



Liebert[®] PSA[™] UPS

GUIDE SPECIFICATIONS

500VA to 1500VA

Single-Phase Uninterruptible Power Supply Systems

1.0 GENERAL

1.1 SUMMARY

This specification defines the electrical and mechanical characteristics and requirements for a continuous-duty single-phase, solid-state, uninterruptible power system. The uninterruptible power system, hereafter referred to as the UPS, will provide high-quality AC power for sensitive electronic equipment loads.

1.2 STANDARDS

The UPS is 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 will govern.

120V Units

- UL 1778, c-UL listed (to CSA 22.2 No. 107.1)
- FCC Part 15, Subpart B, Class B
- ANSI C62.41, Category A, Level 3 (IEEE 587, Category A);
- EN60950-1
- EN60146 series
- EN60529
- EN61000-4-5, Level 3, Criteria A
- EN61000-4-2, Level 3, Criteria A
- EN61000-4-3, Level 3, Criteria A
- EN61000-4-4, Level 4, Criteria A
- EN61000-4-6, Level 3, Criteria A
- EN61000-3-2
- ISTA Procedure 1A

230V Units

- EN50091-1-1, TUV/GS listed, CE compliance mark
- EN50091-2, Class B
- EN62040-1-1
- EN60950-1
- EN60146 series
- EN60529
- EN61000-4-2, Level 3, Criteria A
- EN61000-4-3, Level 3, Criteria A
- EN61000-4-6
- EN61000-4-4, Level 4, Criteria A
- EN61000-4-5, Level 3, Criteria A
- EN61000-3-2
- EN62040-2 2nd Edition
- ISTA Procedure 1 A

1.3. SYSTEM DESCRIPTION

1.3.1 Modes of Operation

The UPS is designed to operate as a line-interactive system in the following modes:

- A. Normal** - The critical AC load is continuously supplied with filtered power. The battery charger maintains a float-charge on the battery.
- B. Voltage Boost/Buck** - During input power source abnormalities (sags and swells), the AC output power is corrected by means of boost (sag correction) or buck (swell correction) compensation taps. Operation of the compensation taps automatically maintains the proper output voltage for the connected critical equipment. The compensation taps are designed for indefinite operation to their limits. Operation of the compensation taps will not discharge the battery.
- C. Recharge** - Upon restoration of utility / mains AC power, after a utility / mains AC power outage and complete or partial battery discharge, the unit automatically restarts and resumes supplying power to the critical AC load. The battery can be charged from the utility whether the UPS is ON or OFF.
- D. Battery** - When the input power source exceeds the parameters defined in section 1.3.3.1, the critical AC load is supplied power by the inverter, which obtains its power from the battery. Typical detection and transfer time is 4-6 ms.
- E. Battery Start**- The UPS is capable of starting without input power. The unit starts up and operates from the battery, with output frequency set to factory defaults of 60Hz for 120VAC units and 50Hz for 230VAC units.

1.3.2 Design Requirements

- A. Voltage:** Input/output voltage specifications of the UPS are:

Input:

120V Units: 0-150 VAC, 60/50 Hz auto-sensing, single-phase, 2-wire-plus-ground.

230V Units: 0-300 VAC, 50/60 Hz auto-sensing, single-phase, 2-wire-plus-earth.

Output:

120V Units: 120 ± 10VAC, 60/50 Hz, single-phase, 2-wire-plus-ground.

230V Units: 230 VAC ± 10VAC, 50/60 Hz, single-phase, 2-wire-plus-earth.

- B. Output Load Capacity:** Maximum specified output load capacity of the UPS, regardless of load power factor, is:

500VA / 300W 650VA / 390W

1000VA / 600W 1500VA / 900W

- C. Internal Battery:** The battery consists of valve regulated, non-spillable, maintenance-free, sealed, lead-acid cells. The battery is user replaceable and “Easy swappable”, requiring the UPS to be powered off.
- D. Battery Reserve Time:** 5 + minutes typical runtime at full load and a ambient temperature of 77°F (25°C).
- E. Battery Recharge:** The UPS contains a battery recharge rate designed to prolong battery life. Recharge time is 6-8 hours typical to 90% capacity after a complete discharge into full resistive load.

1.3.3 Performance Requirements

1.3.3.1 AC Input to UPS

- A. Voltage Configuration:** The UPS operates at these values without drawing power from the batteries.

120 VAC nominal: single phase, 2-wire-plus-ground: 84 – 140 VAC (± 10 VAC),
Buck compensation: 130VAC (± 10 VAC)
Boost1 compensation: 97VAC (± 10 VAC)

230 VAC nominal: single phase, 2-wire-plus-earth: 160 – 287 VAC (± 10 VAC)
Buck compensation: 250 VAC (± 10 VAC)
Boost1 compensation: 210 VAC (± 10 VAC)

- B. Frequency:** The UPS automatically senses the input frequency and operates within the following frequency specifications without drawing power from the batteries.

50 Hz Applications: 45 – 54 Hz (± 0.1 Hz)
60 Hz Applications: 55 – 64 Hz (± 0.1 Hz)

- C. Surge Protection:** The 120 VAC units can withstand input surges of up to 570J without damage per criteria listed in IEEE C62.41, Category A, Level 3. The 230 VAC units can withstand input surges of up to 220J without damage per criteria listed in EN61000-4-5, Level 3, Criteria A.

- D. Input Connections:** The 120 VAC units have an attached input cord 6.0 feet (1.8 meters) in length, measured between the outside edges of the connectors. The attached input cord has a NEMA 5-15 plug. The 230VAC unit requires a user supplied IEC-320-C14 input cord.

1.3.3.2 AC Output

- A. Voltage Configuration:**

120 VAC units: 120 VAC, 60/50 Hz, single-phase, 2-wire-plus-ground.

120VAC ± 5 % (Battery mode)

230 VAC units: 230 VAC, 50/60 Hz, single phase, 2-wire-plus-earth.

230 VAC ± 5 % (Battery mode)

- B. Voltage Regulation:** ± 10 % steady state.

- C. Frequency Regulation:** ± 1 Hz synchronized to utility / mains.

± 0.5 Hz free running or on battery operation.

- D. Load Power Factor Range:** 0.6 lagging to 1.0 (unity).

- E. Inverter Overload Capability:** 120/230VAC (Normal Mode) Units are capable of > 105 % continuous overload (visual and audible alarms present) until AC breaker trips. With 110% load applied to 120/230VAC unit the UPS will shutdown immediately, and then the alarm will come on for 5 sec.

- G. Transient Recovery Time:** To within ± 8 % of nominal voltage in < 2 cycles.

- H. Efficiency:** > 88 % (Normal mode)

> 85 % (Buck/Boost mode)

> 70 % (Battery mode)

1.4 ENVIRONMENTAL CONDITIONS

A. Ambient Temperature

Operating: 32°F – 104°F (0°C – 40°C) for altitudes 10,000 ft (3000 meters) above sea level.

77° F (25°C) for optimum battery performance

Storage: 5°F – 104°F (-15°C – 40°C) with batteries

68°F (20°C) for optimum battery storage

B. Relative Humidity

0 – 90% non-condensing

C. Altitude:

10,000 m (3,000 m max.), without power derating when operated within the temperature specified in section 1.4.A. Ambient temperature will be derated 5°C for each additional 500 m (1640 ft.)

D. Audible Noise

Noise generated by the UPS during normal operation < 40dB, and < 45dB in battery mode when measured at 1 meter from the surface of the UPS.

E. Electrostatic Discharge

The 120/230 VAC units are able to withstand an electrostatic discharge compliant to EN61000-4-2, level 3, Criteria A, without damage and without affecting the connected load.

1.5 USER ACCESSORIES AND PACKAGING

The specified UPS system is supplied with (1) Quick-Start guide. The manual includes installation drawings and instructions, a functional description of the equipment, safety precautions, illustrations, operating procedures, and general maintenance guidelines. The UPS is also supplied with (1) Liebert Shutdown software CD, and (1) USB cable (6-ft; 1.8m).The package meets the requirements of ISTA Procedure 1A.

1.6 WARRANTY

The manufacturer warrants the UPS against defects in materials and workmanship for two (2) years. The warranty covers all parts. An optional one (1) or three (3) year extended warranty is available from the manufacturer.

1.7 QUALITY ASSURANCE

1.7.1 Manufacturer Qualifications

Emerson Network Power provides more than twenty years experience in the design, manufacture, and testing of solid-state UPS systems and the company is certified to ISO 9001.

1.7.2 Factory Testing

Before shipment, the product is tested to assure compliance with the specification.

2.0 PRODUCT

2.1 FABRICATION

All materials and components making up the UPS are new, of current manufacture, and have not been in prior service except as required during factory testing. All relays are provided with dust covers.

2.1.2 Wiring

Wiring practices, materials, and coding are in accordance with the requirements of the standards listed in section 1.2. All wiring is copper.

2.1.3 Cabinet

The UPS unit comprised of: TVSS & EMI/RFI Filters, Bi-Directional Converter, Automatic Voltage Regulator and Battery consisting of the appropriate number of sealed battery cells; is housed in a mini-tower NEMA type 1 enclosure. The UPS cabinet is injection-molded standard color. Dimensions and weights are:

UNIT	120/230VAC DIMENSIONS W x D x H in (mm)	120 VAC WEIGHT lbs (kg)	230 VAC WEIGHT lbs (kg)
500VA	3.7 x 14 x 6.7 (95 x 356 x 171)	14.1 (6.4)	13.2 (6)
650VA	3.7 x 14 x 6.7 (95 x 356 x 171)	14.6 (6.6)	14.3 (6.5)
1000VA	5.8 x 14.2 x 9.2 (147 x 360 x 234)	23.8 (10.8)	22.7 (10.3)
1500VA	5.8 x 14.2 x 9.2 (147 x 360 x 234)	27.8 (12.6)	26.5 (12)

2.1.4 Cooling

The UPS is convection cooled.

2.2 COMPONENTS AND OPERATION

2.2.1 Input Protection

The UPS has built-in protection against under voltage, over current, and over voltage conditions including low-energy lightning surges introduced on the primary input power source. The UPS is provided with an input circuit protector.

2.2.2 Bi-Directional Converter

2.2.2.1 General

The Bi-Directional Converter incorporates solid-state devices and control circuitry to convert AC power to regulated DC power for battery charging; and convert DC power from the battery to regulated and conditioned stepped-sine wave AC power for supporting the critical load. The Bi-Directional Converter is a pulse width modulated (PWM) design. The Bi-Directional Converter operates in the following modes:

1. In Normal mode of operation, the Bi-Directional Converter maintains the battery system at a float charge.
2. In Battery mode of operation, the Bi-Directional Converter converts DC power from the battery to regulated and conditioned stepped-sine wave AC power for supporting the critical load.
3. In the recharge mode of operation, the Bi-Directional Converter converts AC power to regulated DC power to recharge the battery.

2.2.2.2 Battery Recharge

The UPS contains a battery recharge rate designed to prolong battery life. The battery is constant voltage charged to recharge and maintain the battery in a fully charged state. Recharge time is 6-8 hours maximum to 90% rated capacity after discharge into full resistive load.

2.2.2.3 Bi-Directional Converter DC Protection

The following DC shutdown levels protect the UPS:

- DC Over voltage Shutdown
- DC Under voltage Shutdown (End of Discharge)
- DC Under voltage Warning (Low Battery Reserve)

2.2.2.4 Output Protection

For output faults including short circuits and overloads, the UPS is protected by the input circuit protector during Normal mode and by electronic current limiting during Battery mode.

2.2.2.5 Overload

The UPS is capable of supplying power for overloads exceeding 100% and up to 105% of full load rating, until breaker trips. A visual indicator and audible alarm indicate overload operation. For greater current demands, the UPS employs circuit protector and electronic current-limiting protection to prevent damage to components. The UPS is self-protecting against any magnitude of connected output overload. The UPS control logic senses and disconnects the UPS from the critical AC load and clears the protective circuit breaker during Normal mode.

2.2.2.6 Output Frequency

An oscillator controls the output frequency of the UPS. The oscillator maintains the output frequency to ± 1 Hz of nominal when not synchronized to the utility/mains source.

2.2.2.7 Battery Over-Discharge Protection

To prevent battery damage due to excessive discharge levels, the UPS control logic automatically monitors the battery voltage and load level and switches off the output at the predetermined battery shutdown voltage set point.

2.2.3 Display and Controls

2.2.3.1 General

The UPS is provided with a microprocessor-based unit status and control display designed for convenient and reliable user operation. The status and alarm indicators are displayed on a status indicator display

2.2.3.2 System Indicators

There are three (3) status indicators on the front of the UPS (Utility, Battery and Fault) and one (1) on the rear (Site Wiring Fault):

The Utility Indicator illuminates when the UPS is operating and supplying power to connected loads: green indicates Normal, Buck, or Boost mode.

The (amber) overload light will illuminate and constant audible alarm will sound when there is an overload condition. This will continue until the load drops or the breaker trips.

The (amber) Battery Indicator flashes and the audible alarm sounds every 3 seconds to indicate the UPS is operating on battery. The (amber) Battery Indicator flashes and the audible alarm sounds every second to indicate low battery.

The (red) Fault Indicator illuminates when the UPS detects a problem. Solid (steady glow) until UPS shuts down after 5 seconds. When a battery replacement is required there will be a red flash every second for 5 seconds.

The Site Wiring Fault Indicator on the rear panel illuminates red, with the 120VAC units only, when the UPS detects a line-neutral reversal or a poor neutral-ground bond.

2.2.3.3 On/Off Controls

UPS start-up and shutdown operations are accomplished by the "On/Off" push button located on the front panel of the UPS. Depressing the button for more than 0.5 sec will start-up the UPS and to turn the UPS off the button will need to be depressed for > 2 sec.

2.2.3.4 On-Line Battery Test

The UPS is provided with an automatic or remote battery test feature. This test ensures the capability of the battery to supply power to the inverter while loaded. If the battery fails the test, the fault indicator will illuminate (red) and alarm will sound every second for 5 seconds. The battery test feature is user accessible via Liebert Shutdown software.

2.2.3.5 Alarm Silence

The alarm silence function can only be controlled by the Liebert Shutdown software. Alarm Silence only works when unit in battery mode except when operating in overload/low battery/fault condition.

2.2.4 Internal Battery

Valve regulated, non-spillable, lead-acid cells are used as a stored-energy source for the specified UPS system. The battery is housed internal to the UPS cabinet, and sized to support the inverter at rated load and power factor, with ambient temperature of 77 ° F (25 ° C) for a minimum of 3 minutes reserve time. The expected life of the battery is 3 - 5 years or 250 complete discharge cycles.

2.2.5 Output Distribution

Output distribution is integral to the UPS and is located on the rear of the unit.

UNIT	120 VAC UNITS	230 VAC UNITS
500VA & 650VA	(3) NEMA 5-15R (Black) Battery backup + surge protection; (1) NEMA 5-15R (White) surge protection only	(3) IEC-320-C13 (Black) Battery backup + surge protection; (1) IEC-320-C13 (White) Surge protection only
1000VA & 1500VA	(6) NEMA 5-15R (Black) Battery backup + surge protection; (2) NEMA 5-15R (White) surge protection only	(6) IEC-320-C13 (Black) Battery backup + surge protection; (2) IEC-320-C13 (White) Surge protection only

2.2.5.1 Output Power Cords: The package of the 230 VAC units also includes two (2) IEC 320-C13 output power cords (6.6 ft; 2m).

2.2.6 Communications – USB Interface Port

The UPS shall have (1) USB Interface Port. The USB connector shall be a 4P Male connector. The USB interface port shall always be active. The UPS shall be capable of communicating system status and system shutdown via the USB. Hardware shall support and allow operating system communication for Windows 98 and newer. USB port shall be capable of communicating via Liebert Shutdown software, which is provided.