

**Section 16620**  
**Static Transfer Switch Specification**

**1.0 General Requirements for a stand alone static switch**

**1.01 Scope**

- A. Furnish factory assembled fully automatic Static Transfer Switch (STS), model SBR, in accordance with the contract documents and the following specification with all elements to conform to all relevant standards of manufacturing and construction, including but not limited to, CBEMA Power Profile, NFPA, UL1008, NEMA AB-1 and NEC.
- B. Work of this section, as shown or specified shall be in accordance with the requirements of the contract documents.
- C. The bidder shall participate in determining the means available for receiving and handling the equipment.
- D. Off loading, installation, interconnecting cables and lugs and all associated costs are the responsibility of the contractor. Installation shall be in accordance with the manufacturer's recommendations.

**1.02 Work Included**

- A. Furnish components for Static Transfer Switch units as herein specified for installation under another contract.
- B. Provide all materials and services for manufacturing, testing, and delivery to a designated jobsite. The work required under this contract shall include the following:
  - 1. Furnishing Static Transfer Switches as herein specified.
  - 2. Complete configuration drawings and installation drawings.
  - 3. Factory tests as herein specified.

**1.03 Submittal Requirements**

- A. The information with the bid shall include, but not limited to, the following items.
  - 1. Technical proposal, including specification and description of all components, major component manufacturers, SCR ratings, lug sizes, frame sizes and current ratings of circuit breakers and operation.
  - 2. Outline and installation drawings showing dimensions and weight of the equipment, along with external power cable connections and recommended cable entrances and exits.
  - 3. All listing and file numbers showing that the equipment has been tested to and certified by an independent testing laboratory to Underwriters Laboratory (UL) standards as required by contract documents.
  - 4. Proposed fabrication schedule, factory test dates and delivery date per contract documents.
  - 5. Warranty schedule
- B. Bidders shall provide a compliance review of all specifications and addenda. The review will be paragraph-by-paragraph designating Compliance ("C"), Deviation ("D"), Exception ("E") and a numbered footnote with reasons for the proposed deviation or exceptions and how the intent of the specification will be satisfied.

**1.04 Shop Drawings**

- A. Prepare and submit for review detailed shop drawings for the equipment furnished hereunder. Upon receipt of purchase order, four (4) sets of shop drawings shall be submitted within two weeks of accepted purchase order, prior to proceeding with any fabrication or assembly of equipment.
- B. All submittals shall be a complete package properly indexed and cross referenced. Submittals shall contain all required and detailed information.

**1.05 Operating and Maintenance Instructions and Manuals**

- A. The seller shall submit one (1) set of operating and maintenance instructions and manuals, covering completely the operation and maintenance of the equipment furnished hereunder to the owner. One (1)

set of parts lists and manuals for each item of equipment shall be furnished to the owner. Maintenance manuals shall include but not limited to trouble shooting charts, schematics and wiring diagrams.

- B. Provide sufficient operation and maintenance instruction for building operators, with on-the-job factory trained engineers representing the manufacturers. The instruction shall be scheduled at time(s) convenient to the Owner's personnel.

## 1.06 Installation

- A. Installation shall be in compliance with all the manufacturer's recommendations and local codes. All start up and warranty troubleshooting shall be performed by the manufacturer or an authorized representative. Initial startup and site testing shall be done by the manufacturer or an authorized representative.

## 1.07 Guarantee

- A. The STS shall be warranted by the manufacturer to be free from defects in workmanship and material for a period of (18) eighteen months from initial shipment or (1) one year from start-up, which ever occurs first. This warranty is contingent upon having a factory authorized representative perform the start-up. Warranty shall include all costs of repair, parts, labor, travel and living expenses for the service personnel.

## 1.08 Standards

- A. The STS shall be in accordance with the standards previously listed and in compliance with the applicable portions of Underwriters Laboratories UL 1008. All equipment is to be listed and labeled prior to shipment by UL, ETL or CSA.

# 2.0 Product Specification

## 2.01 General

- A. The STS shall consist of two solid state switch elements with logic to control switching and sensing functions. The three phase, dual position design connects the load to source 1 or source 2. The three phase hockey puck style Silicon Controlled Rectifiers (SCRs) are connected in an AC switch configuration. The SCRs shall be rated 1,200 ampere continuous. Transfer from one source to the other, regardless of direction, shall be break before make with a maximum open transition time of 1/4 cycle on all phases.
- B. The STS shall consist of four (4) non-automatic (molded case switch), **plug-in** circuit breakers (two (2) molded case non-automatic breakers controlling input functions and two (2) **plug-in** non-automatic breakers controlling the bypass function), and **one (or two)** molded case **plug-in** output isolation non-automatic breaker(s). All non-automatic circuit breakers shall be 100% rated at the ambient temperature specified.
- C. Key and mechanical interlocks shall be provided for the switches to prevent the operator from closing both the bypass non-automatic breakers at the same time.
- D. The solid state elements shall be high speed Silicon Controlled Rectifiers (SCRs) connected in anti-parallel pairs to transfer the AC power. The outputs of the two sets of non-automatic circuit breakers are connected to furnish power to the load through the one (or two) output molded case switch(es).
- E. The STS shall operate as a three pole, double throw system to connect the three phase load with one of the two, three-phase inputs. Under normal conditions, power shall be provided by the preferred input. Either source 1 or source 2 can be designated preferred.
- F. The STS shall include an automatic mode so upon the failure of the preferred source of power, the STS will sense and transfer the load to the good alternate source within 4 ms. The transfer will be break-before-make.

## 2.02 Construction

- A. Enclosure for the STS shall be constructed to NEMA Type-1 and shall be primed and painted with a suitable semi-gloss enamel both inside and out. The color shall be IBM Pearl White.

- B. The STS shall require **FRONT ACCESS ONLY** for all operations including infrared scanning of bussing and breakers. All normal operating controls and instrumentation shall be mounted on the front door. All breakers and switches shall be mounted behind closed doors. Doors shall be lockable. Each cabinet contains full swivel, heavy duty casters.
- C. All wiring and cables shall be copper or plated copper. Aluminum shall be used for heat sinks only. All bus shall be rated per the National Electric Code.
- D. The STS shall include a computer grade single point ground in accordance with FIPS Pub 94 and the requirements of NEC.

### 2.03 Ventilation And Cooling

- A. For STS units to 400 amperes, only convection cooling is acceptable.
- B. For STS units rated above 400 amperes, forced air cooling with redundant fans shall be furnished. Main and redundant sets of fans shall be individually fused for maximum reliability. Fans shall allow for the STS to be operated in an overload condition long enough for the condition to be corrected.

### 2.04 Design Reliability

- A. The STS shall have a minimum design life span of 25 years of continuous duty with routine maintenance.
- B. The STS shall be designed/design tested by UL laboratories for 6,000 operations at 1,600 Amps (400% of rating) and 50 operations at 4,800 Amps (1200%), at 0.5 power factor. In addition, all power train components shall be subjected to a high potential test of 2.0 kV for one minute.
- C. The design of all logic and power supplies should be such that it eliminates single point failures. Accordingly the STS design shall accomplish three (3) levels of redundancy:
  - 1. **System Redundancy:** static transfer mode power path & bypass transfer mode power path.
  - 2. **Component Redundancy:** Power supplies, control transformers, temperature sensors & fans.
  - 3. **Logic Redundancy:** Voltage sampling/sensing should be redundant. The design shall also include independent logic for each sources scr gate circuits.
- D. Programmable logic shall be used to control the STS transfer. Distributed microprocessor logic shall be used.

### 2.05 Operation

- A. The STS shall be fed from two sources, Source 1 and Source 2. A selector switch shall be provided to make selectable the preferred source – Source 1 or Source 2. Under normal conditions, the source designated as “Preferred” shall be connected to the load. Under all conditions, transfers shall be a break-before-make to ensure that the two sources are never connected together. The maximum sensing time for loss of a preferred feeder shall be two milliseconds. The maximum switching time from one source to the other, including sense time, shall be 4 ms. Transfers from the preferred to alternate source will occur for any one of the following conditions:
  - 1. Logic Failure
  - 2. SCR Failure
  - 3. Output out of voltage condition
  - 4. Voltage out-of-tolerance condition
  - 5. Loss of phase
  - 6. Change in slew rate
  - 7. Manual operation
- B. Automatic transfers from the preferred to alternate source shall be inhibited because of the following:
  - 1. Alternate source RMS voltage exceeds +/-10% of nominal
  - 2. Current fault on the output
  - 3. Manual operation
  - 4. Preferred SCR is shorted
- C. Re-transfers from the alternate to the preferred source will occur when:
  - 1. Preferred source RMS voltage within Hysteresis - adjustable between 99 to 95% of nominal volts
  - 2. Automatic operation selected.
  - 3. Initial transfer not caused by preferred source SCR failure
  - 4. Autoretransfer mode in the “yes” mode
- D. Manual operation shall be possible by selecting the manual operation from the front panel.

- E. An Autoretransfer switch shall allow the user to select whether upon an outage transfer, the unit automatically retransfers back to the preferred source when it returns to nominal (Autoretransfer “Yes”) or remains on the alternate source. If the unit is in the Autoretransfer mode “No”, the unit will remain on the alternate source until a fault condition forces the unit to transfer back to the preferred source.
- F. The unit transfers with a 9 ms center delay whenever the sources are outside of the phase window

## 2.06 Transient Suppression

- A. A high energy surge suppressor system shall be provided on each input of the STS. The Surge Suppressor provides an additional surge element to reduce the rate of rise of high energy transient voltages. Inherent to the surge Suppressor is the added benefit of the noise attenuation capability. The system consists of three (3), three (3) phase capacitors rated for 100,000 amps of surge current for high energy operation. One Surge Suppressor connects to each input, and one to the output. The unit shall be designed for heavy duty service such as motor installations.

## 2.07 Interface/Monitoring Panel

- A. The operate interface panel for the following functions shall be located on the front of the unit for the following functions:
  - 1. Automatic or Manual Select
  - 2. Source 1 or Source 2 Select
  - 3. Auto Retransfer Enable Select
- B. Mimic panel with the following:
  - 1. One line power diagram
  - 2. Green indicator light for sources available
  - 3. Green indicator light for static switches gated-on
  - 4. Green indicator light for input molded case switch status
  - 5. Green indicator light for bypass molded case switch status
  - 6. Green indicator light for molded case isolation switch status
  - 7. Green indicator light for load power available
  - 8. Transfer counter
- C. Annunciation Panel to have:
  - 1. Horn
  - 2. Horn disable
  - 3. Summary alarm light
- D. The STS is provided with a local display with 80 character liquid crystal display for all analog inputs, digital inputs, calculated points, and alarm indications. All values shall be measured (or calculated) in true RMS values. All voltages and currents shall be connected to individual input analog points and alarm on out-of-tolerance conditions . Inputs shall be:
  - 1. Input S1 voltage phase to phase
  - 2. Input S2 voltage phase to phase
  - 3. Output voltage phase to phase
  - 4. Output voltage line to neutral (for 208 volt units)
  - 5. Output current phases A, B, and C
  - 6. Neutral and Ground currents
  - 7. Load level (in % total KVA)
  - 8. Frequency
  - 9. Alarms
    - 1. Bypass 1 switch closed
    - 2. Bypass 2 switch closed
    - 3. Isolation 1 switch open
    - 4. Isolation 2 switch open (if opted)
    - 5. Power Supply failure
    - 6. Remote Fuse blown
    - 7. Logic failure/ SCR open 1

8. Logic failure/SCR open 2
9. Source 1 shorted switching element
10. Source 2 shorted switching element
11. Heat sink over temperature 1
12. Heat sink over temperature 2
13. Output over current
14. Short circuit on source 1
15. Short circuit on source 2
10. The following values shall be calculated:
  1. Load level
  2. Output frequency
  3. Phase rotation error
  4. Time of day and date
11. The following alarm indications shall be included:
  1. High and low voltage for all measured voltage
  2. High current for all measured values
12. The Monitor shall also be capable of communicating with a PC based central monitoring device via a communication port. All communications shall be RS-485 with modbus protocol. Unit status, analog measurements and alarms shall be communicated.

## 2.08 Electrical Characteristics

- A. Source voltage: **600, 480, 208** Vac nominal three-phase, three-wire plus ground (plus neutral).
- B. Frequencies: 60 Hz. +/- 1 Hz, 50 Hz optional
- C. Current rating: **100, 250, 400, 600, 800** amps continuous.
- D. Power factor from .5 leading to .5 lagging.
- E. Molded Case Switch short circuit withstand rating shall be a minimum of **65 kA** (except 600 volts, 400 amps or less – the rating is then 22ka).
- F. Overload rating
  1. 112% for 2 hours
  2. 130% for 1 hour
  3. 4,800 amps for 100 milliseconds
  4. 22,000 amps for 8 milliseconds
- G. Current harmonic distortion will not affect the operation of STS nor will the STS create current distortion.

## 2.09 Environmental Requirements

- A. Storage temperature shall be between -36°C to +50°C (-33°F to 122°F).
- B. Operating temperature shall be between 0°C to +40°C (32°F to 104°F).
- C. Relative humidity from 0% to 95% non-condensing.
- D. Altitude to a maximum of 10,000 feet.

## 3.0 Execution

### 3.01 Factory Tests

- A. The manufacturer shall provide 5 levels of component and module testing to ensure the STS system performance:
  - 1. Vendor quality partnership using manufacturers designed test procedures and equipment.
  - 2. Functional component testing.
  - 3. Component level tests in simulated STS environment.
  - 4. Module level tests
  - 5. Verification of final STS system performance.
- B. The manufacturer shall provide certified test reports with each STS that the unit has passed the following tests:
  - 1. Functional test: All meters, alarms and shunt trips.
  - 2. Transfer tests: The STS transfer functions shall be verified in automatic and manual modes.
  - 3. All features and factory settings shall be verified.
  - 4. No destructive testing shall be performed on equipment provided to the customer.
  - 5. Hi-pot test at 2 kV for 1 minute.

### 3.02 Packaging and Shipping

- A. The manufacturer shall provide adequate packaging to prevent damage to the unit(s) while in transport.
- B. The manufacturer shall provide adequate notice to the contractor of shipping and arrival times.
- C. The contractor shall provide for receiving and storage of any units prior to installation. Unit storage should be provided in accordance to the environmental conditions outlined in this specification.

### 3.03 Field Service

- A. All field service work shall be performed by manufacturer trained and certified personnel.
- B. A 24 hour telephone service organization shall be provided and the phone numbers displayed on the door of each enclosure.
- C. During start-up, the manufacturer shall provide on-site training for the customer's personnel in the operation of the equipment.

### 3.04 Installation

- A. The contractor shall provide labor for the installation of the new equipment in accordance to the manufacturer. All rigging for unloading and installation shall be the responsibility of the contractor. The manufacturer shall assist the contractor as required in interpreting the installation instructions.
- B. The contractor shall install the equipment as shown on the drawings and insure all required working clearances are maintained.
- C. Following installation, the manufacturer shall verify the correct installation of the STS.
- D. For STS units supplied with molded case switches, the upstream site current protection device shall have ratings to protect the STS.

### 3.05 Start up commissioning

- A. The manufacturer shall provide the services of a qualified technician to perform the manufacturer recommended start up procedures. Upon completion, the manufacturer shall provide a commissioning report to the owner.
- B. The contractor shall provide at ten (10) day advance notice of the date when start up will be required. The contractor shall coordinate with the manufacturer and the engineer to establish an agreeable start up and testing schedule
- C. Required load banks for testing and acceptance are the sole responsibility of the contractor.
- D. The manufacturer shall provide the services of a field service engineer for site testing and installation supervision as required to complete the check out.

### 3.06 Acceptance.

Final Acceptance is when the certified start up reports are submitted to the owner.