

**SECTION 26 36 23**  
**AUTOMATIC TRANSFER SWITCHES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the furnishing, installation, connection, and testing of open-transition automatic transfer switches with bypass isolation, indicated as automatic transfer switches or ATS in this section.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:  
Requirements that apply to all sections of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES:  
Low-voltage conductors.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:  
Requirements for personal safety and to provide a low impedance path for possible ground fault currents.
- D. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.
- E. Section 26 05 73, OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY:  
Short circuit and coordination study, and requirements for a coordinated electrical system.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. A factory-authorized representative shall be capable of providing emergency maintenance and repairs at the project site within 4 hours maximum of notification.
- C. Automatic transfer switch, bypass/isolation switch, and annunciation control panels shall be products of the same manufacturer.

**1.4 FACTORY TESTS**

- A. Automatic transfer switches shall be thoroughly tested at the factory to ensure that there are no electrical or mechanical defects. Tests shall be conducted per UL standards. Factory tests shall be certified, and shall include the following tests:
  - 1. Visual inspection to verify that each ATS is as specified.
  - 2. Mechanical test to verify that ATS sections are free of mechanical hindrances.
  - 3. Insulation resistance test to ensure electrical integrity and continuity of entire system.

- 4. Main switch contact resistance test.
- 5. Electrical tests to verify complete system electrical operation.
- B. Furnish four (4) copies of certified manufacturer's factory test reports to the COTR prior to shipment of the ATS to ensure that the ATS has been successfully tested as specified.

#### **1.5 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

##### **1. Shop Drawings:**

- a. Submit sufficient information to demonstrate compliance with drawings and specifications.
- b. Include voltage rating, continuous current rating, number of phases, withstand and closing rating, dimensions, weights, mounting details, conduit entry provisions, front view, side view, equipment and device arrangement, elementary and interconnection wiring diagrams, factory relay settings, and accessories.
- c. Complete nameplate data, including manufacturer's name and catalog number.
- d. A copy of the markings that are to appear on the automatic transfer switches when installed.

##### **2. Manuals:**

- a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
  - 1) Schematic signal and control diagrams, with all terminals identified, matching terminal identification in the automatic transfer switches.
  - 2) Include information for testing, repair, troubleshooting, assembly, disassembly, and factory recommended/required periodic maintenance procedures and frequency.
  - 3) Provide a replacement and spare parts list. Include a list of tools and instruments for testing and maintenance purposes.
- b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

- 1) Include complete "As Installed" diagrams that indicate all pieces of equipment and their interconnecting wiring.
  - 2) Include complete diagrams of the internal wiring for each piece of equipment, including "As Installed" revisions of the diagrams.
  - 3) The wiring diagrams shall identify the terminals to facilitate installation, maintenance, operation, and testing.
3. Certifications:
- a. When submitting the shop drawings, submit a certified test report from a recognized independent testing laboratory that a representative sample has passed UL 1008 prototype testing.
  - b. Two weeks prior to final inspection, submit the following.
    - 1) Certification by the manufacturer that the ATS conform to the requirements of the drawings and specifications.
    - 2) Certification by the Contractor that transfer switches have been properly installed, adjusted, and tested.

#### 1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only:
- B. International Code Council (ICC):  
IBC-2012.....International Building Code
- C. Institute of Electrical and Electronic Engineers (IEEE):  
446-95.....IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications (Orange Book)  
C37.90.1-12.....IEEE Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus  
C62.41.1-02.....IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits  
C62.41.2-02.....IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
- D. National Electrical Manufacturers Association (NEMA):  
250-08.....Enclosure for Electrical Equipment (1000 Volts Maximum)

ICS 4-10.....Application Guideline for Terminal Blocks

MG 1-11.....Motor and Generators

E. National Fire Protection Association (NFPA):

70-2011.....National Electrical Code (NEC)

99-12.....Health Care Facilities Code

110-13.....Standard for Emergency and Standby Power  
Systems

F. Underwriters Laboratories, Inc. (UL):

50-07.....Enclosures for Electrical Equipment,  
Non-Environmental Considerations

508-99.....Standard for Industrial Control Equipment

891-05.....Switchboards

1008-12.....Transfer Switch Equipment

## **PART 2 - PRODUCTS**

### **2.1 GENERAL REQUIREMENTS**

A. Automatic transfer switches shall comply with UL, NEMA, NEC, ANSI, IEEE, and NFPA, and have the following features:

1. Automatic transfer switches shall be open transition switches, 3-pole, draw-out construction, electrically operated, mechanically held open contact type, without integral overcurrent protection. Automatic transfer switches utilizing automatic or non-automatic molded case circuit breakers, insulated case circuit breakers, or power circuit breakers as switching mechanisms are not acceptable.
2. Automatic transfer switches shall be completely factory-assembled and wired such that only external circuit connections are required in the field.
3. Each automatic transfer switch shall be equipped with an integral bypass/isolation switch.
4. Ratings:
  - a. Phases, voltage, continuous current, poles, and withstand and closing ratings shall be as shown on the drawings.
  - b. Transfer switches are to be rated for continuous duty at specified continuous current rating on 60Hz systems.
5. Markings: Markings shall be in accordance with UL 1008.
6. Tests: Automatic transfer switches shall be tested in accordance with UL 1008. The contacts of the transfer switch shall not weld during the performance of withstand and closing tests when used with

- the upstream overcurrent device. Automatic transfer switches shall be rated at 100,000 AIC.
7. Surge Withstand Test: Automatic transfer switches utilizing solid-state devices in sensing, relaying, operating, or communication equipment or circuits shall comply with IEEE C37.90.1.
  8. Housing:
    - a. Enclose automatic transfer switches in a NEMA 3R floor-mounted steel cabinets, with metal gauge not less than No. 14, in accordance with UL 508, or in a switchboard assembly in accordance with UL 891. Automatic transfer switches shall be front connected and shall not need rear access.
    - b. Enclosure shall be constructed so that personnel are protected from energized bypass-isolation components during automatic transfer switch maintenance.
    - c. Automatic transfer switch components shall be removable without disconnecting external source or load power conductors.
    - d. Finish: Cabinets shall be given a phosphate treatment, painted with rust-inhibiting primer, and finish-painted with the manufacturer's standard enamel or lacquer finish.
    - e. Viewing Ports: Provide viewing ports so that contacts may be inspected without disassembly.
  9. Operating Mechanism:
    - a. Actuated by an electrical operator.
    - b. Electrically and mechanically interlocked so that the main contact cannot be closed simultaneously in either normal and emergency position.
    - c. Normal and emergency main contacts shall be mechanically locked in position by the operating linkage upon completion of transfer. Release of the locking mechanism shall be possible only by normal operating action.
    - d. Contact transfer time shall not exceed six cycles.
    - e. Operating mechanism components and mechanical interlocks shall be insulated or grounded.
  10. Contacts:
    - a. Main contacts: Silver alloy.
    - b. Neutral contacts: Silver alloy, with same current rating as phase contacts.

- c. Current carrying capacity of arcing contacts shall not be used in the determination of the automatic transfer switch rating, and shall be separate from the main contacts.
- d. Main and arcing contacts shall be visible for inspection with cabinet door open and barrier covers removed.
- 11. Manual Operator: Capable of operation by one person in either direction under no load.
- 12. Replaceable Parts:
  - a. Include the main and arcing contacts individually or as units, as well as relays, and control devices.
  - b. Automatic transfer switch contacts and accessories shall be replaceable from the front without removing the switch from the cabinet and without removing main conductors.
- 13. Sensing Features:
  - a. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100% of nominal, and dropout voltage is adjustable from 75 to 98% of pickup value. Factory set for pickup at 90% and dropout at 85%.
  - b. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
  - c. Voltage/Frequency Lockout Relay: Prevent premature transfer to the engine-generator. Pickup voltage shall be adjustable from 85 to 100% of nominal. Factory set for pickup at 90%. Pickup frequency shall be adjustable from 90 to 100% of nominal. Factory set for pickup at 95%.
  - d. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
  - e. Test Switch: Simulate normal-source failure.
  - f. Switch-Position Indication: Indicate source to which load is connected.
  - g. Source-Available Indication: Supervise sources via transfer switch normal- and emergency-source sensing circuits.
  - h. Normal Power Indication: Indicate "Normal Source Available."

- i. Emergency Power Indication: Indicate "Emergency Source Available."
  - j. Transfer Override Control: Overrides automatic retransfer control so that automatic transfer switch shall remain connected to emergency power source regardless of condition of normal source. Control panel shall indicate override status.
  - k. Engine Starting Contacts: One isolated and normally closed and one isolated and normally open; rated 5 A at 30 V DC minimum.
  - l. Engine Shutdown Contacts: Time delay adjustable from zero to 15 minutes, and factory set for 5 minutes. Contacts shall initiate shutdown after retransfer of load to normal source.
  - m. Engine-Generator Exerciser: Programmable exerciser starts engine-generator(s) and transfers load to them from normal source for a preset time, then retransfers and shuts down engine-generator(s) after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period.
14. Controls:
- a. Controls shall provide indication of switch status and be equipped with alarm diagnostics.
  - b. Controls shall control operation of the automatic transfer switches.
15. Factory Wiring: Train and bundle factory wiring and label either by color-code or by numbered/lettered wire markers. Labels shall match those on the shop drawings.

## **2.2 SEQUENCE OF OPERATION**

- A. The specified voltage decrease in one or more phases of the normal power source shall initiate the transfer sequence. The automatic transfer switch shall start the engine-generator(s) after a specified time delay to permit override of momentary dips in the normal power source.
- B. The automatic transfer switch shall transfer the load from normal to emergency source when the frequency and voltage of the engine-generator(s) have attained the specified percent of rated value.
- C. Engine Start: A voltage decrease, at any automatic transfer switch, in one or more phases of the normal power source to less than the

specified value of normal shall start the engine-generator(s) after a specified time delay.

- D. Transfer to Emergency System Loads: Automatic transfer switches for Emergency System loads shall transfer their loads from normal to emergency source when frequency and voltage of the engine-generator(s) have attained the specified percent of rated value. Only those switches with deficient normal source voltage shall transfer.
- E. Transfer to Equipment Branch Loads: Automatic transfer switches for Equipment Branch loads shall transfer their loads to the engine-generator on a time-delayed, staggered basis, after the Emergency System switches have transferred. Only those switches with deficient normal source voltage shall transfer.
- F. Retransfer to Normal (All Loads): Automatic transfer switches shall retransfer the load from emergency to normal source upon restoration of normal supply in all phases to the specified percent or more of normal voltage, and after a specified time delay. Should the emergency source fail during this time, the automatic transfer switches shall immediately transfer to the normal source whenever it becomes available. After restoring to normal source, the engine-generator(s) shall continue to run unloaded for a specified interval before shutdown. Provide controls to allow retransfer back to normal only when substation 3 main breaker is closed. See drawings for additional information.

### **2.3 BYPASS-ISOLATION SWITCH**

- A. Provide each automatic transfer switch with two-way bypass-isolation manual type switch. The bypass-isolation switch shall permit load bypass to either normal or emergency power source and complete isolation of the automatic transfer switch, independent of transfer switch position. Bypass and isolation shall be possible under all conditions including when the automatic transfer switch is removed from service.
- B. Operation: The bypass-isolation switch shall have provisions for operation by one person through the movement of a maximum of two handles at a common dead front panel in no more than 15 seconds. Provide a lock, which must energize to unlock the bypass switch, to prevent bypassing to a dead source. Provide means to prevent simultaneous connection between normal and emergency sources.
  - 1. Bypass to normal (or emergency): Operation of bypass handle shall allow direct connection of the load to the normal (or emergency)



source, without load interruption or by using a break-before-make design, or provide separate load interrupter contacts to momentarily interrupt the load.

- a. Ensure continuity of auxiliary circuits necessary for proper operation of the system.
  - b. A red indicating lamp shall light when the automatic transfer switch is bypassed.
  - c. Bypassing source to source: If the power source is lost while in the bypass position, bypass to the alternate source shall be achievable without re-energization of the automatic transfer switch service and load connections.
2. Isolation: Operation of the isolating handle shall isolate all live power conductors to the automatic transfer switch without interruption of the load.
- a. Interlocking: Provide interlocking as part of the bypass-isolation switch to eliminate personnel-controlled sequence of operation, and to prevent operation to the isolation position until the bypass function has been completed.
  - b. Padlocking: Include provisions to padlock the isolating handle in the isolated position.
  - c. Visual verification: The isolation blades shall be visible in the isolated position.
3. Testing: It shall be possible to test (normal electrical operation) the automatic transfer switch and engine-generator(s) with the isolation contacts closed and the load bypassed without interruption of power to the load.
- C. Ratings: The electrical capabilities and ratings of the bypass-isolation switch shall be compatible with those of the associated automatic transfer switch, including any required additional withstand tests.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install automatic transfer switches in accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.
- B. Anchor automatic transfer switches with rustproof bolts, nuts, and washers not less than 12 mm (1/2 inch) diameter, in accordance with manufacturer's instructions, and as shown on drawings.

- C. Mount automatic transfer switches on 4" thick concrete slab with 1" chamfer.
- D. Anchor remote control and/or annunciator panel to wall.

### 3.2 ACCEPTANCE CHECKS AND TESTS

- A. An authorized representative of the automatic transfer switch manufacturer shall technically supervise and participate during all of the field adjustments and tests. Major adjustments and field tests shall be witnessed by the COTR. The manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.
- B. Perform manufacturer's required field tests in accordance with the manufacturer's recommendations. In addition, include the following:
  - 1. Visual Inspection and Tests:
    - a. Compare equipment nameplate data with specifications and approved shop drawings.
    - b. Inspect physical, electrical, and mechanical condition.
    - c. Confirm correct application of manufacturer's recommended lubricants.
    - d. Verify appropriate anchorage, required area clearances, and correct alignment.
    - e. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.
    - f. Verify grounding connections.
    - g. Verify ratings of sensors.
    - h. Vacuum-clean enclosure interior. Clean enclosure exterior.
    - i. Exercise all active components.
    - j. Verify that manual transfer warning signs are properly placed.
    - k. Verify the correct operation of all sensing devices, alarms, and indicating devices.
  - 2. Electrical tests:
    - a. Perform insulation-resistance tests.
    - b. After energizing circuits, demonstrate the interlocking sequence and operational function for each automatic transfer switch at least three times.
      - 1) Test bypass-isolation unit functional modes and related automatic transfer switch operations.

- 2) Power failure of normal source shall be simulated by opening upstream protective device. This test shall be performed a minimum of five times.
  - 3) Power failure of emergency source with normal source available shall be simulated by opening upstream protective device for emergency source. This test shall be performed a minimum of five times.
  - 4) Low phase-to-ground voltage shall be simulated for each phase of normal source.
  - 5) Operation and settings shall be verified for specified automatic transfer switch operational feature, such as override time delay, transfer time delay, return time delay, engine shutdown time delay, exerciser, auxiliary contacts, and supplemental features.
  - 6) Verify pickup and dropout voltages by data readout or inspection of control settings.
  - 7) Verify that bypass and isolation functions perform correctly, including the physical removal of the automatic transfer switch while in bypass mode.
- c. When any defects are detected, correct the defects and repeat the tests as requested by the COTR at no additional cost to the Government.

### **3.3 FIELD SETTINGS VERIFICATION**

The automatic transfer switch settings shall be verified in the field by an authorized representative of the manufacturer.

### **3.4 FOLLOW-UP VERIFICATION**

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the automatic transfer switches are in good operating condition and properly performing the intended function.

### **3.5 INSTRUCTION**

Furnish the services of a factory-trained technician for one 4-hour training period for instructing personnel in the maintenance and operation of the automatic transfer switches, on the dates requested by the COTR.

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