Liebert® STS2™
GUIDE SPECIFICATIONS
Automatic Static Transfer Switch
4P, 1600A-1800A CHASSIS

1.0 GENERAL

1.1 Summary

The intent of the STS Chassis is to provide static transfer functionality to a switchgear or Vertiv designed switch cabinet lineup. The Chassis includes only the electronic controls, heat sinks and SCR components of a standard static transfer switch system; the Chassis does not include any molded case switches or draw-out breakers. The installing contractor will land two inputs and an output connection to the right side (bussed to switchgear) of the Chassis frame. The Chassis will communicate with the attached switchgear lineup, as though it were one seamless integrated system.

The Static Transfer Switch (STS) Chassis is a solid-state, four-pole, dual-position transfer switch designed to switch automatically and manually between two synchronized three-phase AC power sources without an interruption of power to the load. The input power shall be supplied from two different AC power sources, which are nominally of the same voltage level, phase rotation, and frequency. The primary purpose of the STS is to allow virtually uninterrupted transfer from one source to the other in case of the failure of one source or by manual initiation for test or maintenance. The switching action shall not connect the two sources of power that would allow backfeeding one source to the other. The STS shall allow for either source to be designated as the preferred source. The switch will automatically transfer to the preferred source and remain so until manually initiated to transfer or until the selected source fails. If the selected source fails, as specified herein, the STS will typically transfer to the other source—designated as the alternate source—in less than ¼ cycle typically, depending on the load, phase difference between sources, and type of source failure. The STS shall be attached to third party switchgear, which will be furnished with some form of interlocked (keyed or mechanical) static switch isolation and bypass molded-case switches (MCSs) to each source. The MCS's will allow uninterrupted manual transfer to and from either source for maintenance.

1.2 Standards

The specified system shall be designed, manufactured, tested, and installed in accordance with the following:

- American National Standards Institute (ANSI)
- Institute of Electrical and Electronics Engineers (IEEE)
- ISO 9001
- National Electrical Code (NEC)
- National Electrical Manufacturers Association (NEMA)
- National Fire Protection Association (NFPA 70)
- RCM and CE
- EN 61000-6-4 & 6-2
- IEC 62310-1 & 60529

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- AS 62310-1, 60529
- RoHS and REACH compliant

The STS shall comply with the latest FCC Part 15 EMI emission limits for Class A computing devices and the emission limits of EN/IEC61000-6-4Class A.

The STS shall safely withstand the following without misoperation or damage:

- Transient voltage surges on either AC power input as defined by ANSI/IEEE C62.41 for Category B3 locations (high surge exposure industrial and commercial facilities)
- Electrostatic discharges (ESD) up to 10 kV at any point on the exterior of the unit
- Electromagnetic fields from portable transmitters that are not within 3 ft. (1m) of the unit

The STS shall comply with the immunity requirements of EN/IEC61000-6-2 Class A.

1.3 Definitions

- STS - Static Transfer Switch
- SCR - Silicon Controlled Rectifier
- MTBF - Mean Time Between Failure is the actual arithmetic average time between failures of the critical AC output bus.
- Molded-case Switches (MCS) - A circuit breaker that has no automatic thermal overload trip element but does have a magnetic trip element for short-circuit/fault protection. Short-circuit and overload protection must be provided by an upstream overcurrent device.

1.4 System Description

1.4.1 Modes of Operation

The Static Transfer Switch shall be a three-pole, double-throw, solid-state, automatic transfer switch that is fed from two AC power sources. One source shall be designated as the preferred source, while the other is the alternate source. Selection of which input source is preferred shall be user selectable from the operator control panel. All transfers shall be a fast break-before-make with no overlap in conduction from one source to the other. As specified herein, the STS will typically transfer in less than ¼ cycle depending on the load, phase difference between sources, and type of source failure.

The Static Transfer Switch is fuseless and consists of six pairs of Silicon Controlled Rectifiers (SCRs) connected in an AC switch configuration. The SCRs are continuous rated to carry 100% of the STS rated load while operating within the STS specifications. The use of fuses for protection is not permitted because of possible fuse clearing in an out-of-phase transfer.

The Static Transfer Switch logic power shall automatically power up when connected to the power source. The control panel shall be active as long as one input to the STS is energized. The STS shall be supplied with factory default settings; mechanical trim pots shall not be used for calibration or adjusting settings. All settings must be adjustable; the settings shall be adjusted/configured from the LCD display.

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a. **Normal Mode**. The unit is fed by two sources with the output connected to the load. In normal operation, the load shall be connected to the preferred source as long as all phases of the preferred source are within the acceptable limits. The transfer voltage limits shall default to ±10% of the nominal input voltage for steady state conditions, with low voltage transfer limits having an inverse time relationship that is within the ITIC 2000. Upon failure of the preferred source, the load shall be transferred to the alternate source. After the preferred source returns to within the acceptable voltage limits for at least the preset adjustable retransfer time delay (typically 3 seconds) and is in phase with the alternate source, the load shall be retransferred automatically to the preferred source. The automatic retransfer to the preferred source can be disabled if so selected by the user from the operator control panel. Provided the preferred source is qualified, in the event the alternate source fails, the STS will always transfer to the preferred source, regardless of the automatic retransfer setting.

b. **Load Current Inhibit (also called Ipeak or Peak Current Overload)**. The STS shall sense the load current and if the load current exceeds an adjustable preset level deemed to represent a load inrush or fault condition, the STS shall disable the automatic transfer even if the voltage on the selected source exceeds the transfer limits. The load current transfer inhibit shall be [(automatically) (manually)] reset after the current returns to normal to allow for continued protection against a source failure.

c. **Manual Transfer**. The Liebert STS2 shall allow manually initiated transfers between the two sources, provided the alternate source has proper phase rotation and is within acceptable voltage and frequency limits and phase tolerances with the preferred source. Allowable phase differences between the sources for manually initiated transfers shall be adjustable from the operator control panel. The Liebert STS2 shall be capable of tolerating transfers up to 30 degrees out of phase for emergency conditions. The user-adjustable phase synchronization window shall be limited to ±30 degrees. If the transfer is manually initiated, the Liebert STS2 shall transfer between the two sources without interruption of power to the load greater than 1/8 cycle or less provided that both sources are available and synchronized within the user-adjustable phase synchronization window. For sources where the two frequencies are not exactly the same (as would be the case between a utility and standby generator source), manually initiated transfers shall be delayed by the Liebert STS2 until the two sources are within the user-adjustable phase synchronization window.

d. **Emergency Transfer**. In an effort to maintain power to the load, upon loss of the source that the load is connected to, the Liebert STS2 shall automatically transfer to the other source within ¼ cycle typical, (depending on the load, phase difference between sources, and type of source failure), overriding any retransfer time delays or other inhibits except load overcurrent provided that the other source is available.

e. **SCR Failure**. The Liebert STS2 shall continuously monitor the status of the SCR switching devices for proper operation. In the event of a shorted SCR on the source powering the load, the Liebert STS2 shall automatically alarm the condition and trip open the other source isolation MCS. In the event of a shorted SCR on the other source, the Liebert STS2 shall automatically alarm the condition and trip open the other source isolation MCS. In the event of an open SCR, the switch shall automatically alarm the condition and transfer to the other source. All open and shorted SCR alarm conditions shall be latched and require the system to be repaired and reset to restore normal operation.

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f. **System Bypass**. The Liebert STS2 shall be furnished with key-interlocked maintenance bypass MCSs that allow the Liebert STS2 power, controls, and monitoring electronics to be bypassed to either input source for maintenance without interruption of power to the load. The packaging of the Liebert STS2 shall have all electronics isolated from the input, output, and bypass connections to allow servicing of any components without access to hazardous voltages when the unit is in maintenance bypass.

g. **Rotational/Regenerative Loads.** When a rotational load, such as a motor, is connected to the output of the unit, the time to detect a source fail and ultimately transfer to the alternate source can extend beyond the previously outlined timeframe. Regardless, the critical bus voltage is always maintained within the ITIC standard. Recommend contacting Vertiv for guidance if connecting to a rotational/regenerative load to the Liebert STS2.

1.4.2 Performance Requirements

a. **Nominal Input/Output Voltage**: [380] [400] [415] volts three phase, 4-wire-plus-ground

b. **Default Voltage Range**: +10%, -10% of nominal

c. **Nominal Frequency**: 50 Hz

d. **Maximum Continuous Current**: [1600] [1800] amps

e. **Source Voltage Distortion**: Up to 10% THD with notches and ringing transients

f. **Surge Protection**: Sustains input surges without damage per criteria listed in ANSI C62.41 Category B3

g. **Sensing and Transfer Time**: See “1.4.1 Modes of Operation.”

h. **Overload Capability**:

- 125% for 30 minutes
- 150% for 2 minutes
- 500% for 0.25 seconds

i. **Short Circuit Withstand Capability:** 65kA symmetrical amperes for 208 to 600-volt.

1.4.3 Environmental Conditions

a. **Storage Temperature Range**: -20° to +70°C (-4° to 158°F)

b. **Operating Temperature Range**: 0° to 40°C (32° to 105°F)

c. **Relative Humidity**: 0 to 95% without condensation

d. **Operating Altitude**: Up to 4000 ft. (1200m) above sea level without derating. Above 4000 ft. (1200m), output current is derated by 6% per 1000 ft. (18% per 1000m).

e. **Storage/Transport Altitude**: Up to 40,000 ft. (12,200m) above sea level

f. **Audible Noise**: Less than 84 dBA at 5 ft. (1.5m) with audible alarm off

1.4.4 Reliability

MTBF

The STS shall be designed for high reliability and high availability with an MTBF exceeding 22,000,000 hours. To the fullest extent practical, redundant circuits and components shall be used to eliminate single points of failure.

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Power Supply

Redundant power supplies shall be provided to prevent any single-point power supply failure mode. The STS shall have two completely separate power supplies mounted on separate boards so a power supply can be replaced while the load is on bypass. There shall be two separate DC buses, one from each power supply, to provide redundancy throughout the controls.

Logic

Control logic shall be triple-redundant. Each of the three logic modules shall have its own separate power connection to each power supply bus. Each logic module shall be fused to prevent it from shorting the power supplies if an internal failure occurs. Gating and control logic shall be partitioned so that the failure of one source's gating or sensing logic does not prevent the switch from transferring to the other source.

Components

All electrical components requiring normal maintenance or repair shall be replaceable without de-energizing the load, assuming that at least one source is available. Solid-state switching devices shall be packaged to allow safe repair of the switching devices without having to de-energize the load. All MCSs **(provided by others)** shall be of a plug-in or draw-out type to allow replacement without de-energizing the load. All control and logic components shall be mounted separate from the power components.

Fuseless

No fuses are used to protect the solid-state power switching devices.

Access

The STS shall be designed for only front access after installation. The STS shall be designed so all installation, repairs, and maintenance can be done from the front, top, and right-hand side of the unit. The STS shall be designed to minimize the exposure of hazardous voltages to allow safe servicing of the unit while the load is energized.

1.5 Documentation

1.5.1 Equipment Manual

The manufacturer shall furnish an installation, operation, and maintenance manual with installation, startup, operation, and maintenance instructions for the specified system.

1.5.2 Proposal Submittals

Submittals with the proposal shall include the following:

- A system one-line diagram.
- Outline drawing including weights, dimensions, heat dissipation, and recommended service clearances.
- Location and detailed layouts of customer power and control connections.
- Description of equipment to be furnished, including deviations from these specifications.

1.5.3 Delivery Submittal

Submittals upon STS delivery shall include a complete set of submittal drawings and one (1) installation, operation, and maintenance manual that shall include a functional description of the equipment with block diagrams, safety precautions, instructions, step-by-step operating procedures, and routine maintenance guidelines, including illustrations.

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1.5.4 Spare Parts

A list of recommended spare parts shall be furnished upon request.

1.6 Warranty

The manufacturer shall provide a warranty against defects in material and workmanship for 12 months after initial system startup or 18 months after ship date, whichever occurs first. (Refer to the Warranty Statement for details.)

1.7 Quality Assurance

1.7.1 Manufacturer Qualifications

A minimum of five years' experience in the design, manufacture, and testing of STS systems is required. The specified system shall be completely factory-tested before shipment. Testing shall include, but shall not be limited to, quality control checks, Hi-Pot tests (two times rated voltage plus 1000 volts, per UL requirements), transfer tests, and metering calibration tests. The system shall be designed, manufactured, and tested according to world-class quality standards. The manufacturer shall be ISO 9001 certified.

1.7.2 Factory Testing

Before shipment, the manufacturer shall fully and completely test the STS to assure compliance with the specifications.

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2.0 PRODUCT

2.1 Fabrication

2.1.1 Materials

All materials of the STS shall be new, of current manufacture, high grade, and free from all defects and shall not have been in prior service except as required during factory testing.

The maximum working voltage, current of all solid-state power components and electronic devices shall not exceed 75% of the ratings established by their manufacturer. The operating temperature of a solid-state component subassembly shall not be greater than 75% of their ratings.

2.1.2 Wiring

Wiring practices, materials, and coding shall be in accordance with the requirements of the National Electrical Code (NFPA 70). All bolted connections of busbars, lugs, and cables shall be in accordance with requirements of the National Electrical Code and other applicable standards. All electrical power connections are to be torqued to the required value and marked with a visual indicator.

Provision shall be made for power to enter or leave from the right side of the STS Chassis frame and control cables shall exit the top.

2.1.3 Frame and Enclosure

The frame shall be constructed of galvanized steel to provide a strong substructure. Doors and removable exterior panels shall be a minimum of 16GA steel and be powder-painted the manufacturer's standard color textured enamel finish paint. All removable panels shall be grounded to the frame for safety and EMI/RFI protection. The cabinet shall be structurally designed to handle forklifting from the base.

The STS Chassis shall have maximum dimensions of 28 in./711 mm wide by 36 in./914 mm deep by 81.5 in./2070 mm high with a top-hat extension which protrudes 8.5"/216 mm above the cabinet. Total height with top hat is 90.0"/2286 mm.

The STS can be tipped 15 degrees in any direction without falling over.

2.1.4 Cooling

Cooling of the STS shall be by forced air. Low-velocity fans shall be used to minimize audible noise output. All fans shall be redundant so that a single fan failure will not cause temperature to increase beyond acceptable limits. Individual sensor(s) are located on heat sinks for alarm and shutdown. Heat rejection shall be through screened protective openings in the top of the unit. Air filters shall be located in the front door at the point of air inlet.

2.1.5 Grounding

The STS shall operate from sources that are solidly grounded or impedance-grounded (for 480V and below). The unit shall not be used on corner-grounded delta systems.

The AC output neutral shall be electrically isolated from the STS Chassis. The STS Chassis shall have an equipment ground terminal.

2.2 Components

2.2.1 Molded-case Switches (MCSs) (Provided by Others)

Third party switchgear shall be equipped with five or six MCSs. The MCSs shall be UL listed for NA regions and IEC listed for EMEA/APAC for use at the system voltage. The plug-in feature of the breaker

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shall include interlock, which prevents the breaker from being unplugged without being in the Off (open) position. Three of the MCSs shall provide for total isolation of the solid-state switching devices with an input MCS for each source and a load isolation MCS. Two of the MCSs shall provide for maintenance bypassing of the solid-state switching devices to either input source. Interlocks shall be provided on the MCSs to prevent improper maintenance bypassing of the solid-state switch. A bypass MCS cannot be closed unless the solid-state switch is connected to the same input source, and only one bypass MCS can be closed at a time. All MCSs shall be equipped with N.O. and N.C. auxiliary switches for monitoring of the breaker positions. The two input MCSs for the solid-state switching devices also shall be equipped with 48 VDC shunt trips to allow for control by the STS logic.

2.2.2 Silicon Controlled Rectifiers (SCRs)

The STS consist of six pairs of SCRs connected in an AC switch configuration. The SCRs shall be rated to carry the full 100% rated load. The SCRs shall be rated to prevent hazardous device failure in power systems with available fault currents listed under section “1.4.2 Performance Requirements,” item i, “Short Circuit Withstand Capability.”

2.2.3 Control Panel

The STS shall be provided with a microprocessor-based Human-Machine Interface (HMI) to configure and monitor the STS. The HMI shall be located on the front of the unit and can be operated without opening the hinged front door. The HMI shall not be mounted to the front door so the door can be easily removed for maintenance. A backlit, menu-driven, full-graphics, color touch-screen Liquid Crystal Display (LCD) shall be used to display system information, status information, a one-line diagram of the STS, active alarms, alarm history information, and startup and bypass instructions. No mechanical pushbuttons shall be used.

The mimic screen shall indicate the power flow, the status of all MCSs, the preferred source, and the STS position (connected to source 1 or 2), as well as active alarms.

Pop-up boxes selected from the menu bar shall be provided for operator interface to the HMI for menu selection, control of the preferred source, manual transfer initiation, auto/manual retransfer selection, and other system setpoints. In addition, an operator can silence and reset the audible alarm by touching the screen. To facilitate STS operation, help text, step-by-step startup, transfer, and maintenance bypass procedures shall be displayed on the LCD screen. For manual transfers, a syncscope shall display the leading or lagging real-time phase difference between the two input sources.

The HMI shall be equipped with an internal RS232 port and flash memory to allow the STS software to be upgraded by a factory-trained customer engineer without shutting down the load.

To facilitate diagnostics, an event log of the last 512 alarm events shall be stored in non-volatile memory and displayed on the LCD. Two history logs, each having 64 frames of unit status frozen upon an alarm condition designated as a freeze fault, shall be stored in non-volatile memory and displayable on the LCD. A frame shall be acquired every 4 milliseconds, with 40 frames before the fault and 23 frames after the fault. Each frame contains metering data, active alarms/faults, and unit status. A system calendar and real-time clock shall be included to timestamp all stored events. Monitored parameters shall be acquired two times per 4-millisecond frame.

CAN bus shall be used to communicate between the logic and the HMI as well as the options.

For remote monitoring, a serial RS-232 port shall provide present switch status information, alarm history information, and the history of status screens that are triggered upon a major alarm event.

Metering

The following metering parameters shall be displayed:

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- Input AC voltage for both sources, line-to-neutral for each phase
- Input AC current for both sources for each phase
- Input frequency for both sources
- Output kVA
- Output kW
- Percent load
- Number of switch transfers
- Synchronization phase angle

All voltages and currents shall be measured using true-RMS techniques for accurate representation of non-sinusoidal waveforms associated with computers and other electronic loads. The metering parameters shall have a full-scale accuracy of ±2%.

Alarm Messages

Active alarms shall be monitored and displayed simultaneously as part of the LCD event panel. The following alarm messages shall be displayed:

Source 1 Failure	CB1 (Source 1) Open	Power Supply S1 AC Failed
Source 2 Failure	CB2 (Source 2) Open	Power Supply S2 AC Failed
Sources Out of Sync	CB3 (Output) Open	Power Supply DC A Failed
Source 1 Overvoltage	CB3A Open (If used)	Power Supply DC B Failed
S1 Undervoltage (fast)	CB4 (S1 Bypass) Closed	Power Supply Logic Failed
S1 Undervoltage RMS (slow)	CB5 (S2 Bypass) Closed	S1 Voltage sense module failed
Source 2 Overvoltage	CB1 Shunt trip fail	S2 Voltage sense module failed
S2 Undervoltage (fast)	CB2 Shunt trip fail	S1 SCR sense module failed
S2 Undervoltage RMS (slow)	S1 SCR Open	S2 SCR sense module failed
Source 1 Neutral Overcurrent	S2 SCR Open	S1 Current sense module failed
Source 2 Neutral Overcurrent	S1 SCR Shorted	S2 Current sense module failed
Source 1 Overcurrent	S2 SCR Shorted	S1 Gate drive module failed
Source 2 Overcurrent	Primary fan failure	S2 Gate drive module failed
Source 1 Over/Under Frequency	Control Module Fail	Internal comm failed
Source 2 Over/Under Frequency	S1 I-peak	Option comm failed
Source 1 Phase Rotation Error	S2 I-peak	Output voltage sense module failed
Source 2 Phase Rotation Error	Auto Retransfer Inhibit	Heatsink Overtemp
Output undervoltage		
STS on alternate source		
Transfer Inhibit		

An audible alarm shall be activated when any of the alarms occurs. All alarms shall be displayed in text form.

2.3 Accessories (Optional Components And Services)

2.3.1 Programmable Relay Board (optional)

A Programmable Relay Board with eight sets of isolated Form C contacts shall be provided to indicate a change of status of any alarm condition. Any alarm can be programmed onto any channel or channels. Up to two programmable relay boards can be installed in the STS. Programming is performed through the touch-screen display. Each contact shall be rated 1A @ 30 VDC or 250mA @ 125 VAC.

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2.3.2 Input Contact Isolator Board (optional)

An Input Contact Isolator Board with eight relay inputs (normally open dry contacts) shall be provided for owner alarm messages. The owner, through the touch-screen display, can program the alarm messages.

2.3.3 Liebert Intellislot IS-UNITY-DP Card (optional)

2.3.4 The STS can be supplied with an IS-UNITY-DP Card for remote communication using two of the following protocols: HTTP/HTTPS, Emerson Protocol, Email, SMS, SNMP v1/v2c/v3, BACnet IP/MSTP and Modbus TCP/RTU output. A serial RS-485 two-wire connector shall be supplied.

Note: Two of the 3rd-party protocols (SNMP, Modbus or BACnet) may be configured and used simultaneously. Modbus RTU and BACnet MSTP cannot both be enabled simultaneously.

2.3.5 Remote Source Selection (optional)

The STS shall be furnished with Remote Source Selection board to remotely select the preferred source. Closure of one of the two N.O. dry contacts (by others) shall cause the selected source to be the preferred source to which the STS will connect the load as long as the source is available in the same manner as the local source transfer selection. If both input contacts are closed, the current selected preferred source shall be retained. If the unit preferred source selection and remote source selection shall be active at the same time, the STS follows the last request for a preferred source change, regardless of whether it was from the local or remote source select controls.

2.3.6 Key Lockout Switch (optional)

A key lockout switch shall be provided which activates a software lockout of the touch-screen display to prevent manual transfers and configuration changes. When locked out, the touch screen becomes a read-only display and a key is required to do manual transfers or change settings. The alarm silence button shall not be disabled when in the lockout position. The switch shall be located behind the front door but can be operated without opening the front door.

2.3.7 Certified Test Report

A certified copy of the factory test report shall be provided for each unit.

2.3.8 Factory Witness Test

The owner and/or the owner's representative shall attend a factory test of each unit. The factory will perform its standard witness test to demonstrate that the unit meets the STS specification.

2.3.9 Export Crating

Heavy-duty, solid-wood crating with vapor barriers and desiccant shall be provided to meet international requirements regarding package strength and markings for overseas shipments.

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3.0 EXECUTION

3.1 Field Quality Control

The following inspections and test procedures shall be performed by factory-trained field service personnel during the STS startup.

3.1.1 Visual Inspection

- Inspect equipment for signs of damage.
- Verify installation per drawings.
- Inspect cabinets for foreign objects.
- Verify neutral (if used) and ground conductors are properly sized and configured.
- Verify all printed circuit boards are configured properly.

3.1.2 Mechanical Inspection

- Check all control wiring connections for tightness.
- Check all power wiring connections for tightness.
- Check all terminal screws, nuts, and spade lugs for tightness.

3.1.3 Electrical Inspection

- Check all fuses for continuity.
- Confirm input voltage and phase rotation are correct.
- Verify control transformer connections are correct for voltages being used.

3.2 Manufacturer's Field Service

3.2.1 Service Personnel

The STS manufacturer shall directly employ a nationwide service organization consisting of factory-trained field service personnel dedicated to the startup, maintenance, and repair of UPS and power equipment. The organization shall consist of regional and local offices.

The manufacturer shall provide a fully automated national dispatch center to coordinate field service personnel schedules. One toll-free number shall reach a qualified support person 24 hours/day, 7 days/week, 365 days/year. If emergency service is required, response time shall be 20 minutes or less.

An automated procedure shall be in place to ensure that the manufacturer is dedicating the appropriate technical support resources to match escalating customer needs.

3.2.2 Replacement Parts Stocking

Parts shall be available through an extensive network to ensure round-the-clock parts availability throughout the country.

Recommended spare parts shall be fully stocked by local field service personnel with backup available from the national parts center and the manufacturing location. The national parts center Customer Support Parts Coordinators shall be on call 24 hours/day, 7 days/week, 365 days/year for immediate parts availability. Parts from the national parts center shall be shipped within 4 hours on the next available flight out and delivered to the customer's site within 24 hours.

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3.2.3 STS Maintenance Training

Maintenance training courses for customer employees shall be made available by the STS manufacturer. This training is in addition to the basic operator training conducted as a part of the system startup.

The training course shall cover STS theory, location of subassemblies, safety, and STS operational procedures. The course shall include control, metering, and feedback circuits to the Printed Circuit Board (PCB) level. Troubleshooting and fault isolation using alarm information and internal self-diagnostics should be stressed.

3.2.4 Maintenance Contracts

A complete offering of preventive and full-service maintenance contracts for the STS shall be available. An extended warranty and preventive maintenance package shall be available. Factory-trained service personnel shall perform warranty and preventive maintenance service.

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