

SECTION 263600

TRANSFER SWITCHES

1. Scope of Work
 - 1.1. This suggested specification is intended for typical automatic transfer switches consisting of the following main characteristics:
 1. Maximum voltage rating of 480 Volt-60Hz
 2. Maximum amperage rating of 400 Amp
 3. Open transition transfer logic
2. Automatic Transfer Switch
 - 2.1. This Specification covers the supply of a complete operational automatic transfer switch rated 400 Amp, 480 Volt-60Hz, Three phase, 4 Pole, switched neutral.
3. Codes and Standards - The automatic transfer switches and controls shall conform to the requirements of:
 - 3.1. UL 1008 - Standard for Transfer Switch for use in Emergency Systems
 - 3.2. IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment
 - 3.3. NFPA 70 - National Electrical Code
 - 3.5. NFPA 110 - Emergency and Standby Power Systems
 - 3.6. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 - 3.7. NEMA Standard ICS 10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches
 - 3.8. UL 508 Industrial Control Equipment
4. Acceptable Manufacturers
 - 4.1. Automatic transfer switches shall be Kohler model KSS-DMVC-0400S and it is with the price of this equipment that the contractor of this section shall enter with his proposal. If the contractor wants to propose equivalent equipment as manufactured by Russelectric or Cummins, it is to be submitted in a separate document. All additional costs associated with re-engineering and mechanical & electrical modifications to the installation

will be at the contractor's expense. The contractor must also supply the details listed below with his equivalent proposal. Any alternate shall be submitted for approval to the consulting engineer at least 10 days prior to bid date. Alternate bids shall include a line-by-line clarification of the specification marked with "D" for deviation; "E" for exception, and "C" for comply.

5. General Requirements

5.1. General:

1. The unit shall be manufactured in accordance with this specification and applicable UL, NEMA, and ANSI standards.
2. The unit shall be manufactured in a facility, which is registered to an ISO 9001:2000 quality system.
3. Supplier shall be responsible for ensuring the compatibility of all components of the unit.
4. The unit shall be free of defects in material and workmanship.
5. The unit shall be supplied with a 1 year warranty form the manufacturer at no additional cost.

5.2. Engineering Submittals:

The following documentation shall be made available for submission to the project engineer for review/approval purposes on the automatic transfer switch:

1. Physical Layout Drawing-Outline dimensions, cable entry/exit locations, interior/exterior component layouts, connection data.
2. Electrical Schematic Internal wiring, customer connection terminals, optional components, controller settings.
3. Product Data Sheets Equipment Ratings.

5.3. Environmental Conditions:

1. The unit shall be installed with ambient temperature between -15°C and 50°C and a storage range of -20°C to 70°C at a relative humidity of 0-95% non-condensing.

6. Ratings and Construction

- 6.1. Rating of the automatic transfer switch shall be 400 Amps, 480 Volt-60Hz, Three phase, 4 Pole.
- 6.2. The transfer switch shall comprise of 4 Pole switching with a switched neutral.
- 6.3. The completed assembly shall be mounted in a NEMA 3R enclosure for installation outdoors.

- 6.4. All materials and parts used in the unit shall be new, of current manufacturer, of best industrial grade, and free from defects and imperfections.
- 6.5. The transfer switch mechanism shall provide a simple means of manual operation using only components, which are permanently affixed, in the operating position.
- 6.6. The unit shall permit manual operation of the transfer switch while the system is energized and carrying rated load. Transfer switches, which require all sources of power to be de-energized prior to manual load transferring, shall not be acceptable.
- 6.7. Transfer switch control power shall be obtained from the source being transferred to. The controls shall not require any connection to external power source. Transfer switches requiring power from the engine starting (or other) battery are not acceptable.
- 6.8. A control circuit isolation plug shall be provided to isolate all control circuitry inside the transfer switch to facilitate maintenance procedures. When isolated, there shall be no voltage present on the control circuitry.
- 6.9. The automatic transfer switch design shall provide front accessible components and wiring for easy serviceability. Power or control connections, which are not readily serviceable while the transfer switch is mounted in its enclosure, are not acceptable.
- 6.10. All power contacts used shall operate in a quick-make/quick-break manner, the speed of which shall be independent of supply voltage and/or speed of operation by manual means.
- 6.11. Finish: All steel parts shall be cleaned, sealed and painted with one coat rust resistant primer and two coats of ASA #61 gray enamel or polyester powder coat finish inside and out.
- 6.12. Ground Lugs/Bus: Adequate size and quantity of ground lugs shall be provided and shall conform to NEC/CEC guidelines. Where a ground bus is provided, it shall be a full length copper ground bus bonded to the frame with adequate size and quantity of ground lugs and shall conform to NEC/CEC guidelines.
- 6.13. Cable Connections: Provision shall be made to terminate all incoming and outgoing power cables and grounding conductors. Connections shall be via screw type cable lugs.

- 6.14. The Power Switching units shall be fix-mounted, utilize fully enclosed contacts and their withstand/closing rating shall be equal to or exceed the required withstand rating of the complete mechanism.
- 6.15. The automatic transfer switch shall automatically transfer the load to the generator supply in the event of a utility supply failure and return the load to the utility supply upon restoration. The transfer switch power switching devices shall be mechanically and electrically interlocked to prevent the utility and generator supplies from being interconnected.

7. Controller Display and Keypad

- 7.1. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
 1. CISPR 11 Radiated Emissions
 2. IEC-1000-4-2 Electrostatic Discharge
 3. IEC-1000-4-3 Radiated Electromagnetic Fields
 4. IEC-1000-4-4 Electrical Fast Transients (Bursts)
 5. IEC-1000-4-5 Surge Voltage
 6. IEC-1000-4-6 Conducted RF Disturbances
 7. IEC-1000-4-8 Magnetic Fields
 8. IEC-1000-4-11 Voltage Dips and Interruptions
- 7.2. A four-line, 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 communication 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 three 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.

- 7.3. The controller switch shall be rated to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade, plug-in type. The controller panel shall be mounted separately from the transfer switch for safety and ease of operation. The protective cover shall include a built-in product for the storage of operation manuals.

8. Voltage, Frequency, and Phase Rotation Sensing

- 8.1. 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 unbalance	5 to 20%	3 to 18%

- 8.2. Digital metering provided by the transfer switch controller shall have an accuracy of -0.5% for all voltage and frequency readings. Frequency shall be displayed to at least one decimal. Three phase line to line voltages shall be displayed for both generator and utility supplies.
- 8.3. Repetitive accuracy of all settings shall be within +/-0.5% over an operating temperature range of -20°C to 70°C.
- 8.4. And 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.
- 8.5. 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.
- 8.6. 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 BAC). Unacceptable phase rotation shall be indicated on the LCD; the service required LED and the annunciation through communication protocol and dry contacts.
- 8.7. 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.
- 8.8. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases (phase to phase and phase to neutral), frequency, and phase rotation.

9. Time Delays

- 9.1. 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.
- 9.2. 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.
- 9.3. A time delay shall be provided on re-transfer to normal. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.
- 9.4. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.
- 9.5. 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 from 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 disconnect position for delayed transition operation.
- 9.6. All time delays shall be adjustable in 1 second increments.
- 9.7. 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.
- 9.8. Each time delay shall be identified and a dynamic countdown shall be shown on the display.

10. Additional Features

- 10.1. The controller shall have 3 levels of security. Level 1 shall allow monitoring of settings and parameters only. The level 1 shall be capable of restricted 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.

- 10.2. 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, no 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.
- 10.3. A SPDT 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.
- 10.4. Auxiliary 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.
- 10.5. LED 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).
- 10.6. LED indicating lights shall be provided and energized by controller outputs. The lights 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.
- 10.7. A membrane switch shall be provided on the membrane panel to test all indicating lights and display when pressed.
- 10.8. 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.
- 10.9. 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 for occurring.
- 10.10. A time based load control feature shall be available to allow the prioritized addition and removal of loads based during transfer. This feature may be enabled for either or both sources. The user shall be able to control up to nine

loads with independent timing sequences for pre and post transfer delays in either direction of transfer.

- 10.11. A current based load control feature shall be available to allow the prioritized addition and removal of loads based on the measured current through the transfer switch. This feature may be enabled for either or both sources and shall incorporate high and low set points for both sources. The user shall be able to designate up to nine outputs for current based load control. Adjustable time delays shall be available to prevent changes in outputs for momentary current variations.
- 10.12. *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 (1st, 2nd, 3rd, 4th, alternate or every)
 4. Set the duration of the run
 5. At the end of the 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 display when the exercise is active. It shall be possible of ending the exercise event with a single button push.
- 10.13. *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.
- 10.14. *System status* - The controller shall have a default display the following on:
 1. System status
 2. Date, time, and type of the 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 three 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
- 10.15. Controllers that require multiple screens to determine system status or display "coded" system status messages, which shall be explained by references in the operator's manual, are not permissible.
- 10.16. *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 maybe preventing load transfer commands from being completed.
- 10.17. *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 ft. direct connect or multi-drop configuration), Ethernet connectivity (over standard 10baseT 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 genset and transfer switch network through a standard personal computer utilizing current Microsoft operating systems. Separate and specific transfer switch software interfaces shall not be acceptable.
- 10.18. 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.
- 10.19. 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.
- 10.20. *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
 - Total number of transfers

Total number of fail to transfers
 Total number of transfers due to preferred source failure
 Total number of minutes to operation
 Total number of minutes in the standby source
 Total number of minutes not in the preferred source
 Normal to emergency transfer time
 Emergency to normal transfer time
 System start date
 Last maintenance date

3. 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.

- 10.21. *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 ft. direct connect or multi-drop configuration), Ethernet connectivity (over standard 10baseT 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 genset and transfer switch network through a standard personal computer utilizing current Microsoft operating systems. Separate and specific transfer switch software interfaces shall not be acceptable.

11. Tests and Certification

- 11.1. 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.
- 11.2. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, and installation and servicing in accordance with ISO 9001.

12. Service Representation

- 12.1. The manufacturer shall maintain a national service organization of employing personnel located throughout the contiguous United States. The service center's personnel shall be factory trained and shall be on call 24 hours a day, 365 days a year.
- 12.2. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

13. Accessories

- 13.1 Standard I/O Module. The standard I/O Module has two programmable inputs and six programmable outputs.

Inputs Available	2
Contact Closure	Contact Closure
Current	5mA Max.
Connection Type	Terminal Strip
Wire Size	#14-24 AWG
Max Distance	700 feet
Outputs Available	6
Contact Type	Form C (SPDT)
Contact Rating	2A @ 30VDC
	500mA @ 125VAC

Connection Type	Terminal Strip
Wire Size	#14-24 AWG

- 13.2 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.
- 13.3 Logic Disconnect Switch. A Logic disconnect switch shall be mounted inside the enclosure, and shall disconnect power to controller without disconnecting the load. The logic disconnect switch shall disconnect utility power to the controller during maintenance and service without disconnecting power to the load. The switch has two positions, auto and disconnect. The disconnect position shall disconnect the voltage sensing leads for the utility source (A, B, C, N). It is assumed that the user shall disable the generator by placing the controller in the OFF position.