



Liebert[®] GXT5

750 to 3000 VA

Guide Specifications

Liebert® GXT5™

750VA – 3000VA Tower/ Rack
Configuration

GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 SUMMARY

This specification shall define the electrical and mechanical characteristics and requirements for a continuous-duty, single-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 along with the associated equipment and components will be manufactured in accordance with the following applicable standards:

Safety	EN 62040-1:2008+A1:2013; GS mark; UL 1778 5th Edition and CSA 22.2 No. 107.1
EMC	EN 62040-2:2006 EN 61000-3-2:2014 EN 61000-3-3:2013
Surge Immunity	ANSI C62.41 Category B IEC 61000-4-5 Surges/Lightning
RFI/EMI	CISPR22 Class A
Energy star certified	ENERGY STAR: Program Requirements Product Specification for Uninterruptible Power Supplies (UPSs) - Eligibility Criteria, Version 2.0
Transportation and Shipping	ISTA Procedure 1A

The UPS is CB marked. The Quality management grade pertaining to the engineering and manufacturing facility is certificated to conform to the ISO 9001 international standards, specifically catering to the design and production of power protection systems for computers and other sensitive electronic devices.

1.3 SYSTEM DESCRIPTION

1.3.1 Modes of Operation

The UPS will operate in the following modes:

- A. Normal - When utility power is normal, Normal mode employs the rectifier and inverter to provide voltage- and frequency-stabilized power to the load. The charger charges the battery in normal mode.
- B. Battery - Battery mode supplies battery power to the load if utility power fails or if the utility voltage goes outside of the permissible range.
- C. Internal Bypass - Bypass mode supplies power to the load from the bypass source (utility power) if an overload or fault occurs during normal operation.
- D. Automatic Restart - Upon restoration of mains power and after a complete battery discharge, the UPS shall be able to automatically restart and resume supplying power to the critical load based on the settings in the supplied configuration program.
- E. Eco mode -The energy-saving ECO mode reduces power consumption by powering the load via bypass if the bypass voltage is normal or by powering the load via the inverter when the bypass voltage is abnormal. You can use ECO mode to power equipment that is not sensitive to power- grid quality to via bypass and reduce power consumption

1.3.2 Design Requirements

A. Voltage

Input/output voltage specifications of the UPS shall be:

Input

- 230V units: 0 - 288VAC, 50/60Hz, single-phase, 2-wire-plus-earth.

Output

- 230V units: 230VAC (user configurable: 220V, 230V, 240V) $\pm 3\%$, 50/60Hz, single-phase, 2 wire plus earth.

B. Output Load Capacity

Specified output load capacity of the UPS shall be:

- 750VA/750 Watts at unity power factor.
- 1000VA/1000 Watts at unity power factor.
- 1500VA/1500 Watts at unity power factor.
- 2000VA/2000 Watts at unity power factor.
- 3000VA/3000 Watts at unity power factor.

C. Internal Battery

The UPS shall utilize valve-regulated, non-spillable, lead acid cells.

D. Reserve Time (with internal battery)

- 750VA: 10.5 minutes (230V)
- 1000VA: 6.5 minutes (230V)
- 1500VA: 5.5 minutes (230V)
- 2000VA: 3 minutes (230V)
- 3000VA: 3 minutes (230V)

These times shall be at full load with ambient temperature of 77°F (25°C) with resistive loading.

E. Battery Recharge

The UPS shall charge internal batteries of 750VA, 1000VA, and 3000VA in 3 Hours to 90% capacity and 1500VA & 2000VA in 4 Hours to 90% capacity after full discharge with 100% load till UPS auto- shutdown.

1.3.3 Performance Requirements

The solid-state power components, magnetic, electronic devices and over current protection devices will operate within the manufacturer's recommended temperature when the UPS is operating at 100% critical load and maintain battery charging under either of the following conditions:

- Any altitude within the specified operating range $\leq 3000\text{m}$ elevation.
- Any ambient temperature within the specified operating range of 0°C to 50°C

1.3.3.1 AC Input to UPS

A. Voltage: The UPS shall incorporate a variable input voltage window feature that shall operate at the values in the following table, without drawing power from the batteries.

Load Level	750-3000VA 230VAC input voltage
90% ~ 100% loading	168~ 177VAC/288VAC
70% ~ 90% loading	150 ~168VAC/288VAC
28% ~ 70% loading	115~ 150VAC/288VAC
0 ~ 28% loading	115VAC/288VAC

B. Frequency: The UPS shall auto-sense mains frequency of 50Hz or 60Hz when first powered up and shall use this frequency as the default output frequency. Once started the mains frequency operating window shall be 40-70Hz without going to batteries. The UPS shall be capable of cold start (Start Up on Battery) with a default output frequency of 50Hz.

- C. Input power cord: C14
- D. Input Power Factor: >0.99 lagging at rated load.
- E. Input total Current harmonic distortion: 5% THD typical.
- F. Surge Protection: The UPS shall meet IEC/EN EN61000-4-5, Level 4, Criteria A standards

1.3.3.2 Mains Output, UPS Inverters

A. Voltage configuration:

230V units: 230VAC, 50/60Hz, single-phase, 2-wire-plus-earth, configuration program selectable (220V, 230V, 240V).

- B. Steady state voltage regulation: $\pm 2\%$ steady state.
- C. Frequency regulation: $\pm 3.5\text{Hz}$ synchronized to mains.
 $\pm 0.1\text{Hz}$ free running or on battery operation.
- D. Frequency slew rate: 1.0Hz per second maximum
- E. Output power factor: Unity
- F. Voltage distortion: Sine waveform, 2% for linear loads and 5% for non-linear loads

G. Inverter Overload Capability:

	750VA, 1000VA, 1500VA, 2000VA, and 3000VA
230V	>200% for 250ms; 150- 200% for 2 seconds; 125- 150% for 50 seconds; 105-125% 60 seconds;

- H. Voltage Transient Response: The inverter transient response will be $\pm 5\%$ for a 0%-100%-0% step resistor load.
- I. Transient Recovery Time: To nominal voltage within 60 milliseconds.
- J. Double conversion efficiency: All UPS models shall be ENERGY STAR qualified and labeled.
 - 750VA & 1000VA: Up to 91%
 - 1500VA & 2000VA: Up to 93%
 - 3000VA: Up to 94%
- K. Eco mode efficiency: Up to $98 \pm 1\%$

L. Programmable & Controllable Outlets:

The UPS units shall have 2 groups of programmable and controllable outlets. These shall be user customizable to program to perform load shedding based upon battery capacity remaining, time on battery operation, battery time remaining, and overload condition when on battery power. The user shall also be able to program these groups for sequential restart of connected equipment based upon time after input power is restored. The user can also program these to always be turned off to prevent unauthorized equipment from being plugged into the UPS.

1.3.3.3 ENVIRONMENTAL CONDITIONS

A. Ambient Temperature

Operating: 0°C ~ 50°C (no derating @40°C, 0.9 derating @50°C)

Storage: -40°C ~ +70°C (battery excluded); -25°C ~ +55°C (battery included)

B. Relative Humidity: 5%RH ~ 95%RH, non-condensing

C. Altitude: <=3000m; derating when higher than 3000m

D. Audible Noise

The audible noise of the UPS shall be:

- 750-1000VA: <46dBA max @ 3ft. (1m) front and sides <43dBA max @ 3ft. (1m) rear
- 1500VA: <46dBA max @ 3ft. (1m) front and sides <45dBA max @ 3ft. (1m) rear
- 2000VA-3000VA: <48dBA max @ 3ft. (1m) front and sides <48dBA max @ 3ft. (1m) rear

E. Ingress protection level: IP 20

1.4 USER DOCUMENTATION

The specified UPS system shall be supplied with a Safety Instruction & Warning Sheet. The specified UPS system shall be supplied with quick start guides for ease of installation and UPS start up. Each UPS will also contain a full user manual located on the included CD. The user manual shall include installation instructions, a functional description of the equipment with block diagrams, safety precautions, illustrations, step-by-step operating procedures and general maintenance guidelines.

The included CD will shall also include a configuration program to allow user customization of UPS operating parameters and UPS monitoring and computer/server shutdown software.

1.5 WARRANTY

The UPS manufacturer shall warrant the UPS against defects in materials and workmanship for two (2) years. The no-hassle replacement warranty shall include shipping costs to the customer site for the new replacement unit and shipping costs from the customer site for the return of the failed unit. Optional one (1) and three (3) year full coverage extension warranties shall be available from the manufacturer. The manufacturer's standard and extended warranties shall cover all parts, excluding the battery.

1.6 QUALITY ASSURANCE

1.6.1. Manufacturer Qualifications

More than 40 years' experience in the design, manufacture, and testing of solid-state UPS systems shall be required. The manufacturer shall be certified to ISO 9001:2008.

1.6.2 Factory Testing

Before shipment, the manufacturer shall fully and completely test the system to ensure compliance with the specification. Manufacturer shall supply a copy of approved test with shipment of product.

PRODUCT

2.0 FABRICATION

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

2.0.1 Wiring

Wiring practices, materials and coding shall be in accordance with the standards listed in Section 1.2 and other applicable codes and standards. All wiring shall be copper.

2.0.2 Cabinet

The UPS unit shall be composed of: input PFC converter, IGBT inverter, battery charger, input filter and internal bypass circuit; and batteries consisting of the appropriate number of sealed battery cells; and shall be housed in a rack-tower NEMA type 1 enclosure and shall meet the requirements of IP20. The UPS cabinet shall be cleaned, primed and painted RAL 7021 Black.

Unit dimensions and weights shall be (rack mount orientation):

Rating	Dimensions (D x W x H) in mm	Weight in kg
750-1000VA	400 x 430 x 85	16.5
1500-2000VA	470x430x85	21
3000VA	540 x 430 x 85	28.5

2.0.3 Matching Battery Cabinets

The optional Rack-Tower battery cabinet shall contain valve-regulated, non-spill able, lead acid cells, housed in a separate cabinet that matches the UPS cabinet styling. The cabinet shall be cleaned and painted Black RAL 7021. The external battery system shall be sized to provide an additional reserve power specified in section 1.3.2 to the load. The matching battery cabinet shall include detachable, molded interconnect cable, circuit breaker over current protection and provisions for daisy-chain connection of additional battery cabinets. The dimensions and weight information of each optional external battery cabinet shall not exceed below values.

Battery Cabinets	Dimensions (D x W x H) in mm	Weigh in kg
750-1000VA	370 x 430 x 85	22
1500-2000VA	497 x 430 x 85	28.5
3000VA	602 x 430 x 85	39

2.0.4 Cooling

The UPS shall be forced air cooled by internally mounted, continuous fans. Fan power shall be provided from the internal DC supply. Air intake shall be through the front of the unit, and air exhaust shall be out the rear of the unit.

2.1 COMPONENTS

2.1.1 Input Converter

2.1.1.1 General

Incoming AC power shall be converted to a regulated DC output by the input converter supplying DC power to the inverter. The input converter shall provide input power factor correction (PFC) and input current distortion reduction.

2.1.1.2 AC Input Current Limit

The input converter shall be provided with AC input current limiting whereby the maximum input current is limited to 125% of the full load input current rating.

2.1.1.3 Input Protection

The UPS shall have built-in protection against under voltage, over current and overvoltage conditions including low-energy lightning surges, introduced on the primary AC source. The 230VAC UPS shall be able to sustain input surges without damage per criteria listed in ANSI C62.41 Category B IEC 61000-4-5 Surges/Lightning. The 230V model shall have resettable circuit breakers.

2.1.1.4 Battery Recharge

The UPS shall contain a three-stage battery charger designed to prolong battery life. Recharge time for the internal UPS batteries shall be 3 Hours (750VA, 1000VA, and 3000VA models) and 4Hours (1500VA & 2000VA models) to 90% capacity after full discharge with 100% load till UPS auto- shutdown. There shall be DC overvoltage protection so that if the DC voltage exceeds the pre-set limit, the UPS will shut down automatically and the critical load will be transferred to bypass.

2.1.2 Inverters

2.1.2.1 General

The UPS inverter shall be a pulse-width-modulated (PWM) design capable of providing the specified AC output. The inverter shall convert DC power from the input converter output or the battery into precise sinewave AC power for supporting the critical AC load.

2.1.2.2 Overload

The inverter shall be capable of supplying current and voltage for overloads exceeding 100% and up to 200% of full load current. A visual indicator and audible alarm shall indicate overload operation. For greater currents or longer time duration, the inverter shall have electronic current-limiting protection to prevent damage to components. 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 devices.

2.1.2.3 Inverter DC Protection

The inverter shall be protected by the following DC shutdown levels:

- DC Overvoltage Shutdown
- DC Under voltage Shutdown (End of Discharge)
- DC Under voltage Warning (Low Battery Reserve); factory default set at 2 minutes (user configurable 2 to 30 minutes).

2.1.2.4 Output Frequency

An oscillator shall control the output frequency of the UPS. The inverter shall maintain the output frequency to $\pm 0.1\text{Hz}$ of nominal frequency during Battery mode, Frequency Converter mode or when otherwise not synchronized to the utility/mains source.

2.1.2.5 Output Protection

The UPS inverter shall employ electronic current limiting circuitry.

2.1.2.6 Battery Over Discharge Protection

To prevent battery damage from over discharging, the UPS control logic shall automatically raise the shutdown voltage set point; depending on output load and connected battery system at the onset of battery operation

2.1.3 Display and Controls

2.1.3.1 UPS Control Panel

The operator control and display panel will be located on the front of the UPS. The control panel includes a min 320 x 240-pixel multi-lingual, graphic liquid crystal display, allowing the user to operate and control the UPS checking parameters, as well as UPS and battery status and retrieve up to 2000 events/alarm logs for reference and diagnosis. Complete access to all LCD menu is possible through four software- assigned buttons will be located below the display. LCD display will adjust its screen (i.e. vertical or horizontal) automatically depending on the UPS orientation (i.e. Tower or Rack). No physical adjustment to the LCD will be carried out.

2.1.3.2 Logic

UPS system logic and control programming will reside in a microprocessor-based control system with nonvolatile flash memory. Rectifier, inverter and system control logic will utilize high-speed digital signal processors (DSPs). SCI bus will be used to communicate between the logic and the User Interface as well as the options. Switches, contacts and relays will be used only to signal the logic system as to the status of mechanical devices or to signal user control inputs. Customer external signals will be isolated from the UPS logic by relays or optical isolation.

2.1.3.3 Metered Values

The LCD displays the system real-time running data of the system. The following parameters should be displayed on the LCD. All the displayed values are effective value and should be refreshed in less than 10s and the accuracy of the displayed voltage effective value is at least $\pm 2\%$.

- Input: voltage (L-N), current, frequency, power factor, energy (kWh), count of input voltage lost, and count of PFC overload to battery.
- Battery: battery status, battery voltage, battery current, battery backup time, remaining capacity, discharge count, total discharge time(min), battery running time(days), battery replacement time, external battery cabinet group number, and battery average temperature.
- Bypass: bypass voltage, frequency
- Output: voltage(L-N), current, frequency, and energy (kWh)
- Load: Apparent power, active power, power factor, load percentage
- Efficiency curve

2.1.3.4 Power Flow Indications

A power flow diagram shall graphically depict whether the load is being supplied from the inverter, bypass or battery and will provide, on the same screen.

Main Display Screen

The following UPS status messages will be displayed:

- Rectifier (Off / Main Input On / Battery Input On)
- Input Supply (Normal Mode / Battery Mode / All Off)
- Battery Self-Test (True / False)
- EPO (True / False)
- Charger (On / Off)
- Inverter (Off / Soft Start / On)
- Bypass (Normal / Abnormal)
- Output Supply (All Off / Bypass Mode / Inverter Mode / Output Disable)
- Inverter On (Enable / Disable)

2.1.3.5 HMI Control Buttons

Buttons will be provided to start and stop the inverter. A pop-up message requesting confirmation will be displayed whenever a command is initiated that would change the status of the UPS. Other buttons will be provided for the navigation.

2.1.3.6 Configuration

The UPS Configuration screens shall provide the following customizable parameters: (default values are listed first)

Output: voltage selection, startup on bypass, frequency selection, bypass voltage upper limit, bypass voltage lower limit, and run mode.

Battery parameter options: External battery AH, External battery cabinet group No, Low battery time, Battery periodic test enable, Batt. note duration (month), Discharge protection time, Equal charge enable, Max charging current, Temp compensation, and Replace battery

Monitor setting options: language, date, time, display orientation, change settings password, and audible alarm

System parameter options: Auto restart, Auto restart delay, Guaranteed shutdown, start with no battery, Remote control, any mode shutdown auto restart enable, Output contact NO/NC, Input contact NO/NC,

Dry contact 5 (Output)- Selects the output of dry-contact 5. Options are:

- Low battery
- On bypass
- On battery
- UPS fault

Dry contact 6 (Output)- Selects the output of dry-contact 6. Options are:

- Low battery
- On bypass
- On battery
- UPS fault

Dry contact 1 (Input)- Selects the input of dry-contact 1. Options are:

- Disable
- Battery mode shutdown
- Any mode shutdown

Dry contact 2 (Input)- Selects the input of dry-contact 2. Options are:

- Disable
- Battery mode shutdown
- Any mode shutdown

Sleep mode- Enables/Disables sleep mode.

IT system compatibility- Enables/Disables the neutral back-feed relay on battery mode.

Outlet parameter options: Apply the same settings across outlets, turn on outlet, turn on delay, and Turn off when UPS overloads

Outlet settings based on discharging time:

Threshold of turning off the outlet Turn on when power returns

Outlet settings based on backup time

Threshold of turning off the outlet Turn on when power returns

Outlet settings based on capacity

Threshold of turning off the outlet Turn on when power returns

2.1.3.7 Event Log

This menu item will display the list of events that have occurred recently while the UPS was in operation. The Event Log will store up to 2000 events, with the oldest events being overwritten first the log's capacity has reached the maximum value.

2.1.3.8 Alarms

The following alarm messages will be displayed:

- Input abnormal
- Rectifier fault
- Charger Fault
- Battery Reversed
- No Battery

- Fan fault
- Parallel Comm. Fail
- Bypass Abnormal
- Control Power Fail
- Unit Over Load
- System Over Load
- Load Sharing Fault
- Bypass over Current.

2.1.3.9 Controls

System-level control functions will be accessed via control display screen:

- Turn on/off/to bypass
- Mute/unmute audible alarms
- Start/stop manual battery test
- Clear faults
- Reset power statics

2.1.3.10 Self-Diagnostics

Event Log File - The control system will maintain a log of the event conditions that have occurred during system operation. Each log will contain the event name and event date & time stamp.

2.1.3.11 Automatic Battery Test

The UPS shall feature an automatic battery test with the factory default test. The battery test shall ensure the capability of the battery to supply power to the inverter while loaded. If the battery fails the test, the UPS shall display a warning message to indicate the internal batteries need replaced. The battery test feature shall be user accessible by the push button on the front of the unit and with communication software.

2.1.4 BYPASS

2.1.4.1 General

A bypass circuit shall be provided as an integral part of the UPS. The bypass control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals and operating and alarms conditions. This control circuit shall provide a transfer of the load to the bypass source if available and if the inverter is not capable of powering the load (i.e., if there is an overload condition, if the unit is in Manual Bypass mode or if the voltage or frequency is out of tolerance).

2.1.4.2 Automatic Transfers

The transfer control logic shall activate the bypass automatically, transferring the critical AC load to the bypass source, after the transfer logic senses one of the following conditions:

- UPS overload
- UPS over temperature
- PFC failure

- Inverter failure
- DC bus overvoltage

Once the overload condition is reduced, the load shall be automatically transferred back to inverter power.

2.1.5 Internal Battery

Valve-regulated, non-spillable, lead acid cells (VRLA) shall be used as a stored-energy source for the specified UPS system. The battery shall be housed internal to the UPS cabinet and sized to support the inverter at rated load and power factor, with ambient temperature of 25°C (77°F) for a minimum reserve time specified in the section 1.3.2. The expected life of the battery shall be 3-5 years or a minimum 260 complete discharge cycles. The UPS units have the capability to allow the operator to replace the internal battery online without disconnecting the connected load.

All UPS models shall allow connection of up to ten external battery cabinets to provide extended run time capability. External battery cabinets shall match the UPS in aesthetics and color. The UPS shall also have auto-detect feature for detecting the number of external battery cabinets that are connected to it.

2.1.6 Output Distribution

Output distribution shall be integral to the UPS and located on the rear of the unit. There shall be 2 groups of the identified outlets listed below that are programmable and controllable as defined in this specification.

Capacity	230VAC Units
750VA	(8) EN60320/C13
1000VA	(8) EN60320/C13
1500VA	(8) EN60320/C13
2000VA	(8) EN60320/C13
3000VA	(6) EN60320/C13 (1) EN60320/C19

2.1.7 Remote Monitoring and Integration Capabilities

2.1.7.1 Communication Cards

The UPS shall be equipped with following communication port or card(s). These cards may be installed during any state of UPS operation (On, Standby or Off states).

- Communications card shall contain a built-in port to connect to environmental sensors
- Communication card- provides SNMP and/or RS-485 monitoring of the UPS across the network and/or building management system and lets you monitor external temperature, humidity and contact-closure inputs using external sensors. It should also compatible with server shutdown software (used for grace shutdown of servers in the event of battery drained).

2.1.7.2 Software

Optional Software shall be provided to support the monitoring of multiple no of UPS systems at single platform.

2.1.8 Serial Connection

The UPS shall contain on the rear panel a designated connection for use of serial connection for command line interface control and management of the UPS.

2.1.9 Terminal Block Connections

The UPS shall contain on the rear panel a terminal block to provide low voltage signals for configuring On Battery, Low Battery, On bypass, Ups fault, Any Mode Shutdown and Battery Mode Shutdown.