SECTION 16289 - TRANSIENT VOLTAGE SURGE SUPPRESSION

1.0 GENERAL

1.1 DRAWINGS AND GENERAL PROVISIONS OF CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION-1 SPECIFICATIONS SECTIONS, APPLY TO THE WORK OF THIS SECTION.

1.2 DIVISION - 16 BASIC ELECTRICAL MATERIALS AND METHODS SECTIONS APPLY TO THE WORK OF THIS SECTION.

1.3 DESCRIPTION: THIS SECTION DESCRIBES THE MATERIALS AND INSTALLATION REQUIREMENTS FOR TRANSIENT VOLTAGE SURGE SUPPRESSORS (TVSS) FOR THE PROTECTION OF ALL AC ELECTRICAL CIRCUITS FROM THE EFFECTS OF LIGHTNING INDUCED CURRENTS, SUBSTATION SWITCHING TRANSIENTS AND INTERNALLY GENERATED TRANSIENTS RESULTING FROM INDUCTIVE AND/OR CAPACITIVE LOAD SWITCHING.

1.4 SUBMITTALS: SUBMIT SHOP DRAWINGS, PRODUCT DATA AND MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR EACH TYPE OF PRODUCT BEING PROVIDED. MARK THE DATA SHEET FOR THE PRODUCT BEING PROVIDED WITH AN IDENTIFYING MARK OR ARROW. THE SURGE SUPPRESSION SUBMITTALS SHALL ALSO INCLUDE:

A. DIMENSIONAL DRAWING OF EACH SUPPRESSOR TYPE INDICATING MOUNTING ARRANGEMENTS.
B. CATEGORY C3 (20KV, 10KA) TEST RESULTS.
C. UL 1449 CLAMP VOLTAGE DOCUMENTATION.
D. CERTIFIED LIFE EXPECTANCY TESTING
E. ANY REQUIRED DOCUMENTATION IN SECTION 2.0 - PRODUCTS
F. PROVIDE FORMS PROVIDED HEREIN FILLED OUT WITH MANUFACTURER'S DATA.

1.5 SUBSTITUTIONS PRIOR APPROVAL REQUIRED.

2.0 PRODUCTS:

2.1 SERVICE ENTRANCE:

2.1.1 SUPPRESSORS SHALL BE LISTED IN ACCORDANCE WITH UL 1449, STANDARD FOR SAFETY, TRANSIENT VOLTAGE SURGE SUPPRESSORS.

2.1.2 SUPPRESSORS SHALL BE TESTED WITH CATEGORY C3 HIGH EXPOSURE WAVEFORM (20 KV, 10KA, 8/20USEC. WAVEFORM) PER ANSI/IEEE C62.41-1991.

2.1.3 FOR 3 PHASE, 4 WIRE CONFIGURATIONS, SUPPRESSORS SHALL PROVIDE SUPPRESSION ELEMENTS BETWEEN EACH PHASE CONDUCTOR AND THE SYSTEM NEUTRAL, EACH PHASE CONDUCTOR AND SYSTEM GROUND, AND BETWEEN NEUTRAL CONDUCTOR AND GROUND.

2.1.4 VISIBLE INDICATION OF PROPER SUPPRESSOR CONNECTION AND OPERATION SHALL BE PROVIDED.

2.1.5 SUPPRESSORS SHALL MEET OR EXCEED THE FOLLOWING CRITERIA:

A. MAXIMUM SINGLE IMPULSE CURRENT RATING: 150,000 AMPERES PER PHASE.

B. PULSE LIFE RATING: ANSI/IEEE CAT. C3 (8/20SEC. WAVEFORM): 2500 OCCURRENCES WITHOUT FAILING OR DEGRADING THE UL 1449 SURGE SUPPRESSION RATING MORE THAN 10%.

C. UL 1449 CLAMPING VOLTAGE SHALL NOT EXCEED THE FOLLOWING: VOLTAGE L-N, N-G, L-G: 120/208V 400,400,400, 277/480 800,800,800.

2.1.6 SUPPRESSORS SHALL BE OF THE SOLID-STATE COMPONETRY AND SHALL OPERATE BIDIRECTIONALLY.

2.1.7 SUPPRESSORS SHALL BE AS MANUFACTURED BY CURRENT TECHNOLOGY IND3000, LIEBERT LCGXXXYC3, EFI TITAN BP, LEA DYNATECH DYNA SYSTEM 3.

2.1.8 THE SUPPRESSOR WILL HAVE A WARRANTY GUARANTEE FOR A PERIOD OF FIVE YEARS, INCORPORATING A FREE REPLACEMENT IF THE SUPPRESSOR IS DESTROYED BY LIGHTNING WITHIN THE WARRANTY PERIOD INCLUDING ALL PARTS AND LABOR.

2.1.9 CONNECTION OF SURGE SUPPRESSION EQUIPMENT SHALL BE A CIRCUIT BREAKER OR FUSE. BUS MOUNT SURGE EQUIPMENT IN MAIN SWITCHGEAR.

2.2 SURGE SUPPRESSION FOR DISTRIBUTION PANELS:

2.2.1 GENERAL

2.2.2 SUMMARY. THESE SPECIFICATIONS DESCRIBE THE ELECTRICAL AND MECHANICAL REQUIREMENTS FOR A HYBRID HIGH-ENERGY 100,000 AMP CLASS SUPPRESSION FILTER SYSTEM THAT INTEGRATES TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) WITH HIGH-FREQUENCY ELECTRICAL LINE NOISE FILTERING FOR MEDIUM TO LOW EXPOSURE APPLICATIONS. THE UNIT SHALL BE CONNECTED IN PARALLEL WITH THE FACILITY'S WIRING SYSTEMPER ELECTRICAL DRAWINGS. THE UNIT SHALL BE MANUFACTURED IN THE USA BY A QUALIFIED MANUFACTURER OF SUPPRESSION FILTER SYSTEM EQUIPMENT WHO HAS BEEN ENGAGED IN THE COMMERCIAL DESIGN AND MANUFACTURE OF SUCH PRODUCTS FOR A MINIMUM OF FIVE (5) YEARS.

2.2.3 STANDARDS. THE SPECIFIED UNIT SHALL BE DESIGNED, MANUFACTURED, TESTED, AND INSTALLED IN COMPLIANCE WITH THE FOLLOWING STANDARDS:

AMERICAN NATIONAL STANDARDS INSTITUTE AND INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS

(ANSI/IEEE) C62.41-1991 AND C62.45-1987);

CANADIAN STANDARDS ASSOCIATION (CSA);

FEDERAL INFORMATION PROCESSING STANDARDS PUBLICATION 94 (FIPS PUB 94);

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA);

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA 70 [NEC], 75, AND 78);

UNDERWRITERS LABORATORIES (UL 1449 AND 1283).

2.2.4 PRODUCT REQUIREMENTS.

2.2.5 UNIT OPERATING VOLTAGE. THE NOMINAL UNIT OPERATING VOLTAGE AND CONFIGURATION SHALL BE AS INDICATED ON THE DRAWINGS.

2.2.6 MAXIMUM CONTINUOUS OPERATING VOLTAGE (MCOV). THE MAXIMUM CONTINUOUS OPERATING VOLTAGE (MCOV) OF ALL SUPPRESSION COMPONENTS UTILIZED IN THE UNIT SHALL NOT BE LESS THAN 115% OF THE FACILITY'S NOMINAL OPERATING VOLTAGE.

2.2.7 TESTED SINGLE-PULSE SURGE CURRENT CAPACITY. BASED ON ANSI/IEEE C62.41-1991'S STANDARD 8 X 20 MICROSECOND CURRENT WAVEFORM, AND IN ACCORDANCE WITH NEMA PUBLICATION NO. LS 1-1992, THE TESTED SINGLE-PULSE SURGE CURRENT CAPACITY, IN AMPS, OF THE UNIT SHALL BE NO LESS THAN AS FOLLOWS:

PROTECTION MODE	L-L	L-N	L-G	N-G
TESTED SINGLE PULSE SURGE CURRENT		50,000	50,000	50,000

50,000

2.2.8 UNIT STATUS INDICATORS. THE UNIT SHALL INCLUDE SOLID-STATE, LONG-LIFE, EXTERNALLY MOUNTED LED VISUAL STATUS INDICATORS THAT MONITOR THE ON-LINE STATUS OF EACH PHASE OF THE UNIT.

2.2.9 UL 1449 PERFORMANCE RATINGS. THE UNIT'S PUBLISHED PERFORMANCE RATINGS SHALL BE THE UL 1449 LISTED SUPPRESSION RATINGS. THE UL 1449 SUPPRESSION RATING SHALL BE, FOR EACH MODE OF PROTECTION, AS FOLLOWS:

NOMINAL SYSTEM VOLTAGE	L-N	L-G	N-G
120/208	400	400	400
277/480	800	800	800

2.2.10 LIFE EXPECTANCY TESTING. THE UNIT SHALL BE LIFE-CYCLE TESTED TO PROTECT AGAINST AND SURVIVE AT LEAST 2,500 ANSI/IEEE C62.41-1991 CATEGORY C SURGES WITHOUT FAILING OR DEGRADING THE UL 1449 SURGE SUPPRESSION RATING BY MORE THAN 10%.

2.2.11 INTERNAL IMPEDANCE. THE UNIT SHALL PROVIDE A PATH OF EXTREMELY LOW IMPEDANCE AND SHALL NOT UTILIZE PRINTED CIRCUIT BOARDS, QUICK TYPE DISCONNECTS OR SMALL GAUGE WIRE IN THE SURGE CURRENT DIVERSION PATH. ALL INTERNAL PATHS SHALL BE LOW IMPEDANCE # 8 AWG COPPER CONDUCTOR OR COPPER OR ALUMINUM BUS BAR.

2.2.12 HIGH-FREQUENCY EXTENDED RANGE TRACKING FILTER. THE UNIT SHALL PROVIDE EMI/RFI ATTUATION UPTO 50 DB AT 100 MHZ.

2.2.13 FIELD CONNECTIONS. THE UNIT SHALL INCLUDE MECHANICAL LUGS FOR EACH PHASE, NEUTRAL AND GROUND, IF APPLICABLE. THE LUGS SHALL ACCOMMODATE UP TO # 6 AWG COPPER CONDUCTOR.

2.2.14 ENCLOSURE. UNITS SHALL BE PROVIDED IN A NEMA 1 TYPE ENCLOSURE OF 14 GAUGE STEEL.

2.2.15 SUPPRESSORS SHALL BE AS MANUFACTURED BY CURRENT TECHNOLOGY, LIEBERT,

EFI, LEA DYNATECH.

2.2.16 THE SUPPRESSOR WILL HAVE A WARRANTY GUARANTEE FOR A PERIOD OF FIVE YEARS, INCORPORATING A FREE REPLACEMENT IF THE SUPPRESSOR IS DESTROYED BY LIGHTNING WITHIN THE WARRANTY PERIOD INCLUDING ALL PARTS AND LABOR.

2.2.17 THE SUPPRESSORS FOR THE COMPUTER PANELS SHALL BE BUS MOUNTED AND CONTAINED WITHIN THE PANELBOARD ENCLOSURE. THE SUPPRESSORS SHALL BE PROTECTED WITH EITHER A CIRCUIT BREAKER OR FUSE ARRANGEMENT.

2.3 INDIVIDUAL BRANCH CIRCUIT SURGE ARRESTOR. TO BE USED WITH EXTERIOR LIGHTING CIRCUITS.

2.3.1 SUPPRESSOR SHALL BE DESIGNED FOR PROTECTION OF INDIVIDUAL LIGHTING BRANCH CIRCUITS ENTERING OR EXITING THE BUILDING AND INSTALLED AS CLOSE AS POSSIBLE TO THE POINT OF ENTRANCE OR EXIT.

2.3.2 SURGE ARRESTORS SHALL BE SOLID STATE METAL OXIDE VARISTORS ENCAPSULATED IN EPOXY WITH AN INSULATION RESISTANCE OF >100 MEGOHMS.

2.3.4 PROTECTION MODES SHALL BE LINE TO GROUND, LINE TO NEUTRAL, AND NEUTRAL TO GROUND.

2.3.5 MAXIMUM SINGLE IMPULSE CURRENT PER MODE SHALL BE 26,000 AMPS .

2.3.6 SYSTEM VOLTAGE SHALL BE AS INDICATED ON DRAWINGS.

2.3.7 SURGE SUPPRESSOR SHALL BE RATED FOR CONTINUOUS USE ON A FULLY LOADED 20 AMPERE CIRCUIT.

2.3.8 SURGE SUPPRESSOR SHALL BE ENCLOSED IN A 6"X6"X4" NEMA TYPE 1 BOX.

2.3.9 TERMINAL BLOCKS SHALL BE PROVIDED FOR A SERIES FEED-THRU CONNECTION. BLOCKS SHALL BE RATED FOR WIRE SIZE 22-10 AWG CU.

2.3.10 SURGE SUPPRESSOR SHALL HAVE A 5 YEAR LIMITED WARRANTY.

2.3.11 SURGE SUPPRESSOR SHALL HAVE EMI/RFI NOISE REJECTION UP TO 60 DB (10 KHZ - 100 MHZ).

2.3.12 SURGE SUPPRESSOR SHALL HAVE SINE WAVE TRACKER.

2.3.13 SURGE SUPPRESSOR TO BE EFI OEM120EFI-20 OR APPROVED EQUAL.

2.4 INSTALLATION REQUIREMENTS

2.4.1 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. CONNECTION SHALL NOT BE ANY LONGER THAN NECESSARY, AVOIDING UNNECESSARY BENDS. FACTORY TRAINED REPRESENTATIVE SHALL PROVIDE START-UP TO INCLUDE INITIAL VERIFICATION OF PROPER INSTALLATION AND VERIFICATION OF SUPPRESSION CLAMPING ABILITY WITH DIAGNOSTIC TEST SET AND INITIATE FACTORY WARRANTY.

2.4.2 WARRANTY. THE MANUFACTURER SHALL PROVIDE A LIMITED FIVE-YEAR 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.

3.0 EXECUTION:

3.1 SERVICE ENTRANCE:

3.1.1 INSTALL ONE PRIMARY SUPPRESSOR AT EACH UTILITY SERVICE ENTRANCE TO THE FACILITY, ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

3.1.2 SUPPRESSOR SHALL BE INSTALLED ON THE SERVICE PANEL, PER THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.

3.1.3 THE MOUNTING SHALL BE BUSSED BETWEEN SUPPRESSOR AND THE SWITCHBOARD.

3.1.4 SUPPRESSOR'S GROUND SHALL BE BONDED TO THE SERVICE ENTRANCE GROUND.

3.2 SECONDARY DISTRIBUTION PANELS:

3.2.1 INSTALL ONE SECONDARY SUPPRESSOR AT EACH PANELBOARD LOCATION INDICATED ON THE DRAWINGS. VERIFY PROPER VOLTAGE OF PANEL/SUPPRESSOR PRIOR TO INSTALLATION.

3.2.2 CONDUCTORS BETWEEN SUPPRESSOR AND POINT OF ATTACHMENT TO THE PANELBOARD SHALL BE KEPT AS SHORT AND STRAIGHT AS POSSIBLE. PROVIDE A 60/3 CIRCUIT BREAKER IN PANELBOARD BEING PROTECTED FOR CONNECTION TO SUPPRESSOR. SUPPRESSORS FOR THE COMPUTER PANELS SHALL BE BUS MOUNTED.

3.3 INDIVIDUAL BRANCH CIRCUIT SURGE ARRESTOR:

3.3.1 INSTALL SUPPRESSOR ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

3.3.2 PROVIDE A SURGE ARRESTOR FOR EACH INDIVIDUAL EXTERIOR LIGHTING CIRCUIT ADJACENT TO THE CONTACTOR SERVING THE LIGHTING CIRCUITS.

SURGE SUPPRESSOR - SERVICE ENTRANCE

SPECIFICATION SECTION	REQUIREMENTS	PERFORMANCE OF PRODUCT BEING SUBMITTED
2.1.1	UL 1449 LISTED	
2.1.2	ANSI C62.41-1991 C3 TEST RESULTS: 277/480 VOLTS	
2.1.3	UL LISTED SUPPRESSION MODES: L-N, L-G, N-G	
2.1.4	DIAGNOSTICS (TYPE)	
2.1.5.A	150,000 SURGE CURRENT RATING (L-N + L-G)/PHASE	
2.1.5.B	PULSE LIFE TESTING - 2500 SURGES	
2.1.5.C	UL 1449 CLAMPING 277/480V, L-N, L-G, N-G	
2.1.6	SOLID STATE AND BIDIRECTIONAL	
2.1.7	MANUFACTURER AND MODEL NUMBER	
2.1.8	5 YEAR WARRANTY	

SURGE SUPPRESSOR - DISTRIBUTION PANELBOARDS

SPECIFICATION SECTION	REQUIREMENTS	PERFORMANCE OF PRODUCT BEING SUBMITTED
2.2.2	FILTERING AND SINE WAVE TRACKING	
2.2.3	BUILT AND TESTED TO STANDARDS: ANSI, IEEE, CSA, FIPS 94, NEMA, NFPA, UL	
2.2.4	NO REQUIREMENTS	
2.2.5	APPLIED VOLTAGE LIMIT	
2.2.6	MCOV GREATER THAN 115%	
2.2.7	50,000 AMP SURGE CURRENT L-N, L-G, N-G	
2.2.8	DIAGNOSTICS (TYPE)	
2.2.9	UL 1449 CLAMPING 120/208V, L-N, L-G, N-G	
2.2.10	2500 CATEGORY C SURGES	
2.2.11	NO REQUIREMENTS	
2.2.12	EMI/RFI UP TO 50 DB @ 100MHZ	
2.2.13	LUGS TO ACCOMODATE UP TO #6 COPPER CONDUCTORS	
2.2.14	NEMA 1 ENCLOSURE SURFACE OR FLUSH MOUNTABLE	
2.2.15	MANUFACTURER AND MODEL NUMBER	
2.2.16	5 YEAR WARRANTY	

INDIVIDUAL BRANCH CIRCUIT SURGE ARRESTOR

SPECIFICATION SECTION	REQUIREMENTS	PERFORMANCE OF PRODUCT BEING SUBMITTED
2.3.1	SINGLE/DUAL CIRCUIT SUPPRESSOR	
2.3.2	SOLID STATE MOV COMPONENTS	
2.3.3	PROTECTIVE MODES: L-N, L-G, N-G	
2.3.4	26,000 AMP SURGE CURRENT L-N, L-G, N-G	
2.3.5	VOLTAGE SUPPRESSOR BEING APPIED AT	
2.3.6	MAXIMUM CONTINUOUS AMPERAGE OF SUPPRESSOR	
2.3.7	ENCLOSURE RATING	
2.3.8	CONNECTION MEANS (TERMINALS)	
2.3.9	5 YEAR WARRANTY	
2.3.10	EMI/RFI NOISE REJECTION UP TO 60 DB (10 KHZ TO 100 MHZ)	
2.3.11	SINE WAVE TRACKING	
2.3.12	MANUFACTURER AND MODEL NUMBER	

END OF SECTION