SPECIAL SPECIFICATION

SECTION 16426S

LOW VOLTAGE SWITCHGEAR

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SPECIAL SPECIFICATION

SECTION 16426S

LOW VOLTAGE DRAW-OUT SWITCHGEAR

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Low voltage draw-out switchgear; including:

1. Main switchgear, where indicated on drawings.

2. Ratings for continuous current and short circuit capacity shall be as shown in the drawings.

1.02 REFERENCES

Comply with the following applicable standards and codes:

A. National Fire Protection Association (NFPA):

1. NFPA 70 National Electrical Code

B. Underwriters Laboratories, Inc. (UL):

1. UL 486A Wire Connectors and Wiring Lugs for Use With Copper Conductors

2. UL 1066 Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

C. National Electrical Manufacturers Association (NEMA):

1. NEMA EI 21.1 Instrument Transformers for Revenue Metering 110 kV BIL and less

2. NEMA PB 2.2 Application Guide for Ground Fault Protective Devices for Equipment

3. NEMA SG3 Low-Voltage Power Circuit Breakers

4. NEMA 250 Enclosures for Electrical Equipment (1,000 volts, maximum)

D. American National Standards Institute, Inc. (ANSI):

1. ANSI-C12.1 Electricity Metering

E. American National Standards Institute, Inc./Institute of Electrical and Electronics Engineers (ANSI/IEEE):

1. ANSI/IEEE-C37.16 Low-voltage Power Circuit Breaker and AC Power Circuit Breaker Protectors - Preferred Ratings, Related Requirements and Application Recommendations

2. ANSI/IEEE-C37.17 Trip Devices for AC and General Purpose DC Low-Voltage Power Circuit Breaker

3. ANSI/IEEE-C37.20.1 Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear

4. ANSI/IEEE-C39.1 Requirements for Electrical Analog Indicating Instruments

5. ANSI/IEEE-C57.13 Requirements for Instrument Transformers

F. InterNational Electrical Testing Association (INETA):

1. ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems

1.03 SUBMITTALS

A. Indicate detailed dimensions for the front, top and side views and cross sections.

B. Indicate clearance and shipping dimensions.

C. Indicate bus details and dimensions with supports.

D. Furnish detailed circuit breaker data.

E. Include complete three line diagrams with control schematics.

F. Indicate panel arrangement, and point-to-point wiring identification.

G. Furnish a complete bill of material.

H. Furnish schedule of trip unit features and time-current curves on full-size logarithmic paper.

I. Include factory test reports.

J. Provide operation and maintenance manual.

1.04 DELIVERY, STORAGE AND HANDLING

A. Completely assemble before shipment, then disassemble and match-mark to facilitate erection.

B. Deliver products to the site with shipping splits and sub-assemblies sized for passing through openings.

C. Lift only with designated lifting lugs.

1.05 WARRANTY

A. Warrant design, material and workmanship for not less than 12 months after acceptance by Owner from Contractor.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Cutler-Hammer.

B. General Electric.

C. Square D.

2.02 SERVICE CONDITIONS

A. Design For Indoor Use.

B. Seismic Design per IBC 2000: Seismic Design Category D; Use Group 3; Site Class D.

C. Altitude: 6000 feet above sea level.

2.03 SWITCHGEAR STRUCTURE

A. Provide heavy-duty, all steel, dead-front, free-standing switchgear, completely factory built and wired, and listed for "service equipment" conforming to applicable ANSI and UL standards.

B. Fabricate structure of code gage steel with smooth finished surfaces and edges, reinforced to be rigid and self-supporting. Provide separate steel compartments for complete isolation of individually mounted circuit breakers.

C. Provide reinforced steel front access doors with rolled or formed edges of the hinged and bolted type. Separately hinge each door and independently mount. Provide captive type closing bolts. Provide bolted panels for rear access.

D. Provide ventilated type structure with minimal air louvers. Design louvers to prevent entrance of contaminants or foreign objects to energized bus compartments. Provide "dead front" type louvers so that ionized gases and/or metallic particles are prevented from being expelled directly under fault conditions.

E. Provide bus bars and supports with adequate space for feeder cables and busway in the rear portion of the structure. Provide circuit breakers, operating mechanisms, potential and control transformers and required metering in the front portion. Mount current transformers around stationary studs for easy accessibility from the front. Mount neutral current transformers used in four-wire ground fault relaying systems in the rear load terminal compartment only.

F. Include a steel backplate in empty cubicles for complete isolation from all buses.

G. Provide heavy-duty and ruggedly constructed breaker racking mechanisms to maintain tolerances and prevent misalignment, distortion or binding. Minimize points and parts requiring lubrication. Securely hold breaker in the CONNECTED, TEST and DISCONNECTED positions.

H. Finish exterior and interior surfaces in manufacturer's standard gray color consisting of at least one coat of primer and one heavy coat of hard finish alkyd enamel. Provide a sufficient supply of touch-up paint (one quart minimum).

I. Provide factory painted single-line mimic bus on front panel of gear.

2.04 BUS

A. Provide hard-drawn copper buses of 98 percent conductivity sized to carry rated load without exceeding ANSI temperature limits. Rate all bus bars as indicated on drawings, and brace to withstand stresses caused by short circuits of a magnitude shown on the drawings but not less than 65,000 amperes (RMS-symmetrical).

B. Provide readily accessible from the rear, load side terminal connections of all feeder breaker positions for making up cable and/or busway. Isolate the main bus from the breaker load terminals and run-back load bus. Utilize captive type bolts or fasteners on all removable barriers.

C. Orient phases of bus bar consistently throughout.

D. Provide continuous copper ground bus 1/4-inch by 2 inches minimum, the full length of the assembly, and securely bolt to the structure. Provide a lug strap for each vertical section.

E. Provide a fully insulated and silver-plated neutral bus of full capacity and ampacity of phase bus. Identify the neutral bus in each vertical section with permanent decal(s) or stencil stating NEUTRAL BUS.

F. Silver-plate all bus joints and interconnections. Weld or bolt all bus connections with at least two properly torqued bolts to provide full and uniform pressure. Make drilled and plated provisions for future bus extension. Provide high strength, flame-retardant, track-resisting inorganic insulation material bus supports. Provide stand-off type bus support design.

G. Provide compression type terminal lugs and cable supports as required in rear section for proper termination of outgoing cables. Provide double indent, two hole, long barrel type lugs.

H. Where indicated in the drawings, provide feeder busway risers and/or drops within the rear terminal compartment.

I. Provide bus ampacity equivalent to the frame size rating of the connected breaker. Provide epoxy insulated, copper, breaker runbacks and copper-to-copper breaker primary connections.

2.05 POWER CIRCUIT BREAKERS

A. Horizontal draw-out type, equipped with a stored-energy spring mechanism for quick-make, quick-break, trip free operation. Design the stored-energy mechanism so that the closing speed is independent of both control voltage and operator. Provide three-pole, single-throw, 600 volt, 60 hertz breakers with a 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. Provide breakers of like frame sizes that are completely interchangeable.

B. Design guide support rails for racking out or removing breakers as an integral part of the cubicle and not an auxiliary device requiring manual insertion and removal. Provide a heavy duty rail latch to positively prevent breaker from rolling off the guide rail. Provide a breaker racking mechanism of the positive engagement, lead screw type.

C. Provide all breakers without electric operation.

D. Design breaker to prevent removal from, or insertion into, the cubicle with the closing springs fully charged. Do not allow the breaker to be moved between the CONNECTED-TEST-DISCONNECTED positions unless the breaker is in the open position.

E. Provide dead-front construction with a steel barrier between the operator and live parts during racking operations. Provide capability to padlock in at least the DISCONNECTED position such that breaker cannot be closed or moved to any other position.

F. Effectively ground breakers to the enclosure prior to being inserted into the TEST and CONNECTED positions. In the TEST position, separate the primary breaker disconnect contacts by a safe distance from the line and load contacts. Provide contacts which are self-aligning and positively and securely engaged in the CONNECTED position. Provide silver-to-silver contacts which are accessible for inspection. Construct all current carrying parts of the breaker of 98 percent conductivity copper with silver plated joints.

G. Provide secondary disconnecting contacts of rugged self-aligning, constant pressure, silver plated construction for control circuit connections to the movable element. Fully engage secondary contacts when the circuit breaker is in the TEST and CONNECTED positions. Harness all control wiring together, protected from physical damage and kept away from moving parts.

H. Provide breakers that meet applicable ANSI and NEMA operational requirements under no load and full load conditions. Provide solid-state type breaker protective trip devices.

2.06 PROTECTIVE DEVICES

A. Provide three-phase overcurrent trip devices that employ solid-state components to provide a combination of long-time, short-time and instantaneous tripping characteristics. Trip settings as indicated on the drawings. Submit time-current characteristic curves of each breaker with all settings indicated.

B. Provide self-contained circuit breaker and integral solid-state device. Arrange circuit breakers such that an external source of power is not required for tripping the breaker during short circuit or overload conditions. Provide printed circuit cards with heavy-duty, gold-plated contacts. House electronics within a metallic enclosure.

C. Provide the continuous rating of the circuit breaker as indicated and required by the current ratios.

D. Provide all main breakers with integral ground fault protection in accordance with NFPA 70.

E. Design the solid-state circuitry to be unaffected by external magnetic fields and in-line transients or harmonics. Provide a unit which is easily accessible and removable and capable of being tested and calibrated without removing from breaker housing. Provide field adjustable settings.

2.07 CONTROL AND SECONDARY WIRING

A. Provide enclosures for all secondary and control wiring insofar as practical. Terminate all wiring to outgoing circuits, at shipping splits and devices mounted on hinged panels on terminal blocks. Provide No. 14 AWG (minimum) wiring of tinned copper, tagged at both ends with permanent type wire markers, showing destination terminal designation.

B. Provide readily accessible fuse and terminal blocks. Permanently mark size, type and purpose of fuse adjacent to each fuse block.

2.08 INSTRUMENTATION

A. Provide a solid state circuit monitor with digital output display rated for **480** volts, 60 hertz, Square D Class 3020**, Model CM 3250** PowerLogic. Unit shall be UL listed in accordance with UL 508.

B. Provide a six digit LED readout which will allow local display of the following electrical parameters:

1. Voltmeter, phase to phase and phase to neutral.
2. Current, per phase RMS and 3 phase average.
3. Demand current, per phase.
4. Power factor, per phase and 3 phase total.
5. Real power, 3 phase total.
6. Reactive power, 3 phase total.
7. Apparent power, 3 phase total.
8. Energy (MWH).
9. Reactive energy (MVARH).
10. Frequency.
11. Average demand real power.

C. Provide the circuit monitor with the following characteristics:

1. Built-in communications capability which will allow multipoint communication at a 9,600 minimum baud rate to a remote computer workstation, programmable controller or other host device.

2. Adjustable demand interval (5 to 60 minutes).

3. Nonvolatile memory for storing all historical data.

D. 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 to reach rear mounted dip-switches. Include set-up parameters for CT ratio, PT ratio, System type 3 or 4 wire, and demand interval.

E. Provide the following monitor accuracy in percent of full scale for:

1. Current Voltage Measurements: Plus or minus 1 percent.

2. Power and Energy: Plus or minus 2 percent.

3. Frequency: Plus or minus 0.5 percent.

4. Power Factor: Plus or minus 4 percent.

5. Data Update Time: 0.817 S (4 wire).

F. Provide three current transformers (CT) having a primary to match the size of the bus and 5 ampere secondary with metering class accuracy.

2.09 RMS DIGITAL SENSING OF SINUSOIDAL AND NON-SINUSOIDAL

A. Provide accurate overload protection for both sinusoidal and non-sinusoidal currents by direct measurement of the true RMS content of the current wave. Base design on complementary metal oxide (CMOS) technology, to be less sensitive to extraneous noise produced by lighting, instrumentation, radio, etc.

B. Microprocessor Based Relaying Monitoring System:

1. Overload and short circuit protection, protective relaying, metering, event reporting, breaker status reporting and a remote communications link with discrete input monitoring capabilities for the low voltage switchgear. Provide each lineup with a field programming unit (FPU). The field programming unit faceplate will contain a vacuum fluorescent screen display and keys for the operator to modify system parameters. Power supply input voltage 120 volt AC. Control power source located in the switchgear. Provide line conditioner as required. Store all parameters and values in a nonvolatile memory in the system. Provide an on-line HELP facility to provide the operator with information necessary to complete a command.

2. Overload and Short Circuit Protection:

a. Provide each breaker with a programmer, driven by three integral breaker current sensors to provide overload, short circuit and grounds fault protection. Make overcurrent settings using a rotary switch adjustment on the breaker protection unit. Utilize true RMS sensing for long-time and short-time overload. Provide system with allowance for errors of less than 1 percent on systems with distortions through the 13th harmonic.

b. Provide interchangeable rating plugs for changing current ratings. Equip with a long-time timing light to provide visual indication that the breaker is approaching an overload condition or is timing out to trip under an overload. Provide clear cover for the protection unit that can be sealed.

3. Protective Relaying: Provide undervoltage, voltage unbalance, current unbalance and power and delay intervals in the system control unit. Store information in a memory that will retain this data during the loss of power. Provide the ability to switch any or all of these functions off, on a breaker by breaker basis.

4. Metering Functions:

   a. Display the following real time data for each breaker: current for each phase, RMS phase to neutral voltage for each phase, RMS phase to phase voltage for each phase, energy present demand, peak demand, real power, reactive power, total power for each phase, power factor for each phase, percent ampere capacity and frequency. Determine the energy reading by integrating the calculated real power with time. Base real power and reactive power based on current transformer and potential transformer inputs. Calculate the total power values and power factor values based on the real and reactive power data.

   b. Provide the ability to reset the energy, peak demand and peak capacity values from the field programming unit or from the host computer. A security password must be entered before the values will be cleared.

5. Event Reporting: Log events in a memory that will retain the data during a loss of power. Include the following information logged for each event: the number of the event, date of event, time of event to 1/100 of a second, reason for the event, the breaker unit the event occurred on, if event was a trip, the type of trip and if the trip was caused by overcurrent, the value of current causing the trip. Provide capability to delete any or all event logs after events have been viewed and the security password entered.

6. Status Reporting: Display status of each breaker on the system monitor. Include the breaker position, overcurrent status, protective-relaying status and result of continuous self-diagnostic breaker electronic check.

7. Communications Link: Provide an RS232 port and modem for connection to the energy management system. Communicaiton capability shall include Square D powerlogic protocol. Locate the port in an accessible location in the low voltage switchgear. The protection/control system will send information back to the host computer after the host computer has properly requested data. Provide all information that is available locally on the screen display to be connected to a host computer. Provide host interface protocol with the system.

Provide all necessary accessories to communicate with the protection and control system.

8. Discrete Monitoring: In addition to the RS232 port, provide the 16 pairs of terminal points located on a terminal board in the rear section of switchgear. The host computer may request the status of the discrete. The field programming unit will transmit the open/close status of these remote contacts back to the host computer.

C. Monitor and Wiring: Provide interconnecting wiring as required for complete system.

D. Provide an initial program and at least 24 hours of programming and troubleshooting assistance.

2.10 ACCESSORIES

A. 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 mounted crane rail with lifting crane.

B. Provide hoist type lifting crane specifically designed for breaker removal. Lever operated "come along" pullers will not be acceptable.

C. Provide crane rail and hoist operable by one man. Provide with safety chain for attachment to breaker.

D. Provide one portable test kit for field calibration.

E. Provide kirk-key interlocks on service entrance switchgear where shown in the drawings.

2.12 TRANSIENT VOLTAGE SURGE SUPPRESSION

A. At main service entrance only, provide transient voltage surge suppressors.

B. Devices shall comply with IEEE C62.41 and C62.45, NEMA LS-1, UL 1283 and UL 1449.

C. Provide suppressors with the following ratings:

1. Peak single-impulse surge rating: 100kA per phase.

2. Line-to-neutral clamping voltage: 800v maximum.

3. Line-to-ground clamping voltage 800v maximum.

4. Neutral-to-ground clamping voltage: 800v maximum.

5. Fuse rating: 200kA interrupting capacity.

D. Provide permanently wired system with integral disconnect and fuses, redundant modular suppression circuits, indicator lights for power and protection status, audible alarm and 5A, 250VAC dry alarm contact.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's written instructions in location shown on drawings.

B. Provide a 4 inch concrete housekeeping pad with anchor bolts. Bolt enclosure to pad plumb and square.

C. Make up all bolted connections and properly torque.

D. Clean entire assembly. Wipe all bus supports and insulators dust free. Replace or repair all insulators or skirts which are damaged, chipped or bent.

E. Touch-up all surfaces which may be scratched, marred or damaged to match factory finish.

3.02 FIELD QUALITY CONTROL

A. Provide a factory trained and authorized service technician, at no additional expense to Owner, to insure the installation is in conformance to manufacturer's recommendations.

B. Provide field service representative to check out and verify all connections before energization of equipment. Test and verify all interlocks and control sequencing.

C. Provide field service representative to supervise the testing and sequencing of entire line-up and make all adjustments necessary for a complete and operable system.

END OF SECTION