

Vertiv™ Liebert® Power-UPS Lithium 400VA Single-Phase Uninterruptible Power Supply Systems GUIDE SPECIFICATIONS

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 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.

400VA/240W, 120V Models

- cTUVus listed/labeled (certified to UL Standard 1778, 5th Edition and CSA 22.2 No. 107.3)
- Lithium cells to UL 1642 certified and listed
- Battery system to UN38.3, UL 1973, and IEC62619
- FCC Part 15, Subpart B, Class B
- EN61000-4-5, Level 2 (Line Neutral)
- EN61000-4-5, Level 3 (Line Ground)
- ISTA Procedure 2A
- RoHS/3TG, REACH, WEEE compliant
- Energy Star Qualified
- USA Department of Energy 2020 Standard compliant

1.3 System Description

1.3.1 Modes of Operation

The UPS is designed to operate as a standby/offline system in the following modes:

1. Off Mode

The UPS input is plugged into a stable, 120 VAC source, the surge only, and the battery and surge outlets are de-energized. The internal batteries are charging.

2. On/Normal Mode

The UPS input is plugged into a stable, 120 VAC source and the surge only, and the battery and surge outlets are energized. The internal batteries are charging.

3. On/Battery Mode

The UPS input is plugged in, and the input voltage source has become unusable. The UPS automatically switches to the internal battery to provide normal, usable voltage to the battery and surge outlets. The surge only outlet will not have power.

4. Fault Mode

An error or fault condition has occurred. The battery and surge outlets are shut off and the internal batteries are not charging. The surge only outlet may still have power if the UPS is plugged into an electrical outlet.

1.3.2 Design Requirements

1. Input/Output Voltage Specifications of the UPS are:

- Input: 88-142 VAC, 60 Hz, single phase, 2 wire plus ground.
- Output (on utility): 120 VAC, -27% / +18% VAC, 60 Hz, single phase, 2 wire plus ground.
- Output (on battery): 120 VAC, $\pm 10\%$ VAC, 60 Hz, single phase, 2 wire plus ground.

2. **Output Load Capacity:** The maximum specified output load capacity of the UPS is 400 VA / 240 W.

3. **Internal Battery:** The battery consists of Lithium-ion (Lithium Iron Phosphate, LiFePO₄) cells. The battery is not user replaceable. Battery run time is 3 minutes with 100% load and 12 minutes with 50% loading. Battery run times are approximate and shall be based upon a new, fully charged battery at a temperature of 77°F (25°C) using 100% resistive load.

4. **Battery Recharge:** The UPS contains a battery recharge rate designed to prolong battery life and provide a fast recharge. Recharge time is approximately 2 hours to 90% and 2.5-3 hours to 100% capacity after a complete discharge into full resistive load.

1.3.3 Performance Requirements

AC Input to UPS

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

- 120 VAC nominal: single phase, 2 wire plus ground: 88 to 142 VAC (± 3 VAC)

2. **Frequency:** The UPS operates within the following frequency specifications without drawing power from the batteries.

- 60 Hz Applications: 55 to 65 Hz (± 1 Hz)

3. **Surge Protection:** The UPS units can withstand input surges of up to 381J without damage per criteria listed in IEEE C62.41, Category B, Level 2 on the AC input.

4. **Input Connections:** The 120 VAC units shall have an attached input cord 6 ft. (1.8 meters) in length, with a NEMA 5-15 plug.

AC Output

1. **Voltage Configuration:**

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

2. **Voltage Regulation:** Follows input voltage until the unit transfers to battery power. While in battery mode operation the voltage regulation shall be $\pm 10\%$.

3. **Frequency Regulation:** Same as utility/mains in normal mode operation, $\pm 1.0\text{Hz}$ while in battery mode operation.

4. **Load Power Factor Range:** 0.5 lagging to 1.0 (unity).

5. **Output Overload Capability:**

120 VAC Models (Normal Mode)

- 101% - Alarm warning
- 110% - Alarm warning and shutdown after five minutes
- 120% - Alarm warning and immediate shutdown

120 VAC Models (Battery Mode)

- 110% - Alarm warning and shutdown after five seconds
- 120% - Alarm warning and immediate shutdown

6. **Efficiency:** > 98%, meets Energy Star 2.0 and USA Department of Energy 2020 (DOE 2020) requirements.

1.4 Environmental Conditions

1. **Ambient Temperature**

Operating:

- 32 to 104 °F (0 to 40 °C) for altitudes 0 to 6,561 ft. (0 to 2000 meters) above sea level
- 77 °F (25 °C) for optimum battery performance

Storage:

- 5 to 113 °F (-15 to 45 °C) with batteries for altitudes 0 to 49,212 ft. (0 to 15000 meters) above sea level
- 68 °F (20 °C) for optimum battery storage and battery shelf life

2. **Relative Humidity:** 0 to 95% non-condensing
3. **Audible Noise:** Noise generated by the UPS during normal operation and battery mode shall be < 45 dBA, when measured at 1 meter from any surface of the UPS.
4. **Surge Immunity:** The 120 VAC units shall be compliant to EN61000-4-5, level 2 and ANSI C62.41 Category B, level 2.

1.5 User Accessories and Packaging

The specified UPS system shall be supplied with a printed Quick Start guide. The packaging shall be comprised of 100% recyclable material and shall meet the requirements of ISTA Procedure 2A.

1.6 Warranty

The manufacturer warrants the UPS against defects in materials and workmanship for 5 years. The warranty covers all parts.

The user shall not have to pay freight or provide a credit card number for the manufacturer's standard warranty support. The manufacturer shall cover any freight to ship the replacement unit and shall provide a return call tag to cover freight to have the original unit returned to the manufacturer.

1.7 Quality Assurance

1.7.1 Manufacturer Qualifications

The manufacturer shall have more than 45 years of experience in the design, manufacture, and testing of solid-state UPS systems and the company shall be certified to ISO 9001.

1.7.2 Factory Testing

Before shipment, each product shall be tested to assure compliance with the specification.

2.0 PRODUCT

2.1 Fabrication

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

2.1.1 Wiring

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

2.1.2 Cabinet

The UPS unit shall be comprised of TVSS and EMI/RFI filters, battery charger, inverter, and battery consisting of the appropriate number of battery cells to support the UPS rated capacity for 3 minutes minimum. The unit shall be housed in a NEMA type 1 enclosure with IP20 protection. The UPS cabinet shall be injection molded in the manufacturer's standard color.

Dimensions and weights shall be:

- Unit: 4.72" W x 8.3" D x 5.4" H (120 mm W x 210 mm D x 138 mm H); 3.95 lbs (1.79 kg)
- Shipping: 7.4" W x 11.0" D x 9.1" H (189 mm W x 279 mm D x 232 mm H); 5.05 lbs (2.29 kg)

2.1.3 Cooling

The UPS shall be 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 shall be provided with an input circuit protector.

2.2.2 Converters

Inverter

The inverter incorporates solid-state devices and control circuitry to convert DC power from the battery. The inverter shall use IGBT devices and shall utilize a pulse width modulated (PWM) design to provide regulated and conditioned simulated sine wave AC power for supporting the critical load.

Battery Charger

The battery charger shall be provided to convert AC power to regulated DC power for battery charging. The charger shall incorporate a two stage charge method designed to prolong battery life. First stage shall be constant current until the battery reaches float voltage then change to second stage of constant voltage until charge current is negligible. Recharge time shall be 2 hours to 90% rated capacity after complete discharge into full resistive load.

The battery charger shall be able to charge batteries once the UPS is connected to an AC source that is within the input specifications defined in section 1.3.3.1.A of this specification whether the UPS is turned ON or OFF.

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)
- Internal battery or inverter over temperature

Output Protection

For output faults including short circuits and overloads, the UPS shall be protected by the input circuit protector while operating from AC input power and by electronic current limiting during battery mode operation.

Overload

The UPS is capable of supplying power for overloads exceeding 100% as defined in section 1.3.3.2 E. A visual indicator and audible alarm indicate overload operation.

Output Frequency

The output frequency shall follow the input frequency within ± 5 Hz from nominal while operating from AC input. When operating from battery power, the UPS shall use an internal oscillator to control the output frequency of the UPS to maintain the output frequency to ± 1.0 Hz of nominal.

Battery Over-Discharge Protection

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

2.2.3 Display and Controls

General

The UPS is provided with a microprocessor based unit status and control designed for convenient and reliable user operation. The UPS shall include a system status/alarm indicator.

System Indicator

The ON/OFF button shall incorporate an integrated LED status indicator.

The LED Indicator illuminates when the UPS is operating and supplying power to connected loads.

- Solid green indicates normal operation

- Blinking green indicates battery mode operation, and the audible alarm sounds every ten seconds to indicate the UPS is operating on battery

The LED Indicator illuminates when the UPS detects a problem or internal fault.

- Solid red with a 1 second interval audible alarm indicates a UPS overload condition
- Blinking red with a 2 second interval audible alarm indicates low battery
- Solid red with a constant audible alarm indicates a UPS fault

Pressing the ON/OFF button twice within one second will silence the audible alarm.

On/Off Controls

UPS startup and shutdown operations are accomplished by the ON/OFF push button located on the front panel of the UPS. Pressing the button for 2 to 3 seconds will startup the UPS and to turn the UPS off the button will need to be depressed for 2 to 3 seconds.

2.2.4 Internal Battery

LiFePO₄ cells are used as a stored energy source for the specified UPS system. The battery shall be housed internal to the UPS and sized to support the inverter at full rated load. The expected life of the battery shall be 8 to 10 years or 1000 complete discharge cycles.

2.2.5 Output Distribution

Output distribution shall be integral to the UPS and is located on the top of the unit. The UPS shall have 3 NEMA 5-15 receptacles that are surge protected and battery backed and shall have 1 NEMA 5-15 receptacle that is surge protected only.