

SECTION 16120 SWITCHBOARDS

PART 1 – GENERAL

A. Main Distribution Switchboard

B. Switchboard Metering

1.1 SUBMITTALS

A. Submit product data consisting of the following:

1. Manufacturer's published literature on switchboards including individual component information and information on the complete assembled unit.
2. Bus short-circuit with stand ability (RMS symmetrical amperes fault current rating) and with stand ability of lowest rated device.
3. Overall dimensions of switchboards including space available for conduits and conductors.
4. For the switchboards, submit complete drawing providing the following information; complete rating, short-circuit with stand ability of bus and of lowest rated device, overall outline dimensions including space available for conduits, circuit schedule showing circuit numbers, device description, device frame ampere rating, feeder circuit identification, conductor ratings, and one line diagram with each circuit device numbered.

PART 2 – PRODUCTS

1.1 MAIN DISTRIBUTION SWITCHBOARD

A. Manufacturers: Acceptable manufacturers are Square D, General Electric, Cutler Hammer, I.T.E. Seimens, or equivalent.

B. Furnish the factory assembled service entrance switchboard as herein specified and as shown on the drawings. The switchboard shall be Underwriters' Laboratories approved.

C. The switchboard shall be dead-front with front accessibility required. The switchboard framework shall consist of steel channels bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting. The framework is to be formed of code gauge steel rigidly welded together to support all cover plates, bussing and component devices.

D. Each switchboard section shall have an open bottom and individual removable top plate for installation and termination of conduit. The wire way front covers are to be hinged to permit access to the branch breaker load side terminals without removing the covers. All front plates used for mounting meters, selector switches or other front mounted devices shall be hinged with all wiring installed and laced with flexibility at the hinged side. All closure plates shall be screw removable and small enough for easy handling one man. The paint finish shall be grey enamel over a rust-inhibiting phosphate primer.

E. The switchboard bussing shall be copper and of sufficient cross-sectional area to continuously conduct rated full load current with a maximum average temperature rise of 50 degrees C, above an ambient temperature of 40 degrees C. The bus bars shall be rigidly braced to comply with the integrated equipment rating of the switchboard. Minimum 100,000 AIC sym. The main horizontal bus bars between sections shall be located on the back of the switchboard to permit a maximum of available conduit area. The horizontal main bus bar supports, connections, and joints are to be bolted with grade 5 carriage bolts and Belleville washers to be free of periodic maintenance.

F. Each switchboard, as a complete unit, shall be given a single integrated equipment rating by the manufacturer. The integrated equipment short-circuit rating shall certify that all equipment is capable of withstanding the stresses of a fault equal to that of the least over current protective device contained therein. Such rating shall be established by actual tests by the manufacturer on similar equipment constructed as the subject switchboard. This test data shall be furnished to the Owner, with the submittal of approval drawings.

G. The incoming section of the switchboard shall be provided with an auxiliary gutter shall be provided for the entrance of the service conductors.

H. Distribution Breakers: a group mounted section (or sections) containing molded case circuit breakers with trip ratings as shown on the drawings. Branch molded case circuit breakers shall be totally front accessible and front connectable. The breakers are to be mounted in the switchboard to permit installation, maintenance and testing without reaching over any line side bussing. Each breaker is to be furnished with an externally operable mechanical means to trip the circuit breaker, enable maintenance personnel to verify the ability of the breaker trip mechanism to operate as well as exercising the breaker latch and operating mechanisms. Each type of circuit breaker assembly shall have undergone and passed heat tests according to UL test procedures and the UL listed.

I. Provide minimum 45,000 AIC sym. Rating for all circuit breakers.

J. The main Distribution switchboard shall be provided with the metering described as follows in paragraph 1.2.

K. Main Device shall be insulated case solid state breaker with adjustments for longtime, short time, longtime delay, and short time delay. Also provide ground fault monitor with this breaker and shunt trip unit.

1.2 METERING

A. Manufacturers: The metering items specified shall be by the manufacturer supplying the switchboard.

B. The meter shall be an electronic power meter. This meter shall provide 2% accuracy for common measurements of voltage, current, power, power demand and power factor. Other measurements shall be provided as described in the manufacturer's standard literature. Capabilities for this meter shall include data logging and waveform capture and must be LAN/INTERNET compatible.

C. Provide the voltage connections for the meter on the load side of the main lugs. The connections shall be made via fuse block or circuit breaker suitably sized to protect the meter.

D. Provided a current transformer for each phase and the neutral. The CT's shall be installed on the load side bussing of the main lugs.

E. Provide on-site installation support until the metering is functioning correctly.

SECTION 16180 TRANSIENT VOLTAGE SURGE SUPPRESSORS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Electrical and mechanical drawings for the TVSS shall be provided by the manufacturer which shows unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.

B. The manufacturer shall furnish an equipment manual with installation, operation, and maintenance instructions for the specified unit.

C. Documentation of unit's UL 1449 suppression rating shall be included as required product data submittal information.

D. The contractor shall provide detailed compliance exception statements to all provisions of this specification ten (10) days prior to the bid date.

1.2 MANUFACTURERS

A. For the purpose of selecting quality and type of TVSS units, equipment as manufactured by Current Technology Inc. has been specified. The following manufacturers meeting these specifications are acceptable.

1. Liebert
2. Lea International
3. Surge Suppression, Inc.
4. Square D
5. Intermatic
6. Advanced Protection Technologies
7. Siemens

B. The manufacturer shall provide a Limited Five-Year Warranty, from the date of installation, against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's recommended installation, operation and maintenance instructions.

1.3 GENERAL

A. These specifications describe the electrical and mechanical requirements for a high-energy suppression filter system utilizing transient voltage surge suppression (TVSS) for application in Category C (Main Service Entrance) and Category B (Distribution Panels) areas as defined by the IEEE C62.41 standard.

B. The specified unit shall provide effective high energy **transient voltage clamping and surge current diversion** for all electrical modes of equipment connected downstream from the facility's main distribution panel or main over current device. The unit shall be designed for parallel connection to the facility's wiring system.

C. All Category B (distribution panels) shall include a high frequency attenuation filter for all modes protection the TVSS is providing.

D. The unit shall include, but not be limited to, an engineered solid-state high-performance suppression system, utilizing Selenium Cells and/or arrays of fused non-linear voltage dependent Metal Oxide Varistors (MOV).

E. The suppression system shall not utilize gas tubes, spark gaps, or any other components which might short or crowbar the line, thus leading to interruption of normal power to connected loads. The suppression system shall not incorporate non-field replaceable fusing, circuit boards, plug-in or quick-connect connections as part of any surge current carrying path.

F. All internal wiring associated with the suppression filter system and subject to surge currents shall utilize low-impedance copper bus bar and/or copper conductor or equal. All internal connections associated with the suppression/filter system and which are subject to surge currents shall be made with compression type solder less lugs and shall be bolted in place.

G. The unit shall be connected to the panel or switch gear by means of a circuit breaker as specified on the drawings or as recommended by the manufacturer. An integral fused disconnect shall not be furnished with the unit unless otherwise specified.

H. Units shall be provided in a NEMA 1 type enclosure constructed of minimum 14 gauge steel, painted inside and out with rust inhibiting paint. Surface or flush mount enclosures are specified on the drawings.

I. The unit shall be installed as close as practical to the wiring system in accordance with applicable national/local electrical codes and the manufacturers recommended installation instructions. Maximum 6' connections shall be made with copper conductor and shall not be any longer than is reasonably necessary, avoiding unnecessary bends. When possible, current carrying conductors between the panelboard and the suppression unit shall be twisted together.

J. The unit shall include mechanical lugs for each phase, neutral and ground, where applicable. The lugs shall accommodate up to a 1/0 AWG copper conductor.

K. The unit shall include externally mounted visual indicators that monitor the on-line status of each phase of the unit (L.E.D.s, neon lamps, etc.).

L. The unit shall include Form C dry contacts (N.O. or N.C.) to facilitate connection to a building management system in order to monitor the on-line status of the unit. The contacts shall be combination normally open, normally closed and shall operate upon failure of the suppression system. Also include a display event counter.

M. The unit shall include the manufacturer's nameplate and UL inspection labels on interior of cabinet.

1.4 STANDARDS

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

1. American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.41-1991 and C62.45-1987).
2. National Electrical Manufacturers Association (NEMA).
3. National Fire Protection Association (NFPA 70, 75, and 78).
4. Underwriters Laboratories (UL 1449 and 1283).

B The maximum continuous operating voltage (MCOV) or threshold voltage of all suppression components utilized in the unit shall not be less than 125% of the facility's nominal operating voltage for 120 volt systems and not less than 115% of the facility's nominal operating voltage for 208, 277, and 480 volts.

C. Based on ANSI/IEEE C62.41-1991's standard 8/20 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 the following:

MODE OF PROTECTION	L-N	L-G	N-G
Main Service Panel:	150,000	150,000	150,000
Total Capacity per Phase =	300,000		
Distribution Panels:	50,000	50,000	50,000
Total Capacity per Phase =	100,000		

D. The unit shall be UL 1449 Listed as a Transient Voltage Surge Suppressor.

E. The unit shall be factory tested following IEEE C62.41 and C62.45 guidelines without failing or degrading the UL 1449 Surge Suppression Rating by more than 10%.

F. Manufacturer shall provide proof of independent third party testing in accordance with NEMA Standard LS 1-1992; the suppression unit shall provide protection modes as follows:

1. Five (5) modes of protection for a single phase configuration:

- Line-to-Neutral (2)
- Line-to-ground (2)
- Neutral-to-ground (1)

2. Seven (7) modes of protection for a three phase wye configuration:

- Line-to-Neutral (3)
- Line-to-Ground (3)
- Neutral-to-Ground (1)

G. The environmental operating parameters for the unit shall meet or exceed the following conditions:

1. Operating temperature range shall be -40 to +60 C (-40 to +140 F).
2. Operation shall be reliable in an environment with 5% to 95% non-condensing relative humidity.
3. The unit shall not generate noise levels in excess of 10dB, "A" weighted.
4. No appreciable magnetic fields shall be generated. Unit shall be capable of use directly in computer rooms in any location without danger to data storage systems or devices.

H. For purposes of quality assurance, the unit shall be "burned-in" at the factory, applying nominal voltages for which a particular unit is designed.

I. A list of customer-replaceable spare parts where applicable shall be included in the unit's documentation set.

VOLTAGE 208/120
 PHASE 3 WIRE 4
 BUS AMPS 2000

PANEL MSG1
 MAIN AMPS 2000

LOCATION ELECTRICAL R026
 MOUNTING FLOOR
 MAIN BREAKER

DESCRIPTION	VOLT AMPS			BRKR AMP	P	CKT NO	BUS CDNN.	CKT NO	BRKR AMP	VOLT AMPS			DESCRIPTION
	A	B	C							C	B	A	
PANEL_BLA	1.080	400		225	3	1		2	100		9.600	ELEVATOR	
PANEL_BLB	7.790		0			3		4		9.600			
PANEL_BLC	5.655		9.200	225	3	7		6	200	15.335	11.179	PANEL L1E	
PANEL_L1A	19.839		4.520			9		10					
PANEL_L1B	12.394		21.029			11		12		10.882		RELOCATED 200 AMP LOAD CENTER	
PANEL_L1C	13.683			225	3	13		14	200	19.200			
PANEL_L1D	23.793					15		16		19.200			
TOTALS	84234	85465	83078			17		18					

VOLT AMPS
 BUS A 128369
 BUS B 125444
 BUS C 122760
 TOTAL 376573

REMARKS: SERVICE ENTRANCE RATED.
 53.353 AIC MINIMUM.
 PROVIDE MINIMUM (8) 100A/3P PREPARED SPACES.

VOLTAGE 208/120
 PHASE 3 WIRE 4
 BUS AMPS 2000

PANEL MS02
 MAIN AMPS 2000

LOCATION ELECTRICAL R026
 MOUNTING FLOOR
 MAIN BREAKER

DESCRIPTION	VOLT AMPS			BRKR AMP P	CKT ND	BUS CONN.	CKT ND	BRKR AMP	VOLT AMPS			DESCRIPTION
	A	B	C						C	B	A	
DEH-1	19,872			200 3	1	•	2	100				SPACE
PANEL L2A	11,551	19,872	19,872	225 3	7	•	8	100				SPACE
PANEL L2B	18,605		8,717	225 3	13	•	14	100				SPACE
PANEL L2C	21,837		20,155	400 3	19	•	20	100				SPACE
PANEL MP	103,680		20,398	1000 3	25	•	26	100				SPACE
SPACE		103,680	103,680		27	•	28					SPACE
SPACE				100 3	31	•	32	100				SPACE
SPACE					33	•	34					TVSS UNIT
SPACE				100 3	37	•	38	100				TVSS UNIT
TOTALS	175645	175028	172822		41	•	42				0	0

VOLT AMPS
 BUS A 175645
 BUS B 175028
 BUS C 172822
 TOTAL 523495

REMARKS: SERVICE ENTRANCE RATED.
 51,365 AIC MINIMUM.
 PROVIDE MINIMUM (8) 100A/3P PREPARED SPACES.