

SECTION 26 28 26

ENCLOSED TRANSFER SWITCHES WITH BYPASS ISOLATION

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes transfer switches in individual enclosures.

1.02 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA ICS 10 - Industrial Control and Systems: AC Transfer Switch Equipment.
- B. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- C. Underwriters Laboratories Inc.:
 - 1. UL 1008 - Transfer Switch Equipment.

1.03 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Submit shop drawings after Short Circuit and Overcurrent Protective Device Coordination Study, Division 26, is approved. Shop drawings submitted without approved study will be returned and not reviewed.
- C. AIC ratings shown on the single line diagrams are approximate values only. The AIC ratings of all submitted equipment must conform to the approved Short Circuit and Overcurrent Protective Device Coordination Study.
- D. The electrical contractor shall submit 1/4"=1'0" scale sketches of all electrical rooms and areas including actual dimensions of all equipment in electrical rooms and indicate clearances per CEC, as well as door swings or other obstacles. Sketches shall be submitted along with or prior to shop drawing submittals. Shop drawing submittal without sketches shall be returned and not reviewed.
- E. Product Data: Submit catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.
- F. Manufacturer shall provide special seismic certification with submittal.

1.04 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of enclosed transfer switches.
- C. Operation and Maintenance Data: Submit routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience, and with service facilities within 100 miles of Project.
- B. Supplier: Authorized distributor of specified manufacturer with minimum ten years documented experience.

1.06 MAINTENANCE SERVICE

- A. Division 01 - Execution and Closeout Requirements: Maintenance service.
- B. Furnish service and maintenance of transfer switches for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 AUTOMATIC TRANSFER SWITCH

- A. Manufacturers:
 - 1. Eaton
 - 2. ASCO
 - 3. General Electric
- B. Manufacturer
 - 1. The combination transfer bypass/isolation switch manufacturer shall employ a nationwide factory-direct, field service organization, available on a 24-hour a day, 365 days a year, call basis.
 - 2. The manufacturer shall maintain records of each combination transfer bypass/isolation switch, by serial number, for a minimum 20 years.
- C. Product Description: Automatic transfer switch.
- D. Rating: State voltage and current rating and number of poles.
- E. Interrupting Capacity: As required to complete the work.

2.02 CONSTRUCTION

- A. General
 - 1. The automatic transfer switch (ATS) and its associated bypass/isolation (BPS) shall be furnished as required to complete the work and to comply with Code. Voltage and continuous current ratings and number of poles shall be as shown.
 - 2. All 4 pole ATS shall be a true 4-pole switch supplied with all four poles mounted on a common shaft. The continuous current rating and the closing and withstand rating of the fourth pole shall be identical to the rating of the main poles.
 - 3. The automatic transfer switch shall be mounted in a wall mounted NEMA 1 enclosure, unless otherwise determined. Enclosures shall be fabricated from 12-gauge steel. The enclosure shall be sized to exceed minimum wire bending space required by UL 1008.
 - 4. Both the units shall be bused together with silver plated copper bus and/or cable interconnection bus to provide a complete pre-tested assembly. Construction shall be such that the Developer Design/Builder needs to install only the power and control connections.
 - 5. The automatic transfer switch shall be completely isolated from the bypass/isolation switch by means of insulating barriers and separate access doors to positively prevent hazard to operating personnel while servicing the automatic transfer switch.
 - 6. The combination automatic transfer bypass/isolation switch shall be top and bottom accessible.
 - 7. The main contacts shall be capable of being replaced without removing the main power cables.

8. The main contacts shall be visible for inspection without any major disassembly of the transfer switch.
9. When a solid neutral is required, a fully rated bus bar with required AL-CU neutral lugs shall be provided.
10. The complete combination automatic transfer bypass/isolation switch assembly shall be factory tested to ensure proper operation and compliance with the specification requirements. A copy of the factory test report shall be available upon request.

B. Bypass/Isolation Construction

1. All main contacts and operating linkages of the bypass/isolation section shall be identical to the ATS, except that the operation shall be manual.
2. The bypass/isolation switch shall be load break type and shall have the same electrical ratings of ampacity, voltage, short circuit withstand, and temperature rise capability as the associated ATS. The bypass/isolation switch shall be the load-break type. The main contacts of the bypass switch shall be mechanically locked in both the normal bypass and emergency bypass positions without the use of hooks, latches, magnets, or springs and shall be silver-tungsten alloy, protected by arcing contacts with magnetic blowouts on each pole. The switching mechanism shall provide "quick-make," "quick-break" operation of the contacts.
3. The primary buswork of the draw-out automatic transfer switch shall be connected to the stationary bus stabs in the freestanding cubicle by silver plated, segmented, self-aligning, primary disconnect fingers to facilitate proper alignment between the removable draw-out when the ATS is withdrawn and shall be available for inspection without disturbing or de-energizing the main bus.
4. The secondary control disconnect contacts mounted on the ATS shall be self-aligning and shall plug into the stationary elements mounted on the freestanding cubicle. Separate, manual, secondary control disconnect plugs are not acceptable.
5. The isolating portion of the bypass/isolation shall allow the automatic transfer switch to be disconnected from all sources of power and control without opening the enclosure door. The transfer switch shall have a true draw-out configuration that does not require disconnection of any electrically or mechanical device by maintaining personnel. The automatic transfer switch shall be provided with rollers or casters to allow it to be removed from its enclosure simply by rolling it out. Positive mechanical interlocks shall be provided to insure that the bypass/isolation functions can be accomplished without the danger of a short circuit. Overlapping contact bypass/isolation switches, that are dependent upon the position of the automatic transfer switch for proper operation, are not acceptable.
6. A fourth pole, switched neutral shall be provided if the associated automatic transfer switch is designed as 4-pole. Basic 4-pole, bypass/isolation switch construction shall be identical to the associated automatic transfer switch construction.
7. Necessary controls shall be provided to ensure that the "engine run" circuit remains closed when the switch is in the bypass-to-emergency position, even though the associated transfer switch is in the "normal" position or completely removed from the enclosure.

C. Automatic Transfer Switch

1. The transfer switch shall be double throw, actuated by two electric operators momentarily energized, and connected to the transfer mechanism by a simple over center type linkage. Minimum transfer time shall be 400 milliseconds.
2. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in both the normal and emergency positions without the use of hooks, latches, magnets, or springs, and shall be silver-tungsten alloy. Separate arcing contacts with magnetic blowouts shall be provided on all transfer switches. Interlocked, molded case circuit breakers or contactors are not acceptable.
3. The transfer switch shall be equipped with a safe external manual operator, designed to prevent injury to operating personnel. The manual operator shall provide the same contact to contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly. The external manual operator shall be safely operated from outside of the transfer switch enclosure while the enclosure door is closed.

D. Automatic Transfer Switch Controls

1. The transfer switch shall be equipped with a microprocessor based control system, to provide all the operational functions of the automatic transfer switch. The controller shall have two asynchronous serial ports. The controller shall have a real time clock with NiCad battery back up.
2. The CPU shall be equipped with self diagnostics which perform periodic checks of the memory I/O and communication circuits, with a watchdog/power fail circuit
3. The controller shall use industry standard open architecture communication protocol for high-speed serial communications via multi-drop connection to other controllers and to a master terminal with up to 4000 ft of cable, or further, with the addition of a communication repeater. The serial communication port shall be RS422/485 compatible.
4. The serial communication port shall allow interface to either the manufacturer or County furnished remote supervisory control.
5. The controller shall have password protection required to limit access to qualified and authorized personnel.
6. The controller shall include a 20 character, LCD display, with a keypad, which allows access to the system.
7. The controller shall include three-phase over/under voltage, over/under frequency, phase sequence detection and phase differential monitoring on both normal and emergency sources.
8. The controller shall be capable of storing the following records in memory for access either locally or remotely:
 - a. Number of hours transfer switch is in the emergency position (total since record reset).
 - b. Number of hours emergency power is available (total since record reset).
 - c. Total transfer in either direction (total since record reset).
 - d. Date, time, and description of the last four source failures.
 - e. Date of the last exercise period.
 - f. Date of record reset.
9. The controller shall also be capable of monitoring, logging and trending power data and shall include the following: -
 - a. The controller shall be accurate to 1% measured. Voltage and current for all phases shall be sampled simultaneously to assure high accuracy in conditions of low power factor or large waveform distortions (harmonics).
The controller shall be capable of operating at nominal frequencies of 45 to 66 Hz.
 - b. The controller shall accept inputs from industry standard current transformers (5A secondary). Direct phase voltage connections, 600 VAC and under, shall be possible without the use of PT's.
 - c. The controller shall be capable of being applied in single or 3-phase, three and four wire circuits.
 - d. The controller shall use industry standard open architecture communication protocol for serial communications via multi-drop connection to other controllers and to a master terminal with up to 4000 ft of cable, or further, with the addition of a communication repeater. The serial communication port shall be RS422/485 compatible.
 - e. All setup parameters required by the controller for power monitoring shall be stored in non-volatile memory and retained in the event of a control power interruption.
 - f. The following metered readings shall be communicated by the Controller, via local display and serial communication. And to the master Control Cubicle at the Emergency Generator Control and Distribution Switch Gear:
 - 1) Current, per phase RMS and neutral
 - 2) Current Unbalance %
 - 3) Voltage, phase-to-phase and phase-to-neutral
 - 4) Voltage Unbalance %
 - 5) Real power (KW), per phase and 3-phase total
 - 6) Apparent power (KVA), per phase and 3-phase total
 - 7) Reactive power (KVAR), per phase and 3-phase total

- 8) Power factor, 3-phase total & per phase
 - 9) Frequency
 - 10) Accumulated Energy, (KWH, KVAH, and KVARH)
- g. Displaying each of the metered quantities shall be accomplished through the use of menu scroll buttons.
 - h. Setup for systems requirements shall be allowed through the local access display. Setup provisions shall include:
 - 1) CT rating
 - 2) System type (single; three phase, 3 or 4 wire)
 - i. j. Reset of the following electrical parameters shall also be allowed from the local access display:
 - 1) Real Energy (KWH)
 - 2) Apparent Energy (KVAH)
 - 3) Reactive Energy (KVARH)
 - j. All reset and setup functions shall have a means for protection against unauthorized/accidental changes.
 - k. The Controller shall be capable of storing records in memory for access either locally or remotely for up to 100 events. The reports shall include date, time and a description of the event and shall be maintained in a non volatile memory.

E. Sequence of Operation

- 1. When the voltage on any phase of the normal source drops below 80% or increases to 120%, or frequency drops below 90%, or increase to 110%, or 20% voltage differential between phases occurs, after a programmable time delay period of 0-9999 seconds factory set at 3 seconds to allow for momentary dips, the engine starting contacts shall close to start the generating plant.
- 2. The transfer switch shall transfer to emergency when the generating plant has reached specified voltage and frequency on all phases.
- 3. After restoration of normal power on all phases to a preset value of at least 90% to 110% of rated voltage, and at least 95% to 105% of rated frequency, and voltage differential is below 20%, an adjustable time delay period of 0-9999 seconds (factory set at 300 seconds) shall delay retransfer to allow stabilization of normal power. If the emergency power source should fail during this time delay period, the switch shall automatically return to the normal source.
- 4. After retransfer to normal, the engine generator shall be allowed to operate at no load for a programmable period of 0-9999 seconds, factory set at 300 seconds.

F. Automatic Transfer Switch Accessories

- 1. Programmable three phase sensing of the normal source set to pickup at 90% and dropout at 80% of rated voltage and overvoltage to pickup at 120% and dropout out at 110% of rated voltage. Programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases, set at 20%, and phase sequence monitoring.
- 2. Programmable three phase sensing of the emergency source set to pickup at 90% and dropout at 80% of rated voltage and overvoltage to pickup at 120% and dropout out at 110% of rated voltage programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases set at 20%, and phase sequence monitoring.
- 3. Time delay for override of momentary normal source power outages (delays engine start signal and transfer switch operation). Programmable 0-9999 seconds. Factory set at 3 seconds, if not otherwise specified.
- 4. Time delay to control contact transition time on transfer to either source. Programmable 0-9999 seconds, factory set at 3 seconds.

5. Time delay on retransfer to normal, programmable 0-9999 seconds, factory set at 300 seconds if not otherwise specified, with overrun to provide programmable 0-9999 second time delay, factory set at 300 seconds, unloaded engine operation after retransfer to normal.
6. Time delay on transfer to emergency, programmable 0-9999 seconds, factory set at 3 seconds.
7. A maintained type load test switch shall be included to simulate a normal power failure.
8. A remote type load test switch shall be included to simulate a normal power failure, remote switch initiated.
9. A time delay bypass on retransfer to normal shall be included. Keypad initiated.
10. Contact, rated 10 Amps 30 volts DC, to close on failure of normal source to initiate engine starting.
11. Contact, rated 10 Amps 30 volts DC, to open on failure of normal source for customer functions.
12. Light emitting diodes shall be mounted on the microprocessor panel to indicate: switch is in normal position, switch is in emergency position and controller is running.
13. A plant exerciser shall be provided with (10) 7-day events, programmable for any day of the week and (24) calendar events, programmable for any month/day, to automatically exercise generating plant programmable in one-minute increments. Also include selection of either "no load" (switch will not transfer) or "load" (switch will transfer) exercise period. Keypad initiated.
14. Provision to select either "no commit" or "commit" to transfer operation in the event of a normal power failure shall be included. In the "no commit position," the load will transfer to the emergency position unless normal power returns before the emergency source has reach 90% of it's rated values (switch will remain in normal). In the "commit position" the load will transfer to the emergency position after any normal power failure. Keypad initiated.
15. Four auxiliary contacts rated 10 Amp, 120 volts AC (for switches 100 to 800 amps) 15 amp, 120 volts AC (for switches 1000 to 4000 amps), shall be mounted on the main shaft, two closed on normal, two closed on emergency. All contacts will be wired to a terminal strip for ease of customer connections.
16. A three phase digital LCD voltage readout, with 1% accuracy shall display all three separate phase to phase voltages simultaneously, for both the normal and emergency source.
17. A digital LCD frequency readout with 1% accuracy shall display frequency for both normal and emergency source.
18. An LCD readout shall display normal source and emergency source availability.
19. Include (2) time delay contacts that open simultaneously just (milliseconds) prior to transfer in either direction. These contacts close after a time delay upon transfer. Programmable 0-9999 seconds after transfer.
20. 20. A block transfer function shall be included, energized from a 24 VDC signal from the generator control switchgear, to allow transfer to emergency.
21. 21. A load-shed function shall be included, energized from a 24 VDC signal from the generator control switchgear, to disconnect the load from the emergency source when an overload condition occurs.

G. Bypass/Isolation Switch

1. Operation of the bypass/isolation shall be assured, regardless of the position of the automatic transfer switch.
2. Light emitting diodes shall be provided to indicate: bypass position, fully isolated position, and source availability.
3. Positive sequencing of all contacts, with no possible intermediate position, shall be accomplished through the manual operators from a dead front location. Electrical testing during maintenance of the automatic transfer switch shall be possible in the bypass position.
4. Inherent double-throw (break-before-make) operation shall provide positive assurance against accidental short circuitry of the normal and emergency power sources. Arrangements utilizing interlocking of single-throw devices are not acceptable. The operating speed of the contacts shall be independent of the speed at which the handle is moved.
5. The switch shall be fully manually operated and shall not be dependent upon electrical operators, relays, or interlocks for operation.
6. The bypass/isolation switch shall be listed by Underwriters' Laboratories, Inc., Standard UL-1008 and meet the identical withstand ratings of its associated transfer switch.

7. Both the automatic transfer switch and bypass/isolation switch shall be supplied by the same manufacturer. The manufacturer shall verify that the design has been in continuous production for not less than 10 years, with at least 100 similar installations operating continuously and successfully for that period of time.
8. Bypass/isolation switch must have mechanical separation of normal and emergency to assure against accidental connection of unsynchronized sources. Electrical interlocking will not be considered acceptable.

H. Approval

1. As a condition of approval, the manufacturer of the combination automatic transfer bypass/isolation switches shall verify that their switches are listed by Underwriters Laboratories, Inc., Standard UL-1008 with 3 cycle short circuit closing and withstand higher than available fault and minimum ratings as follows:

RMS Symmetrical Amperes 480 VAC

Amperes	Current Limiting Closing and Withstand	Fuse Rating
100 – 400	42,000	200,000
600 – 800	65,000	200,000
1000 – 1200	85,000	200,000
1600 – 4000	100,000	200,000

2. During the 3 cycle closing and withstand tests, there shall be no contact welding or damage. The 3 cycle tests shall be performed without the use of current limiting fuses. The test shall verify that contact separation has not occurred, and there is contact continuity across all phases. Test procedures shall be in accordance with UL-1008, and testing shall be certified by Underwriters' Laboratories, Inc.
3. When conducting temperature rise tests to UL-1008, the manufacture shall include post-endurance temperature rise tests to verify the ability of the combination transfer bypass/isolation switch to carry full rated current after completing the overload and endurance tests.
4. The microprocessor controller shall meet the following requirements:
 - a. Storage conditions - 25 degrees C to 85 degrees C
 - b. Operation conditions - 20 degrees C to 70 degrees C ambient
 - c. Humidity 0 to 99% relative humidity, non-condensing
 - d. Capable of withstanding infinite power interruptions
 - e. Surge withstand per ANSI/IEEE C-37.90A-1978
5. Manufacturer shall provide copies of test reports upon request.

I. Manufacturer

1. The combination transfer bypass/isolation switch manufacturer shall employ a nationwide factory-direct, field service organization, available on a 24-hour a day, 365 days a year, call basis.
2. The manufacturer shall maintain records of each combination transfer bypass/isolation switch, by serial number, for a minimum 20 years.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Combination Transfer Bypass/Isolation Switches shall be provided with adequate lifting means for ease of installation of wall or floor mounted enclosures.
- B. Provide access and working space as indicated or as required.

3.02 ADJUSTMENTS

- A. Tighten assembled bolted connections with appropriate tools to manufacturer's torque recommendations prior to first energization.

END OF SECTION