Vertiv™ Liebert® GXE
6-10kVA 230V Rack-Tower
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. The UPS is not designed to support large inductive or half-wave rectified loads, for example: motors, compressors, vacuum pumps, electric drills, laser printers and hair dryers.

1.2 Standards

The UPS shall be designed in accordance with 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.

Safety

- IEC62040-1:2017-A1:2021

Emission (Low limits - Conducted and radiated)

- IEC/EN/AS 62040-2 2nd Edition (Cat 2 – Table 1)
- IEC/EN 61000-3-2
- CISPR22 Class A (RFI)

Surge Immunity

- IEC/EN/AS 62040-2 2nd Edition (Cat 2 – Table 6)
- IEC/EN EN61000-4-2
- IEC/EN EN61000-4-3
- IEC/EN EN61000-4-4
- IEC/EN EN61000-4-5
- IEC/EN EN61000-4-6

Transportation and Shipping

- ISTA 3E (palletized units)

Additional Agency Compliance

- CE compliance mark
- UKCA compliance mark
- RCM compliance mark
- Morocco compliance mark
- EAC compliance mark
- REACH, 3TD, ROHS2 and WEEE compliant

1.3 System Description

1.3.1 Modes of Operation

The UPS shall be designed to operate as a true on-line double-conversion system in the following modes:

1. Normal - In normal operation incoming AC power shall be fed to the input power factor corrected (PFC) rectifier that converts the AC power to DC power for the inverter. In this mode, power shall also be derived from utility power for the battery charger. The inverter shall derive DC power from the PFC rectifier to regenerate filtered and regulated AC sinewave power for the connected load. The unit shall begin charging the battery once the UPS is connected to utility power, regardless of whether the UPS is ON or OFF. In the event of a utility outage or severe abnormality (sag or swell), the inverter shall support the connected load from battery power until the battery is discharged or the utility power returns, whichever occurs first.

2. Battery - Upon failure of utility / mains AC power, the critical AC load shall be supplied by the inverter, which obtains power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the utility / mains AC source.

3. Recharge - Upon restoration of utility / mains AC power, after a utility / mains AC power outage, the input converter shall automatically restart and resume supplying power to the inverter and the battery charger begins to recharge the battery.

4. Automatic Restart - Upon restoration of utility/mains AC power, after a utility/mains AC power outage and complete battery discharge, the UPS shall automatically restart and resume supplying power to the critical load and the battery charger automatically recharges the battery. This feature shall be capable of being disabled by the user.

5. Bypass - The integral bypass shall perform an automatic transfer of the critical AC load from the inverter to the bypass source, in the event of an overload, PFC failure, internal over temperature, DC bus overvoltage or inverter failure conditions.

6. ECO – The UPS shall allow the user to enable and place the UPS in ECO mode of operation to reduce electrical consumption. The ECO mode operation shall be an Active type, whereas the UPS will power the connected equipment through the bypass path and the UPS inverter shall be on and operating at no load in order to stay synchronized to the bypass to ensure rapid transfers to inverter power when input power falls outside of the user customizable parameters. The UPS shall also have a user customizable requalification time that input power must remain within the ECO mode parameters before transferring back to ECO operation. This is to minimize the number of transfers between bypass and inverter.

1.3.2 Design Requirements

1. Voltage

Input/output voltage specifications of the UPS shall be:

- Input 0 - 288 VAC, 50/60 Hz, single-phase,
- Output 230 VAC (user configurable: 220V, 230V, 240V) ±1%, 50/60 Hz, single-phase, 2-wire-plus-ground

2. Output Load Capacity

The specified output load capacity of the UPS at 230 VAC Input shall be:

Model Number	VA	W	Output PF
GXE3-6000IRT4UXL	6,000	6,000	1.0
GXE3-10KIRT5UXL	10,000	10,000	1.0

3. Internal Battery

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

4. Reserve Time

- GXE3-6000IRT4UXL: Full Load – 5.5 minutes; Half Load – 14.6 Minutes
- GXE3-10KIRT5UXL: Full Load - 3.6 minutes; Half Load – 9.8 Minutes

These times shall be based upon new fully charged batteries installed in an ambient temperature of 25°C with resistive loading.

5. Battery Recharge

The UPS shall contain a two stage battery charger designed to prolong battery life. Recharge time for UPS internal batteries after a full discharge to 90% capacity shall be a maximum of 3 hours.

1.3.3 Performance Requirements

1. AC Input to UPS

a. Voltage: The point at which the UPS transfers to battery operation shall be dependent on the amount of load that the UPS is supporting. The UPS shall operate from the following voltage ranges without drawing power from the batteries:

- Low Line Voltage Range
  a) From 0 to 50% load the low line voltage shall be constant.
  b) From 51-100% load the low line voltage shall increase at a linear rate.
  c) For loads over 100%, the low line voltage remains constant.

Load		Low Line Voltage
101% to 200%	L-N Transfer	176 ± 3.1 VAC
	L-N Comeback	188 ± 3.1 VAC
51% to 100%	L-N Transfer	101 - 176 ± 3.1 VAC
	L-N Comeback	113 - 188 ± 3.1 VAC
0% to 50%	L-N Transfer	100 ± 3.1 VAC
	L-N Comeback	112 ± 3.1 VAC

- High Line Voltage Range

High Line Voltage	
High Line Transfer	288 ± 5 VAC
High Line Comeback	276 ± 5 VAC

b. Frequency: The UPS shall auto-sense input frequency when first powered up and shall operate within the following frequency specifications. UPS shall be capable of cold start with default frequency of 50 Hz. Once started the frequency operating window shall be 40-70 Hz. Three frequency settings shall be available: Auto frequency sensing (factory default setting), 50 Hz frequency conversion and 60 Hz frequency conversion.

c. Input Power Factor: >0.99 lagging at rated load.

d. Input Current Harmonic Distortion:

- THD shall be less than or equal to 3% at linear, full load operation.
- THD shall be less than or equal to 5% at nonlinear, full load operation.

e. Input Current Ratings: The maximum input current for each unit shall be as shown below:

Model Number	Input	VA	Watt	Hz	VAC	Max Amps
GXE3-6000IRT4UXL	HW	6000	6,000	50/60	230	36
GXE3-10KIRT5UXL	HW	10000	10,000	50/60	230	59

f. Inrush Current (Initial startup, no load): The UPS shall have a maximum inrush current of 6 times the full load peak input current.

g. Surge Protection: The UPS shall utilize MOV (Metal oxide varistors) rated at 365V AC (rms), 600 Joules in total.

2. AC Output, UPS Inverter

a. Voltage Configuration: 230 VAC default, 50/60 Hz, single-phase, 2-wire-plus-ground (L-N-G), configuration program selectable (220V, 230V, 240V).

b. Voltage Regulation: ± 1% steady state.

c. Frequency Regulation: ±3.5 Hz synchronized to bypass. ±0.1 Hz in-battery operation.

d. Frequency Slew Rate: 1.0 Hz per second maximum.

e. Voltage Distortion: <2% total harmonic distortion (THD) typical into a 100% linear load, and <5% THD typical into a 100% non-linear load (<6% for 60 Hz).

f. Load Power Factor Range: The load power factor range shall be 0.65 lagging to 1.0 (unity) leading.

g. Output Power Rating: Output power rating shall be as shown below.

Model Number	VA	W
GXE3-6000IRT4UXL	6,000	6,000
GXE3-10KIRT5UXL	10,000	10,000

h. Inverter Overload Capability: Inverter output overload capacity in line mode shall be as shown below.

Overload Percent	Duration Inverter shall Support Rated Load
0% to 105%	continuous
106% to 125%	5 minutes, transfer to bypass
126% to 150%	1 minute, transfer to bypass
> 150%	200 ms, transfer to bypass

i. Voltage Transient Response: The transient response of the output voltage with resistor step loading will be +/-5% for input supply from off to on and for a load from 0% to 100% and 100% to 0%.

j. Transient Recovery Time: To nominal voltage within 60 ms.

k. AC-AC Efficiency:

Model Number	AC-AC Efficiency (maximum efficiency)
GXE3-6000IRT4UXL	94%
GXE3-10KIRT5UXL	94%

Efficiency in ECO model will up to 98%.

1.4 Environmental Conditions

1. Ambient Temperature

Operating: The ambient temperature range, when UPS is operational, shall be from 0°C to 40°C. There shall not be any degradation in the performance when operating in this range. Automatic derating shall occur for operation in higher ambient temperatures.

Storage:

- -15 to 40 ºC with batteries
- -20 to 70 ºC without batteries

2. Relative Humidity

- Operating: 5 to 95% non-condensing.
- Storage: 5 to 95% non-condensing.

3. Altitude

The normally operate altitude will be 2000 m without power derating. Ambient temperature shall be de-rated 1% for each additional 100 m above 2000 m.

4. Audible Noise

The audible noise of the UPS shall be less than 55 dBA maximum for 6 kVA and <58 dBA for 10 kVA when measured at 1 meter from front.

1.5 User Documentation

The specified UPS system shall be supplied with Safety Instruction, printed copy of Quick Install Guide (QIG), printed copy of factory test report. The user manual shall be downloadable from the web and includes installation instructions, a functional description of the equipment with block diagrams, safety precautions, illustrations, step-by-step operating procedures and general maintenance guidelines.

1.6 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 full coverage extension warranties shall be available from the manufacturer. The manufacturer's standard and extended warranties shall cover all parts, including the battery.

1.7 Quality Assurance

1. Manufacturer Qualifications

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

2. Factory Testing

Before shipment, the manufacturer shall fully and completely test the system to ensure 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 shall not have been in prior service except as required during factory testing. All relays shall be provided with dust covers.

2.1.1 Wiring

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

2.1.2 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 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):

Model Number	Dimensions W x D x H (mm)	Net Weight (kg)
GXE3-6000IRT4UXL	430 x 750 x 173	70
GXE3-10KIRT5UXL	430 x 700 x 217	80

2.1.3 Cooling

The UPS shall be forced air cooled by an internally mounted, continuously operating fan. Fan speed shall be controlled by the UPS and offer multi state operation to minimize noise. Air intake shall be through the front of the unit and exhausted out the rear of the unit.

2.2 Components

2.2.1 Input Converter

3. 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.

4. AC Input Current Limit

The input converter shall be provided with AC input current limiting whereby the maximum input current is limited to 150% of the full load input current rating.

5. 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 UPS shall be able to sustain input surges without damage.

6. Battery Recharge

The UPS shall contain a two stage battery charger designed to prolong battery life. Recharge time for the internal UPS batteries shall be 3 hours maximum to 90% capacity (full load discharge rate). 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.

2.2.2 Inverter

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. 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.

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).

4. Output Frequency

An oscillator shall control the output frequency of the UPS. The inverter shall maintain the output frequency to ±0.1 Hz of nominal frequency during Battery mode or when otherwise not synchronized to the utility/mains source.

5. Output Protection

The UPS inverter shall employ electronic current limiting circuitry.

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.

2.2.3 Display and Controls

1. General

The UPS shall be provided with a microprocessor based unit status display and controls section designed for convenient and reliable user operation. The monitoring functions such as voltages, current, UPS status and alarm indicators shall be displayed on a full color graphical LCD display.

2. System

UPS display shall also include LED based system indicators. The system level indicators shall be: run indicator, and alarm indicator:

Indicator	LED Color	LED State	Indication
Run Indicator	Green	On	UPS has output
		Blinking	Inverter is starting
		Off	UPS has no output
Alarm Indicator	Yellow	On	Alarm occurs
	Red	On	Fault occurs
	N/A	Off	No alarm, no fault

3. Controls

UPS startup and shutdown operations shall be accomplished by using power button on the front panel of the UPS. The display shall be menu driven navigation and use four control buttons for ease of navigation and selection of the configurable parameters.

a. Control Buttons

The UPS display control button functionality shall be as follows:

- ESC button: This button shall return to the previous menu or abort any change before confirming the change.
- Up/Left arrow button: This button shall move the cursor up or left, or increase the value displayed when changing parameters. This button shall also be used to scroll up for navigating the screens.
- Down/Right arrow button: This button shall move the cursor down or right, or decrease the value displayed when changing parameters. This button shall also be used to scroll down for navigating the screens.
- Enter button: This button shall enter the next level menu or confirm the parameter changes.

b. Display Menu Structure

The UPS display shall have the following menu structure with the following status and configuration screens.

UPS Flow Screen (Default screen)

The UPS power flow screen shall be the default screen after system startup. It shall display an overview screen showing status information, the active (green) power path, and non-working power path (gray). Details in this default screen include operating mode, the input voltage and frequency; output voltage and

frequency; battery capacity, estimated battery time remaining, and loading percentage of total capacity. To prolong display life, the UPS LCD display will dim and display a screen saver after two minutes of no user interaction if there is no active alarm. Pressing the *ENTER* shall wake up the display and this action shall not perform any operation. If an alarm or fault occurs the display shall also wake up the display.

Main Menu

The main menu shall list 6 submenu selections, from left to right, then top to bottom:

- Status
- Settings
- Control
- Log
- About
- Maintenance

Status

The UPS status screens shall provide the following information:

- Input
- L-N voltage (V)
- L-N current (A)
- Frequency (Hz)
- Energy (kWh)
- Bypass
- L-N voltage (V)
- Frequency (Hz)
- Battery
- Battery status
- Battery voltage (V)
- Battery current (A)
- Backup time (min)
- Remaining capacity (%)
- Discharge count
- External battery cabinet group number
- Batt running time (day)
- Output
- L-N voltage (V)
- L-N current (A)
- Frequency (Hz)
- Load
- Sout (apparent output power, kVA)
- Pout (active output power, kVA)
- Power Factor
- Load Percent (%)

Settings

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

- Output
- Voltage selection
- Startup on Bypass (Enable/Disable)
- Bypass voltage upper limit
- Bypass voltage lower limit
- Run mode (normal mode, or ECO mode)
- Battery
- External battery cabinet group No. (0-4)
- Low Battery time
- Battery replaced time
- Battery test interval
- Battery periodic test weekday
- Battery periodic test time
- Discharge protect time
- Equal charge enable
- Temperature compensation
- Max charge current
- Replace battery

Monitor

- Language
- Date
- Time
- Display Orientation (Auto-rotate, rack, tower)
- Audible Alarm (enable/disable)
- Change settings password

System

- Auto restart
- Auto restart delay
- Guaranteed shutdown
- Remote control
- Remote power on delay
- Remote shutdown delay
- IT system compatibility

Control

The UPS shall have the following controls from the display:

- UPS ON/OFF/Bypass
- Mute/Unmute audible alarm
- Start/Stop battery manual test
- Clear faults

Log

The UPS shall be have an event log to record 255 events and shall be viewable from the display:

- View Log
- Navigate the event log to view the last 255 events.
- Clear Log
- User shall be able to clear the event log
- The event log once full will begin to replace the first event logged to provide a FIFO process for maintaining event history. The event history shall record and display the number of events out of the 255 (xxx/255) as well as the time (days, hours, mins) from when viewing the event and the event that occurred.

About

- The UPS shall be have an about screen to display the UPS model number, serial number, time since startup, hardware version, and firmware version.
- The UPS shall be have the ability to display the network information of the IS-UNITY SNMP/webcard when installed. Information available shall be MAC address and IP address.

Maintenance

The UPS shall be able to reset to factory default settings. Reset will require the UPS to be in the Off state.

4. Automatic Battery Test

The UPS shall feature an automatic battery test with the factory default test interval set at every 8 weeks. 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 Automatic Battery test feature shall be capable of being disabled or configured to operate every 8, 12, 16, 20, or 26 weeks through the UPS Configuration Program or from the LCD display.

2.3 Bypass

2.3.1 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. An over temperature requires manual transfer back to inverter power after cooling.

2.4 Internal Battery

Valve regulated, non-spillable, lead acid cells (VRLA) shall be used as a stored energy source for the specified UPS system. The internal battery shall be user replaceable and includes a blind mate style

connector located on the rear of the battery kit. 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 noted in product documentation. 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 without power down or disconnecting the load.

2.5 Optional External Battery Cabinet

All UPS models shall allow connection of up to four (4) external battery cabinets to provide extended run time capabilities. External battery cabinets shall match the UPS in aesthetics and color.

2.6 Output Distribution

Output distribution shall be:

Model Number	Input Connection	Output Connections
GXE3-6000IRT4UXL	HW (L-N-G)	HW (L-N-G)
GXE3-10KIRT5UXL		

2.7 Communication Options

2.7.1 Vertiv™ Liebert® IntelliSlot™ Communication

The UPS shall include one Liebert® IntelliSlot™ communication port to allow the operator to field-install an optional Liebert® IntelliSlot™ communication card. A Liebert® IntelliSlot™ card may be installed during any state of UPS operation (On, Standby or Off states). Available Liebert® IntelliSlot™ options are described below.

a. Vertiv™ Liebert® Intellislot™ IS-UNITY-SNMP Communications Card (IS-UNITY-SNMP)

The optional Liebert® Intellislot™ IS-UNITY cards shall deliver SNMP and web access to the UPS via 10/100 Mb/s ethernet port. This card shall enable remote or local field upgrades of the SNMP firmware, and managed device firmware and configuration updates.

b. Vertiv™ Liebert® Intellislot™ IS-UNITY-DP Communications Card (IS-UNITY-DP)

The optional Liebert® Intellislot™ IS-UNITY cards shall deliver SNMP and web access to the UPS via 10/100 Mb/s ethernet port. This card shall enable remote or local field upgrades of the SNMP firmware, and managed device firmware and configuration updates.

This card shall support two protocols at the same time for SNMP, and Modbus or BACnet in addition to support for environmental monitoring via Vertiv™ Liebert® SN Sensors.

c. Vertiv™ Liebert® IntelliSlot™ Relay Interface Card (IS-RELAY)

The optional Liebert® IntelliSlot™ Relay Interface Card shall provide contact closure for remote monitoring of alarm conditions in the UPS, delivering signals for On Battery, On Bypass, Low Battery, Summary Alarm, UPS Fault and On UPS. The contacts shall be rated for 24 VAC or 24VDC at 1A. Connections shall be to a terminal block connector with cable provided by the end user.

2.7.2 USB Port

The USB communications port (Version 2.0) shall meet the HID Power Device standard, version 1.0 or later. All models shall work with the Vertiv™ Power Assist and Power Management system in Microsoft Windows XP or later. They shall also support the equivalent functions in Linux, and Mac OSX.

2.7.3 Serial Port

A serial port (RS-232) shall be provided on the rear of the UPS, with an RJ-45 connector. This connector shall enable use of the Vertiv UPS Command Line Interface