SECTION 16250

Automatic Transfer Switch

PART 1 - GENERAL

1.1 SUMMARY

A. It is the intent of this specification to secure a transfer switch that has been prototype tested, factory built, production tested, and site tested, together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein.

1.2 GENERAL REQUIREMENTS

A. A transfer switch with number of poles, voltage and current ratings as shown on the plans and specified herein shall be provided.

B. Each Automatic Transfer Switch shall consist of a power transfer switch unit and a control module interconnected to provide complete automatic operation. All equipment shall be new and of current production by an international firm which manufactures the generator, controls, and transfer switch.

C. The company selected will assemble the standby generator set and transfer switch as a matched unit so that there is one-source responsibility for warranty, parts and service through a local representative with factory-trained personnel.

1.3 SUBMITTALS

A. The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number, each required interconnection between the generator set and the transfer switch if it is included elsewhere in these specifications.

1.4 TESTING

A. To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

B. Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models, which will not be sold, shall have been used for the following tests.

C. Final Production Tests: Each transfer switch shall be tested under load with all guards in place. Tests shall include:

1. The complete Automatic 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 the specification requirements.
2. The complete Automatic Transfer Switch shall be subjected to a dielectric strength test per NEMA Standard ICS 1-109.05.
3. The control panel shall meet or exceed the voltage surge withstand capability in accordance with ANSI C37.90a-2978 and the impulse withstand voltage test in accordance with NEMA Standard ICS 1-109.
4. Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.

D. Site Tests: The manufacturer's local representative shall perform an installation check, start-up, and load test. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test.

1.5 QUALITY ASSURANCE

A. The Automatic Transfer Switch shall conform to the requirements of:

1. UL 1008--Standard for Automatic Transfer Switches
2. NFPA 70--National Electrical Code, including use in emergency and standby systems in accordance with Articles 517, 700
3. NFPA 99--Essential Electrical Systems for Health Care Facilities
4. NFPA 110--Standard for Emergency and Standby Power Systems
5. IEEE Standard 446--Recommended Practice for Emergency and Standby Power Systems (Orange Book)
6. IEEE Standard 241--Recommended Practice for Electric Power Systems in Commercial Buildings (Gray Book)
7. NEMA Standard IC10 (formerly ICS 2-447) Automatic Transfer Switches.
8. UL 508 – Standard for industrial Control Equipment
9. EN61000-4-5 Surge Immunity Class 4 (voltage sensing and programmable inputs only)
10. EN61000-4-4 Fast Transient Immunity Severity Level 4
11. IEC Specifications for EMI/EMC Immunity as follows:
    a. CISPR 1 Radiated Emissions
    b. IEC 1000-4-2, Electrostatic Discharge
    c. IEC 1000-4-3, Radiated Electromagnetic Fields
    d. IEC 1000-4-4, Electrical Fast Transient (Bursts)
    e. IEC 1000-4-5, Surge Voltage
    f. IEC 1000-4-6, Conducted RF Disturbances
    g. IEC 1000-4-8, Magnetic Fields
12. IEC 1000-4-11, Voltage Variations and Interruptions

1.6 WARRANTY AND MAINTENANCE

A. A two year warranty for the Automatic Transfer Switch shall be included to guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from date of start-up. Optional warranties shall be available upon request.

B. The Automatic Transfer Switch manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions, adjustment to the generator, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and proper functioning of all systems.

1.7 STORAGE AND HANDLING

A. Protect equipment during handling and storage prior to installation.

B. Electrical equipment shall be protected from the elements prior to installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The Automatic Transfer Switch shall be a Kohler model KCS-DMTB-0260S or pre-approved equal. Transfer Switch shall meet the following requirements:
1. 260 amp current rating
2. 3 Pole
3. 4 wire, 3 phase
4. 480 Volt-60Hz
5. Solid Neutral
6. The withstand and closing ratings with a current-limiting fuse shall be 200,000 Amps
7. The withstand and closing ratings with any overcurrent protective device shall be 50,000 Amps

B. The Automatic Transfer Switch shall be furnished in a NEMA 3R enclosure.

C. The switch shall be a 600 volt class.

D. Motor starting performance and voltage dip determinations shall be based on the complete generator set. The generator set shall meet the following requirements:
   1. Capable of supplying 460 LRKVA for starting motor loads, with a maximum instantaneous voltage dip of 35%.
   2. The maximum voltage dip shall be as measured by a digital RMS transient recorder in accordance with IEEE standard 115.
      a. Motor starting performance and voltage dip determination that does not account for all components effecting total voltage dip (i.e. engine, alternator, voltage regulator and governor) will not be acceptable. As such, the generator set shall be prototype tested to optimize and determine performance as a generator set system.

E. Vibration isolators shall be provided between the engine-alternator and heavy-duty steel base.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

A. Automatic transfer switches not intended for continuous duty or repetitive load transfer switching are not acceptable.

B. The Automatic Transfer Switch shall be rated in amperes for total system transfer including control of motors, electric-discharge lamps, electric heating, and tungsten-filament lamp load. Switches shall be suitable for 100% tungsten-filament lamp load.

C. All main contacts shall be of silver composition.

D. The contact transfer time shall not exceed one-sixth of a second.

E. All moveable parts of the operating mechanism shall remain in positive mechanical contact with the main contacts during the transfer operation without the use of separate mechanical interlocks.

F. All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.

G. The neutral conductor shall be solidly connected as shown on the plans, a neutral conductor terminal plate with fully rated AL-CU pressure connectors shall be provided.

H. Automatic Transfer switch shall be capable of using generator batteries for backup power. Utilize Kohler External Battery Kit GM26139-KP1, or equal. Kit must be compatible with Automatic Transfer Switch provided.

2.3 TRANSFER SWITCH CONTROL SYSTEM

A. The control module shall direct the operation of the transfer switch. The module's sensing and logic shall be a built-in microprocessor-based system for maximum reliability, minimum maintenance, and inherent digital communications capability. The control settings shall be stored in nonvolatile EEPROM. The module shall contain an integral battery-backed programmable clock and calendar. The control module shall have a keyed disconnect plug to enable the control module to be disconnected from the transfer mechanism for routine maintenance.

B. The control module shall be mounted separately from the transfer mechanism unit for safety and ease of maintenance. Interfacing relays shall be industrial control grade plug-in type with dust cover.

C. The control module shall include a user interface keypad with tactile feedback pushbuttons and light-emitting diode (LED) status indication. These features shall be user accessible when the enclosure door is closed:
   1. Keypad pushbuttons:
      a. Start/end system test
      b. Set/end exercise
      c. End time delay
      d. Lamp test/service reset
   2. Light-emitting diode status indicators:
      a. Contactor Position: Normal, Off, Emergency
      b. Source Available: Normal, Emergency
      c. Service required: immediate, maintenance
      d. Not in automatic mode
      e. Four stage time delay remaining

f. Exercise: load, no load, set/disabled
g. Test: load, no load
h. Load control active: peak shave, load shed, pre/post-transfer signal
i. In-phase monitor/Off delay active

D. Outputs:
1. Generator engine start gold flashed contact rated 2 amps @ 30 VDC/250VAC.
2. Pre-transfer load control, one normally open contact rated 10 amps @ 30 VDC/250 VAC
3. One Programmable output, factory-set to load bank control rated 2 amps @ 30 VDC/250 VAC.

2.4 MONITORING, PROGRAMMING AND COMMUNICATIONS

A. Modbus® link: Industry standard Modbus® RTU communication shall be available with network and setup connections or preapproved equal.
1. A Modbus® master will be able to monitor controller data.
2. A Modbus® master will be able to alter parameters.
3. The Modbus® master must be capable of starting and stopping the generator.
4. The manufacturer shall provide a Modbus® communications protocol manual to facilitate communications with a Modbus® master by a third party developer.
5. The Modbus® network shall communicate to the controller using a twisted pair of wire.

B. Personal Computer Set-up/monitoring Software
1. The controller must have the capability to communicate to a personal computer (IBM or compatible) running Windows 9X or Windows NT through an RS-232 communication format (in addition to the Modbus® connection).
2. The software shall be Windows® based
3. The programming capability shall be password protected

C. It shall be possible to start the generator and transfer the loads to the generator.

D. Event monitoring shall be accessible using either a personal computer with the personal computer software or Modbus® link to view the following:
1. Historical data (total and resettable)
a. Days in operation
b. Hours in standby
c. Hours not in preferred
d. Switch transfers
e. Failure to transfer
f. Transfers due to loss of preferred
g. Start up date
h. Last maintenance date
i. Switch transfer count since last maintenance
2. Transfer switch information
a. Automatic Transfer Switch serial number
b. Controller serial number
c. Contactor serial number
d. Load description
e. Location
f. Branch
g. Network connection ID
h. Baud rate
i. Parity bit
3. System events (time and date stamped) of the last 100 events which include all failures of the sources, transfer switch and all functions of the controller and contactor:
4. Line to line voltage
5. System frequency
6. Time delay active
7. Time delay remaining

8. System status
9. Source available
10. Contactor position
11. Exerciser schedule, mode and time remaining on active exercise.

E. Programmable features may be viewed, selected or adjusted as follows:
1. System voltage
2. System frequency
3. Single/three-phase operationOpen/closed-transition operation
4. ABC or CBA phase rotation
5. In-phase monitor
6. Commit/no commit transfer mode
7. User defined password

F. Programmable inputs shall be defined using either a personal computer with the personal computer software or Modbus® link:
1. End time delay input
2. Inhibit transfer
3. Low external battery fault
4. Peak shave/area protection input
5. Remote common fault
6. Remote test

G. Programmable outputs shall be defined using either a personal computer with the personal computer software or Modbus® link:
1. Auxiliary switch fault
2. Common fault
3. Contactor position
4. Exercise active
5. Failure to acquire standby source
6. Failure to transfer fault
7. Generator engine start
8. Load bank control
9. Loss of phase fault
10. Low backup battery
11. Not in automatic mode
12. Non-emergency transfer
13. Over and undervoltage faults
14. Over and under frequency faults
15. Peak shave/area protection active
16. Phase rotation error
17. Modbus®-controlled relay outputs
18. Source available
19. Test active

PART 3 - EXECUTION

3.1 INSPECTION

A. Automatic Transfer Switch and all equipment shall be carefully examined for defects immediately before unloading.

B. All defective equipment shall be rejected and removed from the site.

3.2 DELIVERY

A. The equipment shall be delivered, F.O.B. to Cedar Rapids Hoosier Lift Station.

B. Delivery of the equipment shall be coordinated by the Contractor.

3.3 INSTALLATION OF EQUIPMENT

A. The equipment shall be installed as outlined in Section 01060.

B. All phases of normal and all phases of emergency shall be monitored for over and under voltage and single phase of normal and emergency for over- and under-frequency. In addition, the controller shall use anti-single phasing protection that detects regenerative voltage (using the phase angle of the source) to determine a failed source condition. Required sensing criteria along with desired settings follow:

1. Voltage and frequency sensing:
   a. Undervoltage pick-up set at 95% of nominal voltage, adjustable 85% - 100% of nominal voltage.
   b. Undervoltage dropout set at 96% of pickup voltage, adjustable 75% - 98% of pickup voltage.
   c. Overvoltage dropout set at 105% of nominal voltage, adjustable 105% - 135% of nominal voltage.
   d. Overvoltage pick-up set at 98% of dropout voltage, adjustable 95% - 100% of dropout voltage.
   e. Voltage dropout time set at 9.9 seconds adjustable 0.1 – 9.9 seconds.
   f. Voltage accuracy: 2%.
   g. Under frequency pick-up set at 95% of nominal frequency, adjustable 85% - 95% of nominal frequency.
   h. Under frequency dropout set at 99% of pick-up frequency, adjustable 95% - 99% of pick-up frequency.
   i. Over frequency dropout set at 101% of pick-up frequency, adjustable 101% - 105% of pick-up frequency.
   j. Over frequency pick-up set at 105% of nominal frequency, adjustable 105% - 120% of nominal frequency.
   k. Frequency accuracy: 1%
2. Time Delays:
   a. Time delay for engine start to delay initiation of transfer for momentary source outages: Range 0-6 seconds. Factory set at 6 seconds.
   b. Time delay for transfer to standby: Range 0-60 minutes. Factory set at 5 minutes.
   c. Time delay for transfer back to normal: Range 0-60 minutes. Factory set at 10 minutes.
   d. Time delay for engine cool down: Range 0-60 minutes. Factory set at 3 minutes.
   e. Failure to acquire standby source: Range 0-60 minutes. Factory set at 1 minute.
   f. Pre-transfer to normal signal: Range 0-60 minutes. Factory set at 3 second.
   g. Pre-transfer to standby signal: Range 0-60 minutes. Factory set at 3 second.
   h. Post-transfer to normal signal: Range 0-60 minutes. Factory set at 0 minute.
   i. Post-transfer to standby signal: Range 0-60 minutes. Factory set at 0 minute.
3. User terminals shall be available to connect a normally open contact that, when closed, signals the control module to start and transfer load to the engine-generator. Opening these contacts shall initiate a retransfer and engine cool down sequence. The load shall be transferred to an available utility source immediately if the generator source should fail.
4. The following features shall be built into the control module logic. These features shall be enabled at the factory or in the field.
   a. Phase rotation sensing programmable ABC or CBA.
   b. In-phase monitoring shall continuously monitor the contactor transfer times, source voltage, frequency and phase angle to provide a self-adjusting, zero crossing contactor transfer signal. A flashing LED on the user interface panel shall indicate active in-phase monitoring.
   c. Plant Exerciser: Programmable seven-day or fourteen-day exerciser with user selectable load or no-load operation. An LED, on the user interface, shall indicate the type of exercise (load or no load). The time remaining on the exercise shall be indicated. The exercise time may be reset at any time with a single keystroke. The engine shall be allowed to run when the exercise period is terminated. The exerciser may be disabled for maintenance purposes. An amber LED shall flash on the user interface if the exerciser has been disabled.
      The exerciser shall have the capability of being programmed, using up to twenty-one (21) event for a calendar mode.

C. No work necessary regarding Modbus® link.

END OF SECTION