

SECTION 26 36 23

AUTOMATIC TRANSFER SWITCHES

PART 1 GENERAL

1.1 DESCRIPTION

- A. Scope:
1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install automatic transfer switches.
- B. Related Sections:
1. Section 26 05 02 - Basic Electrical Work, Identification for Electrical Systems.

1.2 REFERENCES

- A. Standards referenced in this Section are:
1. IEEE 472, Guide for Surge Withstand Capability Tests.
 2. IEEE 446, Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications.
 3. IEEE C62.41, Recommended Practice for Surge Voltages in Low Voltage AC Power Circuits.
 4. NEMA ICS1 109, Tests and Procedures.
 5. NEMA ICS10, AC Automatic Transfer Switches.
 6. UL 1008, Transfer Switch Equipment.
 7. UL 508, Industrial Control Equipment
 8. UL 61010B-1 (previously UL 3111-1), Electrical Measuring and Test Equipment; Part 1: General Requirements.
 9. ANSI C37.90a, Surge Withstand Capability Test (formerly IEEE Standard 472-1974) – Ring Wave Test.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. NEC Article 702, Optional Standby Systems.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
1. Shop Drawings:
 - a. Listing of transfer switches to be provided, including ratings and location of each.
 - b. Equipment dimensions, and construction details of enclosures with conduit entry locations.
 2. Product Data:
 - a. Manufacturer's technical information for products proposed, including catalog cut sheets.

- B. Informational Submittals:
 - 1. Field Quality Control Submittals:
 - a. Submit reports of completed field tests, including test results and procedures used for testing.
 - 2. Supplier Instructions:
 - a. Manufacturer's written instructions for transporting, handling, storing, and installing the products.
 - 3. Supplier Reports:
 - a. Written report of each visit to Site by supplier's service representative.
- C. Closeout Submittals
 - 1. Operation and Maintenance Data:
 - a. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, description of operation, and spare parts information.
 - b. Manuals shall include record drawings of control schematics, including point-to-point wiring diagrams.
 - c. Furnish operation and maintenance manuals.
- D. Maintenance Material Submittals: Furnish the following:
 - 1. Spare Parts and Extra Stock Materials: Provide as specified in this Section.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices to be embedded in cast-in-place concrete in time to prevent delay of the Work.
- B. Shipping sections shall be designed to be shipped by truck, rail, and ship. Indoor sections shall be bolted to skids.
- C. Equipment shall be equipped to be handled by crane. Where cranes are not available equipment shall be suitable for skidding in place on rollers using jacks to raise and lower the sections.

1.6 MAINTENANCE

- A. Spare Parts and Extra Stock Materials:
 - 1. Furnish, tag, and box for shipment and long-term storage the following spare parts for each switch:

Item	Quantity (per Switch)
a. Control relay	Two of each type used
b. Pilot light	Two per ten of each type used
c. Fuses	Two set of each type and size used

- 2. Furnish a list of additional recommended spare parts for an operating period of one year. Describe each part, quantity recommended, and current unit price of each.

3. Package spare parts in suitable containers bearing labels clearly indicating contents and equipment with which they are to be used. Deliver spare parts at same time as switchgear.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Two years from date of Owner Acceptance.

PART 2 PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Provide automatic transfer switches as specified for transferring loads from one power source to another.

2.2 MANUFACTURERS

- A. Manufacturers: Provide products of one of the following:
 1. ASCO Power Technologies.
 2. G.E. / Zenith.
 3. Russelectric.
 4. Or pre-approved equal.

2.3 SWITCH

- A. Ratings:
 1. Switches shall be capable of switching all classes of loads and rated for continuous duty when installed in a non-ventilated enclosure.
 2. Switches shall be rated with continuous ampere rating, number of poles and voltage as shown on Drawings.
 3. Switches shall be rated to withstand the magnitude of fault current available without welding of contacts in compliance with ANSI C37.90a and IEEE C62.41.
- B. Standards and Performance:
 1. Switches shall comply with UL Standard 1008, NEMA Standard ICS10, and applicable requirements of NEC Article 700, IEEE 446, IEEE C62.41, UL 508, and UL 61010B-1. Switches shall be UL labeled with performance meeting or exceed the following:
 - a. Temperature Rise: Measurements shall be made after overload and endurance tests.
 - b. Withstand: UL listed to withstand magnitude of fault current available at switch terminals when coordinated with respective protective devices shown on Drawings at an X/R ratio of 6.6 or less. Main contacts shall not trip open or weld when subjected to fault currents.

- 1) As a condition for approval, manufacturer of automatic transfer switches shall verify that switches are listed by Underwriters Laboratories, Inc., Standard UL-1008 with three-cycle short circuit closing and withstand as follows:

RMS Symmetrical Amperes		
Amperes	3 Cycle Closing & Withstand	
	240 VAC Max	480 VAC Max
100 to 400	65,000	42,000
600 to 800	65,000	65,000
1000 to 1200	85,000	85,000
1600 to 4000	100,000	100,000

- 2) During three-cycle closing and withstand tests, there shall be no contact welding or damage. Three-cycle tests shall be performed without using current limiting fuses, and oscillograph traces across main contacts shall be furnished to verify that contact separation has not occurred, and there is contact continuity across all phases after completion of testing. Test procedures shall be in accordance with UL-1008, and testing shall be certified by UL.
 - 3) When conducting temperature rise tests to UL-1008, Supplier shall include post-endurance temperature rise tests to verify ability of transfer switch to carry full rated current after completing overload and endurance tests.
- c. Dielectric: Measurements shall be made at 1960 VAC RMS minimum following the withstand current rating test.
 - d. Transient Withstand: Control panel shall pass the voltage surge withstand test per IEEE Standard 472 and voltage impulse withstand test per NEMA ICS1 109.

C. Construction:

1. Switch shall be double throw actuated by non-fused, momentarily energized operating mechanism(s).
2. Accomplish mechanical locking of main contacts in each direction without aid of latching solenoids, toggle mechanisms, or gear arrangements.
3. An overload or short-circuit shall not cause switch to go to a neutral position.
4. All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.
5. Switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.
6. Main contacts shall be silver-tungsten composition. Switches shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.
7. Inspection of contacts shall be possible from front of switch without disassembly of operating linkages and without disconnecting power conductors. Switches rated 600 amps and higher shall have front-removable and replaceable contacts.

All stationary and moveable contacts shall be replaceable without removing power conductors or bus bars.

8. Transfer switch shall be equipped with a safe manual operator designed to prevent injury to operating personnel. Manual operator shall provide same contact-to-contact transfer speed as electrical operator to prevent a flash-over from switching main contacts slowly. Manual operation shall be safe even if electrical operator becomes energized and shall not require prior disconnection of operators or control wiring. Safe manual transfer shall be possible under all load conditions, energized or non-energized. Manual operator shall be an external type, operable through door of transfer switch enclosure. Operating personnel shall not be required to open transfer switch door to facilitate manual transfer. Manual operator shall be functional at all times, regardless of switch position or status. Manually initiated electrical operation does not meet intent of this requirement. Manual operator is not required on closed transition type switches.
9. Neutral Connections:
 - a. Provide switch with fully rated neutral transfer contacts.
10. Dual lug configuration shall be provided at the Load terminals for connection of the output feeder conductors and for connection of conductors to a surge protection device. See drawings for conductor sizes.

D. Enclosure:

1. Indoors in prefabricated FRP enclosures: NEMA 4X, 316 stainless steel.
2. Indoors in prefabricated, precast concrete enclosures: NEMA 1 when HVAC is provided for the enclosure and approved by CFPUA and recommended by the Engineer. Otherwise, enclosure shall be NEMA 4X, 316 stainless steel.
3. Outdoors: NEMA 4X, 316 stainless steel.

E. Identification: Identify switches per Section 26 05 02 - Basic Electrical Work, Identification for Electrical Systems.

2.4 TRANSFER SWITCHING FEATURES

- A. Delay Transition (Open): Provide automatic delayed open transition transfer for each switch. Switch shall transfer load in delayed transition (break-before-make) mode. Transfer shall be accomplished with a user-defined interruption period in both directions adjustable from one second to five minutes in at least 15 increments.

2.5 SEQUENCE OF OPERATION

- A. When voltage on any phase of normal source is outside of specified parameters and after a programmable time delay period to allow for momentary dips, engine starting contacts shall close to start generating supply.
- B. Transfer switch shall transfer to emergency source when generating supply has reached specified voltage and frequency on all phases.
- C. After restoration of normal power on all phases to within specified parameters, an adjustable time delay shall delay retransfer to normal to assure stabilization of normal supply. After expiration of the time delay period, transfer switch shall retransfer too

normal. Retransfer to normal shall be prevented until two power supplies approach synchronization. Should emergency power source fail during the time delay period, switch shall bypass time delay and automatically return to normal source.

- D. After retransfer to normal, engine generator shall be allowed to operate at no load for a programmable period to cool down.
- E. Should transfer to emergency source be initiated by test switch rather than an actual source failure, transfer from normal to emergency shall be as described above.

2.6 MICROPROCESSOR CONTROLLER

- A. Each switch shall include a microprocessor controller for operation of the switch. Equip controller with the following:
 - 1. Provide controller’s sensing and logic by a built-in microprocessor with ability to communicate serially through an optional serial communication module.
 - 2. Controller shall provide a minimum of five selectable nominal voltages. Voltage sensing shall be true RMS type and be accurate to plus/minus one percent of nominal voltage. Frequency sensing shall be accurate to plus/minus 0.2 percent. Controller shall be capable of operating over a temperature range of -20 to +60 degrees C and storage from -55 to +85 degrees C.
 - 3. Connect controller to transfer switch by an interconnecting wiring harness that shall include a keyed disconnect plug to enable controller to be disconnected from transfer switch for routine maintenance. Interfacing relays shall be industrial grade plug-in type with dust covers. Enclose controller with a protective cover. Mount controller internally but separately from transfer switch.
 - 4. Customer connections shall be wired to a common terminal block.
- B. Controller Display and Keypad:
 - 1. Display and keypad shall be an integral part of controller for viewing available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through serial communications input port. The following parameters shall be adjustable:
 - a. Nominal line voltage and frequency
 - b. Single- or three-phase sensing
 - c. Operating parameter protection
 - d. Transfer operating mode configuration: Open transition, closed transition, or delayed transition
 - 2. Instructions and controller settings shall be easily accessible, readable, and accomplished without using codes, calculations, or instruction manuals.
- C. Controller Voltage, Frequency and Phase Rotation Sensing:
 - 1. Voltage and frequency on both the normal and emergency sources shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities values shown as a percent nominal unless otherwise specified:

Parameter	Sources	Dropout/Trip	Pickup/Reset
Under-voltage	Normal and Emergency, three-phase	70 to 98%	85 to 100%
Over-voltage	Normal and Emergency,	102 to 115%	2% below trip

	three-phase		
Under-frequency	Normal and Emergency	85 to 98%	90 to 100%
Over-frequency	Normal and Emergency	102 to 110%	2% below trip
Voltage Unbalance	Normal and Emergency	5 to 20%	1% below dropout

2. Repetitive accuracy of all settings shall be within plus/minus 0.5 percent over an operating temperature range of -20 degrees C to +60 degrees C.
3. Voltage and frequency settings shall be field adjustable in one percent increments, either locally with the display and keypad or remotely via serial communications port access.
4. When activated by keypad or through serial port, controller shall be capable of sensing phase rotation of both normal and emergency sources. Source will be unacceptable if phase rotation is not preferred rotation selected (ABC or CBA).
5. Source status screens shall be provided for both normal and emergency to provide digital readout of voltage on all three phases, frequency, and phase rotation.

D. Controller Time Delays:

1. Provide controller with time delays below. Time delay settings shall be adjustable over a range of zero to 9999 seconds (factory set at three seconds) unless specified otherwise.
 - a. Normal source failure, for engine starting.
 - b. Transfer to emergency on availability of emergency source.
 - c. Emergency source failure, retransfer on availability of normal source.
 - d. Engine cool down following retransfer to normal.
 - e. Time delay to control contact transition time during open transition transfer to either source.
 - f. All timers can be bypassed via operation on processor's keypad.
2. Provide adjustable time-delay on retransfer to normal. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.
3. Time delay and sensing functions shall be field adjustable and operate with drift that does not exceed plus/minus one percent of set frequency, plus/minus two percent of set voltage, and plus/minus ten percent of set time delay, over the temperature range of -20 degrees C to +70 degrees C.
4. Time delays shall be adjustable in one-second increments, except extended parallel time, that shall be adjustable in 0.01-second increments.
5. Time delays shall be adjustable by using display and keypad or with a remote device connected to serial communications port. Time delay value displayed shall be time remaining until next event occurs.
6. For (open) delay transition transfer switches, controller shall include the following built-in time delays for delayed transition operation:
 - a. Zero to five-minute time delay for load disconnect position for delayed transition operation.
7. For closed transition transfer switches, controller shall include the following built-in time delays
 - a. One to five-minute time delay on failure to synchronize normal and emergency sources prior to closed transition transfer.

- b. 0.1 to 9.99 second time delay on an extended parallel condition of both power sources during closed transition operation.

2.7 ACCESSORY FEATURES:

- A. Provide each switch with the following:
 1. A two-position maintained-type test switch for test/automatic/ modes. Test position shall simulate a normal source failure.
 2. A SPDT silver-tungsten contact, rated five amps at 30 VDC, for a low-voltage engine start signal. Start signal shall prevent dry cranking of engine by requiring generator set to reach proper output and run for duration of cool down setting regardless of whether normal source restores before load is transferred.
 3. Auxiliary contacts, rated ten amps at 250 VAC, consisting of one contact, closed when switch is connected to normal source and one contact closed when switch is connected to emergency source.
 4. LED indicating lights (30.5 mm, industrial heavy duty, oil-tight, NEMA rated to match automatic transfer switch enclosure). One shall indicate when switch is connected to normal source (green) and one to indicate when the switch is connected to standby source (red).
 5. Provide the following built-in to controller, capable of being activated through keypad programming or serial port only when required by user:
 - a. Provide ability to select “commit/no commit to transfer” to determine whether load should be transferred to standby generator if normal source restores before generator is ready to accept load.
 - b. Provide terminals for a remote contact that opens to signal switch to transfer to emergency, and for remote contacts that open to inhibit transfer to emergency or retransfer to normal. Provide ability to activate both inhibit signals through keypad or serial port.
 - c. Engine Exerciser: Controller shall provide an internal engine exerciser that allows user to program up to seven different exercise routines. For each routine, user shall be able to:
 - 1) Enable or disable routine.
 - 2) Enable or disable transfer of load during routine.
 - 3) Set start time.
 - 4) Time of day
 - 5) Day of week
 - 6) Week of month (first, second, third, fourth, last, alternate, and every)
 - 7) Set duration of run.
 - 8) At end of specified duration, switch shall transfer load back to normal and run generator for specified cool down period. A ten-year life battery that supplies power to real time clock in event of a power loss shall maintain time and date information.
 6. System Status: Controller display shall include a “System Status” screen that shall be readily accessible from all points in the menu by a maximum of two key strokes. System status screen shall display a clear description of active operating sequence and switch position.
 7. Self-Diagnostics: Controller shall contain a diagnostic screen for detecting system errors. Screen shall provide information on status input signals to controller that may be preventing completion of load transfer commands.

8. Communications Interface: Controller shall be capable of interfacing, through an optional full-duplex RS 485 serial communication module, with a network of transfer switches, within 4,000 feet (locally) and remotely through modem serial communications. Standard software specific for transfer switch applications shall be available from transfer switch manufacturer. Software shall include monitoring, control, and setup of parameters.
9. Data Logging: Controller shall have ability to log data and to maintain last 99 events, even during total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory:
 - a. Event Logging
 - 1) Date and time and reason for transfer normal to emergency.
 - 2) Date and time and reason for transfer emergency to normal.
 - 3) Date and time emergency source available.
 - b. Statistical Data
 - 1) Total number of transfers.
 - 2) Last ten numbers of transfers due to source failure.
 - 3) Total number of hours both normal and emergency sources are available.
10. Terminate control wires with crimp lugs and identify with sleeve type markers. Provide suitable copper connector lugs for each service and load connections.
11. Additional Accessories:
 - a. Automatic synchronizing check function to prevent transfer from normal to emergency or retransfer from emergency to normal until both sources are within acceptable limits of synchronism.
 - b. Pushbutton to reset Fail to Transfer.

2.8 SOURCE QUALITY CONTROL

- A. Perform manufacturer's standard factory tests that shall include:
 1. Physical inspection and checking of components.
 2. Mechanical operation and device functional tests.
 3. Control operation and functionality tests.
 4. Primary, control, and secondary wiring hi-pot tests.

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine conditions under which Work is to be performed 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 have been corrected.

3.2 INSTALLATION

- A. Install equipment so that sufficient access and working space is provided for ready and safe operation and maintenance.

- B. Install equipment in accordance with Contract Documents and manufacturer recommendations.
- C. Securely fasten equipment to floors, walls, or other surfaces on which equipment will be mounted. Install freestanding switches on raised concrete pad at locations shown on Drawings. Install in accordance with manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

- A. Perform field testing and inspection of each automatic transfer switch. Testing and inspection shall be in accordance with manufacturer's recommendations and be performed by manufacturer's factory-trained representative, who shall inform Owner and Engineer when equipment has been correctly installed. Do not energize equipment without permission of Owner.

3.4 MANUFACTURER SERVICES

- A. Manufacturer Services:
 - 1. Manufacturer's factory-trained representative shall test the system as specified in Article 3.3 of this Section. Representative shall operate and test system in the presence of Engineer and verify that equipment conforms to requirements.
 - 2. Manufacturer's factory-trained representative shall adjust the system to initial settings specified in Article 2.6 of this Section.
 - 3. Representative shall revisit the Site as often as necessary until all deficiencies are corrected, prior to readiness for final payment.
 - 4. Provide services of manufacturer's factory-trained representatives to correct defective Work within 72 hours of notification by Owner during the Correction Period specified in the General Conditions as amended by the Supplementary Conditions.
 - 5. Replacement parts or equipment installed during the Correction Period shall be equal to or better than the original.
- B. Training: Furnish services of qualified factory trained specialists from manufacturer to instruct Owner's operations and maintenance personnel in recommended operation and maintenance of the products.

END OF SECTION