

SPECIAL SPECIFICATION

SECTION 16495S

TRANSFER SWITCHES

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes transfer switches rated 600 V and less. It includes the following items:
 - 1. Automatic transfer switch.
 - 2. Bypass/isolation switch.
 - 3. Accessories.
- B. Related Sections include the following:
 - 1. Conductors for hard-wired connections between transfer switches and remote equipment are specified in Division 16 Section "Electrical Work."

1.03 SUBMITTALS

- A. Product Data: For each switch specified. Include dimensioned plans, sections, and elevations showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and materials lists.
- B. Wiring Diagrams: Details of wiring for transfer switches and differentiating between manufacturer-installed and field-installed wiring. Show both power and control wiring.
- C. Single-Line Diagram: For each combined transfer switch and bypass/isolation switch, show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions.

- D. Product Certificates: Signed by manufacturer certifying that products furnished comply with requirements and that switches have been tested for short-circuit closing and withstand ratings applicable to units for Project.
- E. Qualification Data: For firms and persons specified in the “Quality Assurance” Article.
- F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- G. Maintenance Data: For each type of product to include in the maintenance manuals specified in Division 1. Include all features and operating sequences, both automatic and manual. List all factory settings of relays and provide relay setting and calibration instructions.
- H. Submit the above in accordance with Section 1300-S.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: In addition to requirements specified in Division 1 Section “Quality Control,” an independent testing agency shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or shall be a full member company of the InterNational Electrical Testing Association.
 - 1. Testing Agency’s Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or National Institute for Certification in Engineering Technologies, to supervise on-site testing specified in Part 3.
- B. Emergency Service: Manufacturer maintains a service center capable of providing emergency maintenance and repairs at Project site with an 8-hour maximum response time.
- C. Source Limitations: Obtain automatic transfer switch and bypass/isolation switch from a single manufacturer who assumes responsibility for all components.
- D. Listing and Labeling: Provide transfer switches specified in this Section that are listed and labeled for emergency service under UL 1008.
 - 1. The Terms “Listed” and “Labeled”: As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” as defined in OSHA Regulation 1910.7.

- E. Comply with NFPA 70, “National Electrical Code,” for components and installation.
- F. Comply with NFPA 110, “Standard for Emergency and Standby Power Systems,” meeting the Level 1 criteria.
- G. Comply with NEMA ICS 1, “general Standards for Industrial Control, “ICS2, “Industrial Control Devices, Controllers and Assemblies,” and ICS 6, “Enclosures for Industrial Controls and Systems.”
- H. UL Compliance: Comply with UL 1008, “Automatic Transfer Switches,” unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work are the following:
 - 1. Conventional Transfer Switches:
 - a. Caterpillar, Inc.; Engine Division.
 - b. Emerson Electric Co.; Automatic Switch Co. Subsidiary.
 - c. Generac Corp.
 - d. Kohler Co.; Generator Division.
 - e. Onan Corp.; Electrical Products Division.
 - f. Russelectric, Inc.
 - g. Zenith Controls, Inc.

2.02 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Units 600 amperes and larger have current ratings that apply to mixtures of loads including 30-percent-maximum tungsten filament lamp load.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices and installation locations in Project under the fault conditions indicated on one-line diagrams based on testing according to UL 1008.

1. Where External Circuit Breaker or Fuses Protect Transfer Switch: Products are listed for use with the actual devices providing the fault-current protection at each location for Project. Rated fault-current, withstand-duration times include the following:
 - a. Units Protected by Molded-Case Circuit Breakers 150 A and Less: 1.5 cycles.
 - b. Units Protected by Molded-Case Circuit Breakers Larger than 150 A: 3 cycles.
 - c. Units Protected by Power and Insulated-Case Circuit Breakers: 10 cycles.
 - d. Unit Protected by Current-Limiting Fuses: 0.5 cycles (nominal).
 2. Where Transfer Switch Includes Internal Protection: Rating of switch and trip unit combination exceeds indicated fault-current value at installation location.
- C. Solid-State Controls: Repetitive accuracy of all settings is plus or minus 2 percent or better over an operating temperature range of minus 20 deg C to 70 deg C.
 - D. Resistance to Damage by Voltage Transients: Components meet or exceed voltage-surge withstand capability requirements when tested according to ANSI C37.90.1. Components meet or exceed voltage-impulse withstand test of NEMA ICS 1.
 - E. Neutral Terminal: Where 2- or 3-pole switches are indicated, provide fully rated solid, un-switched neutral terminal, unless otherwise indicated.
 - F. Four-Pole Switches: Where 4-pole switches are indicated, provide neutral switching.
 - G. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of the circuit in which the switch is installed.
 - H. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6; UL 508, unless otherwise indicated.
 - I. Factory Wiring: Train and bundle factory wiring and label consistent with Shop Drawings, either by color code or by numbered or lettered wire and cable tape markers at termination.

1. Designated Terminals: Pressure type suitable for types for sizes of field wiring indicated.
 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- J. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric motor-operated mechanism, mechanically and electrically interlocked in both directions.
- K. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
1. Limitation: Switches using molded-case switch or insulated-case circuit-breaker components and switches using contractors not designed for continuous-duty repetitive switching between active power sources are not acceptable.
 2. Switch Action: Double-throw; mechanically held in both directions.
 3. Switch Contacts: Silver composition for load current switching. Conventional automatic transfer-switch units rated 225 A and greater have separate arcing contacts.

2.03 AUTOMATIC TRANSFER SWITCH (ATS)

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Comply with NFPA 20 for fire-pump transfer switches.
- C. Switching Arrangement: Double-throw type, with time delay in neutral position, to allow motor counter-eng to decay.
- D. Manual Switch Operation: Manually operated under load, with the door closed, and with either or both sources energized. Transfer time is the same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
- E. Signal-before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
- F. Digital Communications Interface: Full-duplex RS 422 type, matched to capability of remote annunciator or annunciator and control panel.

- G. Transfer Switches Based on Molded-Case Switch Components: Comply with UL 489, UL 869, and NEMA AB 1.

2.04 AUTOMATIC TRANSFER-SWITCH FEATURES

- A. Voltage sensing for each phase of normal source. Pickup voltage is adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
- B. Time delay for override of normal-source voltage sensing delays transfer and engine start signals. Adjustable 0 to 6 seconds and factory set at 1 second.
- C. Voltage/Frequency Lockout Relay: Prevents premature transfer to an emergency generator set. Pickup voltage is adjustable from 85 to 100 percent of nominal. Factory set to pickup at 90 percent. Pickup frequency is adjustable from 90 to 100 percent of nominal. Factory set to pickup at 95 percent.
- D. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes and factory set at 10 minutes. Provides automatic defeat of the delay on loss of voltage or sustained undervoltage of the emergency source, provided normal supply has been restored.
- E. Test Switch: Simulates normal-source failure.
- F. Switch-Position Pilot Lights: Indicate source to which load is connected.
- G. Source-Available Indicating Lights: Supervise sources via the transfer-switch, normal-and emergency-source sensing circuits.
 - 1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - 2. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
- H. Unassigned Auxiliary Contacts: 2 normally open single-pole, double-throw contacts for each switch position, rated 10 A at 240 V, ac.
- I. Re-transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of the condition of the normal source. A pilot light indicates override status.

- J. Engine Starting Contacts: 1 isolated, normally closed and 1 isolated, normally open. Contacts are gold flashed or gold plated and rated 10 A at 32 V, dc minimum.
- K. Engine shutdown Contacts: Instantaneous. Initiates shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
- L. Engine Shutdown Contacts: Time delay adjustable from 0 to 5 minutes; factory set at 5 minutes. Initiates shutdown at remote engine-generator controls after retransfer of load to normal source.
- M. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine-generator set and transfers load to it from normal source for a preset time, then retransfers and shuts down engine 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-set periods are for 7 days, 20 minutes, and 5 minutes, respectively. Exerciser features include the following:
 - 1. Exerciser Transfer Selector switch: Permits selection between exercise with and without load transfer.
 - 2. Push-button programming control with digital display of settings.
 - 3. Integral battery operation of time switch when normal control power is not available.

2.05 BYPASS/ISOLATION SWITCH

- A. Comply with requirements for Level 1 equipment per NFPA 110.
- B. Description: Manual type, arranged to select and connect either source of power directly to the load, isolating the transfer switch from the load and from both power sources. Include the following features for each combined automatic transfer switch and bypass/isolation switch:
 - 1. Means to lock the bypass/isolation in the position that isolates the transfer switch, with an arrangement that permits complete electrical testing of the transfer switch while isolated. While isolated, interlocks prevent transfer-switch operation, except for testing or maintenance.
 - 2. Drawout Arrangement for Transfer Switch: Provides physical separation from live parts and accessibility for testing and maintenance operations.
 - 3. Bypass/Isolation Switch Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of the associated automatic transfer switch, and with the same phase arrangement and number of poles.
 - 4. Contact temperatures of bypass/isolation switches do not exceed those of automatic transfer-switch contacts when they are carrying rated load.

5. Operability: Constructed so load bypass and transfer-switch isolation can be performed by 1 person in no more than 2 operations in 15 seconds or less.
 6. Legend: Manufacturer's standard legend for control labels and instruction signs give detailed operating instructions.
 7. Maintainability: Fabricate to allow convenient removal of major components from the front without removing other parts or main power conductors.
- C. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars, plated at connection points and braced for the indicated available short-circuit current.

2.06 REMOTE ANNUNCIATION

- A. Functional Description: Provide one each Form C contact rated 5A at 120Vac for each of the following:
1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
 2. Switch position.
 3. Switch in test mode.
 4. Failure of digital communications link.

2.07 FINISHES

- A. Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and primer.

2.08 SOURCE QUALITY CONTROL

- A. Factory Test Components, Assembled Switches, and Associated Equipment: Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Floor Mounting of Switches: Level and anchor unit to floor.
- B. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

- C. Identify components according to Division 16 Section “Electrical Identification.”
- D. Identify components according to Division 16 Section “Basic Electrical Materials and Methods.”

3.02 WIRING TO REMOTE COMPONENTS

- A. Match type and number of cables and conductors to control and communications requirements of transfer switches used. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

3.03 CONNECTIONS

- A. Ground equipment as indicated and required by National Electrical Code.
 - 1. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. Where manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 GROUNDING

- A. Make equipment connections for transfer switch units as indicated and as required by the NEC.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Provide the services of a qualified independent testing agency to perform specified acceptance testing.
- B. Preliminary Tests: Perform electrical tests as recommended by manufacturer and as follows:
 - 1. Measure phase-to-phase and phase-to-ground insulation resistance levels with insulation resistance tester. Include external annunciator and control circuits. Use test voltages and procedure recommended by manufacturer. Meet manufacturer’s specified minimum resistance.
 - 2. Check for electrical continuity of circuits and for short circuits.
- C. Field Tests: Give 7 days’ advance notice of tests and perform tests in presence of Owner’s representative.
- D. Coordinate tests with tests of generator plant and run them concurrently.
- E. Tests: As recommend by manufacturer and as follows:

1. Control Resistance Test: Measure resistance of power contacts for automatic transfer switches, non-automatic transfer switches, and bypass/isolation switches. Resolve values in excess of 500 micro-ohms and differences between adjacent poles exceeding 50 percent.
 2. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices to ensure sensors are properly selected and located to optimize ground-fault protection when power is being delivered from either source.
 - a. Verify grounding points and sensor ratings and locations.
 - b. Apply simulated fault current at sensors and observe reaction of circuit-interrupting devices.
 3. Operational Tests: Demonstrate interlocking sequence and operational function for each switch at least 3 times.
 - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Simulate low phase-to-ground voltage for each phase of normal source to automatic transfer switches.
 - c. Verify time-delay settings and pickup and dropout voltages.
- F. Test Failures: Correct deficiencies identified by tests and prepare for retest. Verify that equipment meets specified requirements.
- G. Reports: Maintain a written record of observations and tests. Report defective materials and workmanship and retest corrected items. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.06 DEMONSTRATION

- A. Training: Engage a factory-authorized service representative to instruct Owner's personnel in the operation, maintenance, and adjustment of transfer switches and related equipment. Provide a minimum of 4 hours of instruction scheduled 7 days in advance.

END OF SECTION