PART 1: GENERAL

1.1 Scope of work:

Furnish and Automatic Transfer Switch System(s) with 4 Pole – Switched Neutral, XXX Amps, 480 Volt, 60Hz, to match the project's generator set electrical ratings as described in the specifications and/or as shown in the plans. Each Automatic Transfer Switch shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be of the same manufacturer.

1.2 CODES AND STANDARDS

The automatic transfer switches and controls shall conform to the requirements of:

A. UL 1008 – Standard for Transfer Switch Equipment

B. IEC 947-6-1 – Low voltage switchgear and control gear; Multifunction equipment; Automatic Transfer Switching equipment

C. NFPA 70 – National Electrical Code

D. NFPA 99 – Essential Electrical Systems for Health Care Facilities

E. NFPA 110 – Emergency and Standby Power Systems

F. IEEE Standard 446 – IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

G. NEMA Standard ICS10-1993 (formerly ICS2-447) – AC Automatic Transfer Switches

H. UL 508 – Industrial Control Equipment

I. CSA C22.2 No. 178 Certification

PART 2: PRODUCTS

2.1 Acceptable Manufacturers

A. Automatic Transfer Switches shall be Kohler, Caterpillar, Cummins or approved equivalent

2.2 Mechanically Held Transfer Switch

A. The transfer switch shall be electrically operated and mechanically held with double throw construction and operated by a momentarily energized solenoid driven mechanism. Main operators shall include overcurrent disconnect devices linear motors or gears shall not be acceptable.

B. All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.

C. The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.

D. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on-construction for high withstand and close-on capability and be protected by separate arcing contacts.

E. Inspection of all contact shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 600 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.

F. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between 2 active power sources, are not acceptable.

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

2.3 Enclosure

A. The Automatic Transfer Switch shall be furnished in a NEMA 1 (A) enclosure for indoor applications. For outdoor applications, it shall be NEMA 3R or 4x enclosure.

B. All standard door mounted switches and long life super bright type indicating LEO's described in Section 3 shall be integrated into a flush-mounted, interface membrane or equivalent in the enclosure door for easy viewing and replacement. The panel shall be capable of having manual locking feature to allow the user to lockout all membrane mounted control switches to prevent unauthorized tampering. This cover shall be mounted with hinges and have a latch that may be padlocked. The membrane panel shall be suitable for mounting by others when furnished on open type units.

2.4 Controller Display and Keypad

A. A 4-lines, 20 character LCD display and dynamic 4-button keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the communications interface port. The following parameters shall only be adjustable via a password protected programming on the controller (dip switches shall not be acceptable):

1. Nominal line voltage and frequency
2. Single or 3-phase sensing
3. Operating parameter protection
4. Transfer operating mode configuration (Open transition, Closed transition, or Delayed transition)

All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations or instruction manuals.

2.5 Voltage, Frequency and Phase Rotation Sensing

A. Voltage (all phases) and frequency on both the normal and emergency sources shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

Parameter	Dropout/Trip	Pickup/Reset
Under Voltage	75 to 98%	85 to 100%
Over Voltage	105 to 135%	95 to 100% of trip
Under Frequency	85 to 99%	95 to 99%
Over Frequency	105 to 120%	101 to 105%
Voltage Unbalanced	5 to 20%	3 to 18%

B. Repetitive accuracy of all settings shall be within ± 0.5 % over an operating temperature range of 20°C to 70°C.

C. An adjustable dropout time for transient voltage and frequency excursions shall be provided. The time delays shall be 0.1 to 9.9 seconds for voltage and .1 to 15 seconds for frequency.

D. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via the communications interface port.

E. The controller shall be capable of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or BAG). Unacceptable phase rotation shall be indicated on the LCD; the service required LED and the annunciation trough communication protocol and dry contacts. In addition, the phase rotation sensing shall be capable of being defeated, if required.

F. The controller shall be capable of detecting a single phasing condition of a source, even though a voltage may be regenerated by the load. This condition shall be considered a failed source.

G. Source status screens shall be provided for both normal and emergency to provide digital readout of voltage on all 3-phases (phase to phase and phase to neutral), frequency, and phase rotation.

2.6 Time Delays

A. An adjustable time delay of 0 to 10 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 12 or 24 VDC power supply.

B. A time delay shall be provided on transfer to the emergency source, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.

C. A time delay shall be provided on re-transfer to normal. The time delays shall be adjustable for 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.

D. A time delay shall be proved on shut down of engine generator for cool down, adjustable form 0 to 60 minutes.

E. A time delay activated output signal shall also be provided to drive external relay(s) for selective load disconnect control. The controller shall be capable of controlling a maximum of 9 individual output time delays to step loads on after a transfer occurs. Each output may be individually programmed for their own time delay of up to 60 minutes. Each sequence shall be independently programmed for transferring from normal to emergency and transferring form emergency to normal. The controller shall also include the following built-in time delays for the following operations:

1. 0 to 60 minute time delay on failure to acquire the acceptable electrical parameters from the emergency source.

2. 0 to 60 minute time delay for a failure to synchronize on an in-phase operation.

3. 60 minute time delay for the load disconnects position for delayed transition operation.

F. All time delays shall be adjustable in 1 second increments.

G. All time delays shall be adjustable by using the display and keypad or with a remote device connected to the communications interface port through a security password system.

H. Each time delay shall be identified and a dynamic countdown shall be shown on the display.

2.7 Additional Features

A. The controller shall have 3 levels of security. Level 1 shall allow monitoring of settings and parameters only. Level 1 shall be capable of restriction with the use of a lockable cover. Level 2 shall allow test functions to be performed and Level 3 shall allow setting of all parameters.

B. Membrane-type switches shall be provided for the test functions and be maintained until the end test function is activated. The test function shall be allowed through password security. It shall be possible to defeat the password requirement by way of a circuit board mounted dip switch setting. The test function shall be load-to-load or auto test. The auto test function shall request an elapsed time for test. At the completion of this time delay, the test shall be automatically ended and a retransfer sequence shall commence. All loaded tests shall be immediately ended and retransfer shall occur if the emergency source fails and the normal source is acceptable.

C. A SPOT contact, rated 5 amps at 30 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.

D. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of 2 contacts, closed when the ATS is connected to the normal source and 2 contacts closed, when the ATS is connected to the emergency source.

E. LED indicating lights shall be provided; 1 to indicate when the ATS is connected to the normal source (green) and 1 to indicate when the ATS is connected to the emergency source (red).

F. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal (green) and emergency sources (red), as determined by the voltage, frequency and phase rotation sensing trip and reset settings for each source.

G. A membrane switch shall be provided on the membrane panel to test all indicating lights and display when pressed.

H. Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

I. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which closes to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad or the communications interface port. A "not-in auto" LED shall indicate anytime the controller is inhibiting transfer from occurring.

J. An in-phase monitor shall be a standard feature in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The in-phase monitor shall be specifically designed for and be the product of the ATS manufacturer. The in-phase monitor shall be capable of being enabled or disabled for the user interface.

K. *Engine Exerciser*: The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to 21 different exercise routines based on a calendar mode. For each routine, the user shall be able to:

1. Enable or disable the routine
2. Enable or disable transfer of the load during routine
3. Set the start time, time of day, day of week, week of month (1^{st}, 2^{nd}, 3^{rd}, 4^{th}, alternate or every)
4. Set the duration of the run

5. At the end of specified loaded exercise duration, the switch shall transfer the load back to normal and run the generator for the specified cool down period. All loaded exercises shall be immediately ended and retransfer shall occur if the standby source fails. The next exercise period shall be displayed on the main screen with the type of exercise, time and date. The type of exercise and the time remaining shall be displayed when the exercise is active. It shall be possible to end the exercise event with a single button push.

L. *Date and time*: The date shall automatically adjust for leap year and the time shall have the capability of automatically adjusting for daylight saving and standard times.

M. *System Status*: The controller shall have a default display displaying the following on:

1. System status
2. Date, time and type of next exercise event
3. Average voltage of the preferred and standby sources

Scrolling through the displays shall indicate the following:

1. Line to line and line to neutral voltages for both sources
2. Frequency of each source
3. Load current for each phase
4. Single or 3-phase operation
5. Type of transition
6. Preferred source
7. Commit or no commit modes of operation
8. Source/source mode (Utility/Gen; Gen/Gen; Utility/Utility)
9. In phase monitor enable/disable
10. Phase rotation
11. Date and time.

N. Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual, are not permissible.

O. *Self-Diagnostics*: The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.

P. *Communications Interface*: The controller shall be capable of interfacing, through a standard communications, with a network of transfer switches and generators. It shall be able to be connected via an RS-485 serial communication (up to 4000' direct connect or multi-drop configuration), an Ethernet connectivity (over standard 1ObaseT Ethernet networks utilizing a RJ-45 port or remotely utilizing a dial-up modem). This module shall allow for seamless integration of existing or new communication transfer devices and generators. Monitoring software shall allow for the viewing, control and setup of parameters of the generator set and transfer switch network through a standard personal computer utilizing the latest Microsoft OS version supported by the University of Texas at Dallas at the time of the ATS installation. Separate and specific transfer switch software interfaces shall not be acceptable.

Q. The transfer switch shall also be able to interface to 3rd party applications using Modbus RTU and Modbus TCP/IP open standard protocols utilizing Modbus register maps. Proprietary protocols shall not be acceptable.

R. The controller shall contain a USB port for downloading the controller's parameters and settings; exercise event schedules; maintenance records and event history. The file designator shall be the unique serial number of the transfer switch

S. *Data Logging:* The controller shall have the ability to log data and to maintain the last 2000 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory. The controller shall be able to display up to the last 99 events. The remaining events shall be downloadable to be displayed on a computer.
   1. Event Logging: Data, date and time indication of any event.
   2. Statistical Data
      a. Total number of transfers.*
      b. Total number of fail to transfers.*
      c. Total number of transfers due to preferred source failure.*
      d. Total number of minutes of operation.*
      e. Total number of minutes in the standby source.*
      f. Total number of minutes not in the preferred source*
      g. Normal to emergency transfer time
      h. Emergency to normal transfer time
      i. System start date
      j. Last maintenance date

      * NOTE: The statistical data shall be held in two registers. One register shall contain data since start up and the second register shall contain data from the last maintenance reset.

T. *External DC Power Supply:* An optional provision shall be available to connect up to 2 external 12/24 VDC power supply to allow the LCD and the door mounted control indicators to remain functional when both power sources are dead for extended periods of time. This module shall contain reverse battery connection indication and circuit protection.

PART 3: EXECUTION

3.1 Tests and Certification

A. 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. 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.

B. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have 3rd party certification verifying quality assurance in design/development, production, and installation and servicing in accordance with ISO 9001.

3.2 Service Representation

A. The manufacturer shall maintain a national service organization of employing personnel located throughout the contiguous United States. The service center's personnel must be factory trained.

B. The manufacturer shall maintain records of each switch, by serial number.

3.3 Accessories

A. *Standard 1/0 Module:* The standard 1/0 Module has 2 programmable inputs and 6 programmable outputs.

Inputs Available: 2	
Contact Closure	Contact Closure
Current	5mA Max
Connection Type	Terminal Strip
Wire Size	#14-24 AWG
Max Distance	700’

Outputs Available: 6	
Contact Type	Form C (SPOT)
Contact Rating	2A @ 30 VDC
	500mA @ 125 VAC
Connection Type	Terminal Strip
Wire Size	#14-24 AWG

B. *Current Sensing:* Current sensing shall measure the load bus current on all phases with 1% accuracy. Load current shall be viewable on the controller LCD display.

C. *Line to Neutral Monitoring***:** Line-to-neutral voltage monitoring shall allow the display of the AN, BN, and CN RMS voltages in the normal operation menus.

END OF 26 40 00