

Amphitheater High School
 Medium Voltage Switchgear Replacement
 Basis of Design
 8/21/17
 1 of 3

Item No.	Qty	Product	Description
	1	Medium Voltage Switches	Outdoor, 15kV Max, 13.8kV system, 3 wires, 800A, Silver-Plated Copper bus, 2 Structures

Designation MEB

List of Materials

- Outdoor Enclosure
- Tamper Proof
- IBC/CBC Seismic Qualified
- Copper silver plated bus
- 800A Copper silver plated main bus
- MSB 15KV, 40KA
- Metering Section
- MSB (See Details for Price)
- Set(s) of 12KV Distribution class surge arrestor
- Ring type current transformer
- Provisions for Voltage transformer(s)
- 5KVA Control power transformer
- PX 4000 Meter w/ Com. Exp. Card
- PX Meter Touchscreen Display Module
- Power Xpert Gateway 600B
- Power Supply - 120 Vac to 12Vdc adapter
- RJ45 to RJ45 Bulkhead Pass-through Receptacle
- Meter Socket
- Relay, ETN, EDR5000
- IQ Analyzer Package (2-PT's,3-CT's)
- Test block

General Information

Switchgear Design Type

Design Type: MVS

Switchgear Rating

Voltage Class: 15
 System Voltage: 13.8
 Symm Short Circuit: 40
 BIL: 95 KV
 Number of Wires: 3
 System Ground: Solid
 3rd Party Cert: NA

Bus Specifications

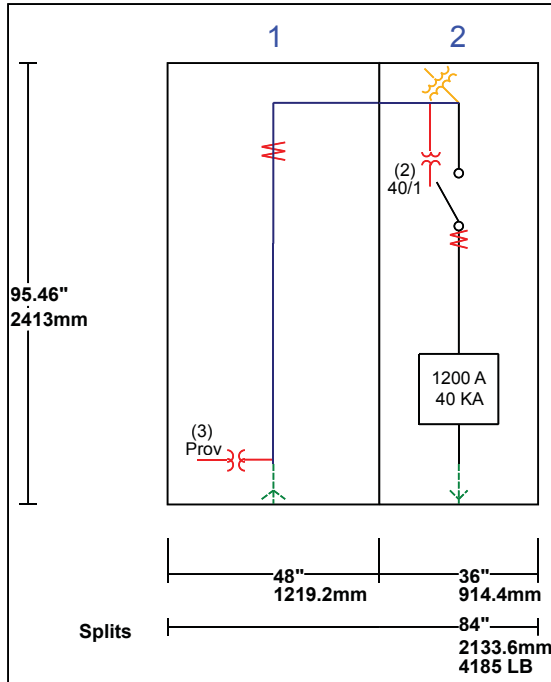
Bus Material: Silver-Plated Copper
 Ground Bus Material: Cu
 Bus Bracing, kA RMS Sym: 40
 Main Bus Amps: 800
 Bus Support Ins: Polyester Finned

Enclosure Info:

: Outdoor
 : Tamper Resistant
 Int. Color: ANSI-61 Light Gray
 Ext. Color: ANSI-61 Light Gray
 : Seismic

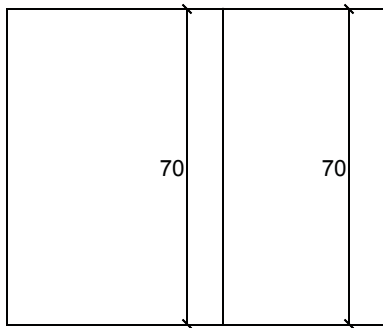
Structure Modifications

Modification **Str #s**
 Sw Wdw; Acrylic Plasti 1,2
 Service Entrance 1,2
 Drive Rod; Glass Poly 2
 Test block 1
 Meter Socket 1
 ; EDR-5000 2
 Power Xpert 4000 2

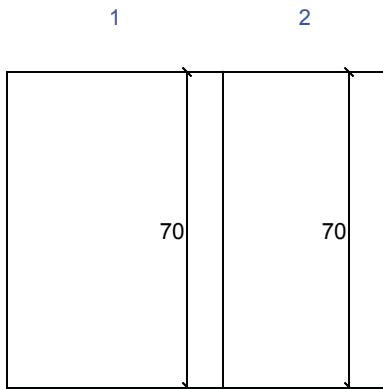


Structure	1	2		
Depth	70	70		
Switch Rating		1200		
Momentary Rating		61		
NP Integ. Rating	40	40		
FUSE OR VCB	Class		Breaker	
	Type		40 KA	
	Amps		1200	
	Spare			
CABLE IN	Size	NEMA		
	#/PH	1		
	Term Type	None		
CABLE OUT	Size		NEMA	
	#/PH		1	
	Term Type	None	None	
(Qty) CT Ratio	(3) Later	(3) Later		
(Qty) VT Ratio	(3) Provisions	(2) 40/1		
CPT Rating (kVA)		5		
SURGE ARREST	KV	12.0		
	TYPE	Distribution		
KEY INTER-LOCK interchanges	QTY			
	SCHEME			
	LO			
	LD			
	LC			

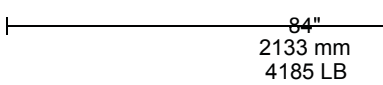
Roof Plan
Rear



Floor Plan
Rear



Splits



SECTION 16347B

METAL-ENCLOSED BREAKER SWITCHGEAR – MEDIUM VOLTAGE FIXED MOUNTED (MSB)

PART 1 GENERAL

1.01 SCOPE

- A. The Contractor shall furnish and install the medium voltage metal enclosed switchgear equipment as specified herein and as shown on the contract drawings.

1.02 RELATED SECTIONS

1.03 REFERENCES

- A. The medium voltage metal-enclosed switchgear and all components shall be designed, manufactured and tested in accordance with the latest applicable standards as follows:
 1. ANSI/IEEE C37.20.3
 2. ANSI/IEEE C37.20.4
 3. ANSI C37.22
 4. ANSI C37.57, C37.58
 5. NEMA SG5
 6. NEMA SG6
 7. CSA 22.2 No. 31-M189
 8. EEMAC G8-3.3

1.04 SUBMITTALS – FOR REVIEW/APPROVAL

- A. The following information shall be submitted to the Engineer:
 1. Master drawing index
 2. Front view elevation
 3. Floor plan
 4. Top view
 5. Single line
 6. Schematic diagram
 7. Nameplate schedule
 8. Component list
 9. Conduit entry/exit locations
 10. Assembly ratings including:
 - a. Short-circuit rating
 - b. Voltage
 - c. Continuous current
 - d. Basic Impulse Level
 11. Major component ratings including:

- a. Voltage
 - b. Continuous current
 - c. Interrupting ratings
12. Cable terminal sizes
13. Product data sheets

- B. Where applicable, the following additional information shall be submitted to the Engineer:
- 1. Busway connection
 - 2. Connection details between close-coupled assemblies
 - 3. Composite floor plan of close-coupled assemblies
 - 4. Key interlock scheme drawing and sequence of operations

1.05 SUBMITTALS – FOR CONSTRUCTION

- A. The following information shall be submitted for record purposes:
- 1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
 - 2. Wiring diagrams
 - 3. Certified production test reports
 - 4. Installation information including equipment anchorage provisions
 - 5. Seismic certification as specified

1.06 QUALIFICATIONS

1.07 REGULATORY REQUIREMENTS

1.08 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.
- B. Each switchgear assembly shall be split into shipping groups for handling as indicated on the drawings or per the manufacturer's recommendations. Shipping groups shall be designed to be shipped by truck, rail or ship. Shipping groups shall be bolted to skids. Accessories shall be packaged and shipped separately. Each switchgear shipping group shall be equipped with lifting eyes for handling solely by crane.

1.09 OPERATION AND MAINTENANCE MANUALS

- A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton

B. Square D

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.02 RATINGS – SWITCHGEAR, SWITCH AND CIRCUIT BREAKER CUBICLES

A. The 15 kV switchgear assembly ratings shall be as follows:

Maximum Design Voltage	15.0 kV
Basic Impulse Level	95 kV
Nominal System Voltage	13.8kV three-phase four-wire
System Grounding	solid
Short-Time (2-Second) Current	25 kA Symmetrical RMS
Main Cross Bus Continuous Current Rating	800 Amperes

B. The 15 kV Breaker/Switch ratings shall be as follows:

3-Phase MVA Class	650 MVA at 15 kV
Continuous Current Rating	1200 Amperes
Circuit Breaker Rated Short-Circuit Current at Rated Maximum kV	25 kA Symmetrical RMS
Voltage Range Factor K=	1
Short-Time (2-Second) Current	25 kA Sym RMS
Circuit Breaker Closing and Latching Capability (and assembly momentary)	40 kA Asym RMS/65 kA Peak
Switch continuous/load break	1200 Amperes
Switch Fault Close	40 kA Asymmetrical RMS/65 kA Peak

C. Load Interrupter Switches

NON-FUSED SWITCH RATING				
Maximum Voltage	Continuous and Load Break Current	Momentary kA RMS Asymmetrical	Fault Close kA RMS Asymmetrical	2-Second Current kA Symmetrical
15	1200	40	40	25

2.03 CONSTRUCTION

- A. The metal-enclosed switchgear assembly shall consist of deadfront, completely metal-enclosed vertical section containing a non-fused load interrupter switch in series with a vacuum circuit breaker. Provide utility termination and metering section as specified.
- B. The following features shall be supplied on every vertical section containing a three-pole, two-position open-closed switch:
1. A minimum 8-inch x 16-inch high-impact viewing window that permits full view of the position of all three switch blades through the closed door. The window shall not be more than 58-inches above the switch pad level to allow ease of inspection
 2. On vertical sections without a circuit breaker, the door shall be interlocked with the switch so that:
 - a. The switch must be opened before the door can be opened.
 - b. The door must be closed before the switch can be closed.
- C. High voltage parts within circuit breaker compartments shall be isolated with grounded metal barriers.
- D. A hinged grounded metal barrier bolted closed in front of every switch to prevent inadvertent contact with any live part, yet allow for a full-view inspection on the switch blade position
1. Provision for padlocking the switch in the open or closed position.
 2. Green OPEN, Red CLOSED switch position indicators with the words Open and Closed in French, Spanish and English.
 3. A hinged cover with rustproof quarter turn nylon latches over the switch operating mechanism to discourage casual tampering.
 4. The primary switch shall be removable from the structure as a complete operational component.
- E. Vertical section construction shall be of the universal frame type using die-formed and bolted parts. All enclosing covers and doors shall be fabricated from steel whose thickness shall be equal to or greater than those specified in ANSI/IEEE C37.20.3. No owner removable hardware for covers or doors shall be thread-forming type. To facilitate installation and maintenance of cables and bus in each vertical section, a split removable top cover and *[split removable rear covers with rustproof nylon handles] [hinged, bolted rear door with padlock provisions] shall be provided. A G90 grade galvanized base shall isolate equipment from contact with the concrete pad providing protection from rust. Heavy-duty hot dipped galvanized anchor clips shall be provided to anchor the switchgear to the concrete pad.
- F. Each vertical section containing a switch shall have a single, full-length, flanged front door and shall be equipped with two (2) rotary latch-type padlockable handles. Provision shall be

made for operating the switch and storing the removable handle without opening the full-length door.

2.04 BUS

- A. All buses shall be silver-plated copper.
- B. Ground bus shall be silver-plated copper and be directly fastened to a galvanized metal surface of each vertical section, and be of a size sufficient to carry the rated (2-second) current of the switchgear assembly.
- C. A neutral bus shall be provided when indicated on the drawings. It shall be insulated for 1000 Vac to ground. The current rating of the neutral bus shall be 600 amperes.

2.05 BUS SUPPORTING SYSTEMS

- A. All bus shall be supported utilizing a high strength and high creep support providing 10.5-inch of creep between phases and ground. The molded fins shall be constructed of high track resistant aramid nylon.
- B. All standoff insulators on the primary switches and fuse mountings shall be glass polyester.

2.06 WIRING/TERMINATIONS

- A. One (1) terminal pad per phase shall be provided for attaching contractor supplied cable terminal lugs for a maximum of two (2) conductors per phase of the sizes indicated on the drawings. Sufficient space shall be allowed for TEP supplied electrical stress relief termination devices. Locate terminals at height to match existing TEP cable terminations. Field verify dimensioning prior to order and fabrication.
- B. Small wiring, fuse blocks and terminal blocks within the vertical section shall be furnished as indicated on the drawings. Each control wire shall be labeled with wire markers. Terminal blocks shall be provided for customer connections to other apparatus.

2.07 CIRCUIT BREAKER

- A. Each circuit breaker shall be operated by a motor-charged spring stored energy mechanism. The spring may be charged manually in an emergency or during maintenance procedures.
- B. Each circuit breaker shall have three (3) vacuum interrupter assemblies. Each vacuum interrupter shall have a contact wear indicator which does not require any tools to indicate the contact wear. The current transfer from the vacuum interrupter moving stem to the breaker main conductor shall be a non-sliding design. The breaker front panel shall be removable when the compartment door is open for ease of inspection and maintenance of the mechanism.
- C. The breakers shall be electrically operated by:
 - 1. 120 Vac close and AC capacitor trip
- D. Each breaker shall be complete with control switch and red and green indicating lights to indicate breaker contact position.
- E. The control voltage shall be derived from a control power transformer mounted in the switchgear.

2.08 PROTECTIVE RELAYS

- A. The switchgear manufacturer shall furnish and install, protection relays in the metal-enclosed switchgear.
- B. Provide Microprocessor-based full-function Three-Phase Protective Relay package.

2.09 UTILITY METERING

- A. TEP SR-451 compliant utility metering vertical section shall contain provisions for current transformers and voltage transformers as required by the utility. The construction shall conform to the utility company's metering standards. It shall also conform to the general electrical and construction design of the switchgear specified above. Obtain written TEP approval for entire switchgear assembly prior to order.

2.10 OWNER METERING

- A. Provide owner metering in the switch or breaker structure on a hinged panel to provide safe isolated access to meters and all associated terminal and fuse blocks for maintenance, calibration or testing while the gear is energized.
- B. Provide current transformers for metering. Current transformers shall be wired to shorting-type terminal blocks.
- C. Provide voltage transformers including primary fuses and secondary protective devices for metering.
- D. Microprocessor-Based Owner's Metering System shall be provided with wireless Ethernet gateway for transmission of fault / relay reporting, breaker position status, power quality, kW/kWh data, current and voltage characteristics. Fully configure metering system for data acquisition over owner's Wi-Fi network. Coordinate all requirements prior to order.

2.11 ACCESSORIES

- A. Supply key interlocks to prevent opening of deadfront doors when energized.
- B. Furnish distribution class surge arresters with ratings in accordance with manufacturer's recommendations.

2.12 ENCLOSURES

- A. Enclosures shall be constructed per IEEE/ANSI C37.20.3 Outdoor specifications. (Exceeds NEMA 3R.)
- B. Each vertical section shall have a sloped weatherproof roof with labyrinth shaped joints. Use of gasket or caulking to make roof joints weatherproof shall not be permitted. All exterior openings shall be screened to prevent the entrance of small animals and barriered to inhibit the entrance of snow, sand, etc. A minimum of one (1) 250-watt, 120-volt space heater shall be provided in each vertical section. Power for the space heater(s) shall be furnished by a control power transformer mounted in the switchgear. The design shall be non-walk-in type.
- C. Each vertical section shall be ventilated at the top and bottom, both front and rear, to allow airflow to provide cooling and help prevent build-up of moisture within the structure. The ventilated covers shall be externally removable to allow safe maintenance of the filter media without providing access to live parts.

- D. Enclosure shall be Dust Resistant. All ventilated openings shall be filtered to inhibit the ingress of dust. The ventilated covers shall be externally removable to allow safe maintenance of the filter media without providing access to live parts. All external doors and covers shall be gasketed.

2.13 NAMEPLATES

- A. A nameplate shall be mounted on the front door of each switch vertical section in accordance with the drawings.

2.14 FINISH

- A. Prior to assembly, all enclosing steel shall be thoroughly cleaned and phosphatized. A powder coating shall be applied electrostatically, and then fused-on by baking in an oven. The coating is to have a thickness of not less than 1.5 mils. The finish shall have the following properties:

Impact resistance (ASTM D-2794)	60 direct/60 indirect
Pencil hardness (ASTM D-3363)	H
Flexibility (ASTM D-522)	Pass 1/8-inch mandrel
Salt spray (ASTM B117-85 [20])	600 hours
Color	ANSI 61 gray

2.15 MISCELLANEOUS DEVICES

- A. Communication equipment shall have the following features:
1. The communication system shall be Eaton PowerXpert Architecture or equal.
 2. Each load interrupter switch position (open and closed) shall be communicated via an addressable relay. This relay shall communicate over owner's Wi-Fi network. The relay shall monitor an auxiliary switch contact that monitors the primary switch position and shall be rated for the application. Each relay shall have a unique address so that it is possible to "call up" and "read" each load interrupter switch's position from a host computer.
 3. Each breaker position (open and closed), where shown, shall be communicated via an addressable relay. This relay shall communicate over owner's Wi-Fi network via vendor provided and configured wireless Ethernet gateway. The relay shall monitor an auxiliary breaker contact that monitors the breaker position and shall be rated for the application. Each relay shall have a unique address so that it is possible to "call up" and "read" each breaker's position from a host computer.
 4. Provide transmission of fault / relay reporting, breaker and switch position status, power quality, kW/kWh data, current and voltage characteristics.
 5. The manufacturer shall wire a network to all communication capable devices within the switchgear and wire the network to a set of easily accessible terminal blocks. Fully configure metering system for data acquisition over owner's Wi-Fi network. Coordinate all requirements prior to order.
 6. Control power for the addressable relays and network shall be 120 volts, 60 Hz made available from a fused control transformer within the enclosure.

3.01 FACTORY TESTING

- A. The following standard factory tests shall be performed on the circuit breaker element provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
 - 1. Circuit breaker operated over the range of minimum to maximum control voltage
 - 2. Factory setting of contact gap
 - 3. One (1) minute dielectric test per ANSI standards
 - 4. Final inspections and quality checks
- B. The following production test shall be performed on the circuit breaker housing:
 - 1. One (1) minute dielectric test per ANSI standards on primary and secondary circuits
 - 2. Operation of wiring, relays and other devices verified by an operational sequence test
 - 3. Final inspection and quality check
- C. The manufacturer shall provide three (3) certified copies of factory test reports.
- D. Factory tests as outlined above shall be witnessed by the owner's representative.
 - 1. The manufacturer shall notify the owner two (2) weeks prior to the date the tests are to be performed

3.02 FIELD QUALITY CONTROL

- A. The Contractor shall provide the services of a qualified factory-trained manufacturer's representative to provide startup and field testing of the equipment specified under this section for a period of 2 working days.
- B. The Contractor shall provide three (3) copies of the manufacturer's field startup report.

3.04 TRAINING

- A. The Contractor shall provide a training session for up to five (5) owner's representatives for (1) one normal workday at a jobsite location determined by the owner.
- B. The training session shall be conducted by a manufacturer's qualified representative and consist of instruction on the assembly of switches, circuit breaker(s), protective devices, and other major components.

3.05 INSTALLATION

- A. The Owner shall install all equipment per the manufacturer's recommendations and the contract drawings.
- B. All necessary hardware to secure the assembly in place shall be provided by the Owner.

3.06 FIELD ADJUSTMENTS

- A. The relays shall be set in the field by:
 - 1. The Vendor in accordance with settings designated by the Engineer.

End of Section.