PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general conditions, Division 26, and Basic Electrical Materials and Methods (Section 260500) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.

B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 SUMMARY

A. Section includes transfer switches rated 600 V and less, including the following:
   1. Automatic transfer switches.
   2. Remote annunciation and control systems.

1.3 SCOPE

A. Furnish labor and related materials, appliances, tools and equipment necessary for and incident to performing all operations in connection with furnishing, delivery, installation, training and start-up of Automatic Transfer Switches.

B. The materials herein shall be of new and domestic manufacturer. The transfer switch shall be designed, tested, assembled, and furnished in accordance with the applicable standards.

C. The transfer switch shall be an integrated assembly of a single manufacturer. Major components shall bear the label of a single manufacturer and shall be assembled in that manufacturer's plant(s) unless specifically approved otherwise.

D. The contractor shall be responsible for verifying physical space constraints, clearances, and layouts prior to shipment.

E. The transfer switch shall be furnished by the engine generator set supplier.

F. The Contractor shall engage the services of a supplier capable of providing equipment as specified, maintaining parts inventory, performing initial start-up, warranty, and 24 hour emergency service.

G. Refer to Construction Documents and specifications herein for arrangement of components.

1.4 QUALITY ASSURANCE AND STANDARDS

A. All work, material or equipment shall comply with the codes, ordinances and regulations of the State of California, including the regulations of serving utilities and any participating government agencies having jurisdiction.

B. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.

C. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

D. Contractor shall ensure that the manufacturer has a minimum of ten (10) years experience in the production of Automatic Transfer Switches. Manufacturer shall have ability to readily provide replacement parts and qualified field service technicians to protect continuity of service

1.5 SUBMITTALS

A. Submit shop drawings per Section 260500 for review including the following:
1. Transfer switch drawings with single line diagram, elevation, floor plan, overall dimensions, weights, layout of components and devices, enclosure type, short circuit withstand ratings, seismic calculations, nameplate schedule, anchor points, front panel layout, conduit area and entry points, interconnecting wiring diagrams, rated voltage, rated current, and conductor sizes.
2. Layout of transfer switch in room, area, or yard including horizontal and vertical clearances.
3. Wiring diagrams for interconnection between engine generator, transfer switches and auxiliary devices.
4. Available fault current withstand ratings.
5. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   a. Features and operating sequences, both automatic and manual.
   b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.
6. Installation instructions.
7. Technical cut-sheets for transfer switch, instrumentation, heaters and other components.
8. Factory test results.
9. Certified prototype test reports.
10. An annotated copy of the specifications indicating at each paragraph whether or not the proposed equipment complies with the specifications. Any deviations shall be clearly explained.
11. Qualifications of factory authorized 24-hour emergency response technician including location and quantity of technicians. Service center shall be capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.
12. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems." Include the following:
    a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

1) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

13. Warranty.

1.6 FACTORY TESTING

A. Factory testing shall be provided for all transfer switches.

B. Factory test results shall be provided to the Engineer and Owner's Representative for review.

C. All factory tests shall be made in strict accordance with ANSI, NEMA, and NETA standards and shall be certified in writing.

D. All factory tests shall be available to be witnessed by the Owner's Representative, Consulting Engineer and Contractor at the factory upon advance request. Transportation, lodging, and food shall be provided by the Contractor or Manufacturer. The schedule for witness testing shall be negotiated with the Owner's Representative.

E. Provide certified prototype test data on a transfer switch of the same design and rating to confirm the following switching capabilities:
1. Overload and endurance capacity testing per UL-1008.
2. Temperature rise testing at 100% rated current after the overload and endurance tests.
3. Withstand current tests per UL-1008, at 480 volts and X/R ratio of 6:1. No welding of contacts shall occur and transfer switch shall be operable to alternate source after the withstand current tests.
4. Dielectric voltage withstand tests at 1960 volts RMS minimum after withstand test.
5. Withstand and closing test.
6. Voltage surge withstand capability per IEEE-587-1980.

F. Provide factory production test data on each transfer switch as follows:
1. The complete transfer switch shall be 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 specification requirements.
2. The complete transfer switch shall be subjected to a dielectric strength test per NEMA Standard ICS 1.109.05.

1.7 WARRANTY

A. Contractor shall guarantee equipment and installation free from defects in materials and workmanship for a period of five (5) years from the date of start-up.

1. Source Limitations: Obtain automatic transfer switches and remote annunciator and control panels through one source from a single manufacturer.

1.8 MANUFACTURERS

A. Manufacturer of the Automatic Transfer Switch shall be Russelectric, Zenith or equal.

PART 2 - PRODUCTS

2.1 GENERAL

A. The transfer switch shall be fully compatible with the emergency power system components including generators and generator control equipment.

B. The transfer switch and installation shall include the necessary features and accessories for a complete operational system as shown on the drawings and specified herein.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA ICS 1.

E. Comply with CEC.

F. The transfer switch shall conform to the requirements of UL-1008.

G. The complete switch assembly shall be listed under UL-1008 for use on emergency and legally required standby systems in accordance with CEC and NFPA 99 requirements.

H. Transfer switches utilizing circuit breakers or molded-case switches are not acceptable.

I. The transfer switch shall be rated for a minimum close and withstand rating (3 cycle) of 85,000A RMS symmetrical unless specifically stated otherwise in the construction documents. Rating shall be obtained without contact welding. The rating shall be verified by U.L.

J. Transfer switch shall be rated to carry 100% of the rated current continuously in the enclosure in an ambient temperature of 122 degrees F.

K. The withstand and close rating of the fourth pole shall exactly match that of the main poles.

2.2 RATINGS

A. The transfer switch shall be automatic type.

~~A.~~B. The transfer switch shall be rated as follows:
1. Continuous duty with switched neutral (ampacity and poles shall be project specific)
2. 480Y/277V 3PH 4W 60Hz (shall be project specific)
3. Withstand and close rating of 85,000A RMS symmetrical
4. Suitable for indoor use (NEMA 1)
5. Equipment shall be floor-mounted type.
6. Dual-motor operator for time-delay-in-neutral operation or approved equivalent operation

2.3 ACCESSORIES

A. The following accessories shall be factory installed in the transfer switch:
1. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
2. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
   a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
   b. Push-button programming control with digital display of settings.
   c. Integral battery operation of time switch when normal control power is not available.
3. Adjustable close differential solid state 3-phase sensing relay energized from the normal source, factory set to pick up at 90% and drop out at 80% of rated voltage.
4. Adjustable 3-phase overvoltage, undervoltage, overfrequency, and underfrequency sensing of normal and emergency sources.
5. Adjustable relay to prevent transfer to emergency until voltage and frequency of generating plant have reached acceptable limits. Factory set at 90% of rated value.
6. 3-phase sequence detection to verify proper installation of normal and emergency phase conductors.
7. Time delay on transfer to emergency. Solid state type, adjustable 1-300 seconds.
8. Push button to bypass time delay on retransfer to normal.
9. Load shed relay energized by DC signal or remote contact closure to disconnect the load from the emergency source when an overloaded condition occurs.
10. Block transfer relay energized by DC signal or remote contact closure to allow transfer to emergency with 2-position key operated switch to bypass block transfer to emergency.
11. External manual operator.
12. Digital ammeter to read current in all three-phases of load circuit.
13. Digital voltmeter to read phase-to-phase and phase-to-neutral voltage of emergency source.

2.4 CONSTRUCTION

A. Transfer switches shall be double throw, actuated by two electrical operators, momentarily energized and connected to the transfer mechanism by a simple overcenter linkage, with a minimum transfer time of 400 milliseconds.

B. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in position in both the normal and emergency positions without the use of hooks, latches, magnets or springs and shall be silver-tungsten alloy. Separate arcing contacts, with magnetic blowouts, shall be provided on all transfer switches. Interlocked molded case circuit breakers or contactors are not acceptable.

C. The transfer switch shall be equipped with a permanently attached, safe manual operator arranged so that the transfer switch can be operated manually under load without opening the enclosure door. The external manual operator shall provide the same contact-to-contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts too slowly.

D. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

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.

F. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.

G. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 260553 "Identification for Electrical Systems."
   1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
   2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
   3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

H. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

I. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

J. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics:
   1. Fully automatic make-before-break operation.
   2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.

3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
   a. Initiation occurs without active control of generator.
   b. Controls ensure that closed-transition load transfer closure occurs only when the 2 sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.
4. Failure of power source serving load initiates automatic break-before-make transfer.

K. Automatic Transfer-Switch Features:
1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value.
2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
   a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
   b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
8. Unassigned Auxiliary Contacts: Two normally closed, single-pole, double-throw contacts for each switch position, rated 15 A at 120-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

2.5 REMOTE ANNUNCIATOR AND CONTROL SYSTEM

A. Functional Description: Include the following functions for indicated transfer switches:
1. Indication of sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Indication of switch position.
3. Indication of switch in test mode.

4. Indication of failure of digital communication link.
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.

B. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation.

C. Remote Annunciation and Control Panel: Solid-state components. Include the following features:
1. Controls and indicating lights grouped together for each transfer switch.
2. Label each indicating light control group. Indicate transfer switch it controls, location of switch, and load it serves.
3. Digital Communication Capability: Matched to that of transfer switches supervised.
4. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.

2.6 SEQUENCE OF OPERATION

A. The transfer switch shall transfer to emergency when 90% of rated voltage and frequency has been reached. Should the voltage of the normal source drop below 80% on any phase after an adjustable time delay of 0.5-6 seconds (factory set at 3 seconds to allow for momentary dips), the transfer switch will switch to emergency. After restoration of normal power on all phases to 90% of rated voltage, an adjustable time delay period of zero to 25 minutes (factory set at 5 minutes) shall delay retransfer to allow stabilization of normal power. If the emergency power source should fail during this time delay period, the switch shall automatically return to the normal source. A test switch shall be included to simulate normal power failure, and pilot lights shall be mounted on the cabinet door to indicate the switch position. Two auxiliary contacts rated 15 amp, 120 volts shall be mounted on the main shaft, two closed on normal, two closed on emergency. Both contacts shall be wired to a terminal strip for ease of customer connections. In addition, one set of relay contacts shall be provided to open upon loss of the normal power supply. All relays, timers, control wiring and accessories shall be front accessible. All control wires shall be 600 volt, SIS switchboard type. All control wire terminations shall be identified by permanent -type markers.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

3.2 FIELD QUALITY CONTROL

A. Inspect installation for physical damage, proper alignment, anchorage, grounding, and completeness.

B. Check continuity of all circuits.

C. Check polarity and phasing of bussing.

D. Inspect bus bar spacing, insulators, wiring and devices for compliance with ANSI, CEC, and UL standards.

E. Check tightness of all bolted connections.

F. Check nameplates and identification.

G. The Contractor shall protect all equipment during shipping, delivery, storage, installation, and at all times during construction. Transfer switches or their components shall not be exposed to weather, moisture, dust, dirt, debris or damage during construction.

3.3 INSTALLATION

A. Install transfer switch in accordance with manufacturer's written instructions, NFPA and NEMA standards, and CEC requirements.

B. Provide clean, level surface for installation with suitable structural strength. Verify compliance with Seismic Design Category D requirements.

C. Floor-Mounting Switch: Anchor to floor by bolting.
   1. Concrete Bases: 4 inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Section 260529 "Supports and Hangers for Electrical Systems."

D. Permanently install all nameplates and circuit identification.

E. Install device handles to a height no greater than allowed by CEC or governing authority.

F. Transfer switch shall be plumb and square to building structure. Provide CEC and CBC required clearance on all sides.

G. Coordinate installation and schedule with all other trades and Owner's Representative.

H. The Contractor shall coordinate all components including their arrangement electrically and mechanically.

I. The Contractor shall coordinate conduit entrances including method of entrance and connections.

J. The Contractor shall coordinate with all other trades necessary to provide a complete, proper installation. Grades, piping, structure, ducting, etc. shall be carefully reviewed by the Contractor prior to installation.

K. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

L. Identify components according to Section 260553 "Identification for Electrical Systems."

M. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.4 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:
1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
   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.
4. 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. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
   f. 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.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
   a. Verify grounding connections and locations and ratings of sensors.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

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

F. Prepare test and inspection reports.

3.6 INSTRUCTION MANUAL

A. The manufacturer shall submit within one week prior to shipment of the transfer switch, operation and maintenance manuals suitable for the specific items to be supplied, including such information as:
   1. Interconnection diagrams.
   2. Drawings.
   3. Instruction describing procedures for items which are to be shipped disassembled but which are to be assembled when delivered on-site.
   4. Special rigging instructions.
   5. Accessories.
   6. Enclosure assembly and disassembly.
   7. Other information designed to assist in proper operation and periodic maintenance of the equipment being supplied.
   8. Table of contents and tab separators.
   9. "As manufactured" drawings and wiring diagrams.

3.7 START-UP AND TRAINING

A. Equipment inspection, start-up, testing and training shall be supervised and documented by the supplier.

B. Check all circuits for continuity and safety prior to energization. Notify Owner's Representative prior to energization such that adequate preparation is made for power.

C. Provide Owner's Representative with instruction and operating manuals.

D. Train Owner's Representative (or appropriate staff) for a period no less than two (2) hours in regard to start-up, operation, and maintenance of the transfer switch and its components. All instructional training shall be professionally recorded by the Contractor and a DVD of the recording shall be provided to the Owner.

E. Refer to Section 263213 Engine Generator start-up and training specification requirements for further transfer switch requirements.

3.8 CLEANING AND REPAIR

A. Clean transfer switch interior and exterior of grease, dirt, debris, dust, excess paint, plaster, spackle, unused wire, etc.

B. Repair and paint enclosure as necessary to return the enclosure to the original factory condition.

C. Damage to electrical components shall be repaired in the factory.

END OF SECTION