

# Electrical - Standard Specifications

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## AUTOMATIC TRANSFER SWITCHES

### STANDARD SPECIFICATIONS

This standard specification is intended to be integrated into the project specifications. The Consultant shall write the specifications to meet the project needs in consultation with the Owner and in accordance with the attached design information section.

**IMPORTANT:** *The Consultant shall clearly indicate in the drawings and specifications whether the PNP, NPNP and/or BIS style switches are required. Eliminate the appropriate sections of this specification if the PNP and/or the BIS features are not required.*

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

##### A. Automatic transfer switches (ATS)

###### 1. Styles and features

***Consultant shall indicate PNP, NPNP and BIS requirements here. See the guidelines listed above.***

#### 1.02 QUALIFICATIONS

##### A. Pre-approved transfer switches

***Consultant shall specify the approved manufacturers based on the criteria defined in the introduction to this standard specifications.***

1. Approved manufacturer: Russelectric.
2. For each project, transfer switches shall be of the same manufacturer.
3. Pre-approval subject to the manufacturer's ability to meet ALL of the specification requirements.

##### B. Pre-approved accessories

1. Selector switches shall be Electro-Switch, Series 24 or approved equal.
2. Russelectric RPTC Microprocessor based control system
3. Electro Industries Gauge (EIG) 200 Shark Meter I/O with Ethernet and Relay outputs cards.

### 1.03 RELATED SECTIONS

- A. The work under this section is subject to requirements of the contract documents, including the **GENERAL CONDITIONS, SUPPLEMENTAL CONDITIONS**, and sections under Division-1 **GENERAL REQUIREMENTS**.
- B. Equipment identification
- C. Requirements in support of the commissioning process
- D. Structural drawings and specifications for housekeeping pad construction details.

### 1.04 REFERENCES

- A. Applicable codes, standards, and references
  - 1. National Electrical Code - NEC
  - 2. National Electrical Testing Association – NETA
  - 3. UL 1008 – Automatic Transfer Switches
  - 4. National Fire Protection Association – NFPA
  - 5. State and local codes and ordinances

### 1.05 COORDINATION

- A. Coordinate with Inspection, Calibration and Testing section
- B. Coordinate Operations and Maintenance training times with the University.

### 1.06 SUBMITTALS

- A. General
  - 1. Submittals shall be in accordance with Conditions of the Contract and Division 01 Specification sections.
  - 2. Submit detailed maintenance manuals and drawings, which include wiring diagrams, dimensions, front and side views and catalog information indicating complete electrical and mechanical characteristics.

### 1.07 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with Conditions of the Contract and Division 01 Specification Sections.
- B. Operations and Maintenance Manuals shall include but not be limited to wiring diagrams, bus layout drawings, dimensions, front and side views and catalog information indicating complete electrical, mechanical characteristics, startup and testing reports.

### 1.08 MEETINGS

- A. Attend meetings with the Owner and/or Owner's representative as required to resolve any installation or functional problems.

## **PART 2 - PRODUCTS**

### 2.01 AUTOMATIC TRANSFER SWITCH AND BYPASS ISOLATION SWITCH

#### A. General

1. Each transfer switch shall be enclosed in NEMA-1 general-purpose enclosure with front opening lockable doors. Access into enclosure shall be from the front.
2. All components of the assembly except those identified in these specifications by the manufacturer shall be a regularly manufactured product of the supplier.
3. Nameplates: Identify all equipment, operating handles, and devices on structure (exterior and interior) with engraved plastic laminated nameplates (red background with white lettering). Engraving shall identify equipment, emergency classification and supply sources to match nomenclature identification shown on equipment schematic and wiring diagrams.
4. Provide microprocessor based control system that includes:
  - a. Setup, alarm acknowledgement, and review of actual data are accomplished using the controller's soft keys and VGA color display. The menu should be able to guide the user through controller setup and the entering of configuration data, including communications and timing set points, adjustable control parameters (interlocks, alarms and security), and event logging.
  - b. Real-time metering of voltage (phase-to-phase and phase-to-neutral), current and power; frequency of both sources; power quality with waveform capture and historical trending.
  - c. Senses Source 1 (usually the electric utility source) and Source 2 (usually the engine generator source) voltages and, by means of easy-to-see LEDs, indicates switch position and source availability. Through the menu, the user shall be able to review operational data such as active time delays, transfer inhibits, metered values, fault and alarm reports, event records, and configuration settings. The controller also automatically displays the status of monitored conditions in color-coded banners at the top of the VGA screen including faults and alarms, inhibits, and informational messages.
  - d. Two communication interfaces - standard Modbus RTU and Modbus TCP/IP via 10/100 Base-T Ethernet
  - e. An external USB communication port on the controller's faceplate.
  - f. Controller design shall accommodate the addition of accessories.
5. Identify all control wire terminations by tubular sleeve-type markers to agree with wire marking identification on manufacturer's equipment drawings.
6. Indicating lamps shall be LED.
7. All transfer switches shall be provided with a connection to the UW FacNet system.

#### B. Automatic transfer switch ratings and performance

1. Transfer to emergency and re-transfer to normal source shall be automatic. Once initiated, NPNP transfer time shall not exceed 1/20th of one second. UL 1008 listed meeting tables 21.1, 23.1, 23.2.
  2. The transfer switch shall be capable of transferring successfully in either direction with 70% rated voltage applied to the switch terminals.
  3. Each automatic transfer switch shall be rated at 480 volts, 3 phase, 4 pole, for 60 Hertz, normal and emergency sources.
  4. All current-carrying parts shall have full 600-volt insulation.
  5. The automatic transfer switch and bypass/isolation switch shall have 42,000 Amps minimum RMS short circuit withstand and closing rating when connected to the load side of standard circuit breakers (not current limiting).
- C. Construction
1. For NPNP applications, the transfer switch actuator shall be double throw, single electrical operator, momentarily energized; connected to the transfer mechanisms by a simple over-center-type linkage.
  2. The transfer switch shall be equipped with a permanently attached safe manual operator design to prevent injury to operating personnel. The manual operator shall provide the same contact-contact transfer speed as the electrical operator to prevent switching the main contacts slowly, and shall allow for manual transfer under full load.
  3. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing.
  4. Main contacts shall be mechanically locked in position in both the normal and emergency positions.
  5. Main contacts: Silver tungsten alloy. Separate arcing contacts, with magnetic blowouts. Interlocked molded case circuit breakers or contactors are not acceptable.
- D. The automatic transfer switch features and accessories:
1. All contacts shall be Form-C dry contacts and wire to a dedicated terminal strip for easy access and connection to remote system.
  2. Number the terminals clearly and sequentially with labels indicating which function each terminal block represents.
  3. Acceptable nomenclature is "Normal Position (N.O.);" or "Normal Position (Common)" where (N.O.) is the normally open contact and common is common with both (N.O.) and (N.C.).
  4. Required remote monitoring contacts and signals
    - a. Normal position; four auxiliary contacts closed in normal position (Russelectric #14ax).
    - b. Emergency position; four auxiliary contacts closed in emergency position (Russelectric #14bx).
    - c. Automatic switch truck position (Russelectric # IS). Normally open dry contact that closes when the ATS is isolated

5. Adjustable close differential 3-phase sensing relay energized from the normal source, factory set to pick up at 90% and drop out at 80% of rated voltage. Potential transformers shall be multi-tap for either 208V or 480V sensing (Russelectric #VSN).
6. Time delay to override momentary normal source power outage, to delay transfer switch operation; adjustable 0.5-3 seconds, factory set at 3 seconds (Russelectric #1d).
7. Time delay on transfer to emergency; pneumatic type, adjustable 1-300 seconds, factory set at 3 seconds (Russelectric #2b).
8. Time delay on re-transfer to normal while in emergency position. Motor driven type, adjustable 0-30 minutes, factory set at 5 minutes. This time delay shall be overridden upon failure of the emergency source (Russelectric #3a).
9. Four-position selector switch with "Manual", "Off", "Auto", "Test" positions
  - a. Manual: Permits pushbutton transfer to normal or emergency
  - b. Off: Override to bypass the automatic transfer switch controls so that the transferred switch will remain indefinitely connected to the power source (emergency, normal, or neutral) regardless of the condition of the power sources.
  - c. Automatic: All control features ready for automatic sensing and transfer (Exception: Remote control has priority over this switch position) (Russelectric #12a).
  - d. Test: Simulates normal power failure with the load test relay (Russelectric #5c).
10. Pushbutton re-transfer to normal, operable only when the 4 position selector switch (Russelectric #6f) is in the manual position.
11. Pushbutton transfer to emergency, operable only when 4 position selector switch is in the manual position (Russelectric #6g).
12. Green LED pilot light to indicate switch in normal position (Russelectric #9a).
13. Red LED pilot light to indicate switch in emergency position (Russelectric #9b).
14. Meters using Cutler Hammer IQ200s with selector switches to read current in all three phases of load circuit. Provide shorting block and terminals for connection of 5 Amp transducer to the current transformers (Russelectric #18b).
15. Voltmeter with 7-position selector switch marked "3-1", "2-3", "1-2", "Off", "1", "2", "3". Three-phase type to read phase-to-phase and phase-to-neutral voltage of the load for 4-pole ATs. (Russelectric #18b).
16. KW and KVAR: Monitor on the load side of the transfer switch with Watt/Var transducers and related hardware. Transducer outputs shall be 4-20ma corresponding to the actual load. Hardware provided should be isolated from all other normal switch operational wiring. Include: P.T. and C.T. fuse protection, facilities for portable testing equipment (e.g. G.E. type "PK-2" test blocks), C.T. shorting blocks.
17. Loss of normal power: Six auxiliary contacts to close on failure of normal source. When applicable, these contacts shall initiate building emergency power procedures: Engine generator start contacts, HVAC control, elevator shutdown, fire alarm annunciation, etc. (Russelectric #7).
18. Contacts operated from voltage sensing network (VSN) to open on failure and close on restoration of normal source (to CMCS signal) (Russelectric #VSN).

19. Loss of emergency power: Terminals and contacts (3-amp 125 VAC) for remote monitoring of emergency source status (within voltage and frequency limits; not within voltage and frequency limits) (Russelectric #21x).
  20. Derangement: Interconnect the following contacts (normally closed) such that any open contact indicates "off normal" condition, including the following:
    - a. Manual/Off/Auto/Test selector switch (acc. 12) is in manual, off, or test position.
    - b. Automatic mechanism of switch is fully isolated (drawn out of the cubicle).
  21. Adjustable relay to prevent transfer to emergency until voltage and frequency of generating plant have reached acceptable limits. Factory set at 90% of rated value (Russelectric #21).
- E. Sequence of operation
1. Contacts shall be provided to initiate an emergency operation (i.e., elevator or HVAC equipment shutdown) should the voltage of the normal source drop on any phase after an adjustable time delay of 0.5 -3 seconds to allow for momentary dips.
  2. The transfer switch shall transfer to emergency when rated voltage and frequency has been reached.
  3. After restoration of normal power on all phases, an adjustable time delay period of 0 to 30 minutes shall delay the automatic re-transfer to allow stabilization of normal power. If the emergency power source should fail during this time delay period, the switch shall automatically and immediately return to the normal source or neutral position.
  4. A maintained contact test switch shall be included to simulate normal power failure, and pilot lights shall be mounted on the cabinet door to indicate the switch position. Operation of test switch shall cause a derangement signal.

***Consultant to include the next section for PNP style transfer switches***

- F. PNP switches
1. PNP applications, the transfer switch actuator shall be dual electrical operators, momentarily energized, and connected to the transfer mechanisms by a simple over-center-type linkage, with a total transfer time that is adjustable between 0 and 300 seconds.
  2. PNP transfer switch styles, provide time delay relays to control contact transition time by suspending contact mechanism in neutral (off) position on transfer to either source, adjustable 1-300 seconds, factory set at 3 seconds. Timing shall start upon failure of old source. Provide terminals for remote contact control (3Amp, 120 Volt from the CMCS by others) to override relay and force ATS to assume the neutral (off) position, regardless of time delay relay status; for use in load shedding (Russelectric #2dx).
  3. PNP transfer switch styles, provide a LED pilot light with a flashing lamp, which indicates when either the load shed or block transfer relays are energized (Russelectric LSBTR).
  4. PNP transfer switch styles: Provide a maintained two-position selector switch for load shed or block transfer enable/disable. This switch shall be capable of being sealed in either position with a lead or plastic tamper indicating seal. Provide contacts for remote monitoring when this switch is placed in the disable position.

5. PNP applications: Provide adjustable time delays for transferring from the normal to the neutral position and from the neutral to the emergency position. A Load Shed signal shall initiate action that removes the load from the emergency source.
6. Each PNP transfer switch shall have a Load Shed Enable/Disable switch. This switch determines if the Central Management Control System (CMCS) has control.
7. PNP transfer switch styles: The CMCS shall have the ability to control loads on the campus emergency feeder system. Load Shed control takes (predetermined) prioritized loads off the system. Block transfer control permits the proper loading of the system when the generators come on line. This control shall be combined into one output signal from the CMCS.
8. Required PNP monitoring and control equipment, contacts and signals:
  - a. Neutral position; four auxiliary contacts closed in neutral position.
  - b. Load shed keyswitch; closed when keyswitch enabled
  - c. Load Shed keyswitch; enables/disables remote load shed control

***Consultant to include the next section for BIS style transfer switches***

- G. Bypass/Isolation Switch (BIS)
  1. Automatic transfer switch and its associated bypass/isolation switch (BIS), shall be mounted in a freestanding enclosure, and bussed together with copper bus to provide a complete and pre-tested factory assembly. Construction shall be such that the installation contractor needs only to make the incoming power and control wiring connections.
  2. Bypass/isolation switches (both normal to load and emergency to load) shall provide safe and convenient means for manually bypassing and isolating the ATS, regardless of the position or condition of the ATS, with the ability to be used as an emergency backup system in the event the transfer switch should fail. In addition, the bypass/isolation switch shall be utilized to facilitate removal of the automatic transfer switch for maintenance and repair.
  3. 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 or removing the automatic transfer switch.
  4. Provide feeder entrance compartment at the top of switch.
  5. Transfer switch removal: Provide drawout-type transfer switch that when withdrawn from its operational position is supported on a rail assembly for ease of maintenance.
  6. Operation of the BIS to either normal or emergency shall be possible without changing and regardless of the position of the automatic transfer switch. Overlapping contact bypass/isolation switches that are dependent upon the position of the ATS for proper operation are not acceptable.
  7. Provide indicating lights to show the bypass/isolation switch in the bypass position, in fully isolated position, and to indicate source availability. Derangement signal shall only indicate the fully isolated position (drawn out of the cubicle).
  8. Accomplish positive sequencing of all contacts, with mechanical linkage which prevents delay in intermediate position, through the manual operators from a dead front location.

9. Electrical testing and maintenance of the automatic transfer switch shall be possible in the bypass position.
  10. Inherent double throw (break-before-make) operation shall provide positive assurance against accidental interconnection of the normal and emergency power sources. Arrangements utilizing interlocking of single-throw devices are not acceptable.
  11. The operating speed of the contacts shall be independent of the speed at which the handle is moved.
  12. The BIS switch shall be fully manually operable and shall not be dependent upon electrical interlock, operators, or relays for operation.
  13. All main contacts and operating linkages of the BIS shall be identical to the ATS except that the operation shall be manual, and the switch shall give the same electrical ratings of ampacity, voltage, short circuit withstand, and temperature rise capability as the associated ATS. The bypass and emergency 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.
  14. The primary buswork of the drawout automatic transfer switch shall be connected to the stationary bus stabs in the freestanding cubicle by silver-plated, segmented, self-aligning, primary disconnect stabs to facilitate proper alignment between the removable drawout element and the stationary cubicle. The ATS stab assemblies shall be drawn out when the ATS is withdrawn and shall be available for inspection without disturbing or de-energizing the main bus.
  15. Similarly, 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.
  16. Provide the ATS with self-contained extension rails, rollers, or casters to allow it to be rolled from its enclosure by one person.
  17. Provide positive mechanical interlocks to ensure that the drawout functions can be accomplished without the danger of a short circuit.
  18. Required BIS monitoring contacts and signals
    - a. Bypassed to emergency position
    - b. Bypassed to normal position
- H. Central Monitoring and Control System (CMCS) Points List:
1. The transfer switches shall have the capability of being supervised by the CMCS (Central Monitoring and Control System.)
    - a. KW and KVAR
    - b. Loss of normal power
    - c. Loss of emergency power
    - d. Derangement:
    - e. Enclosure intrusion.
    - f. Auto switch.
    - g. Load Shed keyswitch.



- h. Normal position.
- i. Neutral position.
- j. Emergency position.
- k. Bypassed to emergency position.
- l. Bypassed to normal position.
- m. Automatic switch truck position.

## **PART 3 - EXECUTION**

### 3.01 REQUIREMENTS

- A. Installation, mounting and electrical connections
  - 1. In accordance with manufacturer's installation instructions and Seismic Zone 3 requirements
  - 2. Install floor mounted transfer switches on housekeeping pads. Housekeeping pads may present difficulties to remove the automatic switching mechanism for maintenance for large and heavy switches, usually 1000A and larger. For large switches, do not use pads but provide other means to prevent dust and debris from entering switch enclosures.
  - 3. Coordinate remote monitor and control signal connections with the University.
- B. Training
  - 1. Provide operation and maintenance training by a factory-trained instructor for two 2-hour sessions of on-site training for a total of 6 maintenance personnel.
  - 2. Include troubleshooting, repair and maintenance manuals for each participant.
- C. Testing
  - 1. Provide factory field startup and testing services to assist the ETC (Electrical Testing Contractor) per the Inspections, Calibration and Testing Section.