

Point Eight Power, Inc.
Switchgear Specification
Low Voltage UL 1558 Metal-Enclosed Switchgear

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1.0 General

- 1.1 This specification requires the manufacturer to furnish the equipment and material specified herein complete and operable.
- 1.2 All standard accessories for normal operation and maintenance of the equipment specified shall be supplied.
- 1.3 All material purchased and fabricated shall be new and of the highest quality available.

2.0 Scope

2.1 This specification shall include:

- 2.1.1 The basic design and functional requirements for UL 1558 listed metal-enclosed switchgear. UL 1558 requires full type testing. Data sheets and drawings shall be considered as part of this specification. The equipment shall be complete and operable.

2.2 The equipment noted in this specification shall also include:

- 2.2.1 Provide production tests and inspections as detailed in this specification.
- 2.2.2 The manufacturer shall furnish all material and information required to reassemble switchgear at final destination.
- 2.2.3 Warranty period shall, at a minimum, cover the equipment for eighteen (18) months from time of shipment or twelve (12) months from date of energization whichever occurs first.
- 2.2.4 Supply all drawings, documentation, and information detailed in this specification.

2.3 Not Included, unless otherwise specified:

- 2.3.1 Field installation of switchgear
- 2.3.2 Connection of incoming or outgoing feeder cables or bus.
- 2.3.3 Connection of external control cables or wiring.

3.0 Applicable Codes, Standards and Qualifications

3.1 Codes and Standards

The assemblies shall be constructed, wired and tested in accordance with the applicable codes and standards listed below and should be considered as part of this specification. The latest revision in effect at time of inquiry shall apply for all standards referenced.

- 3.1.1 National Electrical Manufacturers Association (NEMA)
- 3.1.2 Institute of Electrical and Electronic Engineers (IEEE)
 - 3.1.2.1 IEEE C37.20.1
 - 3.1.2.2 ANSI C37.50
 - 3.1.2.3 ANSI C37.51

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3.1.3 Canadian Standards Association

3.1.3.1 CSA C22.2 No. 31

3.1.4 Underwriter Laboratories

3.1.4.1 UL 1558

3.2 Qualifications

3.2.1 All prototype testing and certifications must be conducted by a 3rd party testing organization. Self-certification is not acceptable.

3.2.2 The manufacturer shall have manufactured similar equipment for a minimum period of five (5) years. When requested, a list of installations with similar equipment shall be provided to demonstrate compliance.

3.2.3 All equipment manufactured shall be ISO 9001 certified.

3.2.4 It shall be the manufacturer's responsibility to be knowledgeable of these standards and codes.

4.0 Service and Environmental Conditions

4.1 The switchgear described in these specifications shall be of the construction required for final installation, either indoor or outdoor construction.

4.1.1 The switchgear shall be designed for system up to 600Vac, with a maximum voltage rating of 635Vac.

4.1.2 The switchgear shall be able to be used in 3-Phase, 3-Wire or 3-Phase, 4-Wire systems.

4.1.3 Unless otherwise specified this equipment is intended for use in ambient temperatures that do not exceed a maximum of 40°C (104°F) or a minimum of -30°C (-22°F).

4.1.4 This equipment is intended for use in an area where the elevation is 2000m above sea level and below. Above 2000m a de-rating factor as required by IEEE Std. C37.20.1 will apply.

4.1.5 The switchgear and major components shall be tested and certified to meet all applicable seismic requirements of Uniform Building Code (UBC) at the installation site. A minimum seismic rating of $S_{DS} = 1.90g$ is required.

4.1.6 The installing contractor shall follow mounting and installation guidelines as specified by the manufacturer.

5.0 Construction

5.1 The switchgear shall be designed and constructed to meet IEEE C37.20.1 with any manufacturer's breaker.

5.1.1 The equipment supplied shall be of metal-enclosed construction using welded or bolted sheet steel. The construction shall be self-supporting and free standing. All metal work shall be free from burrs and sharp edges.

5.1.2 The equipment shall be suitable for industrial service and constructed with an enclosure as specified on the drawings or data sheets.

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- 5.2 The switchgear shall be designed and manufactured to allow extension from either end at a future date without modifications, unless otherwise noted.
 - 5.3 The manufacturer shall electrically and mechanically assemble the vertical sections into one single line-up and 100% electrically tested prior to final inspection and shipment. Spot testing or only testing of components prior to assembly is not acceptable.
 - 5.4 Each shipping section will consist of several vertical structures connected together. Each shipping section shall be provided with lifting angles adequately sized for the equipment.
 - 5.5 The depth of the finished equipment shall be sufficient to allow for entrance, bending, and termination of power cables. Individual units shall be provided for top and bottom power and control cable entrance.
 - 5.6 Each metal enclosed cubicle and barriers shall be 12 gauge sheet steel or equivalent, minimum. In addition, all doors, including low voltage control and breaker doors shall be 12 gauge sheet steel, minimum.
 - 5.7 In order to minimize condensation, each cubicle designed for outdoor application shall have space heaters. Space heaters may be wired with other space heaters in parallel and shall be provided with an adjustable thermostat to maintain cubicle temperature at desired levels.
- 6.0 Front Breaker Compartment Doors
- 6.1 Each compartment shall be provided with steel hinged door.
 - 6.2 All breaker doors shall be provided with provisions for padlocking.
 - 6.3 No special tools shall be required to latch the front compartment door.
 - 6.4 Each breaker door shall have means to rack the circuit breaker in or out without opening the door.
- 7.0 Rear Compartment Doors
- 7.1 Each rear compartment shall be provided with steel bolted rear doors or covers.
 - 7.2 Rear doors or covers shall be properly identified with section designation and warning labels.
- 8.0 Power Circuit Breakers
- 8.1 The power circuit breakers shall be electrically operated, three-pole, drawout type. The power circuit breakers shall be manufactured and tested in accordance with UL1066.
 - 8.2 Power circuit breakers shall be draw-out construction to provide maximum operator safety.
 - 8.3 Safety interlocks and barriers as required by IEEE and UL standards shall be provided to prevent personnel from inadvertent exposure to the bus while the switchgear is energized.
 - 8.4 The continuous current capacity of each power circuit breaker shall range from 800A to 5000A as indicated on the drawings or data sheets. For circuit breakers larger than 5000A, please contact Point Eight Power.
 - 8.5 The breaker shall be installed in a cubicle, separated by metal barriers to other breakers or control cubicles. For additional safety and to prevent inadvertent operation or adjustments to the breaker, the breaker shall be installed behind a pad lockable door. Through the door type breakers are not acceptable. The drawout mechanism shall be fully functional with the front cubicle door closed and shall hold the power circuit breaker rigidly in the fully connected position.

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- 8.6 Interlocks shall be provided to prevent the circuit breaker from disconnecting from the main bus stabs unless the circuit breaker is open.
 - 8.7 Shutters, when specified on the data sheets, shall automatically cover the line and load stab connections when the circuit breaker unit is moved to the disconnected position.
 - 8.8 Auxiliary contacts to provide circuit breaker element position indication (Cell switch or TOC) and to provide circuit breaker contact position (Aux contacts) shall be available when specified.
 - 8.9 Circuit breaker operating mechanism shall be completely trip free both mechanically and electrically.
 - 8.10 For operator safety the circuit breaker shall have provision for padlocking it in the disconnected position.
 - 8.11 A code pins or plates shall be mounted in the bottom of each circuit breaker cell assembly which only allows a higher rated circuit breaker (current and interrupting rating) to be inserted into a lower rated cell assembly.
 - 8.12 Each breaker shall be operated by a motor-charged stored energy spring mechanism, charged normally by a universal electric motor and in an emergency by a manual handle.
 - 8.13 DC control voltage shall be supplied by others.
- 9.0 Power Bus
- 9.1 Main power bus shall be rectangular bar type copper. To minimize corrosion, the entire length of the bus bar, including ground bus bar, shall be silver plated.
 - 9.2 The main power bus shall be completely isolated with metal barriers from the breaker and control compartments.
 - 9.3 Metal barriers, if specified or if a sectionalizing tie breaker is part of the line-up, shall be provided between the main bus and cable connections.
 - 9.4 Main bus can be 800, 1200, 1600, 2000, 2500, 3200, 4000, 5000, or 6000 amp rating. The temperature rise of the bus and connections shall be in accordance with IEEE standards and documented by design tests.
 - 9.5 The bus shall be braced to withstand fault currents of the interrupting rating of the breakers.
 - 9.6 The bus shall be braced to withstand a maximum short time current of 100kA, or below, for 0.5 seconds, as noted on drawings.
 - 9.7 Main bus barriers, made of GPO-3 material, shall be installed between vertical sections when noted on drawings.
 - 9.8 The main power bus shall be supported with insulators and mechanically braced to withstand stresses resulting from the interrupting current values of the smallest breaker.
 - 9.9 Molded flame retardant and track resistant glass reinforced polyester inserts are required whenever bus passes through a barrier of any type.
 - 9.10 Bus joints shall be made with sufficient bolts, Bellville washers and locking nuts and torqued to preserve initial contact pressure over the service life of the equipment. Bolts that are torqued to appropriate levels at the factory shall be identified with torque markings. Bolts shall be rated Grade 5 and plated for corrosion resistance.
 - 9.11 Power bus orientation shall be A-B-C top to bottom, front to back, and left to right when viewed from the front of the switchgear, unless otherwise noted.
 - 9.12 All bus shall be covered with a dielectric coating when noted on drawings.

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- 9.13 A continuous silver-plated copper ground bus shall be provided for the full length of the switchgear assembly. The ground bus shall be capable of carrying the rated short circuit current of the installed circuit breakers.

10.0 Instrument Transformers

10.1 Current Transformers (CT)

- 10.1.1 Current transformers shall comply with the requirements of IEEE C57.13.
- 10.1.2 Each current transformer shall be rated to withstand the thermal and mechanical stresses imposed by the short circuit rating of the applied circuit breaker.
- 10.1.3 The secondary termination of current transformers shall be on a shorting terminal block.
- 10.1.4 All current transformer wiring shall be terminated with ring type lugs.
- 10.1.5 Current transformers shall have a rated 5 ampere secondary current unless otherwise specified.
- 10.1.6 Metering and relaying accuracy classification shall be as specified on the drawings or in the data sheets and shall be suitable for the connected burden.

10.2 Voltage Transformers (VT)

- 10.2.1 Voltage transformers shall comply with the requirements of IEEE C57.13.
- 10.2.2 Fusing for voltage transformers shall be installed in a non-control cubicle to maintain the switchgear 2B rating. No 480V unfused wiring shall be routed in the control cubicle.
- 10.2.3 Voltage transformers shall have 120 volt secondaries unless otherwise specified.
- 10.2.4 Voltage transformers shall have an accuracy rating comparable to the metering equipment and a burden capacity equal to twice the initial load.
- 10.2.5 Current limiting fuse protection shall be provided on the primary side of each voltage transformer.

11.0 Breaker Control and Instrumentation Wiring

- 11.1 Breaker control and CT wiring shall be SIS type #14 AWG, 41 strands extra flexible, stranded copper or larger.
- 11.2 Current transformer secondary wiring shall be terminated with ring type lugs.
- 11.3 All control wiring shall be UL listed and have a VW-1 flame retardant rating.
- 11.4 Exposed wiring shall be suitably protected against contact with sharp edges. Throughout the assembly it must be neatly bundled and secured with nylon wire ties. Control wires passing from cubicle to cubicle through holes will have grommets installed for protection.
- 11.5 Splicing of control wire is not permitted. Control wiring must be a continuous length from terminal to terminal.
- 11.6 Each control wire shall be marked at both terminations to agree with wiring diagrams. Wire markers shall be heat shrink type.
- 11.7 All wiring shall be neatly bundled or installed in wireways. Bundles and wireways shall be permanently secured to the enclosure. Securing with an adhesive is unacceptable.
- 11.8 Where possible, a minimum of 10% spare terminals shall be provided in each cubicle.

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12.0 Meters, Switches, and Relays

- 12.1 Control switches shall be rotary cam type with engraved face plates.
- 12.2 Ammeter and voltmeter transfer switches shall have an off position and shall be provided with knurled knob handles.
- 12.3 Selector type control switches shall have oval handles.
- 12.4 Circuit breaker control switches shall have pistol grip handles.
- 12.5 Current and voltage test switches for field monitoring and maintenance shall be provided when specified.
- 12.6 Indicating lights shall be provided as shown on the control schemes. Lamps shall be replaceable from the front of the switchgear without opening the cubicle door.

13.0 Nameplates

- 13.1 Laminated plastic engraved nameplates shall be provided.
- 13.2 Identification nameplates shall be white with black letters or black with white letters, caution nameplates shall be yellow with black letters, and warning nameplates shall be red with white letters.
- 13.3 Each externally visible device or component shall have an identification nameplate. Lettering shall be, at a minimum, 5/32 inches in height.
- 13.4 Each internal device or component shall have an identification marking.
- 13.5 A single stainless steel nameplate shall identify the work order number, switchgear ratings and date of manufacture.
- 13.6 Equipment rating nameplates shall be installed per IEEE Std C37.20.2, section 7.1.4.1 and IEEE C37.20.7, section 6.3.
- 13.7 All external nameplates shall be installed with stainless steel screws. Stick-on type nameplates are unacceptable.

14.0 Finish

- 14.1 All steel structure members shall be sand blasted to a near white finish.
- 14.2 Coating shall meet the requirements of IEEE C37.20.1.
- 14.3 All internal parts shall be either painted, galvanized or zinc plated for corrosion protection, no bare parts allowed.
- 14.4 Exterior will have a 'textured' finish to reduce glare and minimize blemishes and will be ANSI 61 gray in color, unless otherwise specified.

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15.0 Inspection and Testing

- 15.1 The switchgear shall be type tested by a recognized test lab in accordance with UL 1558. Test reports for design tests shall be available upon request.
- 15.2 Self-testing and certification is not acceptable.
- 15.3 Component bill of material shall be checked for proper quantity, description, and part number.
- 15.4 Physical dimensions shall be checked against approved drawings.
- 15.5 Production tests shall be performed in accordance with IEEE C37.20.2.
- 15.6 Equipment shall be subjected to secondary current injection procedure to determine proper operation of all current sensitive components.
- 15.7 Equipment shall be subjected to a primary voltage injection procedure to determine proper operation of all voltage sensitive components.
- 15.8 Complete assembly shall have a low frequency withstand (an ac high potential) test performed to assure insulation system integrity.
- 15.9 Manufacturer shall have in place a system of recording, correcting, and verifying resolution of discrepancies discovered during the inspection and testing process. The manufacturer shall be ISO 9001 certified.
- 15.10 All instrumentation and control wiring shall be 100% electrically tested for proper operation, accuracy, and interlocking. Spot testing or only testing components before assembly is not acceptable.
- 15.11 Manufacturer shall maintain permanent records of the production test results indicating satisfactory completion of all inspections and tests. These reports shall be available upon request.
- 15.12 Upon request the equipment shall be made available for customer inspection prior to shipment.

16.0 Accessories

- 16.1 One complete set of manufacturer's standard accessories for test, inspection, and operation shall be furnished. Such accessories shall include at least the following, unless a particular item is not used with the selected design:
 - 16.1.1 One Test cabinet
 - 16.1.2 Breaker lifting yoke, if required
 - 16.1.3 One Racking crank for breaker levering-in mechanism.
 - 16.1.4 Special wrench or tool(s) as needed for routine maintenance.
- 16.2 The following accessories should be considered as options:
 - 16.2.1 Electrically operated breaker levering-in mechanism
 - 16.2.2 Remote breaker control and monitoring cabinet
 - 16.2.3 Portable or overhead lifting device

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17.0 Design Standards and Documentation

17.1 Design Standards

- 17.1.1 All mechanical designs shall be developed using Inventor 3-D modeling software to confirm functionality and repeatability of the design
- 17.1.2 All bus designs shall be developed using Inventor 3-D modeling software and intergraded into the mechanical design to confirm functionality prior to manufacturing.
- 17.1.3 Electrical drawings shall be developed using Promis*e intelligent software to ensure proper component usage and schematic cross referencing.

17.2 Drawings

- 17.2.1 Prior to fabrication the following drawings shall be submitted by the manufacturer for approval.
 - 17.2.1.1 Cover sheet with master drawing list and revision control.
 - 17.2.1.2 Construction options/details
 - 17.2.1.3 Device legends, symbols and switch/relay developments
 - 17.2.1.4 Front elevation view with BOM cross referencing
 - 17.2.1.5 Interior device pan layouts with BOM cross referencing
 - 17.2.1.6 Cross Section side views
 - 17.2.1.7 Base plan including mounting details and cable entry area
 - 17.2.1.8 Component bill of material indicating quantity, description, and part number.
 - 17.2.1.9 Nameplate engraving details
 - 17.2.1.10 Bus one-line
 - 17.2.1.11 Schematic three-line schematic.
 - 17.2.1.12 Interconnect terminal block layouts
- 17.2.2 Following the return of approval drawings the manufacturer shall prepare and submit wiring diagrams indicating physical location of secondary control components and the appropriate wiring connections. Each control wire will be labeled. Copies of these drawings shall be submitted to the customer, upon completion, for record.
- 17.2.3 After completion of the inspection and testing procedures the manufacturer shall submit a complete set of "as built" drawings. These drawings shall function as a record of the final construction of the equipment at the time it left the factory.
- 17.2.4 Drawings will be provided in digital PDF format. Upon request, drawings can be provided in the latest version of Autodesk AutoCAD.
- 17.2.5 Each drawing prepared by manufacturer shall show, at a minimum, the name, jobsite location, purchase order number, and equipment identification number in addition to any information required by manufacturer.

17.3 Operating and Maintenance Manuals

- 17.3.1 At time of shipment the manufacturer shall provide a copy of the operating and maintenance instructions for all major components contained in the switchgear assembly.
- 17.3.2 Operating and maintenance manual will be provided as pdf files on a USB flash drive.

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17.4 Spare Parts List

- 17.4.1 Upon completion of the engineering phase, a quotation for one (1) year's recommended spare parts shall be submitted.

For assistance regarding this specification or other support, please contact Point Eight Power at:

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