

## **SUGGESTED SPECIFICATION**

**For**

### **Automatic Closed – Transition Transfer Switches**

*Specification writer please note: This system will momentarily connect the emergency generator to the utility during transfer. This usually necessitates obtaining approval from the utility company. The generator set must be equipped with an isochronous governor capable of maintaining frequency within 0.2Hz of nominal.*

#### **Division 26 - Electrical Standby Power Generator Systems**

##### **PART 1 GENERAL**

###### **1.01 Scope**

- A.** Furnish and install closed transition transfer switches (CTTS) with number of poles, amperage, voltage, withstand and close-on ratings as shown on the plans. Each CTTS shall consist of a power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.
- B.** The CTTS shall transfer the load without interruption (closed transition) by momentarily connecting both sources of power only when both sources are present and acceptable. The maximum interconnection time is 100 milliseconds. The CTTS shall operate as a conventional break-before-make (open transition) switch when the power source serving the load fails, or becomes unacceptable.

###### **1.02 Codes and Standards**

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

- A.** UL 1008 - Standard for Transfer Switch Equipment
- B.** CSA certified to CSA 22.2 No. 178 – 1978 Automatic Transfer Switches
- C.** IEC 60947-6-1 Low-voltage Switchgear and Controlgear; Multifunction equipment; Automatic Transfer Switching Equipment
- D.** NFPA 70 - National Electrical Code
- E.** NFPA 99 - Essential Electrical Systems for Health Care Facilities

- F. NFPA 110 - Emergency and Standby Power Systems
- G. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- H. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches
- I. International Standards Organization ISO 9001:2008
- J. UL 508 Industrial Control Equipment

### **1.03 Acceptable Manufacturers**

Closed transition transfer switches shall be ASCO 4000 Series. Any alternate shall be submitted for approval to the consulting engineer at least 10 days prior to bid. Alternate bids must list any deviations from this specification.

## **PART 2 PRODUCTS**

### **2.01 Mechanically Held Transfer Switch**

- A. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism. Main operators utilizing overcurrent disconnect devices, linear motors or gears shall not be acceptable. The switch shall be mechanically interlocked to ensure only two possible positions, normal or emergency.
- 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 800 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 contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 800 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 two 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.

## 2.02 Microprocessor Controller

- A. The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module or Ethernet connectivity module.
- B. A single controller shall provide twelve selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to  $\pm 1\%$  of nominal voltage. Frequency sensing shall be accurate to  $\pm 0.2\%$ . The panel shall be capable of operating over a temperature range of -20 to +60 degrees C and storage from -55 to +85 degrees C.
- C. The controller shall be connected 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 with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator's manuals.
- D. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
  - 1. EN 55011:1991 Emission standard - Group 1, Class A
  - 2. EN 50082-2:1995 Generic immunity standard, from which:
    - EN 61000-4-2:1995 Electrostatic discharge (ESD) immunity
    - ENV 50140:1993 Radiated Electro-Magnetic field immunity
    - EN 61000-4-4:1995 Electrical fast transient (EFT) immunity
    - EN 61000-4-5:1995 Surge transient immunity
    - EN 61000-4-6:1996 Conducted Radio-Frequency field immunity
  - 3. IEEE472 (ANSI C37.90A) Ring Wave Test.

## 2.03 Enclosure

- A. The CTTS shall be furnished in a Type 1 enclosure unless otherwise shown on the plans.
- B. All standard and optional door-mounted switches and indicating lights described in section 3 shall be integrated into a flush – mounted, interface membrane or equivalent in the enclosure door for easy viewing & replacement. The panel shall include a manual locking feature to allow the user to lockout all membrane mounted control switches to prevent unauthorized tampering. The membrane panel shall be suitable for mounting by others when furnished on open type units.

## PART 3 OPERATION

### 3.01 Controller Display and Keypad

A. A four line, 20 character LCD display and 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 DIP switches on the controller:

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.

### 3.02 Voltage, Frequency and Phase Rotation Sensing

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

<u>Parameter</u>	<u>Sources</u>	<u>Dropout / Trip</u>	<u>Pickup / Reset</u>
Undervoltage	N&E, 3 $\phi$	70 to 98%	85 to 100%
Overvoltage	N&E, 3 $\phi$	102 to 115%	2% below trip
Underfrequency	N&E	85 to 98%	90 to 100%
Overfrequency	N&E	102 to 110%	2% below trip
Voltage unbalance	N&E	5 to 20%	1% below dropout

B. Repetitive accuracy of all settings shall be within  $\pm 0.5\%$  over an operating temperature range of  $-20^{\circ}\text{C}$  to  $60^{\circ}\text{C}$ .

C. 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.

D. Source differential sensing shall be provided for the closed transition operating mode. The sensor shall enable transfer/re-transfer between live sources in the closed transition mode only when the two sources have a maximum voltage differential of 5%, frequency differential of 0.2Hz and are within 5 electrical degrees. If the normal source becomes unacceptable, the controller shall automatically initiate an open transition (break before make) load transfer to the emergency source.

E. Closed transition transfer shall also be initiated when operating the transfer test selector switch. Retransfer to the normal source shall operate in closed transition mode at the conclusion of transfer time delay.

- F.** Closed transition transfer shall be accomplished with no power interruption and without altering or actively controlling standby generator set.
- G.** The transfer switch controls shall contain the following multiple levels of protection against extended parallel times in excess of 100ms by taking the following actions:
- 1) If the Normal and Emergency main contacts both remain closed after a preset time delay, the controller shall attempt to return the transfer switch to “safe state by removing paralleled condition.
    - a. The controller shall open the last set of contacts that closed to remove the overlap condition.
    - b. The controller is locked out from any further automatic operation.
    - c. The “TS Locked Out” indicator (Red LED) is lit.
    - d. The operation shall remain locked out until the “TS Locked Out” push-button is reset.
  - 2) If the main contacts still remain paralleled after the transfer switch controller action described in paragraph G. (1), a second independent extended parallel alarm timer (ASCO Feature 62F) will then operate an output relay with (2) form C contacts to alarm the extended overlap condition and/or shunt trip either normal or emergency source breaker through a customer connected circuit to the breaker.
- H.** The controller shall be capable (when activated by the keypad or through the serial port) 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 CBA)
- I.** Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases, frequency, and phase rotation.
- J.** The controller shall include a user selectable algorithm to prevent repeated transfer cycling to a source on an installation which experiences primary side single phase failures on a Grounded Wye – Grounded Wye transformer which regenerates voltage when unloaded. The algorithm shall also inhibit retransfer to the normal (utility) source upon detection of a single phasing condition until a dedicated timer expires, the alternate source fails, or the normal source fails completely and is restored during this time delay period. The time delays associated with this feature shall be adjustable by the end user through the controller keypad and LCD.

### **3.03 Time Delays**

- A.** An adjustable time delay of 0 to 6 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 24 VDC power supply.
- B.** A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.

- C. An adjustable time delay of 0 – 6 seconds to override momentary emergency source outage to delay all retransfer signals during initial loading of engine generator set.
- D. Two time delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. 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.
- E. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.
- F. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minute time delay in any of the following modes:
  - 1. Prior to transfer only.
  - 2. Prior to and after transfer.
  - 3. Normal to emergency only.
  - 4. Emergency to normal only.
  - 5. Normal to emergency and emergency to normal.
  - 6. All transfer conditions or only when both sources are available.
- G. The controller shall also include the following built – in timer delays for Closed Transition operation:
  - 1. 1 to 5 minute delay on failure to synchronize normal and emergency sources prior to closed transition transfer.
  - 2. 0.1 to 9.99 second time delay on an extended parallel condition of both power sources during closed transition operation.
- H. All time delays shall be adjustable in 1 second increments, except the extended parallel time, which shall be adjustable in .01 second increments.
- I. All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the communications interface port.

### 3.04 Additional Features

- A. Membrane-type switches shall be provided for the **test** and **retransfer to normal** functions. The test position will simulate a normal source failure. The retransfer to normal position shall bypass the time delays on retransfer to normal.
- B. 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.

- C. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of two contacts, closed when the CTTS is connected to the normal source and two contacts closed, when the CTTS is connected to the emergency source.
- D. LED indicating lights shall be provided; one to indicate when the CTTS is connected to the normal source (green) and one to indicate when the CTTS is connected to the emergency source (red).
- E. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.
- F. A membrane switch shall be provided on the membrane panel to test all indicating lights when pressed.

**The following features shall be built-in to the controller, but capable of being activated through keypad programming or the communications interface port only when required by the user:**

- G. 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.
- H. Terminals shall be provided for a remote contact which opens to signal the CTTS to transfer to emergency and for remote contacts which open 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.
- I. An Inphase monitor shall be provided 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 inphase monitor shall be specifically designed for and be the product of the CTTS manufacturer. The inphase monitor shall be equal to ASCO Feature 27.
- J. The controller shall be capable of accepting a normally open contact that will allow the transfer switch to function in a non-automatic mode when a non-automatic version of the user interface membrane is furnished.
- K. **Engine Exerciser** – The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to seven different exercise routines. 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.

At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.

- L. Key Locking Feature** – The control switches on the interface membrane shall be capable of being locked via password protected screens on the controller LCD display to prevent unauthorized tampering. A red LED indicator shall be illuminated on the interface membrane when the membrane controls are locked.
- M. System Status** – The controller LCD display shall include a “System Status” screen which shall be readily accessible from any point in the menu by depressing the “ESC” key a maximum of two times. This screen shall display a clear description of the active operating sequence and switch position. For example,

***Normal Failed  
Load on Normal  
TD Normal to Emerg  
2min15s***

- 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 Module** – Shall provide remote interface module to support monitoring of vendor’s transfer switch, controller and optional power meter. Module shall provide status, analog parameters, event logs, equipment settings & configurations over embedded webpage and open protocol. Features shall include:
  1. Email notifications and SNMP traps of selectable events and alarms may be sent to a mobile device or PC.
  2. Modbus TCP/IP, SNMP, HTTP, SMTP open protocols shall be simultaneously supported.
  3. Web app interface requiring user credentials to monitor and control the transfer switch supporting modern smart phones, tablets and PC browsers. User will be able to view the dynamic one-line; ATS controls status, alarms, metering, event logging as well as settings.
  4. Secure access shall be provided by requiring credentials for a minimum of 3 user privilege levels to the web app, monitor (view only), control (view and control) and administrator (view, control and change settings). 128-Bit AES encryption standard shall be supported for all means of connectivity.



5. Shall allow for the initiating of transfers, retransfers, bypassing of active timers and the activating/deactivating of engine start signal shall be available over the embedded webpage and to the transfer switch vendor's monitoring equipment.
6. An event log displaying a minimum of ninety-nine (99) events shall be viewable and printable from the embedded webpages and accessible from supported open protocols.
7. Four (4) 100 Mbps Ethernet copper RJ-45 ports, five (5) serial ports, Termination dip-switches and LEDs for diagnostics.
8. DIN rail mountable.

This option shall be equivalent to ASCO accessory 72EE2

**Q. Data Logging** – The controller shall have the ability to log data and to maintain the last 99 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:

1. Event Logging

1. Data and time and reason for transfer normal to emergency.
2. Data and time and reason for transfer emergency to normal.
3. Data and time and reason for engine start.
4. Data and time engine stopped.
5. Data and time emergency source available.
6. Data and time emergency source not available.

2. Statistical Data

1. Total number of transfers.
2. Total number of transfers due to source failure.
3. Total number of days controller is energized.
4. Total number of hours both normal and emergency sources are available.

**\*Note Spec Writer:** *The following section is optional and should be deleted if not required.*

**R. Power Meter** – (This feature shall be equal to ASCO accessory 135L, or feature bundle accessory 150\*).

*The Power Meter shall conform to the requirements of:*

1. UL 3111-1-Electrical Measuring and Testing Equipment
2. CAN/CSA-C22.2 No. 23-M89-CSA Safety Requirements for Electrical and Electronic Measuring and Test Equipment
3. The Power Meter shall be capable of operating without modification at a nominal frequency of 45 to 66Hz.
4. The Power Meter shall be rated for an operating temperature of -4°F to 158°F and a storage temperature of -22°F to 176°F. and shall be rated for an 85% non-condensing, relative humidity.

5. The Power Meter shall accept inputs from industry standard instrument transformers (120 VAC secondary PT's and 5A secondary CT's). Direct phase voltage connections, 0 to 600VAC nominal, shall be possible without the use of PT's.
6. The Power Meter shall accept single, 3 phase, or three & four wire circuits. A fourth CT input shall be available to measure neutral or ground current.
7. The Power Meter shall contain a built-in discrete contact to wire an ATS 14A auxiliary contact to indicate switch position.
8. The Power Meter shall accept AC voltage from the sensing lines for operation. Additional provisions shall be provided for external DC voltage input range 9-36 VDC with a nominal of 24 VDC.
9. The Power Meter shall be equipped with a continuous duty, long –life, 4 line x 20 character green backlit LCD
10. All setup parameters required by the Power Meter shall be stored in non- volatile memory and retained in the event of a control power interruption.
11. The Power Meter shall be flush mountable on a surface.
12. The Power Meter enclosure shall be sealed to IP-51 (NEMA 1) and The faceplate shall be sealed to IP-65 (NEMA 4). All push buttons shall be sealed tact switches.
13. The Power Meter shall send, when prompted, information to a central location equipped with a manufacturer supplied critical power management system or 3<sup>rd</sup> party monitor through manufacturer supplied communication modules. All 3<sup>rd</sup> party monitor must utilize industry standard open protocols Modbus/RTU.Modbus/TCP or SNMP.
14. An embedded RS-485 port will be provided which will enable communication at 9600, 19.2K, 38.4K, or 57.6K baud. DIP switches will be provided on the RS-485 port allowing a user to select 2-wire or 4-wire communication as well as the option to activate a terminating resistor on the port.

15. The Power Meter shall help facilities comply with NEC 220. It shall provide Maximum Demand calculations for the past 24 months, as per standards with 15 minute averages.
  
16. The following data will be available on the display and Modbus registers of the Power Meter:
  - Line-to-neutral voltages ( $V_{AN}$ ,  $V_{BN}$ , and  $V_{CN}$ )
  - Line-to-neutral voltage average ( $V_{AVE}$ )
  - Line-to-line voltages ( $V_{AB}$ ,  $V_{BC}$ , and  $V_{CA}$ )
  - Line-Line voltage average ( $V_{LAVE}$ )
  - Current on each phase ( $I_A$ ,  $I_B$ , and  $I_C$ )
  - Current on the neutral conductor ( $I_N$ )
  - Average current ( $I_{AVE}$ )
  - Active power, KW per phase and total ( $W_A$ ,  $W_B$ ,  $W_C$ , and  $W_T$ )
  - Apparent power, KVA per phase and total ( $V_{AA}$ ,  $V_{AB}$ ,  $V_{AC}$ , and  $V_{AT}$ )
  - KWHours importing, exporting and net ( $KWH_{IMP}$ ,  $KWH_{EXP}$ , and  $KWH_{NET}$ )
  - KVARHours leading, lagging and net ( $KVARH_{LEAD}$ ,  $KVARLAG$ , and  $KVARHNET$ )
  - Power factor (PF)
  - Signal Frequency (Hz)
  - Digital Input
  
17. The Power Meter shall offer an LCD which can display no less than nine different languages.
  
18. Displaying each of the metered values shall be done through the use of menu scroll buttons. There will be an escape button which will be used to take the user back to the previous page or to cancel a setting change. Pressing escape no more than three times will return the user to the home screen.
  
19. For ease of operator viewing, the display can be configured to remain on continuously, with no detrimental effect on the life of the Power Meter.
  
20. The display's contrast shall be configurable in intervals of 10% (ranging 0%-100%).

21. Setup of a system requirements shall be allowed from the front of the Power Meter.

**\*Note Spec Writer:** *The following section is optional and should be deleted if not required.*

#### **4.01 ATS Remote Annunciator**

##### **General**

Provide and install ATS Remote Annunciators for monitoring and control of automatic transfer switches remotely over Ethernet.

##### **A. Hardware Specifications**

The ATS Remote Annunciator shall be listed to cUL-60950-1 and UL 1008 and include the following features and ratings:

- *User-configured labels with ATS names and power sources*
- *Dual 10/100 Base-T auto sensing and auto crossover Ethernet ports*
- *LED indication of source acceptability, switch position, common alarm, time delay and Ethernet link activity*
- *Push button for transfer/retransfer control operations and time delay bypass*
- *Push buttons for Alarm Silence and Lamp Test*
- *Key lock to enable and disable the transfer push button*
- *Audible and visual alarm to indicate Communication Error ATS Locked Out Failure to Synchronize Extended Parallel and any of the 8 user-configured discrete inputs*
- *Programmable watchdog timer that can generate a system reset upon timeout (minimum 1 sec)*
- *Factory reset capability*
- *100 ms power ride-through*

##### **B. Software Specification**

The ATS Remote Annunciator shall contain embedded web pages accessible via various web browsers with the following capabilities:

- *Configuration for protocol and communications management with the ability of auto discovering transfer switches on network*
- *Ability to create and print customized labels for ATS names and power sources*
- *The ability to choose a continuous or periodic audible alarm with customizable interval time*
- *View detailed packet status counters i.e. transmitted received and dropped packets with the ability to reset counters*
- *ATS source name configuration page which allows users to configure power source names and print labels*
- *Upgrade firmware from Ethernet network without interrupting equipment operation*

## C. Communications

Dual 10/100 Base-T (RJ-45) Ethernet ports are provided to support TCP/IP communications for up to eight automatic transfer switches via individual remote connectivity modules or daisy-chained serial modules into a single Connectivity Module. Additional features include:

- *Supports Full Duplex Flow Control (IEEE 802.3x)*
- *3.3V power supply with 5V I/O tolerance*
- *Supports 3 LEDs to indicate traffic link speed and collision*

## D. Mounting

The ATS Remote Annunciator is suitable for:

- *Surface mounting using mounting screws studs*
- *Flush Mount from behind a cutout section (Enclosure Door Mounting)*
- *Flush Mount from the front of a cutout section (Enclosure Door Mounting)*

## E. Power Supply

The ATS Remote Annunciator shall be capable of accepting 24VDC, 120 VAC or 240 VAC power source.

## F. Environmental

The ATS Remote Annunciator shall have an Ambient Operating Temperature range of -4 ° to 158 ° F (-20 ° to +70 ° C) @ 5~85% humidity and Ambient Storage Temperature of -40 ° to 185 ° F (-40 ° to 85 ° C).

## PART 5 ADDITIONAL REQUIREMENTS

### 5.01 Withstand and Closing Ratings

- A. The CTTS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the CTTS terminals with the type of overcurrent protection shown on the plans.
- B. The CTTS shall be UL listed in accordance with UL 1008 and be labeled in accordance with .025 and .050 seconds time based ratings, or appropriate short time rating(s) as applicable. CTTSs which are not tested and labeled with .025 and .050 seconds time based ratings, or appropriate short time rating(s) and have series, or specific breaker ratings only, are not acceptable

### 5.02 Tests and Certification

- A. The complete CTTS 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.
- 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.

- C. The CTTS manufacturer shall be certified to ISO 9001:2008 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001:2008.

### 5.03 Service Representation

- A. The CTTS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. 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.

### 5.04 Control Relay Interface Board

- A. *An optional plug-in relay board shall be furnished which mounts on the back of the membrane interface board. The relay board shall contain four relays with form C contacts rated 2A @ 30Vdc, 0.5A@125Vac.*
- B. *The function of relays RL1 through RL3 is as follows:*
  - 1. *RL1 energized if emergency source acceptable output is active.*
  - 2. *RL2 energized if normal source acceptable output is active.*
  - 3. *RL3 energized if load disconnect signal output is active.*
- C. *The function of RL4 shall be capable of being configured via DIP switches on the control relay board, as shown:*
  - 4. *position 1 on relay energized if normal source acceptable output is active*
  - 5. *position 2 on relay energized if emergency source acceptable output is active*
  - 6. *position 3 on relay energized if extended parallel output is active (for Closed Transition Switches only).*
  - 7. *position 4 on relay energized if ATS locked out output is active (for Closed Transition Switches only).*
  - 8. *position 5 on relay energized if fail to sync / load disconnect output is active (for Closed or Delayed Transition Switches only).*
- D. *Multiple conditions can be used to energize RL4 by activating more than one switch. For example, if both positions 1 and 2 are on, the relay will be energized if either the normal or emergency source is acceptable.*

### 5.05 Provisions for External DC Power Supply – An optional provision shall be

*available to connect an external 24 VDC power supply to allow the LCD and the door mounted control indicators to remain functional when both power sources are dead. The option shall be equivalent to ASCO accessory 1G.*