Tripp Lite S3M10-20 kVA series 208V UPS

GUIDE SPECIFICATIONS

Three-Phase Uninterruptible Power System

1.0 GENERAL

1.1 SUMMARY

This specification defines the electrical and mechanical characteristics and requirements for a three-phase, solid-state, uninterruptible power system (UPS). The UPS shall provide high-quality AC power for sensitive electronic equipment loads.

1.2 STANDARDS

The UPS shall be designed in accordance with the applicable sections of the current revision of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification shall govern.

* ANSI C63.4 2014
* CSA 22.2-107.3-14
* FCC Part15 Subpart B Class A
* ISO 9001
* OSHA
* UL Standard 1778: 2014 R10.17

The UPS shall be UL listed per UL Standard 1778, and shall be CSA certified.

1.3 SYSTEM DESCRIPTION

1.3.1 Design Requirements – UPS

A. Voltage. Input/output voltage specifications of the UPS shall be:

Rectifier Input: (_125~260__) volts, three-phase, (___4__)-wire-plus-ground.

Bypass Input (for dual-input modules): (_146~250__) volts, three-phase, (__4___)-wire-plus-ground.

Output: (_208____) volts, three-phase, 4-wire-plus-ground.

B. Output Load Capacity. Specified output load capacity of the UPS shall be (_10/15/20_) kVA at 1.0 power factor.

1.3.2 Design Requirements - Battery

A. Battery Cells: Sealed, lead-acid, valve-regulated.

B. Reserve Time: Depends on the connected loads and the battery pack/cabinet model. Refer to the model page at User manual.

C. Recharge Time: Refer to Configuration of S3M UPS Models and Battery Cabinets in Battery Pack (BP) user manual.

1.3.3 Modes of Operation

The UPS shall be designed to operate as an on-line, double-conversion, reverse-transfer system in the following modes:

A. Normal - The critical AC load is continuously supplied by the UPS inverter. The rectifier/charger derives power from a utility AC source and supplies DC power to the inverter while simultaneously charging the reserve battery.

B. Emergency - Upon failure of utility AC power, the critical AC load is supplied by the inverter, which, without any switching, obtains power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the utility AC source.

C. Recharge - Upon restoration of utility AC power, after a utility AC power outage, the rectifier/charger shall automatically restart, walk-in, and gradually assume the inverter and battery recharge loads.

D. **Bypass** - If the UPS must be taken out of service for maintenance or repair, or should the inverter overload capacity be exceeded, the static transfer switch shall perform a reverse transfer of the load from the inverter to the bypass source with no interruption in power to the critical AC load.

1.3.4 Performance Requirements

1.3.4.1 AC Input to UPS

A. Voltage Configuration for Standard Units: three-phase, (__4___)-wire plus ground.

B. Voltage Range: +25%, -20% of nominal.

C. Frequency: Nominal frequency 40-70Hz.

D. Power Factor: Up to 0.99 lagging at nominal input voltage and full rated UPS output load.

E. Inrush Current: 10kVA:<100A, 15kVA:<100A, 20kVA:<100A

F. Input low line set: 125V±3% : 0% ⩽ Load ⩽ 50% ; 159V±10% : 50% < Load ⩽ 100%

G. Current Distortion: 2% reflected THDi maximum at full nonlinear load

H. Surge Protection: Sustains input surges without damage per criteria listed in IEC 1000-4-5.

1.3.4.2 AC Output, UPS Inverter

A. Voltage Configuration: three-phase, 4-wire plus ground

B. Voltage Regulation:

Operation condition: Full linear load at 0~40℃ operation temperature.

±1% three-phase RMS average for a balanced three-phase load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature, and load power factor.

±3% three-phase RMS average for a 100% unbalanced load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature, and load power factor.

C. Frequency: Nominal frequency ±0.1%.

D. Frequency Slew Rate: 1.0 Hertz per second maximum. Field selectable from 0.5 to 1.0 Hz per second.

E. Phase Displacement:

±1 degree for balanced load,

±3 degrees for 100% unbalanced load.

F. Bypass Line Sync Range:

±10% Hertz,

Field selectable ±1% ~ ±10%.

G. Voltage Distortion:

1% total harmonic distortion (THD) for linear loads.

<3% THD for 100% nonlinear loads (3:1 crest factor) without kVA/kW derating.

H. Load Power Factor Range: 0.7 lagging to 0.7 leading without derating.

I. Output Power Rating: Rated kVA at 1.0 power factor.

J. Overload Capability:

On line mode:

125% for ten minutes.

150% for one minute.

>150% UPS transitions to bypass

Battery mode:

125% for one minutes.

150% for five seconds.

>150% UPS shutdown

K. Inverter Output Voltage Adjustment: ±0.5~±5% manual adjustment.

L. Voltage Transient Response: 100% load step ±5.0%.

M. Transient Recovery Time: to within 1% of output voltage within one cycle.

N. Voltage Unbalance: 100% unbalanced load ±3%.

1.4 ENVIRONMENTAL CONDITIONS

The UPS shall be able to withstand the following environmental conditions without damage or degradation of operating characteristics:

A. Operating Ambient Temperature

UPS Module: 32°F to 104°F (0°C to 40°C).

Battery: 77°F ±9°F (25°C ±5°C).

B. Storage/Transport Ambient Temperature

UPS -5°F to 140°F (-15°C to 60°C).

Battery: -5°F to 95°F (-15°C to 35°C)

C. Relative Humidity

0 to 95%, non-condensing.

D. Altitude

Operating: to 3300 ft. (1000 meters) above sea level. Output derates at 1% for every 100m above 1000 meters.

Storage/Transport: to 40,000 ft. (12,200 meters) above Sea Level.

E. Audible Noise

Noise generated by the UPS under any condition of normal operation shall not exceed 60dBA measured 1 meter from surface of the UPS.

E. Heat Dissipation (BTU/hr)

Online 100% Load: 10kVA:< 2662 BTU/hr, 15kVA:< 4096 BTU/hr, 20kVA:< 5666 BTU/hr

Online 50% Load: 10kVA:< 1160 BTU/hr, 15kVA:< 1628 BTU/hr, 20kVA:< 2143 BTU/hr

1.5 USER MANUAL

UPS delivery shall include one (1) set of instruction manuals 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.

1.6 WARRANTY

1.6.1 UPS

The UPS manufacturer shall warrant the UPS against defects in materials and workmanship for 24 months after initial start-up or 30 months after ship date, whichever period expires first. This warranty includes S3M10-20kVA UPS with internal batteries.

1.6.2 Battery Cabinets

The UPS manufacturer shall warrant the battery against defects in materials and workmanship for 12 months after initial start-up or 18 months after ship date, whichever period expires first.

1.7 QUALITY

1.7.1 Manufacturer Qualifications

A minimum of twenty years' experience in the design, manufacture, and testing of solid-state UPS systems is required. The system shall be designed and manufactured 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 system to assure compliance with the specification.

2.0 PRODUCT

2.1 FABRICATION

2.1.1 Materials

All materials of the UPS 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.

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 bus bars, 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 cables to enter or leave from the bottom of the UPS cabinet.

2.1.3 Construction and Mounting

The UPS unit, comprised of an input circuit breaker, bypass circuit breaker, rectifier/charger, inverter, static transfer switch, maintenance bypass breaker and output breaker, shall be housed in a single free-standing NEMA type 1 enclosure. Cabinet doors/covers shall require a tool for gaining access. Casters and stops shall be provided for ease of installation. Front and rear access shall be required for expedient servicing and adjustments. The UPS cabinet shall be structurally adequate and have provisions for hoisting, jacking, and forklift handling.
The UPS cabinet shall be cleaned, primed, and painted with the manufacturer's standard color. The UPS shall be constructed of replaceable sub-assemblies. Printed circuit assemblies shall be plug connections. Like assemblies and like components shall be interchangeable.

2.1.4 Cooling

Cooling of the UPS shall be by forced air. Low-velocity fans shall be used to minimize audible noise output. Fan power shall be provided by the UPS.

The thermal design, along with all thermal and ambient sensors, shall be coordinated with the protective devices before excessive component or internal cabinet temperatures are exceeded.

2.1.5 Grounding

The AC output neutral shall be electrically isolated from the UPS chassis. The UPS chassis shall have an equipment ground terminal. Provisions for local bonding shall be provided.

2.2 COMPONENTS

2.2.1 Rectifier/Charger

2.2.1.1 General

The term rectifier/charger shall denote the solid-state equipment and controls necessary to convert incoming AC power to regulated DC power for input to the inverter and for battery charging. The rectifier/charger shall be a solid-state SCR/IGBT type with constant voltage/current limiting control circuitry.

2.2.1.2 AC Input Current Limiting

The rectifier/charger unit shall be provided with AC input current limiting whereby the maximum input current shall be limited to 125% of the full input current rating. The rectifier/charger shall operate at a reduced current limit mode whenever the critical load is powered from the UPS static bypass circuit such that the maximum UPS input current will not exceed 125% of full load input current. In addition, the rectifier/charger shall have a battery current limit, adjustable from 0 to 25% of the full load input current.

2.2.1.3 DC Filter

The rectifier/charger shall have a filter to minimize ripple voltage into the battery. Under no conditions shall ripple voltage into the battery exceed 1% RMS. The filter shall be adequate to ensure that the DC output of the rectifier/charger will meet the input requirements of the inverter. The inverter shall be able to operate from the rectifier with the battery disconnected.

2.2.1.4 Automatic Rectifier Restart

Upon restoration of utility AC power, after a utility AC power outage and prior to a UPS automatic end-of-discharge shutdown, the rectifier/charger shall automatically restart, walk-in, and gradually assume the inverter and battery recharge loads.

2.2.1.5 Battery Recharge

In addition to supplying power for the inverter load, the rectifier/charger shall be capable of producing battery charging current sufficient to replace 95% of the battery discharge power within ten (10) times the discharge time. After the battery is recharged, the rectifier/charger shall maintain the battery at full charge until the next emergency operation.

2.2.1.6 Overvoltage Protection

There shall be DC over-voltage protection so that if the DC voltage rises to the pre-set limit, the UPS is to shut down automatically and initiate an uninterrupted load transfer to the static bypass line.

2.2.2 Inverter

2.2.2.1 General

The term inverter shall denote the solid-state equipment and controls to convert DC power from the battery to regulated AC power for supporting the critical load. The inverter shall use Insulated Gate Bipolar Transistors (IGBTs) in a phase-controlled, pulse width modulated (PWM) design capable of providing the specified AC output.

2.2.2.2 Overload Capability

The inverter shall be capable of supplying current and voltage for overloads exceeding 100%. The inverter is to provide 150% of full load for 1 minute and 125% of full load for 10 minutes. A status indicator and audible alarm shall indicate overload operation. The UPS shall transfer the load to bypass when overload capacity is exceeded.

2.2.2.3 Fault Clearing and Current Limit

The inverter shall be capable of supplying an overload current of 150% of its full-load rating for one minute. For greater currents or longer time duration, the inverter shall have electronic current-limiting protection to prevent damage to components. The critical load will be transferred to the static bypass automatically and uninterrupted. The inverter shall be self-protecting against any magnitude of connected output overload. Inverter control logic shall sense and disconnect the inverter from the critical AC load without the requirement to clear protective fuses.

2.2.2.4 Step Load Response

The output voltage shall be maintained to within ±5% with a 0-to-100% step load change or a 100%-to-0 step load change. The output voltage shall recover to within 1% of nominal voltage within 1 cycle.

2.2.2.5 Voltage Distortion

For linear loads, the output voltage total harmonic distortion (THD) shall not be greater than 1%. For 100% rated load of 3:1 crest factor nonlinear loads, the output voltage total harmonic distortion shall not be greater than 3%. The output rating is not to be derated in kVA nor kW due to the 100% nonlinear load with 3:1 crest factor.

2.2.2.6 Fuse Failure Protection

Power semiconductors in the inverter unit shall be fused with fast-acting fuses, so that loss of any one power semiconductor will not cause cascading failures.

2.2.2.8 Inverter Shutdown

For rapid removal of the inverter from the critical load, the inverter control electronics shall instantaneously turn off the inverter transistors. Simultaneously, the static transfer switch shall be turned on to maintain continuous power to the critical load.

2.2.2.8 Inverter DC Protection

The inverter shall be protected by the following disconnect levels:

* DC Overvoltage Shutdown
* DC Undervoltage Shutdown
* DC Unbalance voltage Shutdown

2.2.2.9 Inverter Output Voltage Adjustment

The inverter can adjust the output voltage from 0.5% ~ ±5% of the nominal value on LCD.

2.2.2.10 Output Frequency

The output frequency of the inverter shall be controlled by an oscillator. The oscillator shall be temperature compensated and hold the inverter output frequency to ±0.1% for steady state and transient conditions. Drift shall not exceed 0.1% during a 24-hour period. Total frequency deviation, including short time fluctuations and drift, shall not exceed 0.1% from the rated frequency.

2.2.3 Display and Controls

2.2.3.1 Monitoring and Control

The UPS shall be provided with a microprocessor based unit status display and controls section designed for convenient and reliable user operation. A graphical display shall be used to show a single-line diagram of the UPS, and shall be provided as part of the monitoring and controls sections of the UPS. All of the operator controls and monitors shall be located on the front of the UPS cabinet. The monitoring functions such as metering, status and alarms shall be displayed on the graphical LCD display. Additional features of the monitoring system shall include:

- Menu-driven display with pushbutton navigation
- Real time clock (time and date)
- Alarm history with time and date stamp
- Battery backed-up memory

2.2.3.2 Metering

The following parameters shall be displayed:

- Input AC voltage line-to-neutral
- Input AC current for each phase
- Input frequency
- Battery voltage
- Battery charge/discharge current
- Output AC voltage line-to-neutral for each phase
- Output AC current for each phase
- Output frequency

- Apparent power
- Active power
- Battery time left during battery operation

2.2.3.3 Alarm Messages

The following alarm messages shall be displayed:

- Input power out of tolerance
- Battery charger problem
- Low battery warning
- Low battery shutdown
- DC bus overvoltage
- Bypass frequency out of range
- Load transferred to bypass
- Static switch failure
- UPS output not synchronized to bypass power
- Output undervoltage
- Output overvoltage
- System output overloaded
- Load transferred to bypass due to overload
- Overload shutdown
- Control error
- Power supply failure
- EPO shutdown
- Fan failure
- Over temperature shutdown

An audible alarm shall be provided and activated by any of the above alarm conditions.

2.2.3.4 Status Messages

The following UPS status messages shall be displayed:

- Normal operation
- Load on maintenance bypass
- Load on UPS
- Load on static bypass
- System shutdown
- UPS on battery

2.2.3.5 Controls

UPS start-up, shutdown, and maintenance bypass operations shall be accomplished through the front-panel pushbutton controls. Menu-driven user prompts shall be provided to guide the operator through system operation without the use of additional manuals. Pushbuttons shall be provided to display the status of the UPS and to test and reset visual and audible alarms. A mimic screen shall be available on the LCD screen to depict a single-line diagram of the UPS, with switch positions and power flow.

2.2.3.6 On-Line Battery Test

The UPS shall be provided with a menu-driven On-Line Battery Test feature. The test shall ensure the capability of the battery to supply power to the inverter while the load is supplied power in the normal mode.

2.2.4 Static Transfer Switch

2.2.4.1 General

A static transfer switch and bypass circuit shall be provided as an integral part of the UPS. The static switch shall be a naturally commutated high-speed static (SCR-type) device rated to conduct full load current continuously.

The static transfer switch control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals, and operating and alarm conditions. This control circuit shall provide an uninterrupted transfer of the load to an alternate bypass source, without exceeding the transient limits specified herein, when an overload or malfunction occurs within the UPS, or for bypassing the UPS for maintenance.

2.2.4.2 Uninterrupted Transfer

The transfer control logic shall automatically turn on the static transfer switch, transferring the critical AC load to the bypass source, after the transfer logic senses any of the following conditions:

- Inverter overload capacity exceeded
- Critical AC load overvoltage or under voltage
- Battery protection period expired
- UPS fault condition

The transfer control logic shall inhibit an automatic transfer of the critical load to the bypass source if any of the following conditions are present:

- Inverter/bypass voltage difference exceeding preset limits
- Bypass frequency out of limits

2.2.4.3 Uninterrupted Retransfer

Retransfer of the critical AC load from the bypass source to the inverter output shall be automatically initiated unless inhibited by manual control. The transfer control logic shall inhibit an automatic retransfer of the critical load to the inverter if one of the following conditions exists:

* Overload condition exists in excess of inverter full load rating
* UPS fault condition present

2.2.5 Maintenance Bypass Switch

2.2.5.1 General

A manually operated maintenance bypass breaker shall be incorporated into the UPS cabinet to directly connect the critical load to the bypass AC input power source, bypassing the rectifier/charger, inverter, and static transfer switch.

2.2.5.2 Isolation

All energized terminals shall be shielded to ensure that maintenance personnel do not inadvertently come in contact with energized parts or terminals. A means to de-energize the static switch shall be provided when the UPS is in the maintenance bypass mode of operation.

2.2.5.3 Maintenance Capability

With the critical load powered from the maintenance bypass circuit, it shall be possible to check out the operation of the rectifier/charger, inverter, battery, and static transfer switch. When the application calls for the Maintenance Bypass Breaker to be bolted to the UPS cabinet, the interconnecting cables are to be provided, precut and pre-lugged.

2.2.6 Battery Power Pack

The battery power pack shall include sealed, lead-acid valve regulated battery cells housed in a separate cabinet that matches the UPS cabinet styling to form an integral system line-up. Battery cells shall be mounted on slide-out trays for ease of maintenance. A battery disconnect circuit breaker shall be included for isolation of the battery pack from the UPS module. The UPS shall automatically be disconnected from the battery when the battery reaches the minimum discharge voltage level. Casters and leveling feet shall also be provided with the battery power pack cabinet for ease of installation. When the application calls for the battery cabinet to be bolted to the UPS cabinet, the interconnecting cables are to be provided, precut and prelugged.

2.2.7 Accessories (Optional Equipment)

2.2.7.1 Optional Relay card

Relay card provide dry contacts for UPS external monitoring, and reflect the UPS operation status.

2.2.7.2 Optional Battery Temperature Sensor

1.1 Adapt MODBUS RTU communication protocol, communication speed is 9600bps, 8-bit data bits, 1-bit stop bit, without odd-even check.

1.2 Input voltage 12-15V/DC （±5%）

1.3 Measurement range of temperature: -20 ~ 70 ℃

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 UPS startup.

3.1.1 Visual Inspection

* Inspect equipment for signs of damage.
* Verify installation per drawings.
* Inspect cabinets for foreign objects.
* Verify neutral and ground conductors are properly sized and configured.
* Inspect battery cases.
* Inspect battery for proper polarity.
* 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/or spade lugs for tightness.

3.1.3 Electrical Inspection

* Check all fuses for continuity.
* Confirm input voltage and phase rotation is correct.
* Verify control transformer connections are correct for voltages being used.
* Assure connection and voltage of the battery string(s).