LIEBERT Nfinity UPS

GUIDE SPECIFICATIONS
for a 4 to 16 KVA (220V/230V/240V)
Single - Phase Uninterruptible Power Supply System

1.0 GENERAL

1.1 SUMMARY

This specification describes the Nfinity UPS, a modular uninterruptible power supply system for workstation, server, network, telecon and other sensitive electronic equipment applications. It defines the electrical and mechanical characteristics and requirements for a continuous-duty single-phase, solid-state, uninterruptible power supply system. The uninterruptible power supply system, hereafter referred to as the UPS, shall provide high-quality AC power.

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.

EN50091-1-1, CE, low voltage directive
EN50091-2, class A
EN61000-4-2, level 4, criteria A
EN61000-4-3, level 3, criteria A
EN61000-4-4, level 4, criteria A
EN61000-4-5, level 3, criteria A
EN61000-4-6

1.3 SYSTEM DESCRIPTION

1.3.1 General

The Nfinity UPS system shall consist of the appropriate number of modules for capacity and/or redundancy. All modules are to be operating simultaneously and sharing the load. In a non-redundant system, all the modules making up the UPS are required to supply the full rated load. If a power or control module should malfunction, the load is to be transferred automatically to the bypass line. If a battery module should malfunction, it is to be isolated from the system resulting in reduced back up time. For redundant operation, the UPS will have one or more modules additional to what is required to supply the full rated load. The malfunction of one of the modules shall cause that module to be isolated from the system and the remaining module(s) shall continue to carry the load. Replacement of a module shall be capable without disturbance to the connected load.

1.3.2 Modes of Operation

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

A. Normal - The critical AC load is continuously supplied by the UPS inverter. The input converter derives power from a utility AC source and supplies DC

power to the inverter. The battery charger shall maintain a float-charge on the battery.

B. Back-up - Upon failure of utility AC power the critical AC load is 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 AC source.

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

D. Automatic Restart - Upon restoration of utility AC power, after a utility AC power outage and complete battery discharge, the UPS shall automatically restart and resume supplying power to the critical load. Also the battery charger shall automatically recharge the battery. This feature shall be enabled from the factory and shall be capable of being disabled by the user. The user shall also be able to program two auto restart delay settings

1. Battery capacity % level
2. Countdown timer

E. Bypass - The bypass shall provide an alternate path for power to the critical load that shall be capable of operating in the following manner:

1. Automatic - In the event of an internal failure or should the inverter overload capacity be exceeded, the UPS shall perform an automatic transfer of the critical AC load from the inverter to the bypass source.

2. Manual - Should the UPS need to be taken out of service for limited maintenance or repair, manual activation of the bypass shall cause an immediate transfer of the critical AC load from the inverter to the bypass source. The input converter, inverter, and battery charging operations shall continue to operate, provided the control enable switch is in the " On " position.

1.3.3 Performance Requirements

1.3.3.1 System

A. Configuration: Select UPS systems shall be configured or upgradeable to power ratings as follows:

8 Bay Frame Systems

4.0 kVA single system upgradeable to 8, 12 kVA single systems, 4, 8 or 12kVA redundant systems.
8.0 kVA single systems upgradeable to 12 kVA single systems, 8 or 12kVA redundant systems.
12.0 kVA single systems upgradeable to 12 kVA redundant systems.

12 Bay Frame Systems

4.0 kVA single system upgradeable to 8, 12, 16 kVA single systems, 4, 8, 12, or 16kVA redundant systems.
8.0 kVA single systems upgradeable to 12, 16 kVA single systems, 8, 12, or 16kVA redundant systems.
12.0 kVA single systems upgradeable to 16kVA single systems, 12 or 16 kVA redundant systems.
16kVA single systems upgradeable to 16kVA redundant systems.

B. Isolation

Input to output isolation shall be provided, via the output transformer, on the 220V model, regardless of operating mode. (UPS or bypass). An output isolation transformer will be available as an option for 230V/240V models.

C. Remote Stop

The UPS shall provide provisions for remote stop capability.

1.3.3.2 AC Input to UPS

A. Voltage Configuration: 230 VAC nominal, single-phase to neutral plus ground. The operating voltage range shall be variable based upon output loading percentages as follows:

% UPS Load	Input Voltage
80 – 100 %	170 VAC
60 – 90 %	144 VAC
20 – 70 %	127 VAC
0 – 30 %	110 VAC

B. Frequency: 40 to 70 Hz.

C. Input Current Distortion: 5% THD maximum at full load.

D. Input Power Factor: 0.98 lagging at 100% rated load.

E. Inrush Current: 150% of full load input current maximum for 3 cycles.

F. Surge Protection: Sustains input surges without damage per criteria listed in EN61000-4-5, level 3, criteria A

1.3.3.3 AC Output

A. Voltage Configuration: 230 VAC, single-phase to neutral, plus ground. Field configurable to 240 VAC. 220 VAC available with output transformer.

B. Voltage Regulation: +/- 3% steady state.

C. Frequency Regulation: 50 Hz, +/- 0.5%.

D. Frequency Slew Rate: Selectable from ± 0.5, 1, 2, 3, 4 or 5 Hertz per second maximum.

E. Bypass Frequency Synchronization Range: Selectable from ± 0.5, 1, 2, 3, 4 or 5 Hertz.

F. Voltage Distortion: 5% total harmonic distortion (THD) maximum into a 100% linear load, 7% THD maximum into a 100% non-linear load with crest factor ratio of 3:1.

G. Load Power Factor Range: 0.5 lagging to 1, within kW and kVA rating of UPS.

H. Output Power Rating: Rated kVA at: 0.7 lagging power factor.

I. Overload Capability: >100% - 110% indefinitely, 111% -150% for 8 seconds, 151% - 200% for 0.25 seconds, The load shall be transferred to bypass when any of the above conditions are exceeded.>201% for min. 2 cycles, then shutdown of UPS. Immediate shutdown into a short circuit.

J. Voltage Transient Response: +/- 7% maximum for any load step up to and including 100% of the UPS rating.

K. Transient Recovery Time: To within 1% of steady state output voltage within 120 milliseconds.

1.3.3.4 Batteries

A. Internal Battery: The battery shall consist of gas recombination, valve regulated, lead acid cells. Flame retardant batteries shall be provided, which renders the UPS suitable for installation inside a computer room.

B. Reserve Time: (with ambient temperature between 20 and 25 deg C) The UPS shall contain an internal battery system to provide a reserve time of 7 minutes at 100% load with an equal number of power and battery modules fitted.
The UPS shall contain provisions to fit additional battery modules internally if space permits. The UPS shall also interface with an external battery cabinet to extend reserve time capabilities.

C. Battery Recharge: To prolong battery life, the UPS shall contain temperature-compensated battery charging. When equal number of power modules and battery modules are fitted the battery charger shall be able to recharge the internal batteries to 90% charge in three to five hours at nominal input voltage and nominal ambient temperature.

1.4 ENVIRONMENTAL CONDITIONS

A. Ambient Temperature

Operating UPS 0 deg C to +40 deg C; battery 20 deg C to 25 deg C for optimum performance.
Storage: UPS -20 deg C to +60 deg C; battery -20 deg C to 25 deg C for maximum 6 months.

B. Relative Humidity

Operating: 5 to 95% non-condensing.

Storage: 5 to 95% non-condensing.

C. Altitude

Operating: To 3,000 metres. Derating or reduced operating temperature range required for higher altitudes.

Storage: To 10,000 metres.

D. Audible Noise

Noise generated by the UPS during normal operation shall not exceed 62 dBA measured at 1 metre from the surface of the UPS.

E. Electrostatic Discharge

The UPS shall be able to withstand a minimum 15 kV without damage and shall not affect the critical load.

1.5 USER DOCUMENTATION

The specified UPS system shall be supplied with one (1) user's manual. Manuals shall include installation drawings and instructions, a functional description of the equipment with block diagrams, safety precautions, illustrations, step by step operating procedures, and routine maintenance guidelines.

1.6 WARRANTY

The UPS manufacturer shall warrant the UPS against defects in materials and workmanship for twenty four months from startup or twenty seven months from factory shipment whichever is soonest..

1.7 QUALITY ASSURANCE

1.7.1 Manufacturer Qualifications

A minimum of thirty year's experience in the design, manufacture, and testing of solid-state UPS systems is required.

1.7.2 Factory Testing

Before shipment, the manufacturer shall fully and completely test the system to assure compliance with the specification. These tests shall include operational discharge and recharge tests on the internal battery to guarantee rated performance.

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. The UPS shall be constructed of replaceable subassemblies. All active electronic devices shall be solid-state.

2.1.1 Cabinet

The UPS unit comprised of: power module, battery module, control module, system interconnect module and user interface module housed in a single free-standing enclosure and meets the requirements of IP20. The UPS system shall be designed such that the battery modules may be installed into any module bay in the cabinet and power modules into any module bay in the top half of the cabinet. The UPS cabinet shall be cleaned, primed, and painted with the manufacturer's standard color. Casters and leveling feet shall be provided. UPS cabinet dimensions shall not exceed 508 mm wide, 737 mm deep and 1016 mm high (8 Bay Frame) or 508 mm wide, 737 mm deep, and 1346 mm high (12 Bay Frame).

2.1.2 Cooling

The UPS shall be forced air cooled by internally mounted fans.

2.2 COMPONENTS

2.2.1 Input Converter

A. General

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

B. AC Input Current Limit

The input converter shall be provided with AC input over current protection.

C. Input Protection

The UPS shall have built-in protection against undervoltage, overcurrent, and overvoltage conditions including low-energy surges introduced on the primary AC source and the bypass source. The UPS shall sustain input surges without

damage per criteria listed in EN61000-4-5, level 3, criteria A. The UPS cabinet shall contain an input breaker sized to supply full 12kVA (8 Bay Frame) and 16kVA (12 Bay Frame) rated load and to recharge the battery at the same time.

D. Battery Recharge

To prolong battery life, the UPS shall contain temperature-compensated battery charging. When an equal number of power modules and battery modules are fitted the battery charger shall be able to recharge the internal batteries, after full discharge at 100% wattage load, to 90% charge in three to five hours at nominal input voltage and nominal ambient temperature.

E. Charger Output Filter

The battery charger shall have an output filter to minimize ripple current into the battery.

2.2.2 Inverter

A. General

The inverter shall convert DC power from the input converter output, or the battery, into precise regulated sine wave AC power for supporting the critical AC load.

B. 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 fuses. The load shall be transferred to bypass when any of the above conditions are exceeded.

C. Maximum Load Alarm

The user can set the alarm point to a value less than 100% rating such that the UPS will alarm before an overload condition or loss of redundancy is reached.

D. Output Frequency

The output frequency of the inverter shall be controlled by an oscillator. The oscillator shall hold the inverter output frequency to ± 0.5% for steady state and transient conditions. The inverter shall track the bypass continuously providing the bypass source maintains a frequency within the user selected synchronization range. If the bypass source fails to remain within the selected range, the inverter shall revert to the internal oscillator.

F. Output Protection

The UPS inverter shall employ electronic current limiting.

G. Battery over Discharge Protection

To prevent battery damage from over discharging, the UPS control logic shall control the shutdown voltage set point. This point is dependent on the rate of discharge.

2.2.3 Display and Controls

A. General

The front panel will consist of multiple status LEDs, switches, and a four line by twenty character LCD display for additional alarm/configuration information. All mimic display LEDs shall be green in colour and indicate the following:

AC Input

On Battery .

Load On/Off

On Inverter

On Bypass

The UPS fault indicator is used with additional indicators and audible alarms to notify the user that a UPS fault condition has occurred. The colour of the fault indicator LED shall be amber.

Replace Battery Module

Replace Power Module

Replace Control Module

On Bypass

Low Battery

OverTemp Warning

UPS Shutdown

If there is a fault condition, the UPS shall attempt to maintain conditioned power to the load, or at minimum transfer to bypass.

There shall also be indication on each module should the module fail and need to be replaced.

In addition to a visual fault signal, the UPS shall also record fault occurrences in a rolling event log. The event log on the standard unit shall record up to 255 occurrences, with the oldest events discarded first, etc. The user shall have access to the event log through the LCD display. Every alarm and/or event recorded in the event log will contain a time and date stamp.

B. Audible Alarms

The volume of all audible alarms shall be at least 65dBA at a distance of one metre. An audible alarm shall be used in conjunction with the LED/LCD indication to indicate a change in UPS status.

The audible alarms shall enunciate for utility line loss, low battery (while on battery), and all other alarm conditions. For all alarm conditions, the user must look at the display to determine the cause of error/alarm. All alarm tones shall be a continual tone until the condition rectifies itself or the alarm is silenced. Once silenced, the audible alarm shall not sound until a new alarm condition is present.

C. Alarm Silence Button

In addition to the load on/off switch, the user interface shall include an audible 'Alarm Silence' switch. If the alarm silence switch is pressed for one second, all current audible alarms shall be disabled. If a new alarm occurs, or a cancelled alarm condition disappears and then re-appears, the audible alarm is re-enabled.

D. LCD Display

The LCD display shall be used to provide information to the user. The display shall also be used to program ALL information (voltage, frequency, etc.) into the UPS. Any display values that require time/date shall be 'year 2000' compliant.

2.2.4 Automatic Battery Test

The UPS shall initiate an automatic battery testing sequence periodically, at a programmed day and time of day, selectable by the end user. The user will be able to select the interval of the battery test and will be able to select 1, 2, 3, 4, or 6 week intervals, or can select to disable the automatic battery test.

Should a failure of the battery occur, the UPS will immediately return to normal mode and fault signals (visual, audible, and remote via serial) shall be communicated. No audible or remote (via serial/contact closures) indication of the battery test shall be communicated during the duration of the automatic battery test.

The automatic battery test factory default settings shall be enabled at a two week interval and to occur on Wednesdays at 0600hours (based on the twenty four hour clock).

2.2.5 Remote Emergency Power Off (REPO)

The remote emergency power off function shall allow the user to disable all UPS outputs in an emergency situation. The REPO, in order to be flexible, shall be able to interface with either normally open (N.O.) or normally closed (N.C.) systems. The REPO shall be activated when a pair of contacts, external to the UPS, are activated. The REPO connection shall be through a simple terminal block type connector.

The REPO function shall not operate if no system control modules are present in the UPS or if the manual bypass switch is in the bypass position. The user must also supply a

means of interfacing with the REPO circuit to allow disconnecting the UPS input feeder breaker to remove all sources of power to the UPS and the connected equipment to comply with local wiring codes/regulations.

Regardless of the UPS mode of operation when the REPO is activated, the UPS output shall not be re-enabled until the following occurs:

- REPO contacts are reset (closed if N.C. contacts are used and open if N.O. contacts are used)
- Input circuit breaker is closed
- Control enable switch is turned on
- User interface on/off switch is depressed

2.2.6 Bypass

A. General

A bypass circuit shall be provided as an integral part of the UPS. The bypass shall have an overload rating of 300% rated full load for 10 cycles and 1000% for sub-cycle fault clearing. The bypass 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 a transfer of the load to the bypass source, without exceeding the transient limits specified herein, when an overload or malfunction occurs within the UPS.

B. Automatic Transfers

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

Inverter overload capacity exceeded
Inverter over temperature
UPS fault condition

For inverter overload conditions, the transfer control logic shall inhibit an automatic transfer of the critical load to the bypass source if one of the following conditions exists:

Inverter/Bypass voltage difference exceeding preset limits (±15 % of nominal)
Bypass frequency out of preset limits (± 5 % of nominal frequency)

C. Automatic 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:

Bypass out-of-synchronization range with inverter output
Overload condition exists in excess of inverter full load rating
UPS fault condition present

D. Manual Transfer

In addition to the internal bypass function, the UPS shall have a manual bypass function. The manual bypass function shall be provided via a switch mounted on the bottom-front of the UPS. Removal of the lower front bezel shall be required. The actual AC break time between inverter and bypass shall be less than six milliseconds.

The manual bypass shall also be a partial 'wrap-around' bypass, and shall be configured to wrap around the rectifier, battery charger, inverter, and battery in the same manner as the automatic bypass. The manual bypass shall not wrap around the EMI filtering, overcurrent protection or isolation transformer.

The UPS shall initiate an audible alarm upon transfer to manual bypass. The audible alarm shall be capable of being silenced by the user. The alarm shall continue to sound while in bypass mode. This shall provide a reminder to the user that the load continues to be powered from utility supply alone.

2.2.7 Internal Battery

Flame retardant, valve regulated, gas recombination, lead acid batteries shall be used as a stored-energy source for the specified UPS system. The battery shall be housed in separate replaceable modules that slide into any open bay of the UPS cabinet, and sized to support the inverter at rated load and power factor, in an ambient temperature between 20° and 25° C, for a 7 minutes reserve time. The expected life of the battery shall be 3 to 5 years or a minimum 250 complete discharge cycles. For extended battery reserve time, additional battery modules may be added, if the frame size allows. External battery cabinets shall be also be available as an option.

2.3 COMMUNICATIONS

The UPS shall allow for flexibility in communications. The UPS shall be able to communicate through two communications ports simultaneously; the media of either communications port may change without affecting the operation of the UPS. The use of relay contacts shall not affect the operation of the two communications ports.

2.3.1 Relay Contacts

The relay contacts shall be available through at least one DB-9F communication connector, and shall be compatible with the SiteNet MultiLink system. The UPS shall communicate via relay contact closure the following information:

Low Battery
On Battery

One connector to provide relay contacts shall be fitted on all UPS models as standard (designated comm port 1). Relay contacts shall be rated 48 VDC, 1 A. Additional

signals (such as on bypass and summary alarm) shall be provided by an AS/400 Intellislot card option.

The following pins for comm port 1 shall be used:

Pin 1	Low Battery (normally open)
Pin 4	Shutdown in battery mode (5 – 12 VDC for 1.5 sec)
Pin 5	Common
Pin 7	Low Battery common
Pin 8	On Battery (normally open)
Pin 9	On Battery common

2.3.2 Serial Communications

The Nfinity UPS shall be able to communicate via Liebert proprietary protocol through the following communication ports:

Comm port 2 (standard on UPS)
Intellislot option card port only

At a minimum, the UPS shall be supported by SiteNet MultiLink software.

The pin-out configuration for comm port 2 shall be as follows:

Pin 2	Transmit Data
Pin 3	Receive Data
Pin 5	Common

2.3.3 Network Communications

The user shall have the option of installing an optional Intellislot card to provide SNMPWEB communication over a local area network. 10/100Mbit Ethernet support shall be included. At a minimum, the UPS shall be supported by SiteNet MultiLink software.

2.3.4 Intellislot Specification

All models of the Nfinity UPS product line shall have four Intellislot ports standard. Existing Intellislot cards, such as the MultiPort 4 card, and AS/400 card, shall be compatible.

2.3.5 UPS Status Information

The software shall be able to retrieve all status information present in the UPS (and available on the display). Retrieval of data shall be through either serial communications or through a network connection.

2.5 ACCESSORIES (OPTIONAL COMPONENTS)

2.5.1 External Battery Cabinets

The UPS shall have the capability to add external battery cabinets to the base product. These external battery cabinets with chargers and front access battery terminals, shall be installed in parallel to provide backup times as required. The connections between the UPS and the extended battery cabinets shall contain DC power only. All of these shall be able to be connected or disconnected safely by the user without interrupting power to the load.