SECTION 16231

AUTOMATIC TRANSFER SWITCH

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install automatic transfer switch (ATS) with number of poles, amperage, voltage and withstand current ratings as shown on the plans. The automatic transfer shall consist of an inherently double throw power transfer switch unit and a control module interconnected to provide complete automatic operation. The transfer switch and control module shall be the product of the same manufacturer.

1.2 REFERENCES

The automatic transfer switch and accessories shall conform to the requirements of:

1. UL 1008 - Standard for Automatic Transfer Switches
2. California Electric Code (CEC)
3. NFPA 110 - Emergency and Standby Power Systems
4. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
5. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 16050: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Describe system operation, equipment and dimensions and indicate features of each component.
3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
4. Shop Drawings to Include:
a. Front, plan and side view elevations with overall dimensions indicated.

b. Location of devices and instruments and the make type, size and rating of all equipment.

c. Dimensional locations of conduit entry points and locations of barrier plates.

d. Nameplate legends.

e. AIC rating.

f. Size and number of bus bars per phase, neutral and ground.

g. Detailed point-to-point wiring diagram, differentiating between Manufacturer-installed and field-installed wiring.

5. Furnish structural calculations signed by a California professional structural engineer for equipment anchorage.

6. Outdoor weatherproof equipment enclosure and accessories.

7. Certified independent laboratory test data shall be provided to confirm that the switch rating and design conforms to UL-1008.

8. Manufacturer's installation instructions.

9. Complete bill of material listing all components.

10. Warranty.

B. Dimensions and configurations of transfer switches shall conform to the space allocated on the Drawings. The Contractor shall submit a revised layout if equipment furnished varies in size from that indicated on Drawings for the Engineer's approval.

1.4 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 16050: Basic Electrical Requirements, to include the following:

1. A detailed explanation of the operation of the system.

2. Instructions for routine maintenance.

3. Detailed instructions for repair of the transfer switch.

4. Pictorial parts list and part numbers.
5. Pictorial and schematic Electrical Drawings of wiring systems, including operating and safety devices, control panels, instrumentation and annunciators.

6. Telephone numbers for the authorized parts and service distributors.

7. Include all service bulletins and torque Specifications for all terminations.

8. Final testing reports.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

C. Manufacturer qualifications: Firms regularly engaged in manufacture of transfer switches, of types and sizes required and whose products have been in satisfactory use in similar service for not less than 5 years.

D. Installer's qualifications: Firms with at least 5 years of successful installation experience with Projects utilizing transfer switches similar to that required for this Project.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Transfer switch components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner. Components shall be properly packaged in factory-fabricated containers and mounted on shipping skids.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.7 WARRANTY
A. Units and components offered under this Section shall be covered by a one year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.8 FACTORY TESTS

A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements. Transfer switch shall be completely assembled, wired, adjusted and tested, per ANSI C37.20, at the factory under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment. Factory test report containing documentation and measurements shall be included in Operation and Maintenance Manual.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

1.9 SERVICE REPRESENTATION

A. The ATS manufacturer shall maintain a national service organization of company-employed personnel located within 4 hours of the installation site. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

PART 2 - PRODUCTS

2.1 MANUFACTURER

1. Acceptable manufacturer for automatic transfer switches are ASCO, Onan, or Russelectric.

GENERAL REQUIREMENTS

B. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a dual motor operated mechanism, momentarily energized from the source to which the load is to be transferred. The switch shall be double throw type and mechanically interlocked to ensure only one of three possible positions, normal, neutral or emergency.
C. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

D. All main contacts shall be silver composition. The switch shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.

E. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.

F. 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 to accommodate field wiring.
   2. Power terminal arrangement and field wiring space.
   3. Pressure-type terminals, suitable for copper or aluminum conductors, sized as indicated.
   4. Control wiring equipped with lugs suitable for connection to terminal strips.

G. Transfer switch ratings:
   1. Voltage: ___ volts, ___ phase, ___ wire, 60 Hz.
   2. Switched poles: 3-pole, solid neutral, or 4-pole, switched neutral.
   3. Switch operation: Open transition.
   4. Continuous rating: ___ Amperes or as indicated on the Drawings.
   5. Interrupting capacity: 100 percent of continuous rating.
   6. Withstand current rating: UL-1008; rated to withstand the available RMS symmetrical short circuit current. Rating shall match or exceed the value indicated on Drawings at distribution equipment serving transfer switch (on utility service side).

H. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1½ and 3 cycle, long-time ratings. ATSSs, which
are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.

I. The ATS shall be equipped with a safe manual operator, permanently attached to the motor operator, designed to prevent injury to operating personnel. The manual operator shall provide the same contact-to-contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly.

J. The ATS control section shall be supplied with a protective cover and be mounted at a location within the transfer switch enclosure suitable for ease of maintenance. Sensing and control logic shall be solid-state type. Printed circuit boards shall be keyed to prevent incorrect installation. Interfacing relays shall be industrial control grade plug-in type with dust covers.

K. All switch and relay contacts, coils, springs and control elements shall be removable from the front of the ATS without removal of the switch from the enclosure and without disconnection of drive linkages or power conductors.

L. All control relays shall be continuous duty; industrial type with wiping contacts rated at least 10 amperes.

M. The thermal capacity of the main contacts shall not be less than 20 times the continuous duty rating for a minimum of 3 electrical cycles as established by certified test data.

2.2 CONTROL PANEL

A. The control panel shall direct the operation of the transfer switch. The panel's sensing and logic shall be controlled by a built-in solid state logic controller for maximum reliability and, minimum maintenance, and inherent serial communications capability. The control panel shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the control panel to be disconnected from the transfer switch for routine maintenance.

B. The control panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers.

C. The control panel may meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

1. IEEE472 (ANSI C37.90A) Ring wave test.

2. ENC55011 1991 Class A Conducted and radiated emission.
3. IEC801-2 1991 (EN61000-4-2) Electrostatic discharge immunity, direct contact & air discharge.

4. IEC801-3 1984 (ENV50140) Radiated electromagnetic field immunity.

5. IEC801-4 1988 (EN61000-4-4) Electrical fast transient immunity.

6. ENV50142 (EN61000-4-5) Surge immunity.

7. ENV50141 HF Conducted disturbances immunity.

8. EN61000-4-11 Voltage dips and interruptions immunity.

9. Mil Std 461, Class 3C, Group 1 Test UM05 Radiated & conducted electromagnetic emissions.

D. Enclosure

1. The ATS shall be furnished in a NEMA type 12 enclosure for indoor installation or NEMA 3R for outdoor installation unless otherwise shown on the plans. The ATS shall be a lockable, ventilated or non-ventilated, wall or floor mounted smooth sheet metal enclosure constructed in accordance with UL 1008.

2. For outdoor enclosures provide non-walk-in type housing with hinged lockable access doors. Each section shall have a minimum of 13-inch deep vestibule. Provide a latch for each door to insure adequate closing pressure to seal against harmful weather.

3. Provide each weatherproof housing with the following items power obtained from a control power transformer and circuit breaker within switch:
   
   a. Thermostatically controlled space heater.
   
   b. 120 VAC industrial grade fluorescent lights inside each vestibule.
   
   c. One 120 VAC GFCI type duplex outlet with weatherproof cover. Connect to 120 VAC light circuit.
   
   d. The weatherproof housings shall be provided with lifting eyes.

2.3 OPERATION

A. Voltage and Frequency Sensing

1. The voltage of each phase of the normal source shall be monitored, with pickup adjustable from 85% to 95% of nominal and dropout adjustable from 75% to 98% of pickup setting.
2. Single-phase voltage sensing of the emergency source shall be provided, with pickup voltage adjustable from 85% to 95% of nominal and independent frequency sensing with pickup adjustable from 90% to 100% of nominal.

3. Repetitive accuracy of all settings shall be within ± 2% over an operating temperature range of -20°C to 70°C.

4. Voltage and frequency settings shall be field adjustable in 1% increments without the use of tools, meters or power supplies. Actual settings shall be clearly defined in the operator’s manual.

5. Time Delays
   a. The settings below shall be adjustable without the use of tools and shall be pre-set at the factory.
   b. A time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Adjustable from 0 to 6 seconds. Set at 2 seconds.
   c. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 seconds for controlled timing of transfer of loads to emergency. Set at 0 seconds.
   d. A time delay shall be provided on retransfer to normal, adjustable from 0 to 30 minutes. Set at 30 minutes. Any momentary dips in the line will cause the time delay to reset and start its time cycle over. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable. Provide a pushbutton switch for manual transfer to normal to bypass the time delay. However, if the normal source fails, retransfer to emergency source should be automatic if the emergency source is available. Pushbutton shall be mounted to the front cover.
   e. A time delay shall be provided on shutdown of engine generator for cooldown, adjustable from 0 to 60 minutes. Set at 5 minutes.
   f. A time delay in neutral shall provide a pause in a position connected to neither normal or emergency sources. Neutral time delay shall be in effect in either transfer direction. Time delay in neutral shall be adjustable 1-15 seconds. Set at 3 seconds.

B. ATS/elevator interface operation:
   1. When the normal source fails, all elevators will automatically brake to a stop. The ATS shall close a contact to signal all the elevator controllers when emergency power is available.
2. Before any transfer between two live sources, the ATS shall send a pre-transfer signal of at least 20 seconds to the elevator system. This enables the running elevator to stop at the next available floor, open its doors and lock the elevator out of operation.

3. Elevator system contacts: Provide one set of the following three (3) auxiliary contacts for each elevator bank having one or more elevators operating on emergency power:
   a. Closes when ATS is in emergency. Indicates to the elevator system that it is now powered by the engine generator and that the special elevator sequence operation can now be initiated. Rated 10 amps, 120 volts, 60 Hz, AC.
   b. Pre-transfer signal of 20 seconds prior to transfer from emergency source back to normal source.
   c. Pre-transfer signal of 20 seconds prior to transfer from normal source to emergency source in test mode. Rated 10 amps, 120 volts, 60 Hz, AC.

4. Provisions to permit load "shedding" by switching the main contacts to the off (open) position via the closing of an external set of dry contacts, rated 120 VAC, 10 amperes. Contacts shall transfer to the normal source position automatically if voltage and frequency are within specified tolerances.

5. Provisions to permit the switching of the main contacts to the emergency position only after the following two occurrences:
   a. Emergency source voltage and frequency are within specified tolerances.
   b. Closing of an external set of dry contacts rated 120 VAC, 10 amperes.

6. The control voltage through the contacts specified in the two above accessories, shall originate from the ATS control power transformers.

C. Additional Features

1. A set of DPDT gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage “engine start” signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred. Provide both a contact that opens when normal source fails, and a contact that closes when normal source fails.
2. A four-position test switch shall be provided to simulate a normal source failure. The four positions shall provide for full automatic transfer, off (no transfer) engine start, start with load transfer.

3. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal.

4. Auxiliary SPST isolated contacts, rated 10 amps, 250 VAC shall be provided consisting of two contacts, closed when the ATS is connected to the normal source and two contacts closed, when the ATS is connected to the emergency source. Provide labels at the terminal strip ready for field wiring to EMCS System.

5. Indicating lights shall be provided, one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red). Two white lights shall indicate when each source is available. The light shall illuminate only when the source is truly available, i.e. within normal voltage and frequency tolerances; monitor three phases on the utility and one phase on the emergency.

6. All lights shall be visible without opening the cover. Provide single pushbutton to test all indicating lights.

7. Terminals shall be provided to indicate actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source. Contacts shall close when the source is available. Provide labels at the relays, dry contacts, and terminal strip ready for field wiring to remote annunciator.

8. A two position switch, “TEST-NO LOAD/TEST WITH LOAD,” such that when in the “TEST-NO LOAD” position and the test switch is activated the generators shall start but the ATS shall remain in the normal position. In the “TEST WITH LOAD” position the ATS will transfer to the emergency source. In either position, the switch shall automatically transfer to the live source in the event of a failure of the other source. It shall be possible to use this switch to transfer back and forth between sources during a test. Mount switch to front cover.

9. Engine Exerciser - An engine generator exercising timer shall be provided, including a selector switch to select exercise with or without load transfer. The exerciser shall be programmable to enable exercise for 1 minute to 24 hours per day in 1 minute increments for 1 to 7 days per week. Provide a 1 minute pre-start relay contact, remote alarm bell (to be mounted in generator room) and warning signs reading "WARNING: GENERATOR MAY START AUTOMATICALLY. ALARM BELL WILL RING 1
MINUTE BEFORE AUTOMATIC TESTING." Alarm bell shall ring for one minute then automatically reset. Provide signs for all doors to generator room. In Projects with multiple ATS's provide only one plant exerciser in the main ATS.

10. The ATS shall be equipped with a safe manual operator, permanently attached to the motor operator, designed to prevent injury to operating personnel. The manual operator shall provide the same contact-to-contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly.

11. The ATS control section shall be supplied with a protective cover and be mounted at a location within the transfer switch enclosure suitable for ease of maintenance. Sensing and control logic shall be solid-state type. Printed circuit boards shall be keyed to prevent incorrect installation. Interfacing relays shall be industrial control grade plug-in type with dust covers.

12. All switch and relay contacts, coils, springs and control elements shall be removable from the front of the ATS without removal of the switch from the enclosure and without disconnection of drive linkages or power conductors.

13. All control relays shall be continuous duty; industrial type with wiping contacts rated at least 10 amperes.

14. Provide long barrel, 2-hole, high-compression circumference crimp type lugs for the feeder conductors, and size as specified on the Drawings. Bussing shall be designed to accommodate the number of crimp type lugs as required by the feeder size indicated in the Drawings.

15. All control wires shall be 600 volt, rated.

D. Communications Networks - A full duplex RS485 interface shall be installed in the ATS control panel to enable serial communications with remotely located annunciator and/or network supervisors.

PART 3 - EXECUTION

3.1 WORKMANSHIP AND CONTRACTOR'S QUALIFICATIONS:

A. Only quality workmanship will be accepted. Haphazard or poor installation practice will cause for rejection of work.

B. Provide foreman in charge of this work at all times.

3.2 COORDINATION:
A. Coordinate work with other trades to avoid conflict and to provide correct rough in and connection for equipment furnished under trades that require electrical connections. Inform Contractors of other trades of the required access to and clearances around electrical equipment to maintain serviceability and code compliance.

B. Verify equipment dimensions and requirements with provisions specified under this section. Check actual job conditions before fabricating work. Report necessary changes in time to prevent needless work.

3.3 MANUFACTURER’S INSTRUCTIONS:

A. Where the specifications call for an installation to be made in accordance with Manufacturer's recommendations, a copy of such recommendations shall at all times be kept in the job superintendent's office and shall be available to the Owner's Representative.

B. Follow manufacturer's instructions where they cover points not specifically indicated on drawings and specifications obtain clarification from the Architect before starting work.

C. Transfer switches shall be anchored and braced to withstand seismic forces as calculated per Section 16050: Basic Electrical Requirements.

D. Tighten electrical connectors and terminals; including screws and bolts, in accordance with equipment Manufacturers published torque-tightening values for equipment connectors. Where Manufacturers torque requirements are not indicated, tighten connectors and terminals to comply with tightening torque specified in NETA Standard Tables.

E. Mark torque bolt heads using red or pink paint.

F. "Train" interior wiring; bundle and clamp, using specified plastic wire wraps specified under Section 16123: Building Wire and Cable.

G. Replace any panel pieces, doors or trims having dents, bends, warps or poor fit that may impede ready access, security or integrity.

H. Conduits terminating in concentric, eccentric or oversized knockouts at transfer switch shall have ground bushings and bonding jumpers installed interconnecting all such conduits and the switch enclosure.

I. In damp and wet locations mount transfer switch with a minimum 1” of air space between enclosure and the wall or other supporting material.

CUTTING AND PATCHING:
J. All cutting and patching required for work of this Division is included under other Divisions of this Specification. Coordination with General Contractor and other trades is imperative.

3.4 FIELD TEST AND OPERATIONAL CHECK:

A. Manufacturer's field service: Contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting and adjustment of the transfer switch.

B. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:

1. Assure transfer switch installation conforms to specified requirements and operates within specified tolerances.
2. Field test and inspect to insure operation in accordance with Manufacturer's recommendations and Specifications.
3. Prepare final test report including results, observations, failures, adjustments and remedies.
4. Apply label on transfer switch upon satisfactory completion of tests and results.
5. Verify ratings and settings and make final adjustments.

C. Engineer witnessed testing: Allow a period of two hours per transfer switch for Engineer review and final check. This review shall be done when the transfer switch is de-energized, therefore plan accordingly. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

D. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.

a) Interlocks and limit switch function.
b) Time delay and retransfer upon normal power restoration.
c) Engine cool-down and shutdown feature.
d) Remote monitoring and indications.
E. Functional performance testing: Upon completion of the work, at a time to be designated by the Owner, the Contractor shall demonstrate for the Owner the operation of the ATS, including any and all special items installed by him or installed under his supervision.

F. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

G. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.

H. Failure to Meet Test:

1. Any system material or workmanship which is found defective on the basis of acceptance tests shall be reported directly to the Owner.

2. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.

3. Contractor shall replace the defective material or equipment and have test repeated until test proves satisfactory without additional cost to the Owner.

3.5 CLEANING

A. Prior to energizing of transfer switch the Contractor shall thoroughly clean the interior of enclosure of all construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.

B. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of transfer switch per Manufacturer's approved methods and materials. Remove paint splatters and other spots, dirt and debris.

C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

3.6 TRAINING

A. Factory authorized service representative shall conduct a 4 hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance and testing of equipment with both classroom training and hands-on instruction.
B. Contractor shall schedule training with a minimum of 7 days advance notice.

END OF SECTION