

PART 1 - GENERAL

1.1 REFERENCES

- .1 CSA-C61869-1:14, Instrument Transformers.
- .2 CSA-C22.2 No. 178.1-14, Transfer Switch Equipment.

1.2 SCOPE OF SUPPLY

- .1 Provide one (1) automatic transfer switch.

1.3 SYSTEM DESCRIPTION

- .1 Automatic closed transition load transfer equipment to:
 - .1 Monitor voltage on all phases of normal and emergency power supply.
 - .2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below pre-set adjustable limits for adjustable period of time.
 - .3 Transfer load from normal supply to standby unit when standby generator reaches rated frequency and voltage pre-set adjustable limits.
 - .4 Transfer load from standby generator to normal power supply when normal power restored, confirmed by sensing of voltage on all phases above adjustable pre-set limit for adjustable time period.
 - .5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.
 - .6 Provided time initiated contact to shut down electric load bank prior to transfer to emergency power.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Include:
 - .1 Make, model and type.
 - .2 Single line diagram showing controls and relays.
 - .3 Description of equipment operation including:
 - .1 Automatic starting and transfer to standby unit and back to normal power.
 - .2 Test control.
 - .3 Manual control.
 - .4 Automatic shutdown.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.
- .2 Detailed instructions to permit effective operation, maintenance and repair.
- .3 Technical data:
 - .1 Schematic diagram of components, controls and relays.
 - .2 Illustrated parts lists with parts catalogue numbers.
 - .3 Certified copy of factory test results.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Instrument transformers: to CSA-C61869.
- .2 Transfer switch must meet or exceed the requirements of CSA C22.2 No. 178.1.
- .3 Transfer switch to be mechanically interlocked to provide only two (2) possible positions, normal or emergency.
- .4 All transfer switches and controllers must be products of the same manufacturer.
- .5 Busbars and main connections: 99.3% copper, tinplated.
- .6 Main operators that include overcurrent disconnect devices, linear motors and gears shall not be accepted.
- .7 Designs utilizing components of moulded case circuit breakers or switches will not be accepted.
- .8 Maintenance bypass contactors on normal and emergency supply.

2.2 CONTACTOR TYPE TRANSFER EQUIPMENT

- .1 Two (2) 3-phase contactors mounted on common frame, in double throw arrangement, mechanically and electrically interlocked, solenoid operated. Include a microprocessor controller to provide automatic operation. The operating time must not exceed 8 cycles including the power failure sensing.

- .2 Install equipment in a NEMA type 2 enclosure, wall mounted or free standing floor mounted complete with drip hood.
- .3 Closed transition type switch with a fully rated solid neutral.
- .4 Rated: continuous ampere rating as noted on the drawings, 600 V, 60 Hz, 3 phase, 4 wire.
- .5 Switch and relay contacts, coils, spring and control elements accessible for inspection and maintenance from front of panel without removal of switch panel or disconnection of drive linkages and power conductors.
- .6 Minimum 32kA momentary (rms symmetrical) fault withstand rating. Transfer switch must be suitable for connection to standby generator as indicated.
- .7 Lever to operate switch manually when switch is isolated.
- .8 Equipment to include bypass-isolation switch to provide manual bypass of the load and isolation of all service and load terminals of the main contactor to permit testing, maintenance and service without interrupting power to the load.
- .9 Isolation handle to provide three positions, "closed", "test" and "open". The "test" position shall permit electrical testing of the automatic transfer switch without disturbance to the load. The "open" position will provide complete isolation of the automatic transfer switch from both sources and the load without removal of conductors. With the unit in either the "test" or "open" position, the bypass switch must be capable of functioning as a manual transfer switch.
- .10 The bypass isolation switch must be capable of bypassing the load to either source. The load bypass of the automatic transfer switches connected source must be effected without load interruption.
- .11 Arrange the automatic transfer switch for draw out operation to facilitate its removal.

2.3 MICROPROCESSOR CONTROLLER

- .1 Provide the controller's sensing and logic by a built-in microprocessor for maximum reliability.
- .2 Connect the controller to the transfer switch by an interconnecting wiring harness. Harness to include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.

- .3 An LCD display and keypad must be an integral part of the controller for viewing all available data and setting desired operational parameters.
- .4 Controller LCD display to include a "System Status" screen. Screen to display a clear description of the active operating sequence and switch position.
- .5 Controller to contain a diagnostic screen for the purpose of detecting system errors. The screen will provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.
- .6 Controller must have the ability to log data and to maintain the last 99 events, even in the event of a total loss of power. The following events must be time and date stamped and maintained in a non-volatile memory:
 - .1 Event Logging:
 - .1 Date, time, and reason for transfer normal to emergency.
 - .2 Date, time, and reason for transfer emergency to normal.
 - .3 Date, time, and reason for engine start.
 - .4 Date, time, engine stopped.
 - .5 Date, time, emergency source available.
 - .6 Date, time, emergency source not available.
 - .2 Statistical Logging:
 - .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 are available.

2.4 VOLTAGE, FREQUENCY AND PHASE ROTATION SENSING

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

Parameter	Sources	Dropout	Pickup
Undervoltage	N & E, 3Ø	70-98%	85-100%
Over voltage	N & E, 3Ø	102-115%	2% below trip
Under frequency	N & E	85-98%	90-100%
Over frequency	N & E	102-110%	2% below trip
Voltage unbalance	N & E	5-20%	1% below DO

- .2 Voltage and frequency settings must be field adjustable in 1% increments locally with the display and keypad and remotely via serial communications port access.
- .3 The controller must 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.
- .4 Provide source status screens for both normal and emergency to provide digital readout of voltage on all 3 phases, frequency, and phase rotation.

2.5 TIME DELAYS

- .1 Provide an adjustable time delay of 0 to 6 seconds to override momentary normal outages and delay all transfer and engine starting signals.
- .2 Provide a time delay on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.
- .3 Provide two time delay modes (which are independently adjustable) on re-transfer to normal. One delay will be for actual normal power failures and the other for the test mode function. The time delays will be adjustable from 0 to 60 minutes. Time delay will be automatically bypassed if the emergency source fails and the normal source is acceptable.
- .4 Provide a time delay on shutdown of engine generator for cool down, adjustable from 0 to 60 minutes.
- .5 All time delays must be adjustable in one second increments.
- .6 All time delays must be adjustable by using the LCD display and keypad and through a serial communications port.

2.6 ACCESSORIES

- .1 Provide an in phase monitor in the controller. In phase monitor to compare both the normal and emergency sources and shall signal the transfer switch to operate at an advance angle as determined by the frequency difference between the two sources at the time of transfer. It must automatically adjust the phase advance angle at which the transfer operation is initiated to permit the load to be reconnected, so that inrush currents are limited to no more than normal starting current.
- .2 Provide a set of DPDT gold-flashed contacts rated 10 amps, 32 Vdc for a low-voltage engine start signal.

- .3 Provide LED indicating lights (16 mm industrial grade type 12). One (1) to indicate when the transfer switch is connected to the normal source (green) and one to indicate when the transfer switch is connected to the emergency source (red).
- .4 Provide LED indicating lights (16 mm industrial grade type 12) and energize by controller outputs. The lights will provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.
- .5 Provide four (4) auxiliary contacts (rated 10A, 250 VAC), closed when the transfer switch is in normal position.
- .6 Provide four (4) auxiliary contacts (rated 10A, 250 VAC), closed when the transfer switch is in emergency position.
- .7 Provide a timed contact that will provide a shutdown signal to the electric load bank prior to the transfer to emergency supply.
- .8 Provide a pre-transfer signal prior to transfer occurring in either direction. The contact will close for an adjustable period of 0 to 15 seconds prior to transfer. The circuit will reset immediately after transfer.
- .9 Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if normal source restores before the generator is ready to accept the load.
- .10 Provide terminals for a remote contact which opens to signal the transfer switch to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or re-transfer to normal. Both inhibit signals shall be activated through the keypad and serial port.
- .11 Wire all customer connections to a common terminal block to simplify field wiring connections.
- .12 Provide a three position momentary type test switch for the Test/Automatic/Reset modes. The test position will simulate a normal source failure. The reset position will bypass the time delays on either transfer to emergency or re-transfer to normal.
- .13 Engine exerciser: provide an internal engine exerciser. It must be possible to program up to seven different exercise routines. For each routine, it must be possible 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 exercise. At the end of the specified duration the switch will transfer the load back to normal and run the generator for the specified cool down period.

2.7 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Electrical General Requirements.
- .2 Control panel:
 - .1 For selector switch and manual switch: size 5 nameplates.
 - .2 For meters, indicating lights, minor controls: size 3 nameplates.

2.8 SOURCE QUALITY CONTROL

- .1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested to applicable standards.
- .2 Provide two (2) copies of written factory tests to Departmental Representative for review.
- .3 Tests:
 - .1 Operate equipment both mechanically and electrically to ensure proper performance.
 - .2 Check selector switch, in all modes of operation Test, Auto, Manual, Engine Start and record results.
 - .3 Check voltage sensing and time delay relay settings.
 - .4 Check:
 - .1 Automatic starting and transfer of load on failure of normal power.
 - .2 Retransfer of load when normal power supply resumed.
 - .3 Automatic shutdown.
 - .4 In-phase monitor operation.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Locate, install and connect transfer switch in the main switchboard as indicated on the drawings.
- .2 Check controller and adjust as required.
- .3 Connect auxiliary contacts to PLC/RTU as indicated.
- .4 Mount control switches and annunciation lights in door of automatic transfer switch.
- .5 Connect transfer switch to generator control panel as per manufacturer's recommendations, with 12-#14 AWG RW90 in conduit.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Electrical General Requirements.
- .2 Contract to include a full one (1) year servicing 365 day after substantial completion. Servicing to include replacement of filters, fuses, cleaning and a full inspection of moving parts, contact resistance checks and verification of all switch protective components. Worn or faulty parts are to be replaced with no cost for labour or materials. Coordinate this maintenance to coincide with the maintenance of the generator.
- .3 Energize transfer equipment from normal power supply.
- .4 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.
- .5 Set selector switch in "Manual" position and check to ensure proper performance.
- .6 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.
- .7 Set selector switch in "Auto" position and open normal power supply disconnect. Standby genset should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10 min, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.
- .8 Repeat, at 15 minute intervals, 4 times, complete test with selector switch in each position, for each test.
- .9 After completion of tests above, and a five minute cooling period, load test engine for a minimum of eight (8) hours using the building load. Co-ordinate testing with Departmental Representative to ensure representative load is available for load test. Record the following at 5 minute intervals for the first 15 minutes and at 15 minute intervals thereafter: voltage, frequency, amperes, engine oil pressure and temperature. Tabulate results and submit to the Departmental Representative for review and approval. Submit data in commissioning records. Pay for the fuel to run the test and fuel tank to 100% capacity after the successful completion of the test.
- .10 Arrange and pay for a factory certified representative to set up and commission transfer switch for proper operation to the satisfaction of the Departmental Representative. Document all testing and set up and submit to the Departmental Representative.

- .11 The factory certified representative must fully instruct the facility's operators in the proper operation and maintenance of the automatic transfer switch and controls.

END OF SECTION