SECTION 26 24 13 – SWITCHBOARDS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution switchboards rated 600V and less.
2. Surge protection devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Accessory components and features.
6. Identification.

B. Related Requirements: Section 260573.19 "Arc-Flash Hazard Analysis" for arc-flash analysis and arc-flash label requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.

1. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

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

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Include evidence of NRTL listing for series rating of installed devices.

8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
10. Include diagram and details of proposed mimic bus.
11. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Samples: Representative portion of mimic bus with specified material and finish, for color selection.

D. Delegated Design Submittal:

1. For arc-flash hazard analysis.
2. For arc-flash labels.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include following:
    a. Routine maintenance requirements for switchboards and installed components.
    b. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
    c. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type but no fewer than 2 of each size and type.

2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than 2 of each size and type.

3. Indicating Lights: Equal to 10 percent of quantity installed for each size and type but no less than one of each size and type.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

1. Testing Agency Qualifications: Accredited by NETA.

2. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards.

C. Handle and prepare switchboards for installation per NECA 400.

1.9 FIELD CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

C. Rate equipment for continuous operation under following conditions unless otherwise indicated:

1. Ambient Temperature: Not exceeding 104 degrees F.

1.10 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, bus work, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

B. Manufacturer's Warranty: Manufacturer's agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SWITCHBOARDS

A. Switchboards shall be manufactured by ABB, Eaton, Schneider Electric, or Siemens.

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 2.

E. Comply with NFPA 70.

F. Comply with UL 891.

G. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Panel mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

H. Nominal System Voltage: 480Y/277V.

I. Main-Bus Continuous: As indicated.

J. Indoor Enclosures: Steel, NEMA 250, Type 1.

K. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over rust-inhibiting primer on treated metal surface.

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

M. Buses and Connections: Three phase, 4 wire unless otherwise indicated.

1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from front of switchboard.
2. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity.
3. Copper feeder circuit-breaker line connections.
4. Tin-plated aluminum feeder circuit-breaker line connections.
5. Ground Bus: 1/4-by-2-inch-hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors.
6. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections.
7. Neutral Buses: 100 percent of ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.

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

2.2 SURGE PROTECTION DEVICES

A. SPDs: Comply with UL 1449, Type 2**.**

B. SPDs: Listed and labeled by NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 2.

C. Features and Accessories:

1. Internal thermal protection that disconnects SPD before damaging internal suppressor components.
2. Indicator light display for protection status.
3. Form-C contacts rated at 5A and 250V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of surge diversion module or on opening of current-limiting device. Coordinate with building power monitoring and control system.
4. Surge counter.

D. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase shall not be less than 300 kA. Peak surge current rating shall be arithmetic sum of ratings of individual MOVs in given mode.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277V, 3-phase, 4-wire circuits shall not exceed following:

1. Line to Neutral: 1200V for 480Y/277V.
2. Line to Ground: 1200V for 480Y/277V.
3. Line to Line: 2000V for 480Y/277V.

F. SCCR: Equal or exceed 100 kA.

G. Nominal Rating: 20 kA.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and following field-adjustable settings:
    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long and short time adjustments.
4. MCCB Features and Accessories:
    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
    c. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

2.4 INSTRUMENTATION

A. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for 3- or 4-wire systems and with following features:

1. Switch-selectable digital display of following values with maximum accuracy tolerances as indicated:
    a. Phase Currents, Each Phase: Plus or minus 0.5 percent.
    b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
    c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
    d. Megawatts: Plus or minus one percent.
    e. Megavars: Plus or minus one percent.
    f. Power Factor: Plus or minus one percent.
    g. Frequency: Plus or minus 0.1 percent.
    h. Accumulated Energy, Megawatt Hours: Plus or minus one percent; accumulated values unaffected by power outages up to 72 hours.
    i. Megawatt Demand: Plus or minus one percent; demand interval programmable from 5 to 60 minutes.
    j. Contact devices to operate remote impulse-totalizing demand meter.

2. Mounting: Display and control unit flush or semi-flush mounted in instrument compartment door.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards per NECA 400.

1. Lift or move switchboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's instructions.
2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.
3. Protect from moisture, dust, dirt, and debris during storage and installation.
4. Install temporary heating during storage per manufacturer's instructions.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of Work or that affect performance of equipment.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories per NECA 400.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Install conduits entering underneath switchboard, entering under vertical section where conductors will terminate. Install with couplings flush with concrete base. Extend 2 inches above concrete base after switchboard is anchored in place.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to switchboards.
6. Anchor switchboard to building structure at top of switchboard if required or recommended by manufacturer.

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

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

E. Install filler plates in unused spaces of panel-mounted sections.

F. Install overcurrent protective devices, surge protection devices, and instrumentation.
1. Set field-adjustable switches and circuit-breaker trip ranges.

G. Comply with NECA 1.

3.3 CONNECTIONS

A. Bond conduits entering underneath switchboard to equipment ground bus with bonding conductor sized per NFPA 70.

B. Support and secure conductors within switchboard per NFPA 70.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification."

B. Switchboard Nameplates: Label each switchboard compartment with nameplate complying with requirements for identification specified in Section 260553 "Identification."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with nameplate complying with requirements for identification specified in Section 260553 "Identification."

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:
1. Acceptance Testing:
a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within

switchboard, and remove neutral connection to surge protection and other electronic devices before insulation test. Reconnect after test.

b. Test continuity of each circuit.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

4. Perform following infrared scan tests and inspections, and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.

b. Follow-up Infrared Scanning: Perform additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.

c. Instruments and Equipment: Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Switchboard will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports, including certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573.16 "Coordination Studies."

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature per manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.8 DEMONSTRATION

A. Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION