SECTION 16429100
INDIVIDUALLY MOUNTED REAR ACCESSIBLE
LOW VOLTAGE SWITCHBOARDS - POWER BREAK® II
WITH POWER MANAGEMENT

PART 1 GENERAL

A. The requirements of the Contract, Division 1, and Division 16 apply to work in this Section.

1.01 SECTION INCLUDES

A. Individually mounted rear-accessible low voltage switchboards with Power Management.

1.02 RELATED SECTIONS

1.03 REFERENCES

The low voltage switchboards and protection devices in this specification are designed and manufactured according to latest revision of the following standards (unless otherwise noted).

A. ANSI C37.16, Low Voltage Power Circuit Breakers and AC Power Circuit Protectors, Preferred Ratings, Related Requirements and Application Recommendations for

B. ANSI C37.50, Switchgear - Low Voltage AC Power Circuit Breakers Used in Enclosures - Test Procedures

C. ANSI/IEEE C37.13, In Enclosures, Low - Voltage AC Power Circuit Breakers Used

D. ANSI/NEMA PB 2, Deadfront Distribution Switchboards

E. ANSI/NFPA 70, National Electrical Code

F. NEMA AB 1, Molded Case Circuit Breakers and Molded Case Switches

G. UL 489, Molded-Case Circuit Breakers and Circuit-Breaker Enclosures

H. UL 891, Dead-Front Switchboards

1.04 DEFINITIONS

1.05 SYSTEM DESCRIPTION

A. Switchboards shall be individually mounted with [{draw-out}{stationary}] insulated case feeders and low voltage <{insulated case}{ and }{power}> circuit breaker mains and ties. Switchboards shall have [{insulated / isolated}{bare}] bus. Switchboards shall be factory assembled and metal enclosed. They shall have functionally compartmentalized units for individually mounted protective devices.

B. Switchboards shall be furnished with [{NEMA 1 indoor}{NEMA 3R outdoor, walk-in}{NEMA 3R outdoor, non-walk-in}] enclosure.

1.06 SUBMITTALS

A. Manufacturer shall provide copies of following documents to owner for review and evaluation in accordance with general requirements of Division 1 and Division 16:

1. Product Data on specified product;

2. Shop Drawings on specified product;

3. Switchboard Data, detailed component data on specified product, such as CT ratios, ratings;

4. Certified trip curves for each specified product;

<5. Certified copies of all Production Test Reports.>

1.07 PROJECT RECORD DOCUMENTS

A. Maintain an up-to-date set of Contract documents. Note any and all revisions and deviations that are made during the course of the project.

B. Record drawings shall be furnished providing the following information:

1. Complete rating;

2. Short-circuit rating of bus and interrupting rating of lowest rated device;

3. Overall outline dimensions including conduit space;

4. Device schedule showing location in switchboard;

5. Device description;

6. Device trip or fuse clip ampere rating;

7. Conductor rating;

8. One-line diagram;

9. Instrument panel and barrier layout;

10. Schematic and wiring diagrams.

1.08 OPERATION AND MAINTENANCE DATA

A. Manufacturer shall provide copies of installation, operation and maintenance procedures to owner in accordance with general requirements of Division 1 and Division 16.

B. Submit operation and maintenance data based on factory and field testing, operation and maintenance of specified product.

1.09 QUALITY ASSURANCE (QUALIFICATIONS)

A. Manufacturer shall have specialized in the manufacture and assembly of low voltage switchboards for [25] years.

B. Low voltage switchboards shall be listed and/or classified by Underwriters Laboratories in accordance with standards listed in Article 1.03 of this specification.

C. Manufacturer's Certificate of ISO 9002 Compliance.

<D. Installer's Certificate of ISO 9000 Compliance.>

E. Installer has specialized in installing low voltage switchgear with [minimum _ years documented experience].

1.10 REGULATORY REQUIREMENTS

1.11 MOCK-UPS (FIELD SAMPLES)

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.

B. Deliver low voltage switchboard in shipping sections on shipping splits for ease of handling. Each section shall be mounted on shipping skids.

C. Inspect and report concealed damage to carrier within specified time.

D. Store in a clean, dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic.

E. Handle in accordance with NEMA [___] and manufacturer's written instructions to avoid damaging equipment, installed devices, and finish. Lift only by installed lifting eyes.

F. Switchboard shall have adequate lifting means, and be able to be rolled or moved into installation position and bolted directly to floor without use of floor sills.

1.13 PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)

A. Follow (standards) service conditions before, during and after low voltage switchboard installation.

B. Low voltage switchboards shall be located in well-ventilated areas, free from excess humidity, dust and dirt and away from hazardous materials. Ambient temperature of area will be between minus [30] and plus [25] degrees C. Indoor locations shall be protected to prevent moisture from entering enclosure.

1.14 SEQUENCING AND SCHEDULING

1.15 WARRANTY

A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of startup or 18 months from date of shipment, whichever occurs first.

1.16 MAINTENANCE SERVICE

A. Furnish complete service and maintenance of switchboards for [{1 year}{5 years}] <specify other service contract time period> from date of substantial completion.

B. Include _____.

1.17 EXTRA MATERIALS

A. Provide [{parts}{spares}] as indicated in drawings.

B. Provide sizes and ratings of spare fuses as indicated in drawings.

C. An integral rail mounted breaker lifting device shall be provided with NEMA 1 and walk-in NEMA 3R switchboards, only. Other switchboards shall have a portable breaker lifting device.

1.18 FIELD MEASUREMENTS

PART 2 PRODUCTS

2.01 MANUFACTURER

A. General Electric Company products have been used as the basis for design. Other manufacturers' products of equivalent quality, dimensions and operating features may be acceptable, at the Engineer's discretion, if they comply with all requirements specified or indicated in these Contract documents.

2.02 MANUFACTURED ASSEMBLIES

A. Furnish Individually mounted rear-accessible low voltage switchboards, GE Type Power Break® II with Power Management (or equal) as indicated in drawings.

2.03 COMPONENTS

A. Structure

1. Indoor switchboardshall be completely self-supporting, forming a single metal enclosed structure. Sides, top, and rear covers shall be code gauge steel. Frame structure members shall be die-formed, 11 gauge steel bolted together and reinforced at corners. Switchboard frames are to be suitable for use as floor sills in indoor installations.

2. Outdoor Switchboard

a. Outdoor non-walk-in switchboards shall be similar to indoor assemblies, except they shall be a fully weather-proof, factory assembled outdoor enclosures.

b. Enclosure shall have lifting plates at base of structure, hinged aisle doors with rubber gaskets and padlocking provision. It shall have asphalt base undercoating on exterior bottom, interior lights, [1] space heater per vertical section, outlets, light switch and space heater switch.

c. Walk-in enclosure shall include: front aisle space extending full length of switchgear for breaker maintenance and inspection, sloping roof, rear bolted hinged doors, breaker lifting device, storage provision for hoist operating crank <hinged rear doors gasketed with lockable T-handles> and 3 point catch. <{Provide}{ thermostat}{,}{ and}{ humidistat}{,}{ and }><control power transformer rated ___ KVA><.>

3. Switchboard shall be arranged for [{close coupling to the transformer secondary} through a transition section {connection to the supply source by cable}{connection to supply source by busway}{UL service entrance label}{incoming line isolation}] and shall have side barriers between sections.

4. Breaker compartment doors shall be secured with two captive hex head screws. Barriers shall isolate breaker compartment from bus bar system.

5. Pull box shall extend entire width and depth of cable compartment, shall be 12 to 36 inches high (in one inch increments) and include screw cover plates.

<{6. Provide vertical supports for each vertical section.}>

<{7. Provide drip-proof roof for indoor equipment}. There is no integral breaker lifting device.>

8. Integral breaker lifting device shall be rail mounted on top of equipment, hand operated and movable.

9. [{Bolted covers}{Full height hinged rear covers} that can be bolted closed{Full height hinged rear covers} with (2) T-handles] shall be provided for each cable compartment. A front hinged door shall be provided for each breaker and metering compartment.

10. Switchboards shall be rated as indicated in drawings.

11. Provide shutters in drawout breaker compartments to cover breaker primary line and load disconnects when the breaker is removed from the compartment.

<{12. Provide space heaters } in each vertical section. Heater rating shall be 250 watts.>

13. Switchboard shall have a rear cable and terminal compartment. Cable bending space shall meet National Electrical Code requirements.

14. All switchboard sections shall have open bottoms and removable top plate(s) to install conduit.

B. Bus Bars

1. Bus bars shall be full-sized.

2. A-B-C bus arrangement (left-to-right, top-to-bottom, front-to-rear) shall be used throughout to assure convenient and safe testing and maintenance. Where special circuitry precludes this arrangement, bus bars shall be labeled.

3. Main and riser busses shall be fully isolated from breaker, instrument and auxiliary compartments. Bus bar material shall be bolted copper. All bolted joints for bus interconnections, and connections to equipment shall be [{tin-plated copper}{bolted copper with ring silver plating at bolt joint}]. Bus shall be arranged to permit future additions.

4. Copper bars shall not exceed 1000 amperes per square inch cross section. If a main circuit protection device is provided, continuous bus current rating shall be frame size of device.

5. Vertical bus shall be held rigid in short-circuit support structure of molded glass reinforced polyester bases to inhibit the spread of arcing faults.

6. Provide barrier system to fully insulate each phase of the main bus and isolate each

phase of vertical bus bars from <{each other}{cable area}> so that the only live connections accessible in rear of each section are breaker load side connections. Access to joints shall be provided by replaceable glass-reinforced polyester [{covers}{barriers}]. Phase barriers are glass-reinforced polyester solid insulation (not provided between a vertical bus connected to a 4000 ampere low voltage power circuit breaker). Main bus shall be insulated between joint surfaces by a fluidized epoxy coating.

7. Continuous current rating shall be based on requirements of UL 891.

8. Breaker primary connections shall be copper-to-copper, silver plated on drawout breakers, tin plated on stationary breakers.

9. Main bus bars shall be braced to withstand short circuit mechanical forces as indicated in drawings. Other buswork shall be braced to withstand short circuit mechanical forces during short circuits equivalent to maximum interrupting capacity of associated circuit breakers, or maximum let-through current for load size of a fused circuit breaker.

10. A copper [{800A, 0.25 by 3 inch}{1600A, (2) 0.25 by 3 }] ground bus shall be secured to each vertical section structure. Ground bus shall extend entire length of switchboard and shall be equipped with a 4/0 terminal for connection to purchaser's ground system. A lug strap shall be provided for each vertical feeder section.

11. All feeder device line and load connection straps shall be rated to carry continuous current rating of device frame (not trip rating). Load connection straps shall be insulated and extended beyond the main bus.

C. A utility metering compartment shall be supplied to meet requirements of [utility name].

D. Service Entrance shall comply with UL Service Entrance requirements: service entrance label, incoming line isolation barriers, neutral connection to switchgear ground for solidly grounded wye systems.

E. Incoming Line Section shall be rated as indicated in drawings. Main cable connection shall have [number and size] [{copper}{aluminum}] cables per phase with [{mechanical (standard)}{compression}] lugs. Section shall include [{transition to transformer}{busway connection}] that will include cutout in switchgear, bus riser or other internal connections.

F. Main Metering

1. Electronic Metering - The Meter shall be a GE Electronic Power Meter (EPM) as provided on the specified circuits. The microprocessor based multi-function Meter shall have a two line, backlighted LCD display with 16 alphanumeric characters available on each line. The Meter shall provide the functions listed below.

a. The metering values shall be phase selectable and include current for each phase and neutral, voltage (L-L and L-N), watts, VARs, volt-amperes, power factor, watt-hours, VAR hours (lag and lead), volt-ampere hours, current demand, peak current, watts demand, peak watts demand, peak VARs demand (lag and lead), VARs demand (lag and lead), peak volt-amperes demand, volt-amperes demand, Q-hours, power factor average, power factor during last demand interval, and frequency. The accuracy shall be 0.5 percent for watt hours and 0.25 percent for amperes and voltage. The accuracy shall be a percentage of reading and not full scale.

b. The display shall be user selectable for automatic scrolling and / or manual scroll. The user shall be able to select which metering values are to be displayed on the LCD display using the keypad (from one to all metering values). The user shall have the option to program the demand as a fixed window or a sliding window. The Meter shall allow user definition of a password to provide security protection. The password shall be entered via the three button keypad on the faceplate. Any or all of the user defined values may be password protected.

c. The Meter shall be equipped with a communication port and the capabilities to communicate via an RS485 / Modbus RTU protocol. <{The Meter shall have a KYZ pulse initiation} with two pulse outputs programmable for watt-hours, volt-ampere hours, VAR hours, or Q-hours.>

d. The Meter shall be provided in a S1 switchboard Meter draw-out case with a CT shorting bar installed in the case.

<{e. If advanced functions are required}, see specification section 16945000 for the EPM 3710 or specification section 16945001 for the EPM 3720.>

G. Protective devices

1. Switchboard shall include protective and metering devices as shown on drawings.

2. Main and tie protective devices shall be low voltage <{power}{insulated case}> circuit breakers. Low voltage power circuit breakers shall meet requirements of ANSI/IEEE C37.13, ANSI C37.16, and ANSI C37.50. All protective devices shall be UL Listed.

3. All main and feeder protective devices shall be in individual compartments, and arranged for either draw out or stationary (not available on low voltage power circuit breakers) mounting. Compartment shall be formed with steel barriers on each side, and glass reinforced polyester barriers on top, bottom and rear surfaces. Ventilation openings shall be provided as required.

4. Circuit breakers and fused high pressure contact switches shall have a stored-energy type mechanism to provide a quick-make, quick-break operation. Manual charging of stored-energy mechanism and operation of devices shall be accomplished with compartment door closed and latched.

5. Electrically operated breakers shall have an integrally mounted, spring charging motor mechanism, and shall include open <and close> push buttons.

6. Microprocessor Based Tripping Systems

a. Circuit breakers shall be equipped with solid state self-powered devices which shall include protective trip units, flux-shift trip device, current sensors, and rating plugs

1). Protective trip units shall be a micro-electronic processor that is automatic, self-contained and requires no external relaying, power supply or accessories. Its printed circuit cards shall resist moisture absorption, fungus growth, and signal leakage, and shall have highly reliable programmable controls with repetitive accuracy and precise unit settings. All electronics shall be housed in metallic enclosure to

protect against high-fault interruption arcs, magnetic interference, dust and other contaminants.

2). Programmer shall be RMS sensing for long and short time characteristics for accurate measurement of true RMS content of current wave. Sampling rate shall be 64 times per cycle and up to the 31st harmonic.

3) Current sensors shall be mounted on breaker frame and shall be made of molded epoxy to protect against damage and moisture. For 4-wire ground fault, a fourth current sensor shall be mounted on neutral bar in cable compartment and shall be constructed similar to phase overcurrent sensors. Ground fault function shall contain a memory circuit that integrates arcing fault current with time, summing intermittent ground-current spikes.

4) Solid state microprocessors shall use a broad range of field installable rating plugs for future up-rating capability, minimum size cable selection, and an extra degree of coordination flexibility.

5) The trip unit shall have an LCD display with an integral phase selectable ammeter and voltmeter and shall display frequency, real power, total power, demand / peak demand, and accumulated energy. The trip unit shall have the capabilities to communicate to a remote computer all of the above information plus VARs, and power factor.

6) The trip unit shall be able to display trip fault information. The unit shall display the fault pickup, the type of fault, the magnitude of the fault current and the phase the fault occurred on. The trip unit shall also have an integral trip operations counters which shows the number of long-time, short-time, instantaneous, and ground fault trips. The number of faults shall be stored in nonvolatile memory and can be manually reset by the user.

7) All information from the trip unit shall be able to be viewed at each breaker without opening the breaker cubicle door. The display shall have a lockout function to prevent unwanted personnel from changing breaker settings without cutting a sealing ring.

8) The trip unit shall have an ergonomic 5 button keypad for field setup. Trip target information shall be displayed in international symbols.

9). All metering and tripping information shall have the capability to communicate via RS485 / Modbus RTU protocol.

<{10) Trip unit shall have integral independent protective relays} that include current unbalance, voltage unbalance, overvoltage, undervoltage, and power reversal. Each relay shall be independent of each other and have 0 to 15 second time delays that can be set in one second increments.>

7. Manual breakers shall have front mounted handles for charging closing springs. Breakers shall be closed by pressing a mechanical close button mounted on breaker

escutcheon or by operating the breaker handle. Breakers shall be manually opened by pressing a mechanical trip button mounted on breaker escutcheon.

8. Circuit breakers / switches shall be of [{draw out}{stationary}] construction for individual removal and ready replacement from front of switchboard. Draw out construction, when specified, shall permit breaker to be withdrawn from an engaged position, to test position, and to disengaged position. Draw out mechanism shall be mechanically interlocked with circuit breaker's trip mechanism so that breaker must be OPEN before it can be moved into or out of the CONNECTED position. The breaker shall automatically trip open if it is withdrawn while in CLOSED position. A CLOSED breaker shall trip open before it is racked into the engaged position.

H. Small wiring, necessary fuse blocks and terminal blocks within switchboard shall be furnished as required. All groups of control wires leaving switchboard shall have terminal blocks with suitable numbering strips.

<{I. Tie Breaker Control}>

<{1. Provide automatic transfer control equipment} to transfer a load bus from its normal source of supply to an alternate source. Voltage sensing on each source shall be {single phase}{three phase}{ with loss of phase protection}{.}{ All transfer scheme logic shall be incorporated} into and executed by a programmable Logic Controller (PLC). The PLC shall receive the following inputs: source voltage status as sensed by the voltage relays, breaker status (open, closed, tripped on fault) for main {and bus tie} {breakers}. Interposing relays shall be provided for interfacing the PLC outputs with the circuit breaker close and trip circuits. Additional PLC outputs shall be provided for local indication of the following: transfer scheme status (auto-blue / manual-white) and PLC fault (amber). If the control power source for the PLC is derived from within the switchgear, provide a dedicated "hold up device" for the PLC to ride through any momentary switching of control power sources. {The PLC programs shall be executed} without interruption during an undervoltage {or loss of phase }{condition}.>

<{2. Basic PLC logic features shall include}: interlocking of the main {and bus tie }{breakers }{to prevent paralleling sources;} time delay for initiating a transfer upon an undervoltage {or loss of phase }{condition}; time delay for return to normal after the undervoltage {or loss of phase }{condition has been corrected; and blocking transfer, if the main }{or bus tie }{breaker trips due to a fault.}>

<{3. Description of operation} - three breaker transfer (main-tie-main), delayed transfer / delayed return. Under normal conditions both main breakers are closed and the bus tie breaker is open. The transfer system selector switch is in the auto position. When an undervoltage {or loss of phase }{condition} is detected, the PLC receives an input from the voltage sensing relays. The PLC program executes, tripping the affected main breaker by its interposing trip relay after the programmed time delay. The PLC senses the open main breaker status and the program immediately closes the bus tie breaker by its interposing close relay. With the return of the affected source, the PLC trips the bus tie breaker by its interposing trip relay after the programmed time delay. The PLC senses the open tie breaker and the program immediately recloses the open main breaker by its interposing relay. Simultaneous loss of both sources shall not cause any change in breaker status. Upon return of one source, the PLC shall immediately trip the main breaker without voltage and close the bus tie breaker.>

<{4. Manual operation}--Control switches for the main and bus tie breakers are inoperative when the transfer system control selector switch is in the auto position.

Turning the transfer system control selector switch to the manual position allows the main and bus tie breakers to be manually closed and tripped via their control switches. Electrical interlocking in the breaker close circuits prevents both main breakers and the tie breaker from being closed at the same time. Redundant electrical interlocking, separate from the PLC, shall be provided for the main and tie breakers and shall be operational only when the automatic transfer system is in the manual mode. To transfer the loads from one source to the other, the affected main breaker must first be opened and then the bus tie breaker can be manually closed. To return to normal, trip the bus tie breaker and reclose the main breaker via their respective control switches.>

5. The GE 90/30 PLC shall be able to communicate via RS485 / Modbus RTU protocol.

J. On multi-source switchboards with AC control power, control power automatic throw-over equipmentshall transfer control bus from one control power source to another when one is de-energized.

K. Control wiring shall be SIS type wire. All wiring shall have [{origin}{destination}{origin / destination}] labels that identify each end of the wire where both ends of the wire are connected. Maximum voltage at front panels and instrumentation shall be 240 volts. Instrument transformers shall be used for all metering.

2.04 ACCESSORIES

2.06 FINISH

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that low voltage switchboards are ready to install.

B. Verify field measurements are as [{shown on Drawings}{instructed by manufacturer}].

C. Verify that required utilities are available, in proper location and ready for use.

D. Beginning of installation means installer accepts conditions.

3.02 LOCATION

A. Switchboards shall have adequate clearance for required rear access.

3.03 INSTALLATION
Additional provisions and editing may be required for this part.

A. Install per manufacturer's instructions.

B. Install required safety labels.

3.04 FIELD QUALITY CONTROL

A. Inspect installed low voltage switchboards for anchoring, alignment, grounding and physical damage.

B. Check tightness of all accessible mechanical and electrical connections< with calibrated torque

wrench>. Minimum acceptable values are specified in manufacturer's instructions.

3.05 ADJUSTING

A. Adjust all <{circuit breakers}{, }{switches}{, }{access doors}{, }{operating handles}> for free <{mechanical}{ and / or }{electrical}> operation as described in manufacturer's instructions.

B. Adjust circuit breaker trip and time delay settings to values [{specified}{determined}] by Architect Engineer.

3.06 CLEANING

A. Clean interiors of <{switchboards}{, }{panels}{, }{separate enclosures}> to remove construction debris, dirt, shipping materials.

B. Repaint scratched or marred exterior surfaces to match original finish.

END OF SECTION