

1. Section 16346 INDOOR METAL CLAD MEDIUM VOLTAGE SWITCHGEAR (**Std. Relays**)

**Part 1 General**

1.1 CONDITIONS AND REQUIREMENTS:

- A. Refer to the Drawings, General Conditions, Supplementary Conditions, and Division 01 Requirements.

1.2 DESCRIPTION

- A. Medium voltage free standing, Indoor Metal Clad Switchgear.

1.3 RELATED SECTION

- A. Section 03300, Cast-in-Place Concrete.
- B. Section 16110, Field Test and Operational Check.
- C. Section 16170, Grounding and Bonding.
- D. Section 16195, Electrical Identification.
- E. Section 16950, Electrical Sensing and Measurement.

1.4 REFERENCES

- A. ANSI C12.1 - Code for Electrical Metering.
- B. ANSI/IEEE C37.04 and C37.06 - Standard for AC Medium Voltage Circuit Breakers used in Metal Clad Switchgear.
- C. ANSI/IEEE C37.11 - Requirements for Electrical Control for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis or a Total Current Basis.
- D. ANSI/IEEE C37.12 - Guide to Specification for AC High-Voltage Circuit Breakers Rated on A Symmetrical Basis and a Total Current Basis.
- E. ANSI/IEEE C37.20.2 - Standard for metal clad and station type cubicle switchgear.
- F. ANSI/IEEE 48 Standard Test Procedures and Requirements for High Voltage Circuit Alternating Current Cable Termination's.
- G. ANSI 61, Gray finishes for Industrial Apparatus and Equipment.
- H. ANSI/IEEE C57.13 Requirements for Instrument Transformers.
- I. National Electrical Manufacturers' Association (NEMA) SG4 Alternating Current High Voltage Circuit Breakers.

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- J. NEMA SG5 Power Switchgear Assemblies.
- 1.5 SUBMITTALS:
- A. Submit shop drawings for equipment and component devices under provisions of Section 01300.
  - B. Submit shop drawings indicating outline dimensions, enclosure construction, shipping splits, lifting and supporting points, electrical single line diagram, and equipment electrical ratings.
  - C. Submit manufacturer's installation instructions under provisions of Section 01300.
  - D. Product Data: Provide electrical characteristics and connection requirements, standard model design tests, and options.
- 1.6 OPERATION AND MAINTENANCE DATA:
- A. Submit operation and maintenance data under provisions of Section 01730.
  - B. Included copy of manufacturer's certified drawings in project record documents.
  - C. Include circuit breaker recommended spare parts list.
  - D. Include operating instructions for manually and electrically opening and closing circuit breakers.
  - E. Include maintenance instructions for cleaning methods; cleaning materials recommended; instructions for circuit breaker removal, replacement, testing, adjustment and lubrication.
- 1.7 QUALITY ASSURANCE:
- A. Manufacturer: Company specializing in medium voltage metal clad switchgear with at least five years documented experience. The manufacturer of the circuit breaker need not be the same manufacturer as of the switchgear.
- 1.8 DELIVERY, STORAGE AND HANDLING:
- A. Deliver products to site under provisions of Section 01600.
  - B. Store and protect product under provisions of 01600.
  - C. Accept equipment onsite and inspect for shipping damage.
  - D. Protect equipment from weather and moisture by covering with heavy plastic or canvas and by maintaining heat within enclosure in accordance with manufacturers' instructions.

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1.9 EXTRA MATERIALS/ACCESSORIES:

- A. Submit maintenance materials under provisions of Section 01700.
- B. Submit one racking and one charging handle with equipment.
- C. Provide one set of spare control fuses for each set installed.
- D. For all switchgear provide one circuit breaker lifting device, portable floor supported with a roller base.
- E. Provide one test cabinet.
- F. Provide one test jumper cable.

**PART 2 PRODUCTS**

2.1 ACCEPTABLE MAUFACTURERS:

- A. Industrial Electric Mfg. (IEM). Phone: (800) 576-8724 or Fax: (510) 490-8365

2.2 DESCRIPTION

Switchgear: IEEE 37.20.2, metal-clad switchgear assembly, including horizontal draw-out Vacuum type circuit breakers in free-standing cubicles formed into an integrated indoor (NEMA 1) structure.

2.3 SERVICE CONDITIONS

- A. Meet requirements for usual service conditions described in ANSI C 37.20 and the specified unusual service conditions.
- B. Maximum/Minimum Ambient Temperature: -30/104 Deg. F.
- C. Altitude: 3,300 Feet above sea level.
- D. Meet requirements for use as service disconnecting means.
- E. Meet requirements for equipment installed accessible only to qualified individuals.

2.4 RATINGS

- A. Nominal Voltage: 4,160V, three-phase, 60Hz.
- B. Voltage and Insulation Levels: Conform to ANSI C37.20.

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- C. Main Bus Ampacity: 1200 amperes, continuous.

- D. Ground Bus: Copper, full length of switchgear.
- E. Momentary Current Rating: To ANSI C37.20.

## 2.5 CIRCUIT BREAKERS

- A. Circuit Breaker: ANSI C37.04.
- B. Circuit Breaker Draw-out: Horizontal, capable of being withdrawn on rails.
- C. Circuit Breaker operator: Spring-charged stored energy with electric operator to ANSI C37.11, and manual operator for emergency procedures.
- D. Rated Maximum voltage: 5KV.
- E. Rated Voltage Range Factor: 1.3.
- F. Rated Frequency: 60 Hz.
- G. Rated Continuous Current: 1,200A Frame Minimum for Mains and Feeders or larger as noted on drawings.
- H. Rated Dielectric Strength: 36 KV rms, low frequency; 95KV crest, impulse.
- I. Rated permissible Tripping Delay: 2 Seconds.
- J. Short-Circuit Rating: 29KA rms, at rated maximum voltage (250MVA class)
- K. Operation Endurance Capability: ANSI C37.06.
- L. Rated Tripping Voltage: 120VAC
- M. Provide one per circuit breaker: capacitor tripping device to feed each Vacuum C.B. w/120VAC control voltage.

## 2.6 UTILITY METERING SECTION

- A. Where indicated on the drawings, each utility metering vertical section shall contain or provide provisions for current transformers, voltage transformers and any relays as specified by the local utility. The construction shall conform to the utility company's metering standards as specified by the local utility's specifications. It shall also conform to the general electrical and construction design of the switchgear specified above.

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## 2.7 PROTECTIVE RELAYS

- A. Construction: The switchgear manufacturer shall furnish and install, in the metal clad

switchgear, the quantity, type and rating of protection devices as indicated on the drawings and described hereinafter in this specification.

- B. Each circuit breaker shall be provided with solid-state microprocessor-based multi-function type that operates from the 5 ampere secondary output of the current transformers. The device shall provide ANSI 50/51 protective functions for each of the three phases, and ANSI 50/51N or 50/51G ground fault protection functions as shown on the drawings and as determined by the coordination study.
- C. Protection Curves: Shall be field programmable for close coordination with downstream devices.
- D. Protective Relays, shall be similar to Basler type BE1- 50/51 B.

## 2.8 INSTRUMENTS

- A. Current Transformers: ANSI C57.13, 5 ampere secondary, bar or window type, with single secondary winding and secondary shorting device, primary/secondary ratio as indicated and burden consistent with connected metering and relay devices, 60 Hertz.
- B. Potential Transformers: ANSI 57.13, 120V single secondary, disconnecting type with integral fuse mountings, primary/secondary ratio as indicated, burden and accuracy consistent with connected metering and relay devices, 60 Hertz. Voltage transformers are tilt out mounted with primary current limiting fuses. The transformers shall have mechanical rating equal to the momentary rating of the circuit breaker and shall have metering accuracy per ANSI standards.
- C. Control Power Transformer: Provide 4,160V-120VAC, single phase control power transformer. Transformer shall be sized as indicated on drawings. CPT shall be draw-out type complete with primary and secondary fusing.
- D. Provide test switch modules for instrument transformer secondaries.

## 2.9 FABRICATION

- A. The metal clad switchgear shall consist of an NEMA 1, indoor enclosure containing circuit breakers and the necessary accessory components for all factory assembled (except for necessary shipping splits) switchgear and operationally checked. The assembly shall be a self supporting and floor mounted on a level concrete pad. The integrated switchgear assembly shall withstand the effects of closing, carrying and interrupting currents up to the assigned maximum short circuit rating.
- B. Provide added rigidity using steel member gussets in all corners of structures.
- C. System Voltage: 4,160V nominal, 3-phase, 60 hertz
- D. Maximum Design Voltage: 5KV

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- E. Impulse Withstand: 95KV BIL
- F. Power Frequency Withstand: 36KV, one minute test.

- G. The main bus is to be copper, rated at 1,200 ampere and be fully insulated for its entire length with an epoxy coating by the fluidized process. The conductors are to be silver plated copper and be of a bolted design. Access to this compartment is gained from the front or rear of the structure by removing a steel barrier.
- H. Momentary Current Ratings: Equal to the circuit breaker close and latch rating.
- I. Provide Full Length Copper Ground Bus per NEMA Standards.
- J. Provide Dimensions as Required on Drawings.
- K. All steel members shall be painted.
- L. Provide paint as required by drawings.
- M. All Power Connections shall be Torqued and Marked in Switchgear Manufacturers Assemblies Facility.
- N. Circuit Breaker Compartment:
  - 1. Each circuit breaker compartment shall be designed to house a horizontal draw out metal clad vacuum circuit breaker. The stationary primary disconnecting contacts are to be silver plated copper and mounted on the circuit breaker element for ease of inspections/maintenance.
  - 2. Entrance to the stationary primary disconnecting contacts shall be automatically covered by metal shutters when the circuit breaker is withdrawn from the connected position to the test or disconnected position or removed from the circuit breaker compartment. Extend a ground bus into the circuit breaker compartment to automatically ground the breaker frame with high current spring type grounding contacts located on the breaker chassis when in the test and connected positions.
  - 3. Guide rails for positioning the circuit breaker and all other necessary hardware are to be an integral part of the circuit breaker compartment.
  - 4. Blocking devices shall interlock breaker frame sizes to prevent installation of a lower ampere rating or interrupting capacity element into a compartment designed for one of a higher rating.
  - 5. Indication: Green pilot light to indicate the circuit breaker is in the open position, and red pilot light to indicate the circuit breaker is in the closed position.
  - 6. Provide a full front shield on the breaker.

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- 7. Secondary control circuits shall be connected automatically with a self aligning, self engaging plug and receptacle arrangement when the circuit breaker is racked into the connected position. Provisions shall be made for secondary control plug to be manually connected in test position.

8. A minimum of three auxiliary contacts (1a, 2b), shall be provided for external use. Provisions shall be made for six additional cell mounted auxiliary contacts both MOC and TOC type for external use.
9. The racking mechanism to move the breaker between positions shall be an integral part of the circuit breaker element.
10. An interlocking system shall be provided to make it impossible to rack a closed circuit breaker to or from any position. An additional interlock shall automatically discharge the stored energy operating mechanism springs upon removal of the breaker out of the compartment.
11. Doors and Panels: Relays, meters, control switches, etc., shall be mounted on a formed front hinged panel for each circuit breaker compartment.

O. Control Wiring:

1. The switchgear shall be wired with Type SIS #14 AWG except where larger size wire is specified.
2. The switchgear shall be provided with terminal blocks for outgoing control connections.
3. Wire markers shall be provided for each end of all control wires.

P. Customer Metering: Where indicated on Drawings, Shall be Solid State, Multi-Function Metering per Spec. Section 16950.

## 2.5 FACTORY FINISHING

- A. All steel parts, except galvanized (if used) shall be cleaned and zinc phosphate pretreatment applied prior to paint application.
- B. Paint Application: Provide powder coat paint process. Paint shall be applied TGIC, polyester powder, applied electrostatically through air. Color shall be ANSI 61 light gray, , or color as indicated on drawings.

## **PART 3 EXECUTION**

### 3.1 EXAMINATION:

- A. Visually inspect switchgear for evidence of damage and verify that surfaces are ready to receive work.

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- B. Visually inspect to confirm that all items and accessories are in accordance with spec. and drawings.
- C. Verify field measurements are as shown on shop drawings.

- D. Verify that required utilities are available, in proper location, and ready for use.
- E. Beginning of installation means installer accepts existing surface conditions.
- F. Seismic qualification to meet Seismic Zone 4.

### 3.2 INSTALLATION:

- A. Install in accordance with manufacturer's instructions, applicable requirements of the NEC and in accordance with recognized industry practices.
- B. Use jumper cables, as provided by the switchgear manufacturer, to connect the primary Intermediate Class Surge arrestors.
- C. Bending of high voltage cable should be avoided or minimized. All necessary bends should meet at least the minimum radii specified by the cable manufacturer.

### 3.3 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed by the installing contractor under provisions of section [01400 and 01410].
- B. Visually inspect for physical damage.
- C. Perform torque of all bolted bus connections, including cable terminations.
- D. Check torque of all bolted bus connections, including cable terminations.
- E. Verify key interlock operation.
- F. Perform insulation resistance tests per manufacturers' published instructions.
- G. Perform low frequency withstand tests according to ANSI/IEEE C37.20.2 paragraph 5.5.

**END OF SECTION**