

SECTION 26 13 23 – MEDIUM-VOLTAGE METAL-ENCLOSED SWITCHGEAR

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes metal enclosed interrupter switchgear with the following optional components, features, and accessories:
 - 1. Copper bus bars.
 - 2. Analog instruments.
 - 3. Surge arresters.
 - 4. Provisions for future devices as indicated.
 - 5. Accessories as indicated.
- B. Switchgear must meet PPL requirements.
 - 1. **When submitting gear to PPL for approval, Contractor shall include PPL approval number and the project number on transmittal to ensure prompt review.**
- C. Provide product demonstration as listed in part 3.

1.2 SUBMITTALS

- A. Product Data: For each type of switchgear and related equipment, include the following:
 - 1. Rated capacities, operating characteristics, furnished specialties, and accessories for individual interrupter switches.
 - 2. Time current characteristic curves for overcurrent protective devices, including fusible devices.
- B. Shop Drawings: For each type of switchgear and related equipment, include the following:
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show method of field assembly and location and size of each field connection. Include the following:
 - a. Tabulation of installed devices with features and ratings.
 - b. Outline and general arrangement drawing showing dimensions, shipping sections, and weights of each assembled section.
 - c. Drawing of cable termination compartments showing preferred locations for conduits and indicating space available for cable terminations.
 - d. Floor plan drawing showing locations for anchor bolts and leveling channels.
 - e. Current ratings of buses.
 - f. Short time and short circuit ratings of switchgear assembly.
 - g. Nameplate legends.
 - h. Utility company's metering provisions with indication of approval by utility company.
 - 2. Wiring Diagrams: For each type of switchgear and related equipment, include the following:
 - a. Power, signal and control wiring.

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- b. Three-line diagrams of current and future secondary circuits showing device terminal numbers and integral diagrams.
 - c. Schematic control diagrams.
 - d. Diagrams showing connection of component devices and equipment.
 - e. Schematic diagrams showing connections to remote devices as required.
 - 3. Dimensioned outline drawings of equipment with required working clearances identified.
 - 4. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - 5. Operation and Maintenance Data: For switchgear and switchgear components to include in emergency, operation, and maintenance manuals. Include manufacturer's written instructions for testing, and time current curves, including selectable ranges for each type of overcurrent protective device.
- C. Fuse coordination study documentation, per Division 26 "Short-Circuit, Coordination and Arc-Flash Hazard Studies," indicating proper fuses to be used in gear.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of switchgear and associated components through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of switchgear and are based on the specific system indicated.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C2.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in sections of lengths that can be moved past obstructions in delivery path as indicated.
- B. If gear is designed to be installed outdoors: If stored in areas subjected to weather, cover switchgear to provide protection from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside switchgear; install electric heating to prevent condensation.

1.5 PROJECT CONDITIONS

- A. Interruption of Electrical Service (if required): Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Owner no fewer than ten (10) business days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Owner's written permission.
 - 3. Interruption of electrical service shall be done over weekend, holiday or at night after normal working hours.

1.6 COORDINATION

- A. Provide 6" reinforced concrete slab with 3'-0" frost wall. Coordinate exact size with equipment shop drawings to provide additional 6" around equipment.
- B. Fuse Coordination Study
 - 1. Refer to Division 26, "Short-Circuit, Coordination and Arc-Flash Hazard Studies," for additional information.
 - 2. The Equipment Manufacturer shall perform a fuse coordination study to determine the proper fuse speeds in the medium voltage switchgear. Study shall take into consideration Utility Companies fuses at the service entrance pole, main and distribution fuses in the switchgear, transformer feeding individual buildings, and the main fuse or breakers at the buildings themselves. Provide the proper speed fuses to accomplish coordination. The Contractor shall assist in providing all necessary information to the Equipment Manufacturer to perform this study by coordinating with the utility and manufacturers of the other equipment.
 - 3. Include a copy of this fuse coordination study as a Shop Drawing when submitting the switchgear Shop Drawing submittal. Study shall indicate sizes of all devices and demonstrate full coordination.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Three (3) of each type and rating used.
- B. Maintenance Tools: Furnish tools and miscellaneous items required for interrupter switchgear test, inspection, maintenance, and operation. Include the following:
 - 1. Fuse handling tool.

PART 2 - PRODUCTS

2.1 SWITCHGEAR

- A. Manufacturers:
 - 1. Powercon Corporation
 - 2. Penn Panel
- B. The switchgear line-up shall consist of a fused interrupter main switch, utility metering cubicle, and fused interrupter distribution switches as indicated on drawings. All equipment shall be prior approved in writing with local utility prior to order and install. Approval shall be acquired during the project; prior project approvals shall not be acceptable.
- C. The interrupter switches and utility cubicle shall be outdoor rated, of non-walk-in metal enclosed switchgear.
- D. Units shall have provisions for accepting cables from below.

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2.2 METAL ENCLOSED INTERRUPTER MAIN SWITCH

- A. General: Local utility approved, 12.47kV, 600A, 3 pole, 2 position, service entrance load interrupter switch. Furnish and install three (3) expulsion fuses, three (3) distribution class lightning arresters, and mechanical interlock between switch and fuses.
- B. Interrupter Switch: Stationary, gang operated, and suitable for application at maximum short circuit rating of integrated switchgear assembly.
 - 1. Rating: 600A continuous duty and load break.
 - 2. Duty Cycle, Fault Closing: 40,000 asymmetrical amps.
 - 3. Basic Impulse Level: 95kV.
 - 4. Switch Action: No external arc and no significant quantities of ionized gas released into the enclosure.
 - 5. Switch Construction: Supported entirely by interior framework of structure, with copper switchblades and stored energy operating mechanism.
 - 6. Phase Barriers: Full length of switchblades and fuses for each pole; designed for easy removal; allow visual inspection of switch components if barrier is in place.
 - 7. Protective Shields: Cover live components and terminals.
 - 8. Fuses: De energized if switch is open.
- C. Mechanical Interlock: Prevent opening switch compartment door unless switchblades are open, and prevent closing switch if door is open.
- D. Window: Permit viewing switchblade positions if door is closed.
- E. Power Fuses: Comply with the following and with applicable requirements in NEMA SG 2:
 - 1. Indicator: Integral with each fuse to indicate when it has blown.
 - 2. Mounting: Positively held in position with provision for easy removal and replacement from front without special tools.
 - 3. Expulsion Fuses: Furnished in disconnect type mountings and renewable with replacement fuse units. Gases emitted on interruption are controlled and silenced by chambers designed for that purpose.
 - 4. Fuse type and size as indicated in the coordination study or directed by the utility.

2.3 UTILITY METERING CUBICLE

- A. The utility metering cubicle shall be approved by the local utility, with space and mounting provisions for utility supplied CT's, PT's, and meters. Coordinate installation and meter requirements with utility. Provide size as required by the utility.
- B. Provide separate section with barriers for switches to disconnect strip heaters and convenience receptacles.

2.4 METAL ENCLOSED INTERRUPTER DISTRIBUTION SWITCHES

- A. General – 12.47kV, 600A, 3 pole, 2 position load interrupter switch. Furnish and install three (3) expulsion fuses, three (3) distribution class lightning arresters, and mechanical interlock between switch and fuses.

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- B. Interrupter Switch: Stationary, gang operated, and suitable for application at maximum short circuit rating of integrated switchgear assembly.
 - 1. Rating: 600A continuous duty and load break.
 - 2. Duty Cycle, Fault Closing: 40,000 asymmetrical amps.
 - 3. Basic Impulse Level: 95kV.
 - 4. Switch Action: No external arc and no significant quantities of ionized gas released into the enclosure.
 - 5. Switch Construction: Supported entirely by interior framework of structure, with copper switchblades and stored energy operating mechanism.
 - 6. Phase Barriers: Full length of switchblades and fuses for each pole; designed for easy removal; allow visual inspection of switch components if barrier is in place.
 - 7. Protective Shields: Cover live components and terminals.
 - 8. Fuses: De energized if switch is open.
- C. Mechanical Interlock: Prevent opening switch compartment door unless switchblades are open, and prevent closing switch if door is open.
- D. Window: Permit viewing switchblade positions if door is closed.
- E. Power Fuses: Comply with the following and with applicable requirements in NEMA SG 2:
 - 1. Indicator: Integral with each fuse to indicate when it has blown.
 - 2. Mounting: Positively held in position with provision for easy removal and replacement from front without special tools.
 - 3. Expulsion Fuses: Furnished in disconnect type mountings and renewable with replacement fuse units. Gases emitted on interruption are controlled and silenced by chambers designed for that purpose.
 - 4. Provide S&C SM-4 or SM-5 standard speed power fuses, size as indicated on the coordination study. Verify and coordinate fuse size with transformer manufacturer and local utility.

2.5 FABRICATION

- A. Outdoor Enclosure: Galvanized or Galvannealed steel, weatherproof construction; integral structural steel base frame with factory applied asphaltic undercoating.
 - 1. Each compartment shall have the following features:
 - a. Structural design and anchorage adequate to resist loads imposed by 125mph wind.
 - b. Space heater operating at one half or less of rated voltage, sized to prevent condensation.
 - c. Louvers equipped with insect and rodent screen and filter, and arranged to permit air circulation while excluding rodents and exterior dust.
 - d. Hinged front door with locking provisions.
- B. Finish: Manufacturer's standard finish over rust inhibiting primer on phosphatizing treated metal surfaces.
- C. Bus Transition Unit: Arranged to suit bus and adjacent units.
- D. Incoming Line Unit: Arranged to suit incoming line.
- E. Outgoing Feeder Units: Arranged to suit distribution feeders.
- F. Auxiliary Compartments: Arranged to suit meter and auxiliary equipment; isolated from medium voltage components.

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- G. Provide provisions within utility to allow for future section expansion as indicated.

2.6 COMPONENTS

- A. Main Bus: Copper; full length of switchgear.
- B. Neutral Bus: Copper; 100% rating of main Bus.
- C. Ground Bus: Copper; minimum size 1/4 by 2 inches; full length of switchgear.
- D. Bus Insulation: Covered with flame retardant insulation.
- E. Instrument Transformers: Comply with IEEE C57.13.
 - 1. Potential Transformers: Secondary voltage rating of 120V and NEMA accuracy class of 0.3 with burdens of W, X, and Y. Coordinate with utility company.
 - 2. Current Transformers: Furnished by utility company.
- F. Surge Arresters: Distribution class, metal oxide varistor type. Comply with NEMA LA 1.
 - 1. Install in cable termination compartments in each phase of circuit.
 - 2. Coordinate rating with circuit voltage.
- G. Control power transformer with primary and secondary protection. Locate in switchgear, where acceptable by manufacturer and utility.
- H. Strip heaters and humidistat: 250W per section, 120V from control power transformer.
 - 1. Connect to control power transformer.
- I. Convenience receptacle in each fused switch section.
 - 1. Connect to control power transformer.

2.7 FACTORY FINISHES

- A. Finish: Manufacturer's standard color finish applied to equipment before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive switchgear for compliance with requirements for installation tolerances, required clearances, and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Anchor switchgear assembly to 6-inch-high concrete base, reinforced, with chamfered edges. Extend base no less than 3 inches in all directions beyond the maximum dimensions of switchgear.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchgear units and components.
- C. Provide ground rods, ring and connections to meet local utility and NEC requirements.
- D. Grounding Connections at Interior Locations:
- E. Install bare copper cable not smaller than No. 4/0 AWG for grounding to grounding electrodes.
 - 1. Bond surge arrester and neutrals directly to the switchgear enclosure and then to the grounding electrode system with bare copper conductors.
 - 2. Keep leads as short as practicable with no kinks or sharp bends.
 - 3. Make joints in grounding conductors and loops by exothermic weld or compression connector.
- F. Grounding Connections at Exterior Locations:
 - 1. Install tinned bare copper cable not smaller than No. 4/0 AWG, for counterpoise buried not less than 30 inches below grade interconnecting the grounding electrodes.
 - 2. Bond surge arrester and neutrals directly to the switchgear enclosure and then to the grounding electrode system with bare copper conductors per NEC, no smaller than No. 4/0 AWG.
 - 3. Keep lead lengths as short as practicable with no kinks or sharp bends.
 - 4. Fence and equipment connections must not be smaller than No. 4 AWG.
 - 5. Ground fence at each gate post and corner post and at intervals not exceeding 10 ft. (3 m).
 - 6. Bond each gate section to the fence post using 1/8 by 1 inch (3 by 25 mm) tinned flexible braided copper strap and clamps.
 - 7. Make joints in grounding conductors and loops by exothermic weld or compression connector.
- G. Terminate all grounding and bonding conductors on a common equipment grounding terminal on the switchgear enclosure. Install supplemental terminal bars, lugs, and bonding jumpers as required to accommodate the number of conductors for termination.
- H. Complete switchgear grounding and lightning arrester connections prior to making any other electrical connections.
- I. Provide 6" reinforced concrete slab with 3'-0" frost wall. Coordinate exact size with equipment shop drawings to provide additional 6" around equipment.
- J. Provide documentation to the owner/engineer that the strip heaters are operational in each cubical upon start-up of switchgear.
- K. Verify all openings are sealed around bottom of switchgear and concrete pad to eliminate rodents and insects from entering switchgear.

3.3 IDENTIFICATION

- A. The requirements listed below are in addition to the requirement listed in Division 26 "Electrical Identification."

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- B. Identify field installed conductors, interconnecting wiring, and components; provide warning signs as specified.
- C. Provide laminated tags affixed to each fused switch door, identifying switch use. On the inside of each switch door, provide laminated tag with fuse size and type for that section.
- D. Diagram and Instructions:
 - 1. Frame under clear acrylic plastic on front of switchgear.
 - a. Operating Instructions: Printed basic instructions for switchgear, including emergency procedures.
 - 2. Storage for Maintenance: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

3.4 ADDITIONAL FUSE LABELING

- A. Provide labeling on the exterior of each switch section stating the following:
 - 1. Size, type and quantity of fuses within section.

3.5 WARNING SIGNS

- A. Contractor shall provide warning signs as described in 225.70 of the currently adopted version of NEC. Signs shall include, but not be limited to:
 - 1. "DANGER – HIGH VOLTAGE" signs located at all entrances to electrical equipment vault, room, area or enclosure. Signs shall also be located on all panel doors that provide access to live parts over 600 volts.
 - 2. A permanent, legible, single-line diagram of the switchgear shall be laminated and provided in a readily visible location within sight of the switchgear. Coordinate location with owner.

3.6 CONNECTIONS

- A. Cable terminations at switchgear are specified herein.
- B. Tighten bus joints, electrical connectors, and terminals according to manufacturer's published torque tightening values.
- C. Ground equipment. Provide required ground ring, rods and connections. Provide all excavation and backfill required.

3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of switchgear. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair damaged finishes.

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3.8 PROTECTION

- A. Temporary Heating: Apply temporary heat to switchgear, according to manufacturer's written instructions, throughout periods when switchgear environment is not controlled for temperature and humidity within manufacturer's stipulated service conditions.

3.9 DEMONSTRATION

- A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchgear.

END OF SECTION 26 13 23