SERIES LI Centralized Emergency Lighting Inverter

GuideForm Specification

Part 1

1.0 General

This specification defines all characteristics and requirements for an emergency power supply system (Emergency Lighting Application). The system as specified herein includes all the components required to deliver reliable, high quality uninterruptible power for emergency lighting and related life safety equipment. The system consists of a microprocessor based controller transistorized PWM inverter, high speed transfer devices, constant voltage regulating transformer, battery charging system, energy storage battery, a diagnostic monitoring display panel, and all the related hardware components and software to facilitate a functional centralized system. The emergency power supply system shall provide immunity from all line disturbances and power interruptions. The system includes an uninterrupted, normally on output power section and a normally off standby output power section, thus enabling compatibility with emergency lighting fixtures operating in normally on and standby operating modes. A self-diagnostic monitoring alarm system continuously advises of system status and battery condition.

1.1 Standards

The systems shall be designed in accordance with applicable portions of the following standards:

1.1.1 American National Standards Institute (ANSI C57.110).
1.1.2 Institute of Electrical and Electronic Engineers (IEEE 519-1992) (C62.41-1991).
1.1.3 National Electrical Manufacturers Association (NEMA PE-1).
1.1.4 National Electric Code (NEC 2005) (NEC 2005, Article 700).
1.1.5 National Fire Protection Association (NFPA 70) (NFPA 101) (NFPA 111).
1.1.6 Underwriters Laboratories (U.L. 924).
1.1.7 Federal Communications Commission (FCC Part 15, Sec. J, Class A).
1.1.8 Federal Aviation Administration (FAA-G-201e).

1.1.9 Listed U.L. Standards UL924 Emergency Lighting Equipment, UL924 Auxiliary Power Supplies, UL1778 and CUL1778 Standard for UPS Equipment.

1.2 Submittals

1.2.1 The manufacturer shall supply documentation for the installation of the system, including wiring diagrams and cabinet outlines showing dimensions, weights, BTUs, input/output current, input/output connection locations and required clearances.

1.2.2 The manufacturer shall be ISO9001 “Quality Assurance Certified” and shall upon request furnish certification documents.

1.2.3 The manufacturer shall be a United States based manufacturer with 5 years experience or greater in design and fabrication of centralized stored electrical energy emergency and standby power systems.

1.2.4 Factory test results shall be provided to show compliance with the requirements. The manufacturer shall include battery test documentation to validate the specified minimum emergency reserve with full rated KW load.

1.2.5 The supplier shall furnish (6) equipment submittal copies. Submittals shall be specific for the equipment furnished and shall include as-built information.

Part 2

2.1 Manufacturers

2.1.1 The equipment specified shall be the *SERIES LI* centralized emergency lighting inverter system, manufactured by Power Systems & Controls, Inc.

2.2 Manufactured Units

The system shall be designed and manufactured to assure maximum reliability, serviceability and performance. The system's microprocessor, transistorized PWM inverter, battery charger, high speed transfer devices, constant voltage regulating transformer, filtering components, diagnostic monitor display electronics and all other active and passive components and batteries shall be installed into one vertical profile, front accessible cabinet. The diagnostic monitor display panel and display select push buttons shall be mounted on the front of the system for easy operation and viewing. The system is to be furnished with internally located AC input circuit breaker, DC circuit breaker and AC output circuit breaker panel. Access to the output circuit breaker panel shall be through the front of the system behind a key lockable, hinged access door. All conductors and transformer windings shall be copper constructed. Cabinets shall be constructed of steel, NEMA 1 rated, floor mountable, and include hinged key lockable doors for access to all components. Cabinet dimensions shall not exceed 68" W x 24"D x 84"H.

2.2.1 Systems shall operate in accordance with requirements as specified herein to support any combination of fluorescent ballast fixtures, incandescent lamps, electronic and high power factor fluorescent ballasts, HID fixtures or other approved loads up to the rating of the system. "Normally on" and "Normally off" AC output bus shall be 100% rated and limited only by the system maximum KW output rating.

2.2.2 Normal Operation: The load is supplied with voltage regulated & isolated power derived from the output regulating transformer. When utility AC power is present, the battery charger maintains a ripple free float charge on the batteries.

2.2.3 Uninterrupted Emergency Operation: Upon the failure or unacceptable deviation of commercial AC power, battery power is converted by the PWM inverter and filtered through the constant voltage regulating transformer. There shall be no break or interruption of power to the load upon failure or restoration of the commercial AC power. Any transfer time resulting in a break or loss of power is unacceptable with reference to the uninterrupted output.

2.2.4 Standby Emergency Operation: Upon the failure or unacceptable deviation of commercial AC power or upon a remote input "zone command on signal", the standby, normally off AC output section of the system shall become energized thus providing emergency power for standby lighting fixtures which are required to illuminate only in the event of emergency. Field adjustable timers shall be included for use with on and off delay transition requirements.

2.2.5 Automatic Restart: In the case of a commercial power outage that exceeds the battery run time requirement, the output of the inverter shall shut off, but automatically restart once commercial AC power returns. Recharging of the batteries shall commence immediately.

2.2.6 Manual Maintenance Bypass: The system includes an integral make-before-break service maintenance bypass switch. The service bypass is accessible via the front of the inverter enclosure through a hinged, key lockable door. The maintenance bypass service switch incorporates make before break functionality allowing make before break transitions to and from bypass mode without power interruption or disturbance.

2.2.7 System Power Output Capability: The stored emergency power supply system output power rating shall be: (12.5kW) (14.5kW) (16kW) (18kW)

2.2.8 Battery Time Reserve Capacity: Battery shall be capable of producing emergency power for (30) (60) (90) minutes at full rated watts.

2.2.9 Output Panel: 20 un-monitored single pole circuit breaker positions or 10 monitored single pole circuit breaker positions.

2.2.10 Reliability: MTBF 100,000 hours. MTTR: 1 Hour.

Part 3

3.1 Input Specifications

3.1.1 Input Voltage: 120 VAC or 208 VAC or 240 VAC or 277 VAC or 347 VAC.

3.1.2 Input Voltage Operating Range: +10% to -15% at full load without battery usage.

3.1.4 Frequency Range: 57.5 Hz to 62.5 Hz.

3.1.5 Power Factor: Self correcting to >0.95 (approaching unity).

3.1.6 Input Harmonics: < 5% THD (total harmonic distortion).

3.1.7 Spike Attenuation: 3000:1.

3.2 Output Specifications

3.2.1 Output Voltage: 120 VAC or 240/120 VAC or 277/120 VAC or 347/120 VAC.

3.2.2 Sine Wave Voltage: Maximum 5% harmonic distortion under linear load.

3.2.3 Crest Factor: 3.0 : 1.

3.2.4 Harmonic Attenuation: Reflected load generated harmonics shall be attenuated 23dB at the input.

3.2.5 Line Voltage Regulation: +/-3%.

3.2.6 Load Regulation: Typically better than +/-3%.

3.2.7 Output Power Rating: KVA at 1.0 power factor (unity). KVA = KW

3.2.8 Isolation: NEC article 250-5d, shall comply with this standard that specifies a separately derived power source.

3.3 Battery Specifications

3.3.1 Battery time: 90 Minutes at full rated Kwatt output capability, U.L. 924 Compliant.

3.3.2 Battery Type: Integral, valve regulated, sealed lead calcium, maintenance free,

3.3.3 Charger: Full wave, three stage, filtered.

3.3.4 Recharge Time: U.L. 924, NFPA 101, NFPA 111 compliant.

3.3.5 Buss Voltage: 120 VDC: 12.5KW – 18kW.

3.3.5.1 Float 2.27 VPC, final 1.75 VPC.

3.3.6 Projected Life: Batteries shall have a projected service life of 5 years, 15 year prorate.

3.4 Performance Specifications

3.4.1 Overload Capability: 125% for ten minutes.

3.4.2 Surge Capability: 150% of rated output without need of static bypass.

3.4.3 Frequency Stability: ±0.2 Hz.

3.4.4 Inner Winding Capacitance: 0.01 pF (primary to secondary coupling).

3.4.5 Common Mode: 120 dB (10^6 : 1 ground noise attenuation).

3.4.6 Transverse Mode: 70 dB (3160 : 1 line noise attenuation).

3.4.7 Reactive Power Correction: Load at .6 pf corrected to > 0.95 at input (automatically correcting).

3.4.8 Efficiency: Not less than 89% under full rated load.

3.4.9 Reliability: 100,000 hours MTBF.

3.5 Environmental Specifications

3.5.1 Operating Temperature: 0 (32) to 40 (105) degrees Celsius (F).

3.5.2 Storage Temperature: -20 to 50 degrees Celsius.

3.5.3 Relative Humidity: 95% non-condensing.

3.5.4 Elevation: 5,000 feet, 1,500 meters.

3.5.5 Weight and Cabinet Sizes:

Wattage Rating	Weight	Dimensions
12500	3525 lbs	68”w x 24”d x 84”h
14500	3792 lbs	68”w x 24”d x 84”h
16000	4384 lbs	68”w x 24”d x 84”h
18000	4538 lbs	68”w x 24”d x 84”h

3.5.6 Audible Noise Level: Not greater than 50 dba.

3.5.7 Enclosure: NEMA 1 for indoor use. Sealed, prohibiting rodent entry.

Part 4

4.1 Display Monitor and Diagnostics

4.1.1 Display Monitor – A display monitor shall be included to uphold NFPA guidelines for emergency illumination, emergency back up time and periodic testing of the centralized emergency power system. The system shall include a local, front mounted, sealed, touch screen, LCD display monitor to verify system electrical and temperature measurements, inform/alarm for abnormal system status, allow programming of user specified set points and inform of periodic system and battery test results.

4.1.1.1 The monitor shall display the following electrical parameters:

Input Voltage
Output Voltage L_1-N
Output Voltage L_2-N
Output Voltage L_1-L_2
Output Current L_1-N
Output Current L_2-N
Output Volt-Amperes L_1-N
Output Volt-Amperes L_2-N
Output Volt-Amperes Total
Output Watts L_1-N
Output Watts L_2-N
Output Watts Total
Output Power Factor L_1 – N
Output Power Factor L_2 – N
Output Power Factor Total
Output Percent Load L_1-N
Output Percent Load L_2-N
Output Percent Load Total
Output Frequency
Battery Voltage
Battery Charger Current

4.1.1.2 The monitor shall display the following status and alarm conditions:

Input Voltage High/Low
Output Voltage L-N High/Low
Output Voltage L_2-N High/Low
Output Volt-Amperes High - Overload
Output Volt-Amperes Low
Output Frequency High/Low
Battery Voltage High/Low
Battery Charger Current High
Battery Temperature High
General Alarm
System On Battery
Low Battery Warning
Low Battery Shutdown
Inverter Over Temperature Shutdown
DC Charger Failure / DC Open
Output Circuit Breaker Open
REPO Shutdown
System in Manual Bypass
Off Bus Remote Activation

4.1.1.3 The monitor shall display the following operational conditions:

Battery Temperature
Percent Battery Time Remaining

4.1.2 Programming User Specified Set Points – Include provisions for user interface programming of system status for high/low alarm threshold set points, programming of off bus delay timer(s), programming of periodic battery test duration with date and time and programming of annual

battery test duration with date and time. Allow threshold adjustability limits to comply with NFPA and local code periodic battery and system reliability testing.

4.1.3 The monitor shall incorporate into its design an electrical calibration system which allows the user to calibrate the metering of monitored parameters to insure accurate measurement.

4.1.4 The monitor shall feature a manual, proprietary, password protected "Push to Test" feature.

4.1.5 Periodic Testing - The monitor shall feature diagnostics for automatic and manual battery testing.

4.1.6.1 It shall feature a 5 minute battery discharge test every 30 days or 90 days, user programmable and a programmable annual battery discharge test of either 30minutes, 60minutes, 90minutes, 120minutes or 240minutes.

4.1.6.2 It shall report the Time, Date, and a Pass/Fail Indication locally and/or via an optional Fax/email/voice modem.

4.1.6.3 During the battery test, the monitor shall perform a lighting fixture integrity test. The lighting fixture integrity test shall measure the KVA load on the output of the system and if the output load falls below the customer defined value, the inverter will sound an audible and visual alarm thus indicating fixture maintenance or component replacement.

4.1.6 Periodic Testing Log - The monitor shall maintain a historic log that sequentially records 25 battery tests which indicate time, date and pass/fail results. The log shall be made available through the LCD display of the monitor and remote communication capabilities.

4.1.7 Status Alarm Log - The monitor shall maintain a historic log that sequentially records 25 status alarms which indicate time and date of abnormal occurrences. The log shall be made available through the LCD display of the monitor and remote communication capabilities.

4.2 Communications

4.2.1 The monitoring system shall contain a 25 pin status / alarm port and a terminal strip with potential free,
1 amp, 120 volt rated contacts for use with an optional remotely located audible / visual annunciator panel or optional automatic message dialer, or optional fax modem, or optional computer network integration adapter.

4.2.2 Alarm Port – Include provisions to remotely communicate and/or notify of system on battery power, low battery, general alarm and system on bypass, and manual restart required.

4.2.3 Terminal Strip - Include provisions to remotely communicate and/or notify of inverter on battery power, low battery, general alarm, system on bypass, manual restart required, battery test pass and battery test fail occurrences.

4.2.4 Computer Port - The system shall include provisions to communicate to a single computer or across a computer network, via an optional SNMP adapter.

Part 5

5.1 Accessories (Optional Equipment)

5.1.1 Include automatic message dialer for telephone messaging to inform maintenance personnel of system alarm conditions for system on emergency battery power, low battery warning, general alarm.

5.1.2 Include remote annunciator panel for remote status indication of system alarm conditions for system on emergency battery power, low battery warning, general alarm.

5.1.3 Include (Quantity) control device(s) (dimmer control, wall switch, occupancy sensor) override for use with normally on inverter output bus to provide full illumination to designated emergency lights upon the failure or loss of commercial AC power.

5.1.4 Include (Quantity) zone sensing device(s) to sense voltage at individual zone lighting panels. The sensing device shall detect loss of power at the panel and shall signal the system to illuminate emergency fixtures within the specific zone only. If commercial AC power is acceptable at other zones, emergency lighting shall remain in the standby mode.

5.1.5 Include (Quantity), single pole, 20 amp, un-monitored output circuit breakers for use with normally on bus. Include (Quantity), single pole, 20 amp, un-monitored output circuit breakers for use with normally off bus.

5.1.6 Include (Quantity), single pole, 20 amp, monitored output circuit breakers for use with normally on bus. Include (Quantity), single pole, 20 amp, monitored output circuit breakers for use with normally off bus.

5.1.7 Include system output circuit breaker open or tripped alarm contacts on all output circuit breakers for use with remote and/or local annunciation indicators.

5.1.8 Include fax/voice/email/web modem for automatic reporting of battery system test results.

5.1.9 Include SNMP adapter and monitoring software for network communications.

Part 6

6.1 Warranty

6.1.1 The manufacturer shall guarantee all systems to be free from defects in material and workmanship for a period of 2 years following shipment from the factory.

6.1.2 Battery warranty shall be 15 year prorated with full replacement in the first year.

6.2 Serviceability

6.2.1 The systems shall be constructed of one front-accessible electronics module subassembly. The electronics module shall include AC terminals and DC Anderson connector for rapid replacement. Batteries shall be positioned and wired to facilitate rapid replacement.