CITY OF FORT WAYNE MASTER UPDATED: 11/16/18

SECTION 26 24 13

SWITCHBOARDS

1. GENERAL
	1. DESCRIPTION
		1. Scope:
			1. Contractor shall provide all labor, materials, equipment, services, and incidentals as shown, specified, and required to furnish and install switchboards.
		2. Related Sections:

NTS: List below only sections covering products, construction, and equipment specifically identified in this section and specified in another section and directly referenced in this specification. Do not list administrative and procedural division 01 sections.

* + - 1. Section 03 30 00, Cast-in-place Concrete.
			2. Section 26 05 05, General Provisions for Electrical Systems
			3. Section 26 05 53, Identification for Electrical Systems.
			4. Section 26 05 73, Electrical Power Distribution System Studies.
			5. Section 26 09 13, Electrical Power Monitoring
			6. Section 26 43 00, Surge Protective Devices.
	1. REFERENCES

NTS: Retain applicable standards and add others as required.

* + 1. Standards referenced in this Section are:
			1. NEC Article 408, Switchboards and Panelboards.
			2. NEMA PB2, Dead-Front Distribution Switchboards.
			3. NFPA 70E, Electrical Safety in the Workplace
			4. UL 891, Dead-Front Switchboards.

NTS: Edit article “1.3” below to suit the Project. DO NOT DELETE (NOT USED) ITEMS.

* 1. SUBMITTALS
		1. Action Submittals: Submit the following:
			1. Product Data
				1. Manufacturer’s technical information, including catalog information.
				2. Manufacturer's technical specifications with assembly and component ratings.
				3. Time current curves for protective devices.
			2. Shop Drawings
				1. Manufacturer’s technical information, including catalog information.
				2. Manufacturer's technical specifications with assembly and component ratings.
				3. Time current curves for protective devices.
			3. Samples (NOT USED)
		2. Informational Submittals: Submit the following:
			1. Certificates
				1. Certifications required in this Section, including seismic requirements.
			2. Delegated Design Submittal (NOT USED)
			3. Test and Evaluation Reports (NOT USED)
			4. Manufacturers’ Instructions (NOT USED)
			5. Source Quality Control Submittals
				1. Report of results of testing and inspections performed at manufacturer’s shop.
			6. Field Quality Control Submittals
				1. Report of results of field testing.
			7. Manufacturer Reports
				1. Submit written report of results of each visit to Site by Supplier’s service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.
			8. Sustainable Design Submittals (NOT USED)
			9. Special Procedure Submittals (NOT USED)
			10. Qualifications Statements
				1. Manufacturer, when requested by Engineer.
		3. Closeout Submittals. (NOT USED)
			1. Maintenance Contracts (NOT USED)
			2. Operation and Maintenance Data
				1. Submit in accordance with Section 01 78 23, Operations and Maintenance Data.
				2. Include acceptable test reports, maintenance data and schedules, description of operation, wiring diagrams, and list of spare parts recommended for one year of operation with current price list.
				3. Include record drawings of control schematics, with point-to-point wiring diagrams.
			3. Bonds (NOT USED)
			4. Warranty Documentation (NOT USED)
			5. Record Documentation (NOT USED)
			6. Sustainable Design Closeout (NOT USED)
			7. Software (NOT USED)
		4. Maintenance Material Submittals. (NOT USED)
			1. Spare Parts (NOT USED)
			2. Extra Stock Materials (NOT USED)
			3. Tools (NOT USED)
	2. QUALITY ASSURANCE

NTS: Edit or delete paragraph “a”, below, when Project requirements prohibit an experience clause.

* + 1. Qualifications:
			1. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.
		2. Component Supply and Compatibility:
			1. Obtain all materials and equipment included in this Section regardless of component manufacturer from a single switchboard manufacturer.
			2. Switchboard manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all components furnished under this Section.
			3. Components shall be suitable for the specified service conditions and shall be integrated into overall assembly by switchboard manufacturer.
		3. Regulatory Requirements: Comply with the following:

NTS: Retain applicable regulations and add others as required.

* + - 1. NEC Article 408, Switchboards and Panelboards.
			2. Comply with NEMA PB 2.
			3. Comply with NFPA 70.
			4. Comply with UL 891.

NTS: Retain paragraph “D”, below when seismic requirements apply; otherwise delete. Coordinate with the project structural Engineer to determine project seismic requirements.

* + 1. Seismic Requirements: The Work shall comply with seismic Zone 1Requirements and Site Class as determined by geotechnical evaluation.
	1. DELIVERY, STORAGE, AND HANDLING
		1. Delivery:
			1. Upon delivery, check for evidence of water that may have entered equipment during transit.
		2. Handle equipment in accordance with manufacturer’s instructions. One copy of these instructions shall be furnished with equipment at time of delivery.
		3. Storage:
			1. Store switchboards equipment in a clean, dry location with controls for uniform temperature and humidity. Protect equipment with coverings and maintain environmental controls.
	2. FIELD CONDITIONS
		1. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
		2. 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 temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
			2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
				1. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
		3. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
			1. Notify Engineer no fewer than 14 days in advance of proposed interruption of electric service.
			2. Indicate method of providing temporary electric service.
			3. Do not proceed with interruption of electric service without Engineer's written permission.
			4. Comply with NFPA 70E.
	3. COORDINATION
		1. 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.
		2. Equipment deviating from basis of design shall fit within design footprint.
		3. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
	4. WARRANTY
		1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
			1. Warranty Period: One year from date of Substantial Completion.
	5. EXTRA MATERIALS
		1. 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 three 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 three of each size and type.
			3. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
			4. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
			5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
			6. Indicating Lights: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
1. PRODUCTS
	1. MANUFACTURERS

NTS: Coordinate paragraph A. 3 below with bidding documents.

* + 1. Manufacturers: Provide equipment of one of the following:
			1. Eaton/Cutler-Hammer.
			2. Schneider Electric/Square D Company.
			3. Siemens
			4. All others shall be approved by Designer prior to bidding. Submit to Designer 10 days prior to the bid date.

NTS: Edit article “2.2”, below, to suit the Project.

* 1. SWITCHBOARD EQUIPMENT
		1. Ratings:
			1. Switchboard shall be 600-volt class, suitable for operation on three-phase, 60-Hertz system.
			2. System operating voltage, number of wires, bus ampacity, and short circuit withstand capability and interrupting rating shall be as shown on the Drawings, or as otherwise indicated in the Contract Documents.
		2. General:
			1. Switchboards shall be dead-front type with individual and group-mounted devices, front-accessible.
			2. Arrange switchboards with number of sections and compartments required for distribution arrangement shown.
			3. Provide switchboard in accordance with the arrangement shown on the Drawings. Switchboard shall consist of bus system, structure, circuit breakers, metering, surge protective device (SPD), and enclosure.
			4. Switchboards shall be in accordance with NEMA PB2, UL 891, and NEC Article 408.

NTS: Retain paragraph “5”, below when service entrance switchboards are required.

* + - 1. Switchboard shall be service entrance type and UL-labeled as such. Equip service entrance switchboards with bonding jumper to bond enclosure and ground bus to the neutral bus, and a barrier to isolate service bus bars and terminals.

NTS: Verify all vertical bus requirements.

* + 1. Bus Bars:
			1. Switchboard bus bars shall be tin-plated copper, supported with high-impact, non-tracking insulating material and rated no less than 600 A. Secure bus joints with Belleville type washers, and braced bus joints for mechanical forces exerted during short circuit conditions. Mount main horizontal bus bars with all three phases arranged in the same vertical plane.
			2. Bus bar sizes shall be based upon a maximum temperature rise of 65 degrees C over a 40-degree C ambient in accordance with NEMA PB2 and UL 891.
			3. Provide copper ground bus, minimum size of 1/4-inch by two inches, secured to each vertical section and extending entire length of equipment. Ground bus current capacity shall equal one-half the capacity of main power bus.
			4. Conductor hardware shall be high-tensile strength and zinc-plated. Provide bus joints with conical spring-type washers.
		2. Structure:
			1. Equipment structure shall be completely self-supporting and shall include required number of vertical sections bolted together to form a single metal-enclosed enclosure.

NTS: Retain one version of paragraph “2”, below relative to enclosure NEMA rating, and delete the other. Edit to suit the Project.

* + - 1. Enclosure shall be rated NEMA 3R, non-walk-in with sloped roof.
			2. Enclosure shall be rated NEMA 1.
			3. Enclosure structure frame shall be die-formed, 12-gauge steel bolted together and reinforced.
			4. Equipment shall have identifying nameplates in accordance with Section 26 05 53, Identification for Electrical Systems. Provide nameplates for each breaker circuit and provide typewritten directory of circuits.
			5. Cover sides and rear of enclosure with removable, bolt-on covers. Edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within enclosure.
			6. Sections of switchboard shall be front- and rear-aligned with depth as shown on the Drawings. Devices shall be front-removable and load connections shall be front-accessible.
			7. Provide assembly with adequate lifting means so that assembly is capable of being moved to its installation position.
			8. Conduit entry and exit shall be top and bottom entry and coordinated by Contractor.
			9. Quantity of conduits and cables associated with each feeder shall be as shown or indicated on the Drawings.
		1. Circuit Breakers:
			1. Circuit breakers shall be molded case type with quantity of poles, voltage, and current ratings shown.
			2. Breakers shall be manually-operated thermal magnetic type, including inverse-time overload and instantaneous short-circuit protection. Contacts shall be non-welding silver alloy and arc extinction shall be accomplished by arc chutes.
			3. Breakers shall be operated by a toggle-type handle and shall have quick-make/quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of breakers shall be clearly indicated by handle position.
			4. Where shown or required due to capacity, breakers shall be insulated case type. Insulated case breakers shall be manually-operated with stored energy mechanisms. Breakers shall include open-close pushbuttons, five-cycle close time, and rotary operated stored energy handle mechanism providing quick make/quick-break protection.
			5. Breakers shall have 100-amp frames, minimum. Provide overload protection on all poles, with trip settings as shown. Breakers with frame sizes 250 amps and below shall have thermal-magnetic trip units and inverse time-current characteristics, or equal.
			6. Provide breakers 400-amp frame and larger with an electronic solid state programmable trip unit. For four-wire power systems and circuits, provide a neutral current transformer, and trip unit shall be suitable to accept neutral input. Provide push-to-trip button on front of circuit breaker to provide local manual means of exercising trip mechanism. Electronic trip system shall include:
				1. Plug-in protection programmer, flux shift trip device, and current sensor package. Construct programmer, sensor, and flux-shifting trip device as integral elements of breaker, requiring no externally mounted assemblies for proper operation.
				2. Solid state, microprocessor-based, nine-function programmer shall provide true RMS current sensing and include adjustable continuous and instantaneous current elements with adjustable long time, short time, zero sequence ground fault pickup and delay and zone selective interlocking. Main, tie and feeder circuit breakers shall be connected for zone selective interlocking to allow instantaneous bus protection.
			7. Where shown, provide breakers with shunt trips, bell alarms, and auxiliary devices.

NTS: Coordinate communication requirements with Owner and the project instrumentation and controls Engineer, and edit paragraph “F”, below, to suit the Project.

* + 1. Energy Monitoring
			1. Provide an energy monitor in accordance with 26 09 13 Electrical Power Monitoring or as shown on the Drawings. Each electrical power monitor shall be included and factory-mounted within switchboard-by-switchboard manufacturer.
			2. Provide Ethernet connection using EtherNet/IP communication protocol.
		2. Wiring/Terminations:
			1. Provide small wiring, necessary fuse blocks, and terminal blocks in switchboard as required. Control components mounted in assembly, such as fuse blocks, relays, pushbuttons, switches, and other components, shall be suitably marked for identification corresponding to appropriate designations on manufacturer’s wiring diagrams.
			2. Provide mechanical-type terminals for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of size indicated on the Drawings.
			3. Provide lugs in incoming line section for connection of main grounding conductor. Provide additional lugs for connection of other grounding conductors as indicated on Drawings.
			4. Control wire shall be Type SIS, bundled and secured with nylon ties. Provide insulated locking spade terminals for all control connections, except where saddle type terminals are provided integral to a device. Current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to another device. Provide groups of control wires leaving switchboard with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

NTS: Coordinate accessories required and edit paragraph “H”, below, to suit the Project.

* + 1. Accessories:
			1. Provide a surge protective device in accordance with Section 26 43 13, Surge Protective Devices, for each switchboard bus shown or indicated on the Drawings. Each surge protective device shall be included and factory-mounted within switchboard-by-switchboard manufacturer. Surge protective device monitoring and display shall be visible from switchboard front.
			2. Provide thermostatically-controlled space heater to prevent moisture condensation for outdoor applications.
			3. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
			4. Removable, Hinged Rear Doors and Compartment Covers: Secured by standard bolts, for access to rear interior of switchboard.
			5. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

NTS: Coordinate miscellaneous devices required and edit paragraph “I”, below, to suit the Project.

* + 1. Miscellaneous Devices:
			1. Provide control power transformers with primary and secondary protection, as indicated on the Drawings or as required for proper operation of equipment.
			2. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:
				1. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, double secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
				2. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary bar or window type; double secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
				3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
				4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.
			3. Control Power
				1. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.
				2. 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.
				3. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.
				4. 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. Finishing:
			1. Exterior and interior steel surfaces of switchboard shall be properly cleaned and provided with rust-inhibiting phosphatized coating by switchboard manufacturer. Color and finish of switchboard shall be light gray.
	1. SOURCE QUALITY CONTROL
		1. Tests:
			1. Factory-test switchboards in accordance with NEMA PB2 and UL 891
			2. Perform factory tests on equipment prior to shipment. Tests shall consist of the manufacturer’s standard tests, and shall include:
				1. Physical inspection and checking of all components.
				2. Operation and device function tests under simulated service conditions to verify accuracy of wiring and functioning of all equipment.
				3. Primary, control, and secondary wiring hi-pot tests.
1. EXECUTION
	1. INSPECTION
		1. Examine conditions under which materials and equipment will be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.
	2. INSTALLATION
		1. Install switchboards and accessories according to NECA 400 or NEMA PB 2.1.
		2. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."
			1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
			2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
			3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
			4. Install anchor bolts to elevations required for proper attachment to switchboards.
		3. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
		4. 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.
		5. Install filler plates in unused spaces of panel-mounted sections.
		6. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.
			1. Set field-adjustable switches and circuit-breaker trip ranges.
		7. Comply with NECA 1.
	3. IDENTIFICATION
		1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
		2. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
		3. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
	4. FIELD QUALITY CONTROL
		1. Site Tests:
			1. After installation, inspect and perform field testing of each switchboard. Testing and inspections shall by Supplier's factory-trained representative, in accordance with manufacturer’s recommendations. Inform Owner and Engineer when Supplier's representative indicates that equipment is correctly installed.
			2. Perform the following tests and checks before energizing equipment:
				1. Verify proper installation.
				2. Inspect all mechanical and electrical devices for proper operation.
				3. Check tightness of bolted connections. Mark connections with paint stick marker when properly torqued.
				4. Measure insulation resistance of each bus section, phase-to-phase and phase-to-ground.
				5. Measure insulation resistance of each circuit breaker, pole-to-pole and from pole-to-ground.
				6. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
				7. Check for proper anchorage, required area clearances, physical damage, and proper alignment.
				8. Clean and lubricate as required.
				9. Perform other tests and adjustments recommended by equipment manufacturer.
		2. Manufacturer’s Services: Provide services of qualified, factory-trained serviceman to perform the following:
			1. Instruct Contractor in installing equipment.
			2. Inspect and adjust equipment after installation and ensure proper operation.
			3. Instruct operations and maintenance personnel in operation and maintenance of the equipment.

NTS: Edit visit descriptions as required. Insert at No. 1 and No. 2 the minimum number of on-site hours per visit.

* + - 1. Manufacturer’s technician shall make visits to the Site as follows:
				1. First visit shall be for instructing Contractor in proper equipment installation, and assisting in installing equipment. Minimum number of hours on-Site: (--1--) hours.
				2. Second visit shall be for checking completed installation, start-up of system; and performing field quality control testing. Minimum number of hours on-Site: (--2--) hours.

NTS: Coordinate with section 01 79 23, Instruction of Operations and Maintenance Personnel, to specify the duration of training required, number of sessions, and operating shift for each.

* + - * 1. Third visit shall be to instruct operations and maintenance personnel.

Furnish services of manufacturer’s qualified, factory-trained specialists to instruct Owner’s operations and maintenance personnel in recommended operation and maintenance of equipment.

Training requirements, duration of instruction and qualifications shall be in accordance with Section 01 79 23, Instruction of Operations and Maintenance Personnel.

Number of hours on-Site shall be in accordance with Section 01 79 23, Instruction of Operations and Maintenance Personnel.

* + - * 1. Technician shall revisit the Site as often as necessary until installation is acceptable.
			1. All costs, including expenses for travel, lodging, meals and incidentals, and cost of travel time, for visits to the Site shall be included in the Contract Price.
	1. ADJUSTING
		1. Calibrate, set and program protective devices. Coordinate the protective devices furnished under this Section and provide proper settings of devices per the results of the study specified in Section 26 05 73, Electrical Power Distribution System Studies.

+ + END OF SECTION + +