

# SPECIFICATION FOR LOW VOLTAGE SWITCHGEAR

## TABLE OF CONTENTS

<b>1. SCOPE</b>	<b>1</b>
<b>2. CODES, STANDARDS AND SPECIFICATIONS</b>	<b>1</b>
<b>3. DESIGN REQUIREMENTS</b>	<b>2</b>
<b>4. MANUFACTURING AND FABRICATION REQUIREMENTS</b>	<b>2</b>
<b>5 POWER CIRCUIT BREAKERS</b>	<b>3</b>
<b>6. INSTRUMENT AND CONTROL POWER TRANSFORMERS</b>	<b>3</b>
<b>7. GENERAL CONTROL AND METERING</b>	<b>4</b>
<b>8. CONTROL DEVICES AND WIRING</b>	<b>4</b>
<b>9. TESTING AND INSPECTION REQUIREMENTS</b>	<b>4</b>
<b>10. PROTECTIVE COATINGS AND PAINTING</b>	<b>5</b>
<b>11. PACKING AND SHIPPING REQUIREMENTS</b>	<b>5</b>

### 1. SCOPE

This will describe the requirements for the vendor to provide a 480 VAC low voltage switchgear having the ratings, features/accessories and enclosures as specified herein and as shown on the Data Sheets.

### 2. CODES, STANDARDS AND SPECIFICATIONS

2.1 Unless noted otherwise, the design, fabrication, testing, and performance of the low voltage metal-enclosed switchgear shall be in accordance with the latest edition of the following standards and codes where applicable:

- American National Standards Institute (ANSI)
- National Fire Protection Association (NFPA)
- National Electric Manufacturer's Association (NEMA)
- Institute of Electrical and Electronics Engineers (IEEE)
- Local Codes and Regulations

The equipment and materials furnished shall be labeled, listed, certified, accepted or otherwise determined to be safe for the use intended by a nationally recognized testing laboratory such as one of the following where applicable:

- Underwriter's Laboratories, Inc. (UL 1558)

2.3 It shall be the manufacturer's responsibility to be knowledgeable of the requirements of these Standards and Codes. Any changes or alternations to the equipment to make it meet Standards and Codes requirements shall be at the expense of the Vendor.

## **SPECIFICATION FOR LOW VOLTAGE SWITCHGEAR**

### **3. DESIGN REQUIREMENTS**

- 3.1. The switchgear shall have a voltage rating of 480V.
- 3.2. The switchgear shall be draw-out air circuit breaker type completely factory assembled in an enclosure consisting of functionally compartmentalized units for the removable power circuit breaker. Components shall be of the Manufacturer's standard product line.
- 3.3. The type of enclosure, voltage, frequency, current rating, interrupting rating, relay and metering data etc. shall be specified on the associated electrical Data Sheet and One-line Drawings.
- 3.4 Approved manufacturers shall be as per the following:
  - ESS Metron

### **4. MANUFACTURING AND FABRICATION REQUIREMENTS**

- 4.1 The switchgear assembly shall consist of heavy-duty, all steel (or stainless steel 304 or 316), NEMA 1 (or NEMA 3R walk-in or non-walk in) dead-front steel structures containing circuit breaker compartments and circuit breakers, primary bus system, ground bus system, auxiliary compartments and transformers, protection and control devices, control bus and connection provisions for primary, ground, and control circuits. The basic structure will be of modular construction and fabricated mainly from #10, #12, and #14-gauge sheet steel. The switchgear enclosure will be constructed of double wall structure with an air gap between sheets.
- 4.2 The switchgear shall be fabricated with structure of code gage steel with smooth finished surface and edges, reinforced to be rigid and self-supporting. The switchgear shall be provided with separate steel compartments for complete isolation of individually mounted circuit breakers.
- 4.3 Vertical structures shall be provided with hinged front panel doors, hinged rear doors with locking handles to facilitate easy removal and installation and grounded metal internal barriers to prevent the transfer of ionized gases between compartments and between compartments and buses. Barriers shall also separate power and control components to confine electrical disturbances and faults.
- 4.4 Switchgear assemblies shall be adequately ventilated.
- 4.5 Circuit breakers, operating mechanisms, potential and control transformers and required metering shall be located in the front portion. Mount protective relaying and metering systems in the front door.
- 4.6 Switchgear assemblies shall include a steel back plate in empty cubicles for complete isolation from all buses.
- 4.7 Bus Structure:
  - 4.7.1 Switchgear shall be provided with hard drawn copper silver (or tin) plated buses of 98% conductivity sized to carry rated load without exceeding ANSI temperature limits. Rate all bus bars as indicated on single line drawing, and brace to withstand stresses caused by short circuits of a magnitude shown on the drawings up to 100KAIC short circuit and short time withstand for 60 cycles.
  - 4.7.2 Switchgear assemblies shall be provided with a copper ground bus sized to carry the equivalent to the momentary rating of the largest circuit breaker in the assembly. The ground bus shall run the full length of the assembly and shall be provided with mechanical (or compression) type lugs.

## **SPECIFICATION FOR LOW VOLTAGE SWITCHGEAR**

- 4.7.3 Bolted bus bar joints, main and auxiliary contacts shall be silver (or tin) plated.
- 4.7.4 Main buses, ground bus and control power buses shall be arranged for possible future extension at both ends.
- 4.8 For NEMA 3r applications space heaters with overcurrent protection shall be provided in each switchgear section. Thermostat, humidistats and necessary relays shall be provided in the assembly to control the space heaters.
- 4.9 All metal parts shall be protected from rust and corrosion by plating or paint. Painted parts shall be chemically treated, painted with topcoat of baked enamel or equivalent hammer (or smooth) finish. All other parts such as handles, levers, and fasteners that are not stainless steel shall be tin, cadmium, nickel, or chrome plated.
- 4.10 All bolted joints shall be equipped with bolts, washers, and spring washers. Electrical bus fasteners shall be designed to maintain positive clamping force for good electrical contact.
- 4.11 Nameplates:
  - 4.11.1 Nameplates shall be laminated white plastic with black lettering.
  - 4.11.2 Nameplates shall be provided on all relaying, metering, and control devices.
- 4.12 Provisions for Handling and Field Erection
  - 4.12.1 Each “shipping section” of stationary structures shall be furnished with removable lifting angles and/or plates suitable for crane hooks or slings.

### **5. POWER CIRCUIT BREAKERS**

- 5.1 Circuit Breakers shall be UL1066 horizontal draw-out type, equipped with a stored-energy spring mechanism for quick-make, quick-break, trip free operation and the controls shall include an anti-pump feature. The stored-energy mechanism shall be designed so that the closing speed is independent of both control voltage and operator. Breakers shall be manufactured by Siemens, Cutler Hammer, or GE.
- 5.2 Circuit breakers shall be three-pole, single-throw, 600-volt, 60 Hz breakers with continuous current and trip ratings as shown on the drawings and three independent arc quenchers, closing mechanism, mechanical trip device, interpole barriers and positive position indicator.
- 5.3 Circuit breakers of the same rating shall be interchangeable. To preserve interchangeability, attachments for special controls shall not be mounted directly on draw-out type circuit breakers.
- 5.4 Circuit breakers shall meet applicable ANSI and NEMA operational requirements under no load and full load conditions.
- 5.5 Circuit breakers shall be provided with solid-state trip devices.

### **6. INSTRUMENT AND CONTROL POWER TRANSFORMERS**

- 6.1 Current Transformers
  - 6.1.1 The CT winding shall terminate on a screw type terminal on the CT housing and shall be wired to shorting terminal blocks.
  - 6.1.2 Each current transformer shall have a 5-ampere secondary, and a primary rating as shown on the Data Sheets and One-Line Diagram.
  - 6.1.3 Ratings and accuracies shall be in accordance with ANSI C57.13 for the metering and relay applications shown on the Data Sheets.

## **SPECIFICATION FOR LOW VOLTAGE SWITCHGEAR**

- 6.1.4 Each current transformer shall have a short-circuiting device (shorting type terminal blocks). The first termination of each current transformer shall be at the short-circuiting device terminal blocks where the ground connection is also made.
- 6.1.5 The current transformers classes and burdens shall be selected by the Manufacturer so as to guarantee that they do not saturate for the maximum values of short-circuit current available. When this value (maximum short-circuit) is not specified in the Requisition, the Manufacturer shall consider it to be 20 times the main bus current rating in RMS symmetrical value.

### **6.2 Potential Transformers**

- 6.2.1 The primary and secondary of potential transformers shall be fused.
- 6.2.2 Unless otherwise specified, the potential transformer burdens shall be selected by the Manufacturer so as to guarantee 0.3 class accuracy.

## **7. GENERAL CONTROL AND METERING**

- 7.1 Switchgear shall be provided with a Microprocessor based power monitor with digital output display rated for 480 volts, 60 hertz, Unit shall be listed in accordance with UL 508.
- 7.2 Monitor shall provide a LED readout which will allow local display of the following electrical parameters:
- Voltage, phase to phase and phase to neutral.
  - Current, per phase RMS and 3 phase average.
  - Watts, vars, power factor and power quality
- 7.3 Set-up of the monitor shall be accomplished from the front of the device. It shall not be necessary to open the front of the enclosure.

## **8. CONTROL DEVICES AND WIRING**

- 8.1. Control devices, control buses, local control, instrument cables and wiring on the equipment shall be installed at the factory. Cables shall be enclosed in grounded metal wireways when routed through a high voltage compartment. The wires shall be neatly bundled, and tie wrapped where applicable, protected from rubbing against door flanges or other parts of the enclosure. Adhesive or 'sticky back' wire tie supports will not be permitted.
- 8.2. Control relays, auxiliary contacts and small mechanisms shall be enclosed and protected but shall be accessible for maintenance.
- 8.3. All specified auxiliary contacts and other devices for Purchaser's use shall be wired to terminal blocks.
- 8.4. Control wire shall be #14AWG, SIS stranded extra-flexible, 600V flame retardant, gray color and UL-listed wire except where larger sizes are needed for current carrying requirements. Current transformers shall be provided with a minimum of #12 AWG wire. The conductors shall be stranded copper for fixed wiring and extra flexible stranded copper for hinge wiring. The conductors shall be 90 degrees Celsius normal operating temperature, flameproof 600-volt switchboard cable and shall meet NEMA publication No. WC-7 Standards for cross-linked thermosetting polyethylene insulated wire and cable. Flexible connections between stationary and hinged panels or doors shall be made between terminal blocks or clamped in such a manner as to afford flexibility without damage to the wires. The wires shall be neatly bundled, and tie wrapped. Adhesive or 'sticky back' wire tie supports will not be permitted

## **SPECIFICATION FOR LOW VOLTAGE SWITCHGEAR**

- 8.5. Terminal blocks shall be provided for terminating all power and control wiring. Terminal blocks shall be rated at 600-volts, strap screw terminals with white marking strips showing terminal numbers.
- 8.6. Terminal blocks shall be conveniently located for external connection without accessing the high voltage compartments. Terminal blocks will be clearly marked for wiring, which will be installed by the Purchaser. A wire label at both ends will identify each internal interconnecting wire.
- 8.7. Each compartment shall be provided with circuit protective devices to isolate the cubicle from all power sources.
- 8.8. Provide power circuit breakers contacts for showing Open and Closed positions of the breakers.

### **9. TESTING AND INSPECTION REQUIREMENTS**

- 9.1 Inspection and testing shall be in accordance with the attached Inspection Requirements.

### **10. PROTECTIVE COATINGS AND PAINTING**

- 10.1 The switchgear shall be cleaned, iron phosphate and painted in accordance with the manufacturer's standard practice for the environmental conditions specified. The enclosure final exterior color paint coat shall be ANSI No. 61 gray hammer (or smooth) finish.
- 10.2 Manufacturer shall supply paint, matching each color used, for field "touch up" after installation of the equipment.

### **11. PACKING AND SHIPPING REQUIREMENTS**

- 11.1 Preparation for Shipment shall be in accordance with manufacturer's standards, unless otherwise noted on the Request for Quotation and/or Purchase Order.
- 11.2 The power circuit breaker shall be individually tagged with its proper unit number and the equipment number of the assembly to which it belongs. Circuit breakers should not be shipped inside the switchgear lineup to avoid damage.
- 11.3 Relays shall be shipped installed in the stationary structures and shall be securely blocked and braced to prevent damage during shipment if required.
- 11.4 Each "shipping section" of stationary structures shall be provided with a permanently attached, readily visible identification tag bearing the equipment number of the assembly of which it is a part. Provide tilting brackets if switchgear needs to be tilted onto the front for getting it through a doorway.
- 11.5 The switchgear will be split in the most efficient manner for shipping.
- 11.6 If shipped in sections the wiring between the units shall be terminated on terminal blocks on each side of the shipping split. Shipping split connectors shall be provided and marked for convenient connection in the field.
- 11.7 All accessory items will be shipped with the switchgear. Boxes and crates containing accessories will be clearly marked with the contents. Accessories include:
- 11.8 Provide one complete set of all special tools and accessories required for operation and maintenance. Provide necessary breaker handling and removal device consisting of a permanent top rail gear mounted or portable rolling crane.
- 11.9 Provide hoist type breaker lifting yoke specifically designed for breaker removal.