SECTION 16250

AUTOMATic transfer switch

# GENERAL

## DESCRIPTION

### This section includes materials and installation of automatic transfer switches.

## RELATED WORK SPECIFIED ELSEWHERE

### Section 16010: General Electrical Requirements.

### Section 16480: Low-Voltage Motor Control.

### Section 16938: Power System Study

## SUBMITTALS

### Submit shop drawings in accordance with the General Conditions.

### All functions and features identified in this specification are to be provided regardless of if they are a standard of the manufacturer. Acceptance of any submittal where required items were not included does not alleviate the Contractor from the need to provide the items per plans and specifications.

### Submit manufacturer’s descriptive data including ratings, circuit diagrams, dimensional data, conduit entry restrictions, and a list of accessories. ATS submittal shall contain at a minimum, the following:

#### Dimensioned outline drawing with clearance requirements.

#### Schematic diagram.

#### Component list.

#### Conduit entry and exit locations.

#### Complete wiring, panel elementary and process/instrument diagrams.

#### Seismic certification and equipment anchorage details if it is a stand-alone unit

#### Assembly ratings including:

##### Short circuit rating

##### Voltage

##### Interrupting current

##### Continuous current

## MANUFACTURER’S SERVICES

### Provide manufacturer’s services at the jobsite for the minimum man-days listed below, travel time excluded:

#### Two man-days to check the installation, supervise start-up, and supervise testing and adjustments of the transfer switches.

## MEASUREMENT AND PAYMENT

### Payment for the work in this section shall be included as part of the lump-sum bid amount stated in the Proposal.

# MATERIALS

## TRANSFER SWITCH

### Transfer switch shall be open type integrated in a MCC or a switchboard and installed as shown in the drawings. Transfer switch shall have three poles or four poles where specifically shown on the drawings, with amperage and voltage ratings as shown in the drawings. Withstand current rating shall not be less than 42,000-ampere rms symmetrical or to match with the short circuit rating of the MCC or the switchboard.

### Switch shall be listed per UL-1008 as a recognized component for emergency systems and rated for all classes of loads including motors.

### Transfer switch shall be electrically operated and mechanically held in each direction by an operating mechanism momentarily energized from the source to which the load shall be transferred. Accomplish mechanical locking in each direction without the aid of latching solenoids, toggle mechanisms, or gear arrangements. Provide delayed transition feature to provide transfer of loads between power sources with a timed load disconnect position for an adjustable period of time. Based on this description the automatic transfer switch will have three positions 1. Normal, 2. Disconnected/Off, 3. Emergency.

### Electrical spacings must not be less than those listed in Table 15.1 of UL-1008. Provide a handle to permit no-load manual operation.

### Operation shall be inherently double throw where normal and emergency contacts operate simultaneously with no momentary delay in a mid-position. Operation shall allow for delayed transition. An overload or short circuit shall not cause the switch to go to a neutral position. Do not use main contact structures not originally manufactured for transfer switch service (molded case circuit breakers or contactors). Inspection and replacement of all contacts (stationary and arcing) shall be possible from the front of the switch without any disassembly of operating linkages or power conductors. Provide a handle to permit no-load manual operation.

### Transfer switches with neutral controls shall have fully rated neutral transfer contacts that momentarily interconnect the neutrals of the two sources during the transfer/retransfer operations. The neutrals shall remain interconnected until the power source contacts close on the source to which the load is being transferred.

## BYPASS ISOLATION (if required by the design drawings)

### A manual bypass isolation switch shall provide isolation of the source and load power conductors to the ATS. The bypass transfer switch shall have current, voltage, and withstand ratings equal to the interconnected automatic transfer switch. Transfer to bypass shall be a manually initiated no-load break type transfer.

### Positive mechanical interlocks shall be provided for bypass isolation switches to prevent cross connection of services.

### When provided, the automatic transfer switch and the bypass isolation switch sections shall be factory interconnected with copper bus.

### The bypass isolation transfer switches shall be provided with a draw-out mechanism to allow access for preventive maintenance, testing or inspection. The draw-out mechanism shall provide visual indicators as to the position of the switch/breaker during the draw-out operation.

## ACCESSORIES

### Provide a panel-mounted, solid-state sensing and control logic panel. Include the following operational characteristics and functions:

#### Adjustable (0.5 to 15 seconds) time delay on engine starting to override momentary dips in normal source, set at 1 second.

#### Full phase voltage relay supervision of the normal source with at least one close differential relay to detect “brownout” condition, set at 70% dropout and 90% pickup.

#### Voltage/frequency lockout relay to prevent premature transfer, set at 90% voltage and 90% frequency.

#### Engine starting control contacts (one normally open and one normally closed).

#### Adjustable (0.5 to 32 minutes) time delay on retransfer to normal, initially set at 20 minutes.

#### Unloaded running time delay for generator cool down (adjustable 0.1 to 10 minutes), initially set at 5 minutes.

#### Transfer to emergency time delay (adjustable 1 to 300 seconds), initially set at 1 second.

#### Adjustable time delay for load disconnect position.

### Provide a maintained system test switch on the front of the enclosure that simulates loss of normal power source.

### Manual push button to bypass the time delay on retransfer.

### Pilot lights or display to indicate source to which the load is connected.

### Pilot light or display to indicate presence of normal power source.

### Auxiliary contacts for remote indication of switch position, two normally open and two normally closed contacts for normal and emergency position. Provide dry auxiliary contact for utility power available indication to the PLC.

### Transfer switch shall include two pilot contacts (10 amperes at 480-volt a-c) that close 600 seconds (adjustable) prior to transfer and re-open three seconds (nominal) after transfer. These contacts shall de-energize motor loads during the transfer time of the switch and shall send indication to PLC.

### An in-phase monitor shall control transfer/retransfer operation between live sources when the sources are approaching and are sufficiently close to a zero-phase angle difference so as to avoid excessive motor inrush currents. The monitor shall cause in-phase transfer/retransfer to take place over engine/generator frequency ranges of 58 to 62 hertz with a utility source of 60 hertz. Normal transfer/retransfer operation shall automatically occur, without the use of manual overrides, in the event of a complete failure of the load-carrying source.

### Provide remote control circuit that will transfer the switch to emergency position by closing a remote dry contact and retransfer to normal by opening the contact from the TCP. If 24 volts d-c is required to perform this function, utilize the 24-volt d-c power source from the generator control panel. Refer to P&IDs for interface with remote SCADA (PLC).

### Provide Quad-Ethernet Module accessory 72EE2 for connection to PLC network. Connection to the Ethernet network shall be accomplished by installing a patch panel in the ATS, terminating the solid conductor ethernet cable to the patch panel and installing a stranded conductor cable from the patch panel to the ATS switch. Patch cable shall be at least 6 feet in length.

### Communications protocol shall be Modbus TCP/IP. Serial communications shall not be accepted. The following are the minimum points that shall be available via the communications port:

### Ability to read and adjust all timing parameters identified in this specification

### 3 phase voltage (accurate to within 1% of full scale) for both generator and line

### All digital and analog inputs / outputs identified in this section.

## MANUFACTURERS

### The transfer switch shall be manufactured by ASCO 7000 Series to match with DISTRICT’s existing equipment and spare parts. No substitutions will be acceptable.

## CONSTRUCTION

### The ATS shall be positively interlocked both mechanically and electrically to prevent simultaneous closing of both sources under either automatic or manual operation. Main contacts shall be mechanically locked in position in both normal and emergency positions. A transfer switch position indicator shall be visible from the front of the switch to show to which source the transfer switch is connected.

### Inspection and replacement of all separate arcing contacts (moving and stationary) shall be possible from the front of the transfer switch.

### A solid-state sensing and control logic panel shall be separately mounted from the power switching portion of the transfer switch. The two sections shall be connected by control cables with plug-in connectors. The control section shall be capable of being disconnected from the power section for maintenance purposes.

### The logic circuit shall utilize solid-state components mounted on printed circuit boards to accomplish functions such as timing, time delays, and voltage and frequency monitoring. LEDs shall be furnished to indicate the operation of each solid-state function. Construction shall be such that functions are individually replaceable without requiring replacement of the complete solid-state package. Plug-in modifications shall be available for field installation without voiding the UL label.

### A two-way bypass-isolation switch shall provide manual bypass of the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors. All main contacts shall be manually driven.

### Separate bypass and isolation handles shall be utilized to provide clear distinction between the functions. Handles shall be permanently affixed and operable without opening the enclosure door. Designs requiring insertion of loose operating handles or opening of the enclosure door to operate are not acceptable.

### Bypass to the load-carrying source shall be accomplished with no interruption of power to the load (make before break contacts). Designs which disconnect the load when bypassing are not acceptable. The bypass handle shall have three operating modes: "Bypass to Normal," "Automatic," and "Bypass to Emergency." The operating speed of the bypass contacts shall be the same as the associated transfer switch and shall be independent of the speed at which the manual handle is operated. In the "Automatic" mode, the bypass contacts shall be out of the power circuit so that they will not be subjected to fault currents to which the system may be subjected. Bypass switches shall be interlocked to prevent paralleling of sources.

### The isolation handle shall provide three operating modes: "Closed," "Test," and "Open." The "Test" mode shall permit testing of the entire emergency power system, including the automatic transfer switches with no interruption of power to the load. The "Open" mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the "Open" mode, it shall be possible to completely withdraw the automatic transfer switch for inspection or maintenance to conform to code requirements without removal of power conductors or the use of any tools.

### When the isolation switch is in the "Test" or "Open" mode, the bypass switch shall function as a manual transfer switch.

### Provide provision for front cables connection.

### Terminals shall be solderless pressure type.

### Bypass handle shall have three operation modes: "Bypass to Utility", "Automatic", and "Bypass to Generator". In "Automatic" mode, the bypass contacts shall be out of the power circuit so that they will not be subjected to fault currents to which the system may be subjected.

### Isolation handle shall provide three operating modes: "Closed", "Test", and "Open". The "test" mode shall permit testing of the entire standby power system without power interruption of power to the load. The "Open" mode shall completely isolate the transfer switch from all sources and load power conductors. When in the bypass isolation mode, it shall be possible to completely withdraw the transfer switch for inspection or maintenance to conform to Code requirements without removal of power conductors. When the isolation switch is in "Test" or "Open" mode, the bypass switch shall function as a manual transfer switch.

## SEQUENCE OF OPERATION

### Upon loss of phase-to-phase voltage of the normal source to 70 percent of nominal, and after a time delay, adjustable from 1 to 60 seconds, to override momentary dips and/or outages, a 10 ampere, 30VDC dry contact shall close to initiate starting of the emergency or standby source power plant. Transfer to the alternate source shall take place immediately upon attainment of 90 percent of rated voltage and frequency of that source.

### When the normal source has been restored to 90 percent of rated voltage, and after a time delay, adjustable from 0.5 to 32 minutes (to ensure the integrity of the normal power source), the load shall be retransferred to the normal source.

### A time delay, adjustable from 0.5 to 32 minutes, shall delay shutdown of the emergency or standby power source after retransfer to allow the generator to run unloaded for cool-down, after which the generator shall be automatically shut down.

### If the emergency or standby power should fail while carrying the load, transfer to the normal power supply shall be made after a preset time delay upon restoration of the normal source to satisfactory conditions.

## METERING & COMMUNICATIONS

### ASCO accessory 150B and 72EE2

## ACCESSORIES

### Provide the following accessories:

#### Time delay normal to emergency/standby, adjustable from 0.2 to 30 minutes.

#### Time delay emergency/standby to normal, adjustable from 0.2 to 30 minutes.

#### Green pilot light to indicate switch in Utility Source position and red pilot light to indicate switch in Standby Source position.

#### White pilot lights marked "Utility Source" and "Emergency/Standby Source" to indicate that respective source voltages are available.

#### Relay auxiliary contacts (2 NO and 2 NC) to indicate transfer switch position and the availability of each source.

#### Time delay engine start, adjustable from 0.2 to 30 minutes.

#### Time delay engine cool off, adjustable from 0.2 to 30 minutes.

#### Engine start command in a form of a dry contact output.

#### Frequency/voltage relay for emergency/standby source, frequency adjustable from 45 to 60 Hz and voltage fixed at 90 percent pickup, 70 percent dropout.

#### Delayed transition time delay, adjustable from 0 to 120 seconds, to allow disconnection of the load during transfer in either direction to prevent excessive inrush currents due to out-of-phase switching of large inductive loads.

#### Four-position selector switch permitting four modes of transfer switch operation: "Test" (simulates normal power outage), "Auto" (standard automatic operation), "OFF" (de-energizes control relays and opens the engine start circuit for maintenance purposes), "Engine Start" (retains transfer switch in normal position and initiates a testing of the engine start circuit). Furnish pilot light for "OFF" indication.

#### Pickup relays:

##### 3-phase voltage pickup relay, adjustable 85 to 100 percent.

##### Frequency pickup relay (standby source only), adjustable 90 to 100 percent.

#### Time delay relay:

##### Normal to standby; adjustable from 0.2 to 50 seconds.

##### Standby to normal; adjustable from 0.2 to 30 minutes.

#### Auto return to normal source defeat selector switch.

#### Neutral position time delay; adjustable from 0 to 120 seconds.

#### Five dry contacts for remote monitoring to indicate the following:

##### Transfer switch in normal position.

##### Transfer switch in standby position.

##### Normal source power available.

##### Standby source power available.

#### Contacts:

##### Provide 2 pre-transfer signal contacts adjustable 0 to 120 seconds to permit load shedding.

##### Contacts shall be closed when switch is in “utility position,” and shall open before transfer is made to the generator.

#### Engine generator start contact.

#### 7-day pump station exerciser with selectable load or no load transfer for any duration, any time during a week.

### Transfer switch position indicator shall be visible from the front of the switch to show to which source the transfer switch is connected. All configuration parameters can be inputted using the front panel display. If PC is required for configuration, 5 copies of all software and the associated licenses required shall be provided.

# EXECUTION

## INSTALLATION

### Install transfer switch in the motor control center or in the switchboard as per the design documents. Secure transfer switch rigidly to wall and floor or mounting pad with anchor bolts or Phillips Drill Company concrete anchors for stand-alone unit. Anchor bolts or concrete anchors shall be Type 316 stainless steel.

### Verify the ATS section or unit be provided with an arc flash label as the result of the Power System Study.

## FIELD TESTING

### Field test and calibrate timing and monitoring logic. All adjustments shall be within 5% of the previously specified set points.

### Field test and calibrate the in-phase monitor (if required by the design drawings). Demonstrate that the switch transfers when source phase differences are within 20 degrees under varying generator speeds. Vendor shall provide a submittal on the test procedure that will be used to validate the phase angle and measurement technique to demonstrate compliance.

END OF SECTION