

SECTION 16495 TRANSFER SWITCHES

PART 1 GENERAL

1.1 SUMMARY:

- A. This Section includes transfer switches rated 600 V and less. It includes the following items:
 - 1. Automatic transfer switch (ATS).
 - 2. Bypass/isolation switch (BP/IS).
 - 3. Nonautomatic transfer switch (NATS).
 - 4. Double throw disconnect switch.
 - 5. Remote annunciation and control system.

1.2 SUBMITTALS:

- A. Product data and shop drawings for each transfer switch, including dimensioned plans, sections, and elevations showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and materials lists.
- B. Wiring diagrams, elementary or schematic, differentiating between manufacturer-installed and field-installed wiring.
- C. Single-line diagrams of transfer switch units showing connections between automatic transfer switch, bypass/isolation switch, power source, and load, plus interlocking provisions.
- D. Operation and maintenance data for each type of product. Include all features and operating sequences, both automatic and manual. List all factory settings of relays and provide relay setting and calibration instructions.
- E. Manufacturer's certificate of compliance to the referenced standards and tested short-circuit closing and withstand ratings applicable to the protective devices and current ratings used.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of electrical power transfer switches, of types, ratings, and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects utilizing electrical power transfer switches similar to that required for this project.
- C. Emergency Service: Manufacturer with a service center capable of providing emergency maintenance and repairs at the Project site with an 8-hour maximum response time.
- D. Comply with NFPA 110, "Standard for Emergency and Standby Power Systems."
- E. Comply with NEMA Standard ICS-2-447-AC Automatic Transfer Switches.
- F. UL Listing and Labeling: Items furnished under this Section shall be listed and labeled by UL for emergency service under UL Standard 1008.
- G. National Recognized Testing Laboratory Listing (NRTL) and Labeling: Items furnished under this Section shall be listed and labeled by a NRTL for emergency service under UL Standard 1008.

1. Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- H. Single-Source Responsibility: Obtain ATs, BP/ISs, remote annunciators, and remote annunciator and control panels from a single manufacturer that assumes responsibility for all system components furnished.
- I. Source Quality Control: Factory test components, assembled switches, and associated equipment to ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for conformance with specified requirements. Perform dielectric strength test conforming to NEMA ICS 1.
- 1.4 DELIVERY, STORAGE AND HANDLING:
- A. Deliver transfer switches and associated devices in factory-fabricated type containers or wrappings, which properly protect equipment from damage.
 - B. Store transfer switches and associated devices in original packaging, and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.
 - C. Handle transfer switches and associated devices carefully to prevent physical damage to equipment. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Russelectric, Inc.
 2. Cummins/Onan (When associated with Onan generator only)
 3. Caterpillar, Inc. (When associated with Caterpillar generator only)
 4. Zenith Controls, Inc.
 5. Automatic Switch Company. (ASCO)

2.2 TRANSFER SWITCH PRODUCTS, GENERAL:

- A. Number of Poles and Current and Voltage Ratings: As indicated
 1. Units smaller than 400 amperes shall not have different current ratings for different classes or mixtures of loads, including 100 percent tungsten filament lamp or 100 percent inductive load.
 2. Units 400 amperes and larger shall have current ratings that apply to mixtures of loads including 30-percent-maximum tungsten filament lamp load.
 3. The current rating shall be a continuous rating when the switch is installed in an unventilated enclosure and shall comply with NEMA temperature rise standards.
- B. Tested Fault-Current Ratings: Closing and withstand ratings shall exceed the indicated available rms symmetrical fault current at the equipment terminals based on testing according

to UL Standard 1008, conducted at full-rated system voltage and 20 percent power factor. Rate each product for withstand duration time as follows when tested for rated short-circuit current correlated with the actual type of circuit protective device indicated for transfer switches for this Project.

1. 150 Amperes or Smaller: 1.5 closing and withstand duration cycles.
 2. Larger than 150 Amperes: 3 closing and withstand duration cycles.
 3. Power Circuit Breakers: 10 closing and withstand duration cycles.
 4. Current-Limiting Fuses: 0.5 (nominal) closing and withstand duration cycles.
- C. Annunciation and Control Interface Components: Provide devices at transfer switches for communicating with remote annunciators or annunciator/control panels which have communications capability matched with the remote device.
- D. Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 degrees C. to 70 degrees C.
- E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage surge withstand capability requirements when tested according to ANSI C37.90.1, IEEE Guide for Surge Withstand Capability (SWC) Tests. Components meet or exceed voltage impulse withstand test of NEMA ICS 1.
- F. Neutral Terminal: Where 2- or 3-pole switches are indicated, provide fully rated, solid, unswitched neutral terminal.
- G. Four-Pole Switches: Where 4-pole switches are indicated, provide full-capacity and neutral switching.
- H. Enclosures: Provide a general-purpose NEMA 1 enclosure, conforming to UL Standard 508, "Electrical Industrial Control Equipment," except as otherwise indicated.
- I. Heater: Provide a heater within enclosure of units exposed to outdoor temperature and humidity conditions. Connect thermostat within enclosure to control heater.
- J. Factory Wiring: Train and bundle factory wiring and identify consistently with shop drawings, either by color code or by numbered or lettered wire and cable tape markers at terminations.
1. Designated terminals accommodate field wiring.
 2. Power Terminal Arrangement and Field Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 3. Terminals: Pressure-type, suitable for copper or aluminum conductors of sizes indicated.
 4. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- K. Electrical Operation: Where indicated, accomplish by a nonfused, momentarily energized solenoid or electric motor-operated mechanism, mechanically and electrically interlocked in both directions. Switches using components of molded-case circuit breakers or contactors not designed for continuous-duty, repetitive switching between active power sources are not acceptable.
- L. Switch Action: The switch contacts shall be mechanically held in both directions for double-throw switches.
- M. Switch Contacts: Use silver composition for switching load current. Units rated 225 amperes and more shall have separate arcing contacts.

- N. Overcurrent devices are not part of switch products.
 - O. Transfer switch shall use copper bus throughout.
 - P. Control power for transfer switches shall operate from either source as available and shall include a connection terminal for a third separate source of power. Control, indication alarms, etc. shall operate from any of these sources automatically.
 - Q. Provide two-hole compression lugs on all incoming and load side phase, neutral, and ground connectors.
- 2.3 AUTOMATIC TRANSFER SWITCHES (ATSS):
- A. Comply with Level 1 equipment according to NFPA 110, "Standard for Emergency and Standby Power Systems."
 - B. Comply with NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps," for ATS's serving fire pumps.
 - C. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning [except for neutral position, to enable programmed transition.]
 - D. Manual Switch Operation: The switch shall have provision for manual operation under load with the door closed with either or both sources energized. Transfer time shall be the same as for electrical operation. Control circuit shall automatically disconnect from electrical operator during manual operation.
 - E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts shall operate in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
 - F. Digital Communications Interface: Provide full-duplex RS - 485/422/232 type, matched to capability of remote annunciator and control panel.
 - G. In-Phase Monitor: Include factory-installed and factory-wired internal in-phase monitor relay. The relay controls transfer so it occurs when the 2 sources are synchronized in phase. the relay compares phase relationship and frequency difference between the normal and emergency sources and initiates transfer when both sources are within +5 electrical degrees and +5 percent voltage difference, and then only if the transfer can be of nominal frequency and 70 percent or more of nominal voltage.

OR

Programmed Transition with Motor Control: Provide factory-installed and factory-wired internal motor control undervoltage and timing relays. Relays shall control designated starters to de-energize motors prior to transfer and re-energize them selectively at adjustable time intervals after transfer. Control connection to motor starters shall be through wiring external to the ATS. Time delay for individual motor loads shall be adjustable between 1 and 60 seconds and settings are as indicated. Relay contacts shall be rated for actual motor-control circuit inrush and seal currents, or for pilot duty as indicated.

OR

Programmed Transition: Switch Operator shall have a programmed neutral position arranged to provide a midpoint between the 2 working switch positions with an intentional, controlled, timed pause during transfer at the midpoint. The midpoint pause shall be adjustable from 0

to 60 seconds minimum, and factory set at 5 seconds, except as indicated. Time delay shall occur for both transfer directions.

2.4 AUTOMATIC TRANSFER SWITCH FEATURES:

- A. Provide for normal source voltage sensing of each phase of normal source. Pick-up voltage shall be adjustable from 85 percent to 100 percent nominal, and drop-out voltage is adjustable from 75 percent to 98 percent pick-up value. Factory set for pick-up at 95 percent and drop-out at 85 percent.
- B. Provide for emergency source voltage sensing to prevent premature transfer. Voltage pick-up shall be adjustable from 85 percent to 100 percent of nominal. Factory set to pick-up at 90 percent. Pick-up frequency shall be adjustable from 90 percent to 100 percent of nominal and factory set to pick-up at 95/98 percent.
- C. Provide a transfer switch signal time delay to override normal source voltage-sensing, delay transfer signal and engine start signal. Delay shall be adjustable from 0 to 6 seconds, and factory set at 1/5 sec.
- D. Provide a transfer to emergency time delay to delay transfer switch changeover after transfer signal. Delay shall be adjustable from 0 to 5 minutes and factory set at 0 minutes.
- E. Provide a retransfer time delay to provide for automatic defeat of the delay upon loss of voltage or sustained under-voltage of the emergency source, provided the normal supply has been restored. Delay shall be adjustable from 0 to 30/60 minutes and factory set at 15 minutes.
- F. Provide an engine shut-down time delay adjustable from 0 to 5/15 minutes and factory set at 5 minutes.
- G. Provide a momentary type test switch to simulate normal source failure.
- H. Provide switch position pilot lights to indicate source to which the load is connected.
- I. Provide source available indicating lights to supervise sources via the transfer switch normal and emergency source-sensing circuits.
 - 1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - 2. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
- J. Provide a transfer override switch to override automatic retransfer control so the ATS will remain connected to the emergency power source regardless of the condition of the normal source. Provide a pilot light to indicate the override status.
- K. Provide engine starting contacts, one isolated normally closed and one isolated normally open. Contacts shall be gold flashed or gold plated and rated 10 amperes at 32 V d.c. minimum.
- L. Provide two normally open and two normally closed spare SPDT contacts for each switch position, rated 10 amps at 240 VAC.

AND/OR

- M. Provide auxiliary emergency position and normal position relays. Each relay shall have two normally open and two normally closed SPDT contacts for each switch position, rated 10 amps at 120 VAC.
 - N. Provide an elevator pre-signal relay (when interface with elevator is within scope) to signal the elevator equipment that re-transfer to normal source is imminent and to shutdown SCR controller, then startup after re-transfer.
 - O. Provide a solid-state programmable engine-generator exerciser time switch to start engine-generator set and transfer load to it from normal source for a preset time, then retransfer loads to normal source and shut down engine after a preset cool-down period. The exercise cycle shall be initiated at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes and factory-set for 7 days and 20 minutes respectively. Exerciser features include:
 - P. Exerciser transfer selector switch which permits selection between exercise with and without load transfer.
 - 1. Push button programming controls with digital display of settings.
 - 2. Integral battery operation of time switch when normal control power is not available.
- 2.5 BYPASS/ISOLATION SWITCH FEATURES:
- A. Comply with requirements for Level 1 equipment per NFPA 110, Standard for Emergency and Standby Power Systems.
 - B. Description: Manual type, arranged to select and connect either source of power directly to the load, isolating the transfer switch from the load and from both power sources. Include the following features:
 - 1. Means to lock the BP/IS in the position that isolates the transfer switch, with an arrangement that permits complete electrical testing of the transfer switch while isolated. While isolated, interlocks shall prevent transfer switch operation except for testing or maintenance.
 - 2. Draw-out arrangement for the transfer switch: Provide physical separation from live parts for testing and maintenance operations.
 - 3. Current, voltage, closing, and short-circuit withstand rating shall be equal to or greater, than that of the associated ATS, with the same phase arrangement and number of poles.
 - 4. Contact temperatures of BP/IS shall not exceed those of ATS contacts when they are carrying rated load.
 - 5. Construct so that load bypass and transfer switch isolation can be performed by 1 person in no more than 2 operations in 15 seconds or less.
 - 6. Provide a Manufacturer's standard legend for control labels and instruction signs which give detailed operating instructions.
 - 7. Fabricate BP/IS to allow convenient removal of major components from the front without removal of other parts or main power conductors.

- C. Interconnect BP/IS and ATS with copper bus bars plated at connection points and braced for the indicated available short circuit current.

2.6 NONAUTOMATIC TRANSFER SWITCHES FEATURES:

- A. Comply with applicable requirements of NFPA 100, "Standard for Emergency and Standby Power Systems."
- B. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." Provide a removable manual handle. Provide quick-make, quick-break switching action. The switch shall be capable of electrically or manually transferring the load in either direction, with 1 or both sources energized. The control circuit shall disconnect from the electrical operator during manual operation. Control shall ensure switch will not transfer to a dead source.
- C. Double-Throw Switching Arrangement: Incapable of pauses or intermediate position stops during switching sequence unless otherwise specified.
- D. NATS Accessories
 - 1. Provide pilot lights to indicate source to which the load is connected.
 - 2. Provide source availability indicating lights which supervise sources via the transfer switch normal and alternate source sensing circuits, respectively.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Alternate Source Available."
 - 3. Provide two sets of spare normally closed and normally open SPDT contacts for each switch position, rated 10 amperes at 240 VAC.

2.7 DOUBLE THROW DISCONNECT SWITCH (DTDS):

- A. Standards:
 - 1. Comply with UL 98 - Enclosed and Dead Front Switches, NEMA Enclosed Switch Standard KSI-1990.
 - 2. Heavy duty rating.
- B. Description: Manually operated load break switch, double throw with intermediate OFF position, 2/3-pole with solid neutral terminal, service entrance rated, non-fusible.
- C. Accessories:
 - 1. Provide padlock provision for both "OFF" and "ON" positions.
 - 2. Provide dual cover interlock with keyed defeat mechanism.
 - 3. Label switch positions
 - a. "UTILITY"

b. "OFF"

4. Provide electrical interlocks with two normally open and two normally closed contacts in "ON" position.

2.8 REMOTE ANNUNCIATION AND CONTROL SYSTEM DESCRIPTION:

A. Provide a remote annunciation and control panel which shall provide the functions listed below at indicated transfer switches.

1. Sources-available indication (as defined by actual pick-up and drop-out settings of transfer switch controls).
2. Switch position indication.
3. Switch in test mode indication.
4. Failure of digital communications link indication.
5. Key switch or user code access to control functions of panel.
6. Control of switch test initiation.
7. Control of switch operation in either direction.
8. Control of bypass of time delay for transfer to normal source.
9. Malfunction of the annunciator unit or communication link shall not affect functions of the ATS. In the event of a failure of the communication link, the ATS automatically reverts to stand-alone, self-contained operation. No ATS sensing, controlling, or operating function depends on the remote panel for proper operation.

B. Remote Annunciator and Control Panel Features:

1. Description: Solid-state control and indicating panel. Group controls and indicating lights for each transfer switch together. Label each group indicating the transfer switch it controls, the location of that switch, and the load it serves.
2. Provide digital communications matched to that of the transfer switches to be supervised.
3. Provide flush/surface mounted modular, steel cabinet except as indicated.

2.9 FINISHES

A. Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and primer.

PART 3 EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which transfer switches are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 INSTALLATION OF AUTOMATIC TRANSFER SWITCHES:

A. Install transfer switches, including associated control devices as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that transfer switches comply with requirements. Comply with applicable requirements

of NEC and NFPA pertaining to wiring practices and installation of electrical power transfer switches.

- B. Coordinate with other electrical work, including raceways, and electrical boxes and fittings, as necessary to interface installation of transfer switch work with other work.
 - C. Tighten factory-made connections, including connectors, terminals, bus joints, mountings, and grounding. Tighten field-connected connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque values. When manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with torque values specified in UL Standards 486A and 486B.
- 3.3 WIRING TO REMOTE COMPONENTS:
- A. Match the type and number of cables and conductors to the control and communications requirements of the transfer switches used. Increase raceway sizes at no additional cost to the Owner if necessary to accommodate required wiring.
- 3.4 GROUNDING:
- A. Make equipment grounding connections for transfer switch units as indicated and as required by the NEC.
- 3.5 FIELD QUALITY CONTROL:
- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise field tests.
 - B. Preliminary Tests: Perform electrical tests as recommended by the manufacturer and as follows:
 - 1. Measure phase-to-phase and phase-to-ground insulation resistance levels with insulation resistance tester, including external annunciator and control circuits. Use test voltages and procedure recommended by the manufacturer. Meet manufacturer's specified minimum resistance.
 - 2. Check for electrical continuity of circuits and for short circuits.
 - C. Field Tests: Give one week advance notice of the tests and perform tests in presence of Owner's representative.
 - D. Coordinate tests with tests of generator plant and run them concurrently.
 - E. Tests: As recommended by the manufacturer and as follows:
 - 1. Contact Resistance Test: Measure resistance of power contacts for ATs, NATs, and BP/ISs. Resolve values in excess of 500 micro-ohms and differences between adjacent poles exceeding 50 percent.
 - 2. Ground Fault Tests: Coordinate with testing specified in Division 16 Section on Overcurrent Protective Devices to ensure sensors are properly selected and located to optimize ground-fault protection where power is being delivered from either source.
 - a. Verify grounding points and sensor ratings and locations.

- b. Apply simulated fault current at the sensors and observe reaction of circuit interrupting devices.
 3. Operational Tests: Demonstrate interlock, sequence, and operational function for each switch at least 3 times.
 - a. Simulate power failures of normal source to ATs and of emergency source with normal source available.
 - b. Simulate low phase-to-ground voltage for each phase of normal source of ATs.
 - c. Verify time-delay settings and pick-up and drop-out voltages.
 - d. Verify all control and relay devices operate properly in each sequence.
 4. Test Failures: Correct deficiencies identified by tests and prepare for retest. Verify that equipment meets the specified requirements.
 5. Reports: Maintain a written record of observations and tests. Report defective materials and workmanship and retest corrected items. Record adjustable relay settings and measure insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- 3.6 DEMONSTRATION:
 - A. Training: Furnish the services of a factory-authorized service representative to instruct Owner's personnel in the operation, maintenance, and adjustment of transfer switches and related equipment. Provide a minimum of 4 hours of instruction scheduled 7 days in advance.
 - B. Post step-by-step procedures for each switch provided.

END OF SECTION 16495