Specification for States MFG. Automatic Transfer Switch

Note to specification author: Transfer switch is designed for use only in applications with one (1) utility source and one (1) generator source. If multiple utility or generator sources are required please reference States MFG. paralleling switchboards/switchgear specification. Furthermore the generator set must be equipped with an automatic isochronous governor and a solid state voltage regulator and be setup for use in utility paralleling applications. The governor and voltage regulator must be capable of accepting analog bias inputs to adjust output frequency (speed) or voltage up or down. Voltage regulator must also accept an input from a droop CT for fast acting var and PF control.

Section 26 XX XX – Automatic Transfer Switch

PART 1: GENERAL

1.1. Section Includes

A. Automatic Transfer Switch (ATS)
B. Etc.

1.2. References

A. Section 26 XX XX: Grounding and Bonding for Electrical Systems
B. Section 26 XX XX: Engine Generator Systems
C. Etc.

1.3. Applicable Codes and Standards

A. UL 50 – Enclosures for Electrical Equipment
B. UL 489 – Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures
C. UL 508 – Industrial Control Equipment
D. UL 891 – Dead Front Switchboards
E. UL 1008 – Standard for Transfer Switch Equipment
F. National Fire Protection Association (NFPA). NFPA - 70 - National Electrical Code
G. NFPA - 99 - Essential Electrical Systems for Health Care Facilities
H. NFPA -110 - Emergency and Standby Power Systems

1.4. Submittals

A. Submit complete shop drawings of the Automatic Soft Loading Power Transfer Switch as a completely integrated, U.L. listed and factory-tested package.
B. Submit shop drawings, bill of materials, manufacturer cut sheets, and descriptive data in accordance with Section 26 XX XX: "Submittals, Closeout Documents, Training and Spare Parts".

1.5. Quality Assurance

A. Furnish products listed and labeled by U.L. as suitable for use in emergency power systems.
B. Manufacturer must specialize in the design and construction electrical power systems and distribution equipment with a minimum of 30 years of experience.

PART 2: PRODUCTS

2.1. Manufacturers

A. States Manufacturing

B. Pre-approved alternate. Alternates must be submitted for approval to consulting engineer at least 10 days prior to bid. Alternates must clarify all deviations from specification.

2.2. Scope

A. Provide automatic transfer switch (ATS) with voltage (600V maximum), amperage (3000A maximum), interrupting rating (100kA maximum), and number of switched poles (3 or 4) as shown on the plans. All necessary devices and control logic required for a complete factory tested unit shall be included.

B. Core components of the ATS shall be two (2) insulated case power circuit breakers for the transferring of load between the normal source and the emergency source, power transfer controller (PTC), human machine interface (HMI) and multifunction protective relay (MFR). Designs using contactors or molded-case circuit breakers for power transfer are not acceptable.

2.3. Product Options and Features

A. Circuit breakers

1. Must be 100% rated, electrically operated, drawout type, with solid state trip unit, internal ground fault and minimum interrupting rating as indicated on the plans. Provide trip units with field adjustable trip parameters for long time setting, short time setting, instantaneous setting, and ground fault setting. Provide neutral current transformer, if necessary, to allow for proper ground fault detection and trip. Breakers must be equipped with manual charge handle and mechanical pushbuttons for both open and close operations.
2. Breakers must be of like frame size to allow for interchangeability of the normal source and emergency source breaker in the event of a breaker failure and commonality of parts.

B. Power transfer controller (PTC) shall control the output frequency (speed) and voltage of the generator. Synchronization of the emergency source to the normal source shall be “active” type synchronization where the emergency source is driven into synchronization limits with the normal source. Passive synchronization or “slip” synchronization shall not be allowed. PTC shall allow for the following operational modes:

1. Open transition – Transfers between the normal source and emergency source are accomplished by opening one source before closing the other (break-before-make).
2. Closed transition – Transfers between the normal source and the emergency source are accomplished by closing both breakers together before one is opened (make-before-break). Synchronization is achieved by driving the emergency source into voltage and phase lock with the normal source. Transfers must be accomplished in <100 ms.
3. Soft loading – Transfers between the normal source and the emergency source are accomplished by closing both breakers together before one is opened (make-before-break). Synchronization is achieved by driving the emergency source into voltage and phase lock with the normal source. Once both breakers are closed facility load is

transferred either to or from the emergency source at approximately 50kW per second.

4. Continuous parallel – Normal source and emergency source are synchronized by driving the emergency source into voltage and phase lock with the normal source. The normal source and emergency source remain in parallel and power is either exported or imported from the normal source. The emergency source may also be run at a fixed, or base load, setting.

C. Power transfer controller shall offer the following protections:
   1. Generator: voltage / frequency 59 / 27 / 81O / 81U
   2. Generator: overload, reverse/reduced power 32 / 32R / 32F
   3. Generator: Synch Check 25
   4. Generator: unbalanced load 46
   5. Generator: power factor 55
   6. Generator: rotation field
   7. Mains: voltage / frequency / synch check 59 / 27 / 81O / 81U / 25
   8. Mains: phase shift / rotation field / ROCOF (df/dt) 78
D. Power transfer controller adjustable parameters
   1. Voltage
      a. Adjustable dropout from 70% to 98% of nominal voltage.
      b. Adjustable pickup from 85% to 100% of nominal voltage.
      c. Synch check: Adjustable 1 – 5% voltage differential with the sources being within an adjustable 5 – 15 electrical degrees and adjustable 0.1 - .02 Hz frequency differential.
   2. Frequency
      a. Adjustable dropout from 85% to 98% of nominal frequency.
      b. Adjustable pickup from 90% to 100% of nominal frequency.
   3. Time delays
      a. Time delay start adjustable 0 – 5 seconds (preset at 1)
      b. Transfer time delay adjustable 2 – 120 seconds (preset at 3)
      c. Retransfer time delay adjustable 1 – 30 minutes (preset at 10)
      d. Generator cool down time delay adjustable 0 – 10 minutes (preset at 5)
E. The ATS power transfer controller shall not rely on any type of communication with any other hardware, internal or external, to the ATS for proper operation.
F. Power transfer controller shall be able to detect phase rotation of both the normal and emergency sources. Source shall be considered unacceptable if the phase rotation does not match the pre-programmed set point of either ABC or CBA.
G. Circuit breaker auxiliary contacts shall be wired out to common terminal block for hardwired indication of connected source.
H. Human machine interface (HMI) shall provide mode selection and metering of the ATS. Features shall include:
   1. Three-phase true RMS power sensing with Class I accuracy

2. Operation modes: AUTO, STOP, MANUAL, and TEST modes accessible through face plate or discrete input to the PTC.
3. Breaker control: Open and close control, breaker monitoring
4. Load transfer: Select between Open transition, Closed transition, Soft loading, or Continuous parallel.
5. Remote control via interface (Modbus TCP, Modbus RTU) and via discrete/analog inputs for adjusting speed, frequency, voltage, power, reactive power, and power factor set points
6. Time/Date synchronization over Simple Network Time Protocol (SNTP)
7. Counters for operating hours / starts / maintenance / active/reactive energy
8. Event recorder entries with real time clock (battery backup)
9. Operating Temperature: -20 – 70 degrees Celsius
10. Simulated analog synchroscope

I. Multifunction Protective Relay (MFR) shall be utility grade Schweitzer SEL-751 series or GE Multilin 350 series or pre-approved equal.
   1. The MFR shall contain the following functions at a minimum:
      a. Synch Check (25)
      b. Phase Sequence/Over, Under Voltage (27/47/59)
      c. Reverse Power (32)
      d. Over/Under Frequency (81 o/u)
   2. Utility MFR shall provide protection and alarming independent of the PTC.
   3. Test switches shall be provided for all non-drawout style relays.

J. All customer interconnect terminations shall be wired to a common terminal block for ease of installation.

K. All interior bussing shall be silver plated copper.

L. Manufacturer to provide adequate number of mechanical type set screw lugs for cable termination.

PART 3 – OPERATIONAL SUMMARY

3.1. Auto (Standby) Sequencing

A. Operational Summary with open transition sequencing
   1. Upon loss of normal power the following sequence occurs:
      a. Utility (normal source) failure is detected by the PTC.
      b. The PTC sends a ‘start/run’ signal to the generator (emergency source) and verifies that it is running at rated voltage and speed.
      c. The PTC shall open the utility breaker.
      d. Once the PTC has received verification that the utility breaker is open and the pre-determined open transfer time delay has expired the PTC shall close the generator breaker.
      e. Loads are now being fed from the generator.
   2. Upon return of normal power the following sequence occurs:
      a. Utility return is detected by the PTC.
      b. After the pre-determined utility return time delay has expired the PTC shall open the generator breaker.

c. After the pre-determined open transfer time delay has expired the PTC shall close the utility breaker.
d. The generator will continue to run until the pre-determined cool down time delay has expired.

B. Operational Summary with closed transition sequencing
1. Upon loss of utility power the following sequence occurs:
a. Utility failure is detected by the PTC.
b. The PTC sends a ‘start/run’ signal to the generator and verifies that it is running at rated voltage and speed.
c. The PTC shall open the utility breaker.
d. Once the PTC has received verification that the utility breaker is open and the pre-determined open transfer time delay has expired the PTC shall close the generator breaker.
e. Loads are now being fed from the generator.
2. Upon return of utility power the following sequence occurs:
a. Utility return is detected by the PTC.
b. After the pre-determined utility return time delay has expired the PTC shall command the master synchronizer to synchronize the generator with the utility source.
c. When synchronization has been successfully achieved the PTC shall close the utility breaker.
d. The PTC shall ramp the load off of the generator and onto the utility source.
e. When the load on the generator is approximately 100kW the PTC shall open the generator breaker.
f. The generator will continue to run until the pre-determined cool down time delay has expired.

3.2. Soft loading (Isolate) Sequencing

A. Operational Summary with open transition sequencing
1. Upon system operator initiating Soft load mode:
a. The PTC sends a ‘start/run’ signal to the generator and verifies that it is running at rated voltage and speed.
b. The PTC shall open the utility breaker.
c. Once the PTC has received verification that the utility breaker is open and the pre-determined open transfer time delay has expired the PTC shall close the generator breaker.
d. Loads are now being fed from the generator.
2. Upon system operator exiting Soft load mode:
a. The PTC shall open the generator breaker.
b. After the pre-determined open transfer time delay has expired the PTC shall close the utility breaker.
c. The generator will continue to run until the pre-determined cool down time delay has expired.

B. Operational Summary with closed transition sequencing
1. Upon system operator initiating Soft load mode:

a. The PTC sends a start signal to the generator and verifies that it is running at rated voltage and speed.
b. The PTC shall command the master synchronizer to synchronize the generator with the utility source.
c. When synchronization has been successfully achieved the PTC shall close the generator breaker.
d. The PTC shall ramp the load off of the utility source and onto the generator.
e. When the load on the utility source is approximately 100kW the PTC shall open the utility breaker.
f. Loads are now being fed from the generator.

2. Upon system operator exiting Soft load mode:
   a. The PTC shall command the master synchronizer to synchronize the generator with the utility source.
   b. When synchronization has been successfully achieved the PTC shall close the utility breaker.
   c. The PTC shall ramp the load off of the generator and onto the utility source.
   d. When the load on the generator is approximately 100kW the PTC shall open the generator breaker.
   e. The generator will continue to run until the pre-determined cool down time delay has expired.

3.3. Import/Export Sequencing

A. Operational Summary

1. Upon system operator initiating Import mode:
   a. The PTC sends a start signal to the generator and verifies that it is running at rated voltage and speed.
   b. The PTC shall command the master synchronizer to synchronize the generator with the utility source.
   c. When synchronization has been successfully achieved the PTC shall close the generator breaker.
   d. The PTC shall ramp the load on/off of the utility source and the generator source to maintain a set level on the utility source, depending on total system load.
   e. The utility source and generator source remain in parallel for the duration of this sequence.
2. Upon system operator exiting Import mode:
   a. The PTC shall ramp the load off of the generator and onto the utility source.
   b. When the load on the generator is approximately 100kW the PTC shall open the generator breaker.
   c. The generator will continue to run until the pre-determined cool down time delay has expired.

3.4. Baseload Sequencing

A. Operational Summary

1. Upon system operator initiating Baseload mode:

a. The PTC sends a start signal to the generator and verifies that it is running at rated voltage and speed.
b. The PTC shall command the master synchronizer to synchronize the generator with the utility source.
c. When synchronization has been successfully achieved the PTC shall close the generator breaker.
d. The PTC shall ramp the load on to the generator source and maintain a set level on the generator source, regardless of total system load.
e. The utility source and generator source remain in parallel for the duration of this sequence.

2. Upon system operator exiting Import mode:
   a. The PTC shall ramp the load off of the generator and onto the utility source.
   b. When the load on the generator is approximately 100kW the PTC shall open the generator breaker.
   c. The generator will continue to run until the pre-determined cool down time delay has expired.

PART 4 – ADDITIONAL REQUIREMENTS

4.1. Installation

A. It shall be the responsibility of the contractor installing the equipment to verify that the following items have been completed.
   1. Inspect equipment for obvious signs of damage that may have occurred during shipping and handling.
   2. Ensure the equipment is properly grounded per NEC guidelines.
   3. Installation of equipment in accordance with manufacturer's instructions.
   4. Torque all connections per manufacturer's recommendations prior to energizing.
   5. Provide all conduit and wiring and make all connections associated with the completion of the interconnection wiring between the engine generator system and the automatic transfer switch, and all accessories.
   6. Energize equipment.

4.2. Onsite Assistance

A. The manufacturer shall provide a factory trained service technician to provide assistance for the startup and commissioning of the ATS.
   1. Before the generator and ATS are subject to full load testing, check all alarms and protective devices and verify their proper operation.
   2. Work in conjunction with generator service technician to gain speed and voltage control of the generator set. Calibrate PTC as required for reliable and consistent operation.
   3. Simulate power outages by interrupting the normal source and demonstrate that the overall system operates to provide emergency power.
   4. Verify operation of all alarm and shutdown circuits by simulating conditions.

5. Verify operation of modes of operation that are applicable to particular equipment.
6. Properly calibrate any and all power transfer devices and protective devices.
7. Remove and replace malfunctioning units and retest.
8. Provide training for onsite staff.