

SECTION 16428000
LOW VOLTAGE SWITCHBOARDS - AV-3 ACCESS

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. Low Voltage, Front-Accessible, Rear-Connected Switchboards for Molded-Case Circuit Breakers

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 C37.47, Distribution Fuse Disconnecting Switches, Fuse Supports, and Current-Limiting Fuses, Specifications for (includes supplement ANSI C37.47a-1983)
- C. ANSI C39.1, Electrical Analog Indicating Instruments, Requirements for
- D. ANSI/IEEE C37.13, In Enclosures, Low - Voltage AC Power Circuit Breakers Used
- E. ANSI/IEEE C57.13, Instrument Transformers, Requirements for
- F. ANSI/NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum)
- G. ANSI/NEMA PB 2, Deadfront Distribution Switchboards
- H. Federal Specification W-C-375, Rev. B, Amend. 1, Circuit Breakers, Molded Case; Branch Circuit and Service
- I. NEMA AB 1, Molded Case Circuit Breakers and Molded Case Switches
- J. NEMA AB 3, Molded Case Circuit Breakers and Their Application
- K. NEMA AB 4, Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications
- L. NEMA ICS 6, Industrial Control and Systems: Enclosures
- M. NEMA PB 2.1, General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less
- N. NEMA SG 3, Low Voltage Power Circuit Breakers
- O. UL 1012, Power Units Other Than Class 2
- P. UL 489, Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
- Q. UL 891, Dead-Front Switchboards

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1.04 DEFINITIONS

Define unusual terms or terms used in unique ways not normally included in standard references.

1.05 SYSTEM DESCRIPTION

A. Switchboards shall be Class [_]with all devices individually mounted. Switchboards shall be rear-accessible and front and rear aligned.

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 Type (Design) and Verification 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.

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)

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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 each switchboard section in individual shipping splits for ease of handling. Each section shall be mounted on shipping skids and wrapped for protection.

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. (Heat enclosures to prevent condensation.)

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.

1.13 PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)

A. Follow NEMA PB 2 service conditions before, during and after switchboard installation.

B. 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 installation or 18 months from date of purchase, whichever occurs first.

1.16 MAINTENANCE SERVICE

A. Furnish complete service and maintenance of switchboards for [1 year]{5 years}] 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 N/A

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

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acceptable, at the Engineer's discretion, if they comply with all requirements specified or indicated in these Contract documents.

2.02 EQUIPMENT

A. Furnish GE Type AV-3 Access switchboards (or equal) as indicated in drawings.

2.03 COMPONENTS

Refer to Drawings for: actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; and other required details.

A. Standard Features

1. Switchboards shall be fully self-supporting structures with [90] inch tall vertical sections (excluding lifting eyes and pull boxes) bolted together to form required arrangement.
2. Switchboard(s) shall be [{{indoor, NEMA 1}}< with drip hood>[{{outdoor, NEMA 3R}}] <{walk-in}{non-walk-in}>< and shall have deadfront construction>.
3. Switchboard frame shall be die formed 11 gauge steel reinforced with internal and external corner gussets. Frame shall be rigidly [{{assembled}}{bolted}] to support cover plates, bus bars and installed devices during shipment and installation.
4. All sections may be rolled, moved or lifted into position and shall be [{{front}}{rear}] aligned.
5. Switchboard frames are to be suitable for use as floor sills in indoor installations.
6. Sides, top, and rear cover shall be code gage steel, bolted to the switchboard structure.
7. All switchboard sections shall have open bottoms and removable top plate(s) to install conduit.
8. Switchboards shall be rated as indicated in drawings. Maximum circuit breaker rating shall be 600 VAC, <{800 amperes, fusible}{ and }{1200 amperes, non-fusible}>.
9. Switchboard current ratings, including all devices, shall be based on [25] degree C ambient room temperature [UL 891].
10. Mount to provide working access behind switchboards.
11. Each feeder device shall be individually mounted with an external operating handle located through front door.
12. Each feeder device shall be isolated from adjacent devices by steel barriers at sides and insulating barriers at top and bottom of each breaker compartment.
13. Door shall be formed steel <hinged> and shall be retained in closed position by two captive, hex head hand screws.
14. Show all top and bottom conduit areas on shop drawings.
15. For Service Entrance applications only, switchboard includes:

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- a. UL service entrance label;
- b. Neutral bonding jumper;
- c. Ground bus;
- d. Lug for grounding electrode;
- e. Ground fault protection as required by NEC
- f. And shall comply with all utility company requirements for service entrances and associated metering.

16. Switchboard protective devices shall be furnished as listed on drawings and specified in these specifications, including interconnections, instrumentation and control wiring.

B. Barriers

1. Rear and side barriers are standard.
2. Feeders compartmented by top and bottom horizontal barriers of glass-reinforced polyester.

<{3. Select following options as indicated in drawings:}

{a. Feeder section vertical bus insulated and isolated} from main horizontal bus with {reinforced glass polyester} {polypropylene} {barriers that extend full height over vertical bus.}

{b. Each phase of main horizontal bus} in feeder sections insulated and isolated from each other and device load legs. (Taping is not permitted.) Bus joints shall be insulated with removable caps to allow maintenance without removal of barriers or tape.

{c. Each section greater than 15 inches wide shall be isolated from adjacent} sections by full height and depth reinforced glass polyester and steel barriers.>

C. Bus Bars

1. Bus bars shall be mounted on high-impact non-tracking insulated supports.
2. Vertical bus in each section shall be silver-plated copper.
3. Horizontal bus between vertical sections shall be tin-plated copper. Bus joints shall be bolted with high tensile steel [Grade 5] bolts with split type lock washers. All bus joints shall be accessible from rear of switchboard for maintenance. Welded connections are unacceptable.
4. Bussing shall have sufficient cross-sectional area to meet UL 891 temperature rise requirements. Phase <and neutral >bus(es) shall have an ampacity shown in plans. For 4-wire systems, neutral shall have [{ 50 percent} {100 percent}] ampacity of phase bus bar.
5. Bus bars shall be braced to withstand mechanical forces exerted during short circuit conditions as indicated in drawings.

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6. Ground bus shall be secured to each vertical section structure. Ground bus shall extend full length of switchboard. Ground Bus shall be [{"(1) 0.25 by 3 inch"} {"(2) 0.25 by 3 inch"}] copper bar(s).

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

8. 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.

9. Busway entrances shall be GE Spectra Series™ busways, (or equal).

10. Main horizontal bus bars shall be full-sized as indicated in drawings.

<{D. Furnish a utility metering compartment} to meet requirements of > <utility name.>

<{1. Metering compartment shall have removable links in bus work} for utility supplied current transformers. Comply with all utility company requirements for service entrances and provide mounting in the compartment for utility supplied metering devices as required.>

E. Lugs

1. All lugs shall be tin-plated aluminum and UL listed for use with [{"solid"} {"stranded"}] [{"copper"} {"aluminum"}] cable. Ampacity shall be based on 75 degree C conductor temperature ratings.

2. Provide [{"mechanical"} {"compression"}] type lugs to accommodate conductors.

F. Bussed Pull Sections available in various widths and depths for installing and pulling cables including underground pull sections.

G. Individually Mounted Main, Sub-Main and Tie devices

1. Devices shall be:

a. Molded case circuit breakers GE Type <{SG}{, } {SK}>, (or equal);

b. GE Tri-Break® circuit breakers <{TB4}{, } {TB6}{, } {TB8}>;

c. GE Type THLC <{2}{ and } {4}> Current limiting circuit breakers;

d. GE <{Power Break®}{ and } {Power Break® II}> circuit breakers;

e. GE AKR low voltage power circuit breakers, [{"fused"} {"unfused"}];

f. GE HPC High Pressure Contact switches;

g. Pringle bolted pressure switches.

2. Main device(s) shall be completely isolated from feeder sections of switchboard, in device section of cubicle. Suitable barriers shall be provided to meet the requirements of UL Service Entrance, when specified.

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H. Individually Mounted Feeder devices

1. Feeder devices shall be plug-in type, individually mounted. Feeder devices shall be individually removable from front of switchboard.

2. Devices shall be:

<{a. GE Spectra RMS™ circuit breakers } {SE}{, } {SF}{, } {SG}{, } {SK}{;}>

<{b. Current limiting breakers GE } {SE}{, } {SF}{, } {SG} {fuseless THLC2}{, }
{ fuseless THLC4}{, } {fused Tri-Break® } {TB4}{, } {TB6}{, } {TB8}{.}>

3. Insulated case devices above 1200 amperes are available as sub-mains.

I. Future provisions shall be provided per drawings. Space for future devices shall include all appropriate connectors and mounting hardware. Full provisions for addition of future sections shall be provided. Bussing shall include all necessary hardware to accommodate splicing for future additions.

2.04 AUTOMATIC BUS TRANSFER

A. GE Automatic Transfer Control Equipment.

1. Use with electrically operated circuit breakers:

a. Power Break® <{stationary}{ and } {drawout}>

b. AKR drawout

c. Molded case with stationary motor operator, 2-breaker throwover only.

B. Transfer Controls

<{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

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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.>

2.05 INCOMING LINE SECTION

A. 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.

2.06 METERING

A. 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 and provide the functions listed below.

1. 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.

2. 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.

3. The Meter shall be equipped with a communication port for remote metering to a personal computer via PMCS software. <{The Meter shall have a KYZ pulse initiation } with two pulse outputs programmable for watt-hours, volt-ampere hours, VAR hours, or Q-hours.>

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

2.07 METERING TRANSFORMERS

A. All instrument transformers shall be UL listed.

B. Current Transformers: [5] ampere, single secondary winding, window type; primary / secondary ratio shown on drawings; burden and accuracy shall support connected meters and relays; 60 Hz.

C. Potential transformers: 120 volt single secondary winding; primary / secondary ratio shown on drawings; burden and accuracy shall support connected meters and relays, 60 Hz.

2.08 FINISH

A. All steel surfaces shall be chemically cleaned prior to painting.

B. Exterior paint color shall be Light Gray ANSI 61.

2.09 ACCESSORIES

A. GE Ground Break® solid state ground fault protection (or equal).

B. Outdoor Enclosures

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

2. Walk-in 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.

3. 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 wire mesh over louvers and rodent guards. Provide <{thermostat}{ and }{,}{ humidistat}{.}{, }{and }>{local}{remote}} <control power.>

C. Fuses for protective devices

1 Manufacturer: [Gould-Shawmut].

2. Fuses shall be rated 600 volts, [_] amperes and shall be NEMA Class <{J}{, }{L}>.

3. Interrupting Rating of all fuses shall be [200,000] RMS amperes.

D. Furnish mimic bus for switchboards adhesive plastic strip as indicated in drawings.

E. Furnish nameplates for each device as indicated in drawings. Use [{black letters on white background}]{white letters on black background}].

F. Accessories to support specified metering devices.

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2.10 TESTING

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine installation area to assure there is enough clearance to install switchboard.
- B. Check concrete pads for uniformity and level surface.
- C. Verify that switchboards are ready to install.
- D. Verify field measurements are as [shown on Drawings]{instructed by manufacturer}].
- E. Verify that required utilities are available, in proper location and ready for use.
- F. Beginning of installation means installer accepts conditions.

3.02 LOCATION

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 switchboard(s) for anchoring, alignment, grounding and physical damage.
- B. Megger and record phase to phase and phase to ground insulation resistance of each bus section. Megger for [1] minute for each measurement at minimum voltage of [1000] VDC. Measured Insulation resistance shall be at least [1] megohm(s). Refer to manufacturer's instructions for proper testing procedures.
- C. Check tightness of all accessible mechanical and electrical connections< with calibrated torque wrench>. Minimum acceptable values are specified in manufacturer's instructions.
- D. Test each key interlock system for proper functioning.
- E. Operate test push button to check ground fault system(s).

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.
- C. Return "odd" Kirk keys to Engineer before energizing equipment.

3.06 CLEANING

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- 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