SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

1.2 SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. 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.

B. Comply with NEMA PB 2, "Deadfront Distribution Switchboards."

C. Comply with NFPA 70.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MANUFACTURED UNITS

A. Manufacturers:

2. Siemens Energy & Automation, Inc.
3. Square D.

B. Front-Connected, Front-Accessible Switchboard: [Panel-mounted] [Fixed, individually mounted] main device, panel-mounted branches, and sections rear aligned.

C. Nominal System Voltage: [480Y/277 V] [208Y/120 V] <Insert system voltage>.

D. Main-Bus Continuous: [4000] [3000] [2500] [2000] [1600] [1200] <Insert ampere rating> A.

E. Enclosure: Steel, NEMA 250, Type [1] [3R] [3R, with interior-lighted walk-in aisle].

F. Enclosure Finish: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

G. Barriers: Between adjacent switchboard sections.

H. Utility Metering Compartment: Fabricated compartment and section complying with utility company's requirements. If separate vertical section is required for utility metering, match and align with basic switchboard.

I. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

J. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

K. Pull Box on Top of Switchboard:

1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
2. Set back from front to clear circuit-breaker removal mechanism.
3. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

L. Buses and Connections: Three phase, four wire, unless otherwise indicated. Hard-drawn copper of 98 percent conductivity with feeder circuit-breaker line connections.
   1. Ground Bus: 1/4-by-2-inch- minimum-size, hard-drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
   2. Contact Surfaces of Buses: Silver plated.
   3. Main Phase Buses, Neutral Buses, and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
   5. Neutral Buses: 50 percent of the ampacity of phase buses, unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables. Bus extensions for busway feeder neutral bus are braced.

M. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.3 TRANSIENT VOLTAGE SUPPRESSION DEVICES

A. IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules.

B. Minimum single-impulse current rating shall be as follows:
   1. Line to Neutral: [100,000] <Insert value> A.
   2. Line to Ground: [100,000] <Insert value> A.
   3. Neutral to Ground: [50,000] <Insert value> A.

C. Protection modes shall be as follows:
   1. Line to neutral.
   2. Line to ground.
   3. Neutral to ground.

D. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.

E. Maximum Category C combination wave clamping voltage shall not exceed [600 V, line to neutral and line to ground on 120/208 V] [1000 V, line to neutral and line to ground on 277/480 V] systems.
F. Maximum UL 1449 clamping levels shall not exceed [400 V, line to neutral and line to ground on 120/208 V] [800 V, line to neutral and line to ground on 277/480 V] systems.

G. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.

H. Accessories:
   1. Form-C contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts to reverse position on failure of any surge diversion module.
   2. Audible alarm activated on failure of any surge diversion module.
   3. Six-digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125 V.

2.4 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: NEMA AB 3, with interrupting capacity to meet available fault currents.


3. Electronic trip-unit circuit breakers shall have RMS sensing, field-replaceable rating plug, and the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and $I^2t$ response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.


B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: [Mechanical] [Compression] style, suitable for number, size, trip ratings, and conductor material.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.


4. Communication Capability: [Circuit-breaker-mounted] [Universal-mounted] [Integral] [Din-rail-mounted] communication module with functions and features compatible with power monitoring and control system, specified in Division 16 Section "Electrical Power Monitoring and Control."

5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [55] [75] percent of rated voltage.

6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage [without intentional] [with field-adjustable 0.1- to 0.6-second] time delay.

7. Auxiliary Contacts: [One SPDT switch] [Two SPDT switches] with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

8. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.


C. Insulated-Case Circuit Breaker: Fully rated, encased-power circuit breaker with interrupting capacity rating to meet available fault current.

1. [Fixed] [Drawout] circuit-breaker mounting.

2. Two-step, stored-energy closing.

3. Microprocessor-based trip units with interchangeable rating plug, LED trip indicators, and the following field-adjustable settings:

   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments with I^2t response.
   d. Ground-fault pickup level, time delay, and I^2t response.

4. Remote trip indication and control.

5. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Division 16 Section "Electrical Power Monitoring and Control."

6. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

7. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

8. Control Voltage: [40] [125] [250]-V, [dc] [ac].

D. Bolted-Pressure Contact Switch: Operating mechanism uses rotary-mechanical-bolting action to produce and maintain high clamping pressure on the switch blade after it engages the stationary contacts.
1. **Manufacturers:**
   a. Eaton Corporation.
   b. Siemens Energy & Automation, Inc.
   c. Square D.

E. **Fused Switch:** NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

F. **Fuses are specified in Division 16 Section "Fuses."**

2.5 **INSTRUMENTATION**

A. **Instrument Transformers:** NEMA EI 21.1, IEEE C57.13, and the following:

1. Potential Transformers: Secondary voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
2. Current Transformers: Ratios shall be as indicated with accuracy class and burden suitable for connected relays, meters, and instruments.
3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kV.
4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondaries to ground overcurrent relays to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker ground-fault protection.

B. **Multifunction Digital-Metering Monitor:** Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
   a. Phase Currents, Each Phase: Plus or minus 1 percent.
   b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
   c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
   d. Megawatts: Plus or minus 2 percent.
   e. Megavars: Plus or minus 2 percent.
   f. Power Factor: Plus or minus 2 percent.
   g. Frequency: Plus or minus 0.5 percent.
   h. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from 5 to 60 minutes.
   i. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent. Accumulated values unaffected by power outages up to 72 hours.

2. **Mounting:** Display and control unit flush or semiflush mounted in instrument compartment door.
C. Watt-Hour Meters: Flush or semiflush type, rated 5 A, 120 V, 3 phase, 3 wire, with 3 elements, 15-minute-indicating-demand register, and provision for testing and adding pulse initiation.

D. Recording Demand Meter: Usable as totalizing relay or as indicating and recording maximum-demand meter with 15-minute interval. Meter shall count and control a succession of pulses entering two channels. House in drawout, back-connected case arranged for semiflush mounting.

2.6 CONTROL POWER

A. Control Circuits: 120 V, supplied through secondary disconnecting devices from control-power transformer.

B. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.

C. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

D. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.7 ACCESSORY COMPONENTS AND FEATURES

A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Furnish portable test set to test functions of solid-state trip devices without removal from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

C. Furnish one portable, floor-supported, roller-based, elevating carriage arranged for movement of circuit breakers in and out of compartments for present and future circuit breakers.

D. Furnish overhead circuit-breaker lifting device, mounted at top front of switchboard, with hoist and lifting yokes matching each drawout circuit breaker.

E. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.
2.8 IDENTIFICATION

A. Mimic Bus: Continuously integrated mimic bus factory applied to front of switchboard. Arrange in single-line diagram format, using symbols and letter designations consistent with final mimic-bus diagram. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.

B. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1 and NECA 40.

B. Install and anchor switchboards level on concrete bases, 4-inch nominal thickness. Concrete base is specified in Division 16 Section "Basic Electrical Materials and Methods Electrical Supports and Seismic Restraints," and concrete materials and installation requirements are specified in Division 3.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

E. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

   1. Set field-adjustable switches and circuit-breaker trip ranges.

F. Install spare-fuse cabinet.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 260553- Identification for Electrical Systems.

B. Switchboard Nameplates: Label each switchboard compartment with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.
3.3 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Sections 7.1, 7.5, 7.6, 7.9, 7.10, 7.11, and 7.14 as appropriate. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION