2 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.

3.3 UL1449 Second Edition Listing / Clamping Voltages. The manufacturer shall provide data showing UL 1449 Second Edition product listing. The manufacturer shall also submit certified documentation of applicable Location Category Testing in full compliance with NEMA LS 1-1992, paragraphs 2.2.10 and 3.10.

3.4 Single Pulse Surge Current Capacity Testing. Certified documentation of the unit's Single Pulse Surge Current Capacity Testing shall be included in the submittal.

3.5 Minimum Repetitive Surge Current Capacity Testing. Certified documentation of the unit's Minimum Repetitive Surge Current Capacity Testing shall be included in the submittal.

3.6 Diagnostic Signature Card. The unit shall include a Diagnostic Signature Card listing factory-established benchmark suppression voltage values for all modes of protection. The suppression voltage values shall be established during final production line testing utilizing the DTS-2 Diagnostic Test Set. This Diagnostic Signature Card shall provide space for subsequent field testing allowing comparison of the initial factory benchmark testing with subsequent field testing suppression voltage values.

4.0 TESTING

4.1 Single Pulse Surge Current Capacity Testing. In compliance with NEMA LS-1-1992, paragraphs 2.2.9 and 3.9, each design configuration shall have the maximum single pulse surge current capacity per mode verified through testing. The test shall include a UL1449 Second Edition surge defined as a 1.2 X 50 μsec 6000V open circuit voltage waveform and an 8 X 20 μsec 500A short circuit current waveform to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an approximated 8 X 20 μsec waveform. To complete the test, another UL1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage found from the two UL1449 surges does not vary by more than ±10%.

4.2 Minimum Repetitive Surge Current Capacity Testing. Each design configuration shall have a repetitive surge current capacity rating which shall be verified through testing. The test shall include a UL1449 Second Edition surge defined as a 1.2 X 50 μsec 6000V open circuit voltage waveform and an 8 X 20 μsec 500A short circuit current waveform to benchmark the unit's suppression voltage, followed by a repetitive number of ANSI/IEEE C62.41-1991 Category C3 surges defined as a 1.2 X 50 μsec 20,000V open circuit voltage waveform and an 8 X 20 μsec 10,000A short circuit current waveform. To complete the test, another UL1449 surge shall be applied to verify survival. Survival is achieved if the suppression voltage resulting from the two UL1449 surges do not vary by more than ±10%. Proof of such testing shall be the test log generated by the surge generator.

4.3 UL 1449 Second Edition Suppressed Voltage Performance Testing. Each design configuration shall have a UL 1449 Second Edition Suppressed Voltage Rating that has been tested and assigned by Underwriters Laboratories utilizing the following waveforms and procedure. The test shall be initiated with a surge of 6,000V / 500A, using waveshapes defined within ANSI/IEEE C62.41-1991 as a 1.2 X 50 μsec open circuit voltage waveform and an 8 X 20 μsec short circuit current waveform, to benchmark the unit's suppression voltage. The unit shall then be subjected to 10 positive polarity and 10 negative polarity 1.2 X 50 μsec 6,000V open circuit voltage waveforms and an 8 X 20 μsec 3,000A short circuit current waveforms. For comparison with the initial benchmark voltage reading, another ANSI/IEEE surge defined as 1.2 X 50 μsec 6000V open circuit voltage waveform and an 8 X 20 μsec 500A short circuit current waveform shall be applied. Deviation from initial to final clamping value may not exceed ±10%. Upon successful completion, an appropriate UL 1449 Second Edition Suppression Voltage Rating is assigned by Underwriters Laboratories.

4.4 Short Circuit Fuse Testing. Each design configuration shall be short circuit tested in accordance with the type of fusing utilized in the suppression path. Testing shall include application of a sustained overvoltage that causes the unit to enter a bolted fault condition. This bolted fault condition shall occur with the full rated AIC current of the fuse available. The fuse shall fail in a safe manner with no physical or structural damage to the unit and any failure shall be self-contained within the unit.

4.5 Surge Current Fuse Testing. Each design configuration shall be surge tested with fusing in series to verify that a transient of maximum surge current capacity magnitude is fully suppressed without fuse failure, operation or degradation.

4.6 MCOV (Maximum Continuous Operating Voltage) Testing. Each unit shall be factory tested at the applicable MCOV to assure proper field operation.

4.7 Quality Assurance Testing. Each unit shall be thoroughly factory tested before shipment. Testing of each unit shall include, but shall not be limited to, UL manufacturing and production-line tests, quality assurance checks, MCOV and clamping voltage verification tests.

4.8 Start-Up Testing. Upon completion of installation, a factory-authorized local service representative shall provide testing services. The following tests shall be performed: (a) voltage measurements from Line-to-Ground, Line-to-Neutral, Line-to-Line and Neutral-to-Ground (no neutral in DELTA configurations) at the time of the testing procedure, (b) impulse injection to verify the system suppression voltage tolerances for all suppression paths. Impulse testing shall be completed while the unit is off-line to isolate the unit from the distribution system. Test results should be recorded and compared to factory benchmark test parameters supplied with each individual unit. 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 suppression filter system function. In addition, the integrity of the neutral-ground bond should be verified through testing and visual inspection. A Seven-Year Limited Warranty shall initiate after the owner has accepted the testing results and taken possession of the equipment.

WARRANTY

5.1 Seven-Year Limited Warranty. The manufacturer shall provide a Seven-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.

5.2 MasterPLAN® Extended Ten-Year Limited. When simultaneously installed in a coordinated system consisting of selenium-enhanced product (SEL300 and/or SEL250) located electrically upstream of TransGuard product(s), the manufacturer shall provide a MasterPLAN® Ten-Year Limited Warranty from the date of shipment against failure for the TransGuard product(s). All product(s) must be installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.

6.0 PRODUCT

6.1 High Performance Suppression System. The unit shall include an engineered solid-state high performance suppression system utilizing arrays of non-linear voltage dependent metal oxide varistors with similar operating characteristics. The suppression system components shall optimally share surge currents in a seamless, low-stress manner assuring maximum performance and proven reliability. 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.

6.2 High Frequency Extended Range Power Filter. The unit shall include a high frequency extended range power filter and shall be UL 1283 listed as an Electromagnetic Interference Filter. The filter shall reduce fast rise-time, high frequency, error-producing transients and electrical line noise to harmless levels, thus eliminating disturbances, which may lead to electronic system upset. The filter shall provide minimum noise attenuation as specified in section 2.10 of this specification.

6.3 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.

6.4 Field Connections. The unit shall include mechanical or compression lugs for each phase, neutral and ground, if applicable. Recommended wire size range is as follows:

Phase Conductor Wire Size	Neutral Conductor Wire Size	Ground Conductor Wire Size
#2 - #8 AWG Copper	#2 - #8 AWG Copper	#2 - #8 AWG Copper

6.5 Field Installation. The unit shall be installed as close as practical to the facility's wiring system in accordance with applicable national/local electrical codes and the manufacturer's recommended installation instructions.

6.5.1 If an overcurrent protection device is used to connect the phase conductors, it is recommended to use a 100 amp fuse or breaker. If a non-fused external disconnect or molded case breaker is used, a 100 amp rating is recommended.

6.5.2 For connecting the phases, neutral, and ground of the device, it is recommended to use #8 to #2 AWG copper conductors.

6.6 Unit Phase Indicators. The unit shall include long-life, solid state, externally visible phase indicators that monitor the on-line status of each phase of the unit.

6.7 Enclosure

6.7.1 Standard Enclosure. Standard unit shall be supplied in a NEMA 4 fiberglass reinforced polyester enclosure. Enclosure sizes and weights are as follows:

Model	Enclosure Size/Weight Non-metallic Enclosure	Enclosure Size/Weight Metal Enclosure (w/ disc)
TG200-300	19.5”H x 17.5”W x 9.5”D / 57 lbs.	28”H x 16”W x 9.5”D / 91 lbs.
TG100-150	17.5”H x 15.5”W x 7”D / 40 lbs.	20”H x 16”W x 9.5”D / 59 lbs.
TG60-80	15.5”H x 13.5”W x 7”D / 28 lbs.	16”H x 16”W x 9.5”D / 45 lbs.

6.7.2 Optional Open Frame. The unit shall be optionally available in an open-frame configuration to facilitate installation within a switchgear cubicle, electrical enclosure, or other barriered section. Open-frame space requirements are as follows:

Model	Space Required for Mounting Without Disconnect	Space Required for Mounting With Disconnect
TG200-300	17.58”H x 11.62”W x 4.55”D / 57 lbs. (max)	25.5”H x 16”W x 11.88”D / 91 lbs. (max)
TG100-150	12.48”H x 11.62”W x 4.55”D / 40 lbs. (max)	17.5”H x 14.5”W x 10.25”D / 59lbs.(max)
TG60-80	9.0”H x 11.62”W x 4.55”D / 28 lbs. (max)	14”H x 14.5”W x 10.25”D / 45 lbs. (max)

7.0 FEATURES / OPTIONS

7.1 Disconnect.

7.1.1 The device shall have optionally available a NEMA designed and certified safety interlocked integral disconnect switch located within the unit with an externally mounted metal manual operator. With disconnect, the unit is supplied in a NEMA 4 metallic enclosure.

7.1.2 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.

7.1.3 The switch shall be rated for 600Vac.

7.1.4 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.

7.1.5 The integral disconnect switch shall be capable of withstanding, without failure, the published maximum surge current magnitude without failure or damage to the switch.

7.2 PRIMARY Monitoring Option.

7.2.1 Dual Form "C" Dry Contacts. The TransGuard product with Primary monitoring option shall be provided with two (2) sets of form "C" dry contacts (normally open and normally closed) to facilitate connection to a building management system or other remote monitoring system. The contacts shall be normally open or normally closed and shall change state upon failure of the suppression filter system or power loss in any of the phases.

7.3 ADVANCED Monitoring Option. The TransGuard product shall be provided with an integral monitoring option as specified below:

7.3.1 Dual Form "C" Dry Contacts. The TransGuard product with Advanced monitoring option shall be provided with 2 sets of form "C" dry contacts (normally open and normally closed) to facilitate connection to a building management system or other remote monitoring system. The contacts shall be normally open or normally closed and shall change state upon failure of the suppression system or power loss in any of the phases.

7.3.2 Display Event Counter. The TransGuard product with Advanced monitoring option shall be provided with a display event counter that makes available the cumulative number of transients to which the device has been subjected. The detection circuitry must be current sensing to eliminate erroneous counts that may be produced from stray voltages and noise signals, both conducted and radiated.

7.3.3 Battery Powered Audible Alarm and LED Indicators. The TransGuard product with Advanced monitoring option 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. The alarm shall have a silence switch as well as a test switch for ensuring positive function and an alarm LED that illuminates when the alarm is disabled. The monitoring unit shall have an easily replaceable, commonly available battery for backup to ensure audible alarm function in the event of a total power failure. The unit shall have a battery backed-up monitor LED that shall illuminate when battery requires replacement.

7.4 MasterMIND™ Monitoring Option. The TransGuard product shall be provided with an integral multifunction power monitor analyzer. The monitoring system shall provide realtime product performance data along with distribution system power analysis via multiport visual status indicators (LEDs) and a touchpad accessible LED data display. It shall include the following features:

7.4.1 Enhanced Status Indicators. The TransGuard product with MasterMIND monitoring option shall be provided with enhanced status indication allowing for visual inspection of the online status of all hybrid elements: MOVs, and capacitors. Such indication shall be provided for each phase.

7.4.2 Dual Form "C" Dry Contacts. The TransGuard product with MasterMIND monitoring option shall be provided with 2 sets of form "C" dry contacts (normally open and normally closed) to facilitate connection to a building management system or other remote monitoring system. The contacts shall be normally open or normally closed and shall change state upon failure of the suppression system or power loss in any of the phases.

7.4.3 Display Event Counter. The TransGuard product with MasterMIND monitoring option shall be provided with a display event counter that makes available the cumulative number of transients to which the device has been subjected. The detection circuitry must be current sensing to eliminate erroneous counts that may be produced from stray voltages and noise signals, both conducted and radiated.

7.4.4 Battery Powered Audible Alarm. The TransGuard product with MasterMIND monitoring option 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. The alarm shall have a silence switch as well as a test switch for ensuring positive function and an alarm LED that illuminates when the alarm is disabled. The monitoring unit shall have an easily replaceable, commonly available battery for backup to ensure audible alarm function in the event of a total power failure. The unit shall have a battery backed-up LED which shall illuminate when battery requires replacement.

7.4.5 % Protection Available. The TransGuard product with MasterMIND monitoring option shall provide numeric display of the available surge protection online. Sensing each hybrid element's fuse, the microprocessor-based circuitry shall be capable of calculating the amount of protection still active in the circuit and displaying a percentage amount.

7.4.6 Neutral-to-Ground Current Sensing. The TransGuard product with MasterMIND® monitoring option 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). This indication might signal neutral-ground bonding problems within the distribution system.

7.4.7 Neutral-to-Ground Voltage Sensing. The TransGuard product with MasterMIND monitoring option shall provide digital display of the voltage across the neutral and ground. This indication might signal neutral-ground bonding or asymmetrical load problems within the distribution system.

7.4.8 True RMS Voltage Monitor. The TransGuard product with MasterMIND monitoring option shall provide true RMS voltage monitoring for all phases along with neutral-to-ground.

7.4.9 Voltage Sag Detection. The TransGuard product with MasterMIND monitoring option shall provide visual indication and count of all voltage sags < 90% of nominal.

7.4.10 Voltage Swell Detection. The TransGuard product with MasterMIND monitoring option shall provide visual indication and count of all voltage swells > 110% of nominal.

7.4.11 Power Dropout Detection. The TransGuard product with MasterMIND monitoring option shall provide visual indication and count of all power dropouts < 1 cycle.

7.4.12 Power Outage Detection. The TransGuard product with MasterMIND monitoring option shall provide visual indication and count of all power outages > 1 cycle.

8.0 APPROVED VENDORS.

8.1 Current Technology

Danaher Power Solutions
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