SECTION 26 3600

TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Automatic transfer switches rated 600 volts and less.

1.2 RELATED SECTIONS

A. Identification of electrical systems: Section 26 0553.

B. Overcurrent protective device coordination study: Section 26 0573.

C. Generator: Section 26 3213.

1.3 REFERENCES

A. NFPA 110: Emergency and Standby Power Systems.

B. UL 1008: Transfer Switch Equipment.

1.4 SUBMITTALS

A. Product data: Include assembly ratings and dimensioned plans, sections, and elevations showing minimum clearances, cable termination sizes, conductor entry, gutter space, installed features and devices, and material lists for each switch.

B. Bill of materials: Provide detailed list of components.

C. Shop drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each transfer switch specified. Wiring diagrams showing detail wiring for transfer switch, differentiating between manufacturer-installed and field-installed wiring, and including power and control wiring.

1. Single-line diagram: Show connections between transfer switch, power sources, and load.

D. Source quality-control test reports.

E. Field quality-control test reports.

F. Certifications:

1. Product certificate signed by manufacturer certifying that products furnished comply with requirements and that switches have been tested for applicable load ratings and short-circuit closing and withstand ratings.
2. Manufacturer's test reports showing that controllers meet the specified requirements.
3. Evidence that manufacturer, installer, and equipment meet the requirements specified in "Quality Assurance" below.

G. Operation and maintenance data: For transfer switches and associated components, provide product data, shop drawings, and test reports in operation and maintenance manual. In addition to items specified in Division 01 Section “Operation and Maintenance Data,“ include the following:

1. Features and operating sequences, both automatic and manual

1.5 QUALITY ASSURANCE

A. Transfer switches shall comply with UL 1008. Where specified requirements exceed requirements of UL 1008, switch shall meet the stricter requirements.

B. automatic transfer switch shall be manufactured by the same manufacturer. Design shall have been in production for not less than 10 years, with at least 100 installations operating successfully.

1. Manufacturer shall maintain records of each switch, by serial number, for no less than 20 years.

C. Qualifications of manufacturer: Maintain a factory-authorized service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

D. Qualifications of supplier/installer:

1. Staff factory-trained and -authorized in the installation, testing, and operation of the specified equipment.
2. Provides emergency service on call 24 hours a day, seven days a week.
3. Maintains an adequate stock of manufacturer's genuine or approved parts to service this equipment.
4. Has service contracts available which can meet requirements specified for the equipment of this project.

1.6 COORDINATION

A. Coordinate layout and installation of switches and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store switches indoors in clean dry space with uniform temperature to prevent condensation. Protect switches from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.8 PROJECT CONDITIONS

A. Product selection for restricted space:

1. Drawings indicate maximum dimensions for switches, including clearances between switches, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
2. Contractor shall make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum clearances specified in NFPA 70.

B. Interruption of existing electrical service: 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 seven days in advance of proposed interruption of electrical service. Provide applicable details of proposed outage including sequence of work and methods of providing temporary electrical service.
2. Do not proceed with interruption of electrical service without written permission.

1.9 WARRANTY

A. Special warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of transfer switch and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty period: Two years from date of substantial completion.
2. Warranty shall include all parts and labor.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide products manufactured by Kohler Co.; Power Systems, or comparable product by one of the following:

1. ASCO Power Technologies / Schneider Electric
2. Caterpillar; Power Generation
3. Cummins Inc.; Power Systems
4. Eaton
5. Generac Power Systems, Inc.
6. Kohler Co.; Power Systems
7. MTU Onsite Energy; Rolls-Royce Power Systems AG
8. Russelectric, Inc. / Siemens
9. Zenith / ABB

2.2 GENERAL TRANSFER SWITCH REQUIREMENTS

A. Equipment shall be based on the following: 480/277 volts, 3-phase, 4-pole; Level 1 equipment according to NFPA 110; rated in accordance with UL 1008 for continuous loading and total system transfer; suitable for motor, resistance heating, electric-discharge lighting, and tungsten filament lamp loads.

B. Tested fault-current closing and withstand ratings (3 cycles): Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Provide transfer switches with ratings based on available fault current determined by Short-Circuit Analysis performed under Section 26 0573 or as indicated on one-line diagram, whichever is larger.

C. Neutral switching. Provide neutral pole switched simultaneously with phase poles on four-pole transfer switches.

D. Enclosure: NEMA 250, Type 1; NEMA ICS 6; and UL 508.

E. Terminal block: Termination of all auxiliary contacts, switches, pilot lights, and appurtenances mounted in transfer switch enclosure.

F. Clearly label and identify each indicating light and switch as to its purpose or function.

2.3 AUTOMATIC TRANSFER SWITCH

A. Ratings: Unit ratings involving ampacity, number of poles, and withstand close rating are indicated on drawings.

B. Switching arrangement:

1. Delayed, Open Transition Transfer Operation: Double-throw design, with break-before-make capability. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in both the normal and emergency positions without the use of hooks, latches, magnets, or springs.

    a. ATS-1: Emergency / life-safety.
    b. ATS-2: Standby equipment.

2. Switch characteristics:

    a. Designed for continuous-duty, repetitive transfer of full-rated current between active power sources.
    b. The contact driving system shall be mechanically held and electrically operated by a single motor operator.
    c. Contacts: Silver alloy, capable of making or breaking any load within the rating of the switch.

        (1) Contacts that close to start the engine generator: Include a time delay of transfer switch and engine starting signals, factory set at 5.0 seconds (adjustable from 0-5 minutes).

    d. Interlocked, molded case circuit breakers or contactors are not acceptable.

C. Controls: Microprocessor-based controller integrally mounted in the transfer switch with all components and wiring accessible from the front.

1. Tested and rated as follows:

    a. For storage at temperatures from minus 25 to plus 85 degrees C.
    b. For operation:

        (1) At minus 20 to plus 70 degrees C.
        (2) At 0 to 99 percent humidity, non-condensing.
        (3) Withstands infinite power interruptions.
        (4) Withstands surges when tested in accordance with ANSI/IEEE C37.90.1.

2. Include a real-time clock with nickel-cadmium battery backup.
3. Monitoring: On both normal and emergency sources, include three-phase over or under voltage, over or under frequency, and phase sequence detection, and phase differential monitoring.
4. Communications: Industry standard open-architecture communication protocol for high-speed serial communications via multidrop connection to other controllers and to a master terminal with up to 4000 feet of cable, or farther with the addition of a communication repeater.

    a. Serial communication port: RS422/485 compatible

5. Self-diagnostics: Shall perform periodic checks of the memory I/O and communications circuits, with a power failure circuit.
6. Password protection shall limit access to designated personnel.
7. Operation: Keypad with multi-character liquid crystal display.
8. Memory / flash-backup: Accessible both locally and from remote controller, including:

    a. Number of hours transfer switch has been in the emergency position (total since reset).
    b. Number of transfers in either direction (total since reset).
    c. Date, time, and description of the last 4 source failures.
    d. Date of the last exercise period.
    e. Date the record was reset.

D. Provide close differential voltage sensing of all phases of both the normal and alternate sources of power. Factory settings preset for:

    1. Dropout at 87 percent of nominal voltage (adjustable 75-98 percent)
    2. Pickup at 95 percent of nominal voltage (adjustable 85-100 percent).

E. The transfer of the load shall occur only if the alternate source has attained factory setting of 95 percent of nominal voltage (adjustable 85-100 percent) and 95 percent of nominal frequency (adjustable 90-100 percent) and the transfer to alternate time delay has expired. The time delay shall be factory set for 5 seconds and adjusted in the field to comply with system priority requirements outlined in Part 2 below. (Field adjustable range of 0 to 2 minutes.)

    1. Upon return of the normal source to within the limits of the voltage sensor, the switch shall retransfer to the normal source after a retransfer to normal time delay. The time delay shall be factory preset for 15 minutes. (Field-adjustable range of 0.5 to 30 minutes.) A synch-check function shall confirm synchronization prior to retransfer.

F. Time delay for engine generator cooldown: Unloaded, running, factory-set at 5 minutes (adjustable 0-5 minutes).

G. Indicating lights: LED type. Green, indicating that the normal source is connected to the load, and red, indicating that the alternate source is connected to the load.

H. Test switch: Simulates a normal source outage.

I. Reset switch: To manually retransfer the automatic transfer switch to the normal source, except that retransfer shall occur automatically if alternate source fails.

J. In-phase monitor control for transfer and retransfer of motor loads.

K. Automatic exerciser with load for 0.5 hour weekly. The automatic exerciser function shall be enabled in one transfer switch selected by the Owner.

L. Relay protection:

    1. Full-phase voltage on normal side.
    2. Three-phase voltage frequency on generator side.

M. Auxiliary contacts: Provide number of sets of auxiliary contacts necessary to initiate generator starting through paralleling switchgear and interface with Owner monitoring system.

N. The transfer switch shall have the following programming functions available:

1. Block transfer to emergency source.
2. Load shedding.
3. Peak-shaving.

O. The transfer switch shall control the load functions.

2.4 MONITORING SYSTEM

A. Provide contacts from each automatic transfer switch for monitoring by the power monitoring system for each of the following functions.

1. Switch in normal position.
2. Switch in emergency position.
3. Switch in maintenance bypass position.
4. Normal power available.
5. Emergency power available.

2.5 TRANSFER SWITCH OPERATION AND EMERGENCY SYSTEM PRIORITY

A. Priority status: Transfer switch priority shall apply as follows:

1. ATS-1
2. ATS-2

B. Transfer to generator source: Switches shall transfer to emergency power source in order of priority status listed above. In the event that the emergency source cannot generate enough capacity to carry the total emergency system load, switches shall transfer in decreasing order of priority until system capacity is reached. Switches can later be transferred to the emergency source if additional capacity is available. Field adjust the time delay settings to achieve system transfer of loads as follows:

1. ATS-1: Use factory setting or 5 seconds, whichever is less. Total system transfer time shall not exceed 10 seconds per NFPA 110.
2. ATS-2: Time delay: 30 seconds.

C. Generator failure: In the event generator system power is not sufficient to carry the loads of each emergency branch, transfer switches shall open and shed load in reverse priority order.

D. Transfer back to normal source: Switches shall transfer back to normal source in reverse priority order as follows:

1. Delayed, open transition operation: When the normal source has been restored and is within the pre-selected ranges for voltage and frequency, and after an adjustable time delay to ensure the integrity of the normal power source, the load shall be transferred back to normal source in a break-before-make transfer scheme. The generator set will continue to run for a user adjustable time to allow the generator set to run unloaded for cool down, after which the engine will be shut down. Upon completion, the system will then be ready for automatic operation.

2.6 REMOTE ANNUNCIATOR SYSTEM

A. Remote annunciator panel:

1. Functional Description: Annunciate conditions at each transfer switch including the following indications:

    a. Source availability, both Normal and Emergency sources, as defined by actual pickup and dropout settings of transfer-switch controls.
    b. Switch position.
    c. Switch in test mode.
    d. Failure of communication link.

2. Features: LED-lamp indicators with audible signal and silencing switch.

    a. Indicating Lights: Grouped for each transfer switch monitored.
    b. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
    c. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
    d. Lamp Test: Push-to-test or lamp-test switch on front panel.

2.7 SOURCE QUALITY CONTROL

A. Factory-test components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test in accordance with NEMA ICS 1.

B. As a condition of approval, the manufacturer of the automatic transfer switches shall verify that their switches are listed by Underwriters Laboratories, Inc., Standard UL-1008 with 3-cycle short circuit closing and withstand of 65,000 RMS symmetrical amperes at nominal voltage of building electrical service, utilizing a 200,000-ampere current limiting fuse on the normal load side of the automatic transfer switches.

C. During the 3-cycle closing and withstand tests, there shall be no contact welding or damage. The 3-cycle tests shall be performed without the use of current limiting fuses. The test shall verify that contacts separation has not occurred, and there is contact continuity across all phases. Test procedures shall be in accordance with UL-1008, and testing shall be certified by Underwriters' Laboratories, Inc.

D. When conducting temperature rise tests to UL-1008, the manufacturer shall include post-endurance temperature rise tests to verify the ability of the combination transfer bypass/isolation switch to carry full rated current after completing the overload and endurance tests.

E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install transfer switches on concrete equipment foundations (housekeeping pad).

    1. Anchor equipment to concrete housekeeping pad according to manufacturer’s written instructions and requirements in other sections of Division 26.
    2. Install each unit level and plumb.

B. Maintain minimum clearances and workspace at equipment according to manufacturer’s written instructions and NFPA 70.

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C. Install in accordance with national, state, and local codes, and manufacturer's instructions.

D. Include items not specifically mentioned but necessary for proper operation.

E. Connect wiring as indicated on the drawings and in accordance with manufacturer's recommendations.

F. Identify components.

3.2 CONNECTIONS

A. Ground equipment according to Division 26 Section “Grounding and Bonding for Electrical Systems.”

B. Wiring to Remote Components: Provide type and number of cables and conductors in raceway as recommended by manufacturer between emergency distribution system components for control and communication requirements.

3.3 IDENTIFICATION

A. Materials: Refer to Division 26 Section "Identification of Electrical Systems." Identify units, devices, fuse blocks, relays, controls, and wiring. Identify equipment ratings.

B. Nameplates: Refer to Division 26 Section “Identification of Electrical Systems” for additional requirements. Provide nameplate for each switch and major control or display component located on front of assembly.

1. Furnish master nameplate, stamped metal, listing standard manufacturer information including voltage, ampere, frequency, and short-circuit ratings; manufacturer’s model and project designations.

C. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be identified corresponding to designations on manufacturer’s drawings using tags and other identification materials.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer’s field service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections; and to assist the Contractor in testing.

B. Tests and inspections:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform tests recommended by manufacturer. Perform electrical tests and visual and mechanical inspection described under "Emergency Systems, Automatic Transfer Switches" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.

   a. Check for electrical continuity of circuits and for short circuits.
   b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
   c. Verify that manual transfer warnings are properly placed.
   d. Perform manual transfer operation.

3. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

C. Coordinate automatic transfer switch tests with tests of generator and run them concurrently.

D. Remove and replace malfunctioning units and retest as specified above.

E. Correct deficiencies identified by tests and observations and retest until specified requirements are met.

F. Demonstrate satisfactory operation of each feature required of the transfer switches.

G. Test emergency power system: After completion and acceptance of the generator tests, perform an operational test of the emergency power system. Perform a power failure test on the emergency electrical system. This shall be performed by interrupting the normal power source and verifying proper generator start and transfer switch operation.

H. Report results of tests and inspections in writing. Record adjustable relay settings.

3.5 CLEANING

A. Inspect and clean surfaces and repair damaged finishes to match original finish.

B. Clean interior of equipment according to manufacturer's instructions.

3.6 OPERATING INSTRUCTIONS

A. As specified in Section 26 0500, provide operating instructions.

B. Provide a period of 4 hours for equipment instruction to operating personnel.

C. Coordinate this instructional training with that for generator equipment.

END OF SECTION