LOW VOLTAGE Metal Enclosed SWITCHGEAR

PART 1 ‑ GENERAL

1.1 DESCRIPTION

 This section specifies the furnishing, installation, connection and testing of the low voltage power circuit breaker switchgear (UL 1558).

1.2 Switchgear Features and Ratings

The design standard for the equipment specified herein is Metal Enclosed Power Circuit Breaker switchgear (UL 1558) as manufactured by Industrial Electric Mfg, Fremont, California. Other equipment meeting all requirements specified may be acceptable.

1.2.1 The switchgear shall have the following features and ratings

 Metal Enclosed Power Circuit Breaker (UL 1558) switchgear

 System Configuration: 3-Phase, 50/60 Hz, 3 Wire/4 Wire, Grounded Neutral/3 Wire

 Ungrounded/3 Wire High-Impedance Grounded System

 Voltage Ratings: 600V AC or 480V AC or 240V AC or 208V AC

 Maximum Voltage Ratings: 635V AC, 508V AC, 254V AC, 220V AC

 Main Bus Current Ratings: 1,200A, 1,600A, 2,000A, 3,200A, 4000A, 5,000A

 Maximum Cross Bus Rating: 10,000A

 Neutral Bus Continuous Current Rating: 100% of Main Bus Current Rating

 Short Circuit Withstand Rating: 65 kA / 85 kA / 100 kA / 125 kA / 150 kA / 200 kA

 Short Time Rating (30/60 Cycle): 65 kA / 85 kA

 Draw out or Fixed Power Circuit Breaker

 Optional IR windows and Viewing windows

 Breaker: Power Circuit Breaker UL 1066 rated

The equipment supplied shall be UL and cUL / CSA listed product of a manufacturer of electrical power equipment with a minimum of five years of experience in the production of the type of equipment herein specified.

1.3 FACTORY TESTs

A. Low voltage switchgear shall be thoroughly tested at the factory to assure that there are no electrical or mechanical defects. Tests shall be conducted as per UL, ANSI and CSA Standards.

B. Thoroughly test the switchgear at the factory with the circuit breakers in the connected position in their cubicles. The factory tests shall be in accordance with IEEE C37.20.1, IEEE C37.51, IEEE C37.13 and IEEE C37.17 and shall include the following tests:

1. Design Tests

2. Production Tests

1.4 SUBMITTALS

A. Shop Drawings:

1. Provide detailed drawings with sufficient information, clearly presented, to determine compliance with drawings and specifications.

2. Prior to fabrication of switchgear, submit four copies of the following data for approval:

a. Complete electrical ratings

b. Circuit breaker sizes

c. Interrupting ratings

d. Elementary and interconnection wiring diagrams

e. Single line and three line diagrams

f. Dimensioned exterior views of the switchgear.

g. Floor plan of the switchgear.

h. Foundation plan for the switchgear.

1.5 APPLICABLE Standards and PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American National Standards Institute (ANSI) / IEEE Standards:

C37.13 Low Voltage AC Power Circuit Breakers used in Enclosures

C37.16 Preferred Ratings, Related Requirements, and Application Recommendations for low voltage Power Circuit Breakers

C37.17………………............Trip Systems for Low-Voltage AC and General Purpose DC Power Circuit Breakers.

C37.20.1 Metal Enclosed Power Circuit Breaker Switchgear

C37.50 Test Procedure for AC Power Circuit Breakers used in Enclosures

C37.51 Metal-Enclosed Power Circuit Breaker Switchgear Assemblies – Conformance Testing

 C. Canadian Standards Association

 CSA C22.2 No. 31-14 …………… Switchgear Assemblies

 D. UL Standard

 UL 1558 …………………..Metal Enclosed Power Circuit Breaker Switchgear

 UL 1066…………………..Power Circuit Breaker

D. National Electrical Manufacturers Association (NEMA):

NEMA SG5 Power Switchgear Assemblies

NEMA SG3…………………Low Voltage Power Circuit Breakers

PART 2‑PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The switchgear shall be in accordance with NEMA SG-5, NEMA SG3, IEEE C37.20.1, applicable UL, and CSA standards and listings and the National Electrical Code as minimum requirements, and shall be as shown on the drawings and as specified.

B. Indicating instruments shall be in accordance with ANSI C39.1

C. Relays and relay systems shall be in accordance with IEEE C37.90.

D. Instrument transformers shall be in accordance with IEEE C57.13.

E. The switchgear line‑up shall be a complete, grounded, continuous‑duty, metal enclosed, dead‑front, dead‑rear, self‑supporting switchgear assembly. Incorporate devices shown on the drawings and everything required to fulfill the operational and other requirements shown on the drawings.

F. Ratings shall be not less than shown on the drawings. Short circuit ratings shall be not less than 65 kA, but the ratings on the drawings shall apply if higher.

G. Switchgear shall conform to the arrangements and details of the drawings and space designed for installation.

H. Interlocking shall be provided as shown on the drawings and as required for the safety of personnel and safe operation of the equipment.

2.2 Seismic Requirements

The switchgear shall meet the following seismic standards. The equipment shall be tested

on a shake table to comply with these standards.

1. International Building Code, IBC-2012, California Building Code, CBC 2013,

ASCE/SEI 7-05, Minimum Design Loads for Buildings and Other Structures

1. International Code Council, ICC-ES-AC156 Acceptance Criteria for Seismic

Qualification by Shake Table Testing of Nonstructural Components and Systems

1. IEEE-693-2005, Recommended Practices for Seismic Design of Substations
2. Telcordia GR-63, Recommended Practices for Seismic Design of Telecommunications Equipment.
3. California OSHPD Pre-approved.
4. Seismic Requirements: Sds = 1.8, 2.0, or 2.4, Ip = 1.5, Fp/Wp = 1.8, ap = 2.5
5. Seismic Zones: All US regions and California Site Classes A, B, C, D, And E

2.3 HOUSING

A. The equipment and structure shall have the following features:

1. Frames and enclosures:

a. The assembly shall be braced with reinforcing gussets as required to assure rectangular rigidity.

b. The enclosure shall be steel with all exposed parts painted and fabricated from not less than the gauge required by UL, NEMA, and ANSI Standards.

c. Provide adequately spaced holes for connecting adjacent structures to insure proper alignment and to allow for future additions.

d. The equipment sections shall be configured with the ability to have all cable terminations located near the front/rear of the equipment with suitable clearances and bending radius for the cable type and terminations types specified. The cable compartment and CTs shall be front/rear accessible.

e. Provide optional infrared windows as required.

f. Properly isolate circuit breakers, buses, and cable terminations in separate compartments with partitions or barriers of approved and tested materials.

g. Meet all UL, ANSI, CSA and NEMA standards regarding individual section isolation for bus compartments.

2. Switchgear Barriers:

a. Barriers shall be supplied to isolate the bus compartment from the cable compartment.

b. Barriers shall be provided to isolate the bus compartment from the breaker compartment.

C. Finish:

1. All metal surfaces shall be thoroughly cleaned, phosphatized and finished using a power coat system tested to at least 3000 hours for salt spray resistance.

2. Provide a light gray (ANSI #61) or other suitable standard factory finish for the switchgear.

3. The cutouts in the low voltage compartment shall be fully painted after punching the low voltage compartment door.

2.4 BUS

A. Bus Bars and Interconnections:

1. Provide silver plated copper buses, fully rated and tested for the amperage shown on the drawings. Tin plated bus can be an option.

2. Totally enclose the buses within the bus compartment of the switchgear.

 Insulate the buses with epoxy or Raychem as an option.

3. Mount the buses on appropriately spaced insulators and brace to withstand the available short circuit currents.

4. The bus and bus compartment shall be designed and tested so that the acceptable NEMA, ANSI, UL, and CSA standard temperature rises are not exceeded.

5. Install a ground bus the full length of the switchgear assembly. Provide the ground bus bracing to withstand the short time rating and short circuit rating.

 B. Mimic Bus

 The arrangement of power circuit breakers shall be shown in single line diagram

 on front of the switchgear in the form of continuous Mimic Bus if required.

2.5 CIRCUIT BREAKERS

A. Breakers shall comply with the requirements of ANSI/IEEE C37.13, C37.16, C37.17, C37.50, UL 1066, and NEMA SG-3.

B. The circuit breakers shall have connected, test and disconnected indicators and open, closed, ready to close indicators which shall be visible to the operator with compartment door closed. It shall be able to rack the breaker with the compartment door closed.

C. Interlocks shall be provided to prevent the breaker racking when the breaker is closed.

D. Breaker Type: The switchgear shall have any one of the following power circuit breaker (UL1066 listed) types either in fixed or draw-out arrangement with corresponding accessories:

 (a) Schneider MasterPact NW

 (b) ABB Emax and Emax 2

 (c) GE Entelliguard

 (d) Siemens WL

E. Each low voltage power circuit breaker shall be equipped with self-powered, microprocessor based trip device to sense overload and short circuit conditions. The circuit breaker shall measure true RMS current. The trip unit shall have selectable LSIG functions and shall be field adjustable locally or remotely via MODBUS or ETHERNET.

F. The circuit breaker accessories shall be UL listed and shall be changeable in the field if required.

2.6 CONTROL WIRES

 Switchgear control wires shall not be less than No. 14 AWG copper 600 volt, Stranded SIS. Install wiring complete at the factory, adequately bundled and protected. All conductors across hinges and all conductors for interconnection between shipping units shall be stranded.

 Conductors shall be sized in accordance with the NEC. Provide separate control circuit fuses in each breaker compartment and locate for ease of access and maintenance.

 Point to point and schematic wiring diagrams shall be required.

2.7 nameplates

1. Nameplates: Provide laminated black phenolic resin nameplates with white core with engraved letters identifying each circuit breaker.
2. Nameplates shall indicate equipment served, spaces, or spares in accordance with one line diagram shown on drawings.
3. Nameplates shall be mounted with suitable plated screws.

**3.1 Acceptance Checks and Tests**

A. If required Perform factory acceptance tests and/or field acceptance tests including inspections below.

1. Visual and Mechanical Inspection

a. Compare equipment nameplate data with specifications and approved shop drawings.

b. Inspect physical, electrical, and mechanical condition.

c. Confirm correct application of manufacturer's recommended lubricants.

d. Verify appropriate anchorage, required area clearances, and correct alignment.

e. Verify that circuit breaker sizes and types correspond to approved shop drawings.

f. Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.

g. Verify appropriate equipment grounding.

h. Confirm correct operation and sequencing of electrical and mechanical interlock systems.

i. Clean switchgear.

j. Inspect insulators for evidence of physical damage or contaminated surfaces.

k. Verify correct shutter installation and operation.

l. Exercise all active components.

m. Verify the correct operation of all sensing devices, alarms, and indicating devices.

n. Verify that vents are clear.

o. Inspect control power transformers.

2. Electrical Tests

a. Perform insulation-resistance tests on each bus section.

b. Perform over potential tests.

c. Perform insulation-resistance test on control wiring; do not perform this test on wiring connected to solid-state components.

d. Perform phasing check on double-ended switchgear to ensure correct bus phasing from each source.