STACO ENERGY PRODUCTS UNISTAR SCLI924-E
Online *Emergency Lighting Inverter* (ELI)
2.4KW – 4.2KW "E" Models
Technical Specifications

PART 1 GENERAL

1.1 SUMMARY

A. This Emergency Lighting Inverter, ELI specification describes a single phase, on-line, double conversion, solid state Lighting Inverter System utilizing Patented ECM Technology, here after referred to as ELI. The ELI shall operate in conjunction with the existing building electrical system to provide high quality power conditioning, back-up power protection and distribution for Lighting loads and other critical loads. The system shall consist of a solid-state inverter, a temperature compensated rectifier/battery charger, a 100% rated for continuous duty static switch, an internal maintenance bypass switch, battery plant, status/control panel, and synchronizing circuitry as described herein.

1.2 STANDARDS

A. The ELI shall meet the requirements of the following standards:

1. IEEE 587-1980/ANSI C62.41 1980 Standards for Surge Withstand Ability

2. FCC rules and regulations of Part 15, Subpart J, Class A

3. UL 924, Standards for Lighting Inverter Equipment

4. NEMA PE 1 (National Electrical Manufacturers Association) – Lighting Inverter Systems

5. NEMA 250 (National Electrical Manufacturers Association) – Enclosures for Electrical Equipment (1000 Volts Maximum)

6. NFPA 70, NFPA 101 and National Electrical Code (NEC)

7. ISO 9001

8. Occupational Safety & Health Administration (OSHA)

9. Complies with Buy American Act

1.3 SUBMITALS

A. Submittals for engineering approval shall contain the following documentation:

1. Installation Drawings: Indicate electrical characteristics and connection requirements. Provide cabinet dimensions; battery type, size, dimensions, weight and location of conduit entry and exit; single-line diagram, control, and external wiring requirements; heat rejection and air flow requirements.

2. Product Data: Provide catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements.

B. Upon delivery of the CLI system the following submittals shall be included:

1. An Operator/User Manual showing safe and correct operation of all ELI functions.

1.4 QUALIFICATIONS & QUALITY ASSURANCE

A. Manufacturers Certification: The manufacturer shall specialize in manufacturing of on-line, double conversion single phase ELI modules specified in this document with a minimum of twenty years documented experience, and with a nationwide service organization. The manufacturer will use only patented ECM technology. The manufacturer shall be comply with ISO 9001 shall be designed to internationally accepted standards.

B. Factory Testing: Prior to shipment the manufacturer shall complete a documented test procedure to test all functions of the ELI module and batteries (via a discharge test) and guarantee compliance with the specification. The manufacturer shall provide a copy of the test report upon request.

C. Materials and Assemblies: All materials and parts comprising the ELI shall be new, of current manufacture, and shall not have been in prior service, except as required during factory testing. All active electronic devices shall be solid state and not exceed the manufacturers recommended tolerances for temperature or current to ensure maximum reliability. All semiconductor devices shall be sealed. All relays shall be provided with dust covers. The manufacturer shall conduct inspections on incoming parts, modular assemblies and final products.

1.5 DELIVERY, STORAGE, AND HANDLING

A. All products shall be packaged in a manner to prevent penetration by debris and to allow safe delivery by all modes of ground transportation and air transportation where specified.

B. Prior to shipping all products shall be inspected at the factory for damage.

C. Equipment shall be protected against extreme temperature and humidity and shall be stored in a conditioned or protected environment.

D. Equipment containing batteries shall not be stored for a period exceeding three months without powering up the equipment for a period of eight hours to recharge the batteries.

1.6 ENVIRONMENTAL REQUIREMENTS

A. The ELI shall operate under the following environmental conditions:

1. Temperature:

a. ELI Module

(1). Operating: 0° to 40°C (32°F to 104°F)

(2). Non-Operating: -20°C to +60°C (-4°F to 140°F)

b. Batteries: 25°C (77°F)

2. Relative humidity (operating and storage): 5 to 95% non-condensing

3. Barometric Pressure:

a. Up to 1000 meters above sea level

b. Up to 2000 meters with ambient temperature less than 28°C

c. Up to 12,000 meters above sea level non-operating

4. Audible Noise: 45 DBA at 3 feet

1.7 WARRANTY

A. The ELI Module shall be covered by a full parts and labor warranty from the manufacturer for a period of twelve (12) months from date of installation or acceptance by customer or eighteen (18) months from date of shipment from the manufacturer, whichever occurs first.

B. Battery: The battery manufacturer's warranty shall be passed through to the final customer and shall have a minimum period of one year, with 9 years prorated.

1.8 SERVICE AND SPARES PARTS

A. The manufacturer shall upon request provide spare parts kits for the ELI module in a timely manner as well as provide access to qualified factory trained service personnel to provide preventative maintenance and service on the ELI module when required.

1.9 MAINTENANCE, ACCESSIBILITY AND SELF DIAGNOSTICS

A. All ELI subassemblies, as well as the battery, shall be accessible from the front only. CLI design shall provide maximum reliability and minimum MTTR (mean time to repair). To that end, the ELI shall be equipped with a self-test function to verify correct system operation. The electronic ELI control and monitoring assembly shall therefore be fully microprocessor based.

1. Auto-compensation of component drift;

2. Self-adjustment of replaced subassemblies;

3. Extensive acquisition of information vital for computer-aided diagnostics (local or remote);

B. The ELI shall be repairable by replacing standard subassemblies.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/PRODUCT

A. STACO Energy Products Co. UniStar SCLI924 “E” ELI series Emergency Lighting System

2.2 PRODUCT SPECIFICATION

A. ELI Design Requirements

1. Output Power Continuous Rating: The continuous output power rating of the ELI shall be shall be _____ KW (refer to product data sheet for power levels).

2. Input Voltage: _____ VAC – 15% / +10%, single phase, 2-wire plus ground.

3. Output voltage(s): _____VAC single phase, 2 wire plus ground.

4. Battery Autonomy: The ELI shall be capable of operating at full load for 90 minutes at unity PF output at a temperature of 25°C on battery power.

5. Battery Type: Maintenance free valve regulated lead calcium (VRLA).

B. AC Input Characteristics

1. Input Frequency: 60 Hz

2. Power walk-in: 0 to 100% over a 10-second period.

3. Magnetizing Inrush Current: Less than nominal input current for less than one cycle.

4. Input Surge Protection: The ELI is equipped with standard input filter assembly will withstand surges per IEEE 587-1980/ANSI C62.41

C. AC Output Characteristics

1. Voltage Regulation: + 3% for no-load to full load and full 90 minute battery discharge mode.

2. Frequency: 60 Hz (+ 1Hz when free running).

3. Voltage Distortion: Maximum 5% total (THD) @ 100% linear loads.

4. Voltage Transient (Step Load) Response:

a. + 5% for 50% step load change

b. + 8% for 100% step load change

c. + 3% for loss or return of AC input power or manual transfer at full load.

5. Voltage Recovery Time: Return to within 3% of nominal value within 50 milliseconds.

6. Non-Linear Load Capability: Output voltage total harmonic distortion shall be less than 8% when connected to a 100% non-linear load with a crest factor not to exceed 2.5%.

7. Slew Rate: 1 Hz/second maximum

8. Power Factor: Unity power factor.

9. Inverter Overload Capability:

a. 125% of rated load for 1 minute

b. 145% of rated load for 10 seconds

10. Bypass Overload Capability: > 200% for one cycle; > 150% for 30 seconds

D. DC Bus

1. DC Bus Voltage: 2.3 VDC/cell nominal Float level. The battery charger will compensate for temperature changes in accordance with the battery manufacturer's requirements. ELI will utilize our watch-dog interface software to control DC voltage; this control will extend life of batteries by 50%.

2.3 MODES OF OPERATION

A. The ELI module shall be designed to operate as a double conversion, on-line reverse transfer system in the following modes.

1. Normal: The inverter shall continuously supply power to the critical load. The rectifier/battery charger shall derive power from the utility AC source, supply DC power to the inverter and simultaneously float charging the battery.

2. Emergency: Upon failure of the utility AC power source, the critical load shall be supplied by the inverter, which, without any switching, shall obtain its power from the battery.

3. Recharge: Upon restoration of the utility AC power source (prior to complete battery discharge), the rectifier/battery charger shall power the inverter and simultaneously recharge the battery.

4. Bypass Mode: The static bypass transfer switch shall be used to transfer the load to the bypass without interruption to the critical power load. This shall be accomplished by turning the inverter off. Automatic re-transfer or forward transfer of the load shall be accomplished by turning the inverter on.

5. Manual Bypass Switch: A manual make before break internal bypass switch shall be provided to isolate the ELI inverter output and static bypass and connect the load directly to the utility until service personnel can arrive to repair unit.

2.4 COMPONENT DESCRIPTION

A. Rectifier / Battery Charger: Incoming AC power shall be converted to a regulated DC output voltage. The rectifier / battery charger shall provide high quality DC power to charge the batteries and power the inverter and shall have the following characteristics:

1. Input Current Limiting: The ELI shall be equipped with a system designed to limit the battery recharge current to conform to UL924 standard.

2. Modular Assembly: The rectifier/battery charger assembly shall be constructed of modular design to facilitate rapid maintenance.

3. Charging Levels: The battery charging circuitry shall be capable of being set for automatic battery recharge operation, float service and equalizing operation.

4. Temperature Compensated Charging: The battery charger shall be equipped with a temperature compensated charging and adjust the battery float voltage to compensate for the ambient temperature using a negative temperature coefficient of 3 mV per cell per degree Celsius at a nominal temperature of 25°C.

5. Capacity: The rectifier/battery charger shall have sufficient capacity to support a fully loaded inverter and fully recharge the battery to full capacity in accordance with UL 924 specifications.

B. Inverter: The ELI output shall be derived from a Pulse Width Modulated (PWM) IGBT inverter design. The inverter shall be capable of providing precise output power while operating over the battery voltage range. The inverter assembly shall be constructed as a modular assembly to facilitate rapid maintenance.

C. Static Bypass: The static bypass transfer switch shall be solid-state, rated for continuous 100% duty and shall operate under the following conditions:

1. Uninterrupted Transfer: The static bypass transfer switch shall automatically cause the bypass source to assume the critical load without interruption after the logic senses one of the following conditions:

2. Inverter overload exceeds unit's rating

3. Inverter failure

4. Automatic Uninterrupted Forward Transfer: The static bypass transfer switch shall automatically forward transfer power from the bypass to the rectifier / inverter, without interruption, after the ELI inverter is turned "ON", after an instantaneous overload-induced reverse transfer has occurred and the load current returns the ELI’s nominal rating or less.

D. Microprocessor Controlled Logic: The full ELI operation shall be provided through the use of microprocessor controlled logic. All operation and parameters are firmware controlled. The logic shall include a self-test and diagnostic circuitry such that a fault can be isolated down to the printed circuit assembly or plug-in power assembly level.

E. Standard Communication Panel: The ELI will include a standard easy to use communication panel. Included will be a LED display. The CLI communication panel will include pushbuttons that will permit the user to safely command the ELI.

2.5 SYSTEM CONTROLS AND INDICATORS

A. Front Panel LED Display: The ELI control panel shall provide a LED display. The indication of ELI status, metering, battery status, alarm event log and advanced operational features will be available. The display provides access to:

1. Measurements, status indications and events
2. Event log with time stamping
3. Access to all measurements

B. System Parameters Monitored (data displayed): The visual display will display the following system parameters based on true RMS metering:

1. Measurements
    a. Input voltage indicator
    b. ELI output voltage indicator
    c. ELI output current indicators
    d. DC voltage indicators
2. Status indications and events
    e. Load on battery
    f. Load on ELI
    g. Load on automatic bypass
    h. Low-battery warning
    i. General alarm
    j. Additional indications shall provide maintenance assistance

2. Time-stamped historical events: This function shall time-stamp and store all important status changes, anomalies and faults and make this information available for automatic or user-requested consultation; it shall interpret the events and indicate remedial measures if applicable.

3. DB-9 RS232 Connector: One DB-9 connector utilizing AS400 communication protocol will be provided for field diagnostic actions.

Signals provided shall be;

a. Inverter/UPS Failure

b. Summary Alarm

c. Remote Shutdown

d. Unit in Bypass

e. Low Battery

f. Inverter/UPS On

g. Line Loss

4. Dry Contacts (Optional): The ELI shall be capable of providing optional relay contacts. The contacts will be a form “C” contact and will change state to indicate the operating status. The contacts will be rated at 2.0 A (125 VAC / 30 VDC). Contacts shall be programmed as:

a. Unit on Line

b. Load on Bypass

c. Unit on Battery

2.6 MECHANICAL DESIGN AND VENTILATION

A. The ELI enclosure shall be housed in a freestanding enclosure. The mechanical structure of the ELI shall be sufficiently strong and rigid to withstand handling and installation operations without risk. Access to ELI subassemblies shall be through the front only. The sheet-metal elements in the structure shall be protected against corrosion by a suitable treatment, such as zinc electroplating, epoxy paint or an equivalent.

B. Cable Access: The standard ELI available shall accommodate side, top and bottom entry cables.

C. Ventilation and Heat Rejection: The ELI shall be designed for forced air-cooling. Air inlets shall be provided from the front bottom of the ELI enclosure. Air exhaust shall be from the top or side portions of the unit.

2.7 BATTERY

A. The ELI module shall use a valve regulated sealed lead calcium heavy-duty industrial battery, designed for auxiliary power service in a ELI application. The primary battery shall be furnished with battery with impact resistant plastic case and housed in the cabinet.

1. Protection against Deep Discharge and Self-Discharge: The ELI shall be equipped with a device designed to protect the battery against deep discharge depending on discharge conditions, with isolation of the battery by a circuit breaker. In particular, a monitoring device shall adjust the battery shutdown voltage as a function of a discharge coefficient to avoid excessive discharge.

2. Battery Self-Tests: The battery monitoring system shall be to perform the following automatic functions:

a. Battery circuit check

2.8 OPTIONS

A. External Maintenance Bypass (EMBS):
The maintenance bypass provides a wrap-around bypass configuration for total isolation during maintenance. Maintenance bypass transfers shall be without interruption and shall have mechanical interlocks to protect the ELI from damage in the event of an out of sequence transfers.

B. Environmental Control Module (ECM):
Allows fixtures and lamps on the emergency circuit (s) to be operated by normal switching and/or dimming devices in NON-emergency conditions. Provides superior dependability and security to commercial and industrial environments. It can operate individual fixtures, lamps, circuits, or be daisy chained for con-trolling multiple loads (One ECM is used per switching device or circuit)/qty. The ECM is perfect for hall-ways, classrooms, corridors, meeting rooms or individual offices.
The ECM was designed specifically for the egress emergency lighting market. It is a small module that has many applications. The dimensions are 1.25”x1”x2”, and comes in two voltage sensing ranges—a 100VAC which has a range of 100-140VAC, and a 200VAC which has a 200-300VAC range. This small and powerful unit is the most versatile module for many applications in the egress emergency lighting market.

C. Normally OFF Output Circuit (NOF):
This feature is an excellent option when the customization needs is to provide, in addition, power only in cases of emergency (i.e. exiting lighting or evacuation power). In the event of an AC power outage, the fixtures, lamps and/or loads connected to the emergency circuit (s) will immediately begin operating at full-light output for a maximum of 90 minutes.

D. Normally OFF “Hold On” (NOH):
Outputs are basically the same as our Normally Off Circuit option. Both are excellent options when the customization needs is to provide, in addition, power only in cases of emergency (i.e. exiting lighting or evacuation power). The difference between the two is that the NOH feature allows the emergency circuit (up to 10 minutes) to remain energized after the utility power is re-stored. This means that in the event of an AC power outage, the fixtures, lamps and/or loads connected to the emergency circuit (s) will immediately begin operating at full-light output for a maximum of 90 minutes. When utility power is restored, the emergency circuit (s) will stay energized for up to 10 minutes (depending on user setting). At the end of the pre-set time, the normally-off circuit (s) will shutoff OCB—Output Circuit Breaker/(s)

E. Output Circuit Breakers (OCB):
An excellent feature for separating and controlling the load in the ELI. Furthermore, the controlling of the individual branches that constitutes your load can be done while the UPS is running, giving the customer multiple options or ways to use their ELI's.

F. Emergency Power Off (EPO):
Provides the user the ability to instantly turning the UPS off without having to throw the breakers. The EPO option is primarily used as a personnel safety feature that will shutoff all power to the ELI output and load. When pressed the input utility power is still on the terminal block, but the microprocessor turns the inverter and rectifier off.

G. Remote Indication Panel (RSSP):
Enables the user to remotely monitor the ELI. Through the use of re-lays, the RSSP allows the user to know if the ELI is operating on the input utility power or its battery bank and if the ELI's output is "On" or "Off". This feature allows for the ELI to be located away from the load that it operates or controls.

H. SNMP Network Card:
is an "Internet-standard protocol for managing devices on IP networks." Devices that typically support SNMP include routers, switches, servers, workstations, printers, modem racks, and more. It is used mostly in network Management systems to monitor network-attached devices for conditions that warrant administrative attention.
UPS and Emergency Lighting Inverter manufacturers have adopted the SNMP standard to allow users to easily communicate with their UPS systems. SNMP makes it possible for one node on a network to communicate with another node enabling the power supply to send out emails to anyone on the net-work, if an email server is available.
The SNMP will be able to send emails to interested parties when a problem with the power supply occurs. The SNMP will host a java webpage that shows all the relevant voltages, cur-rents, powers, energies, times, alarms, associated with the power supply. The operator will also be able to remotely operate the power supply as if they are standing in front of it pushing buttons.

I. Form C Contacts:
The ELI shall be capable of providing optional relay contacts. The contacts will be a form "C" contact and will change state to indicate the operating status. The contacts will be rated at 2.0 A (125 VAC / 30 VDC). Contacts shall be programmed as:

a. Unit on Line

b. Load on Bypass

c. Unit on Battery

J. Internal Dimmer Bypass:
Dimming Panel Interface allows use with emergency lights controlled by common dimmer panel.

K. Harsh Environment Enclosure:
The ELI and any accessory cabinet(s) shall have the capability to be mounted and completely wired internal to, include AC cooling, inside any NEMA type enclosure (NEMA 12, 3R, 4X) by the ELI Manufacturer.

L. Spare Parts:
Shall be available in three levels, Level 1- Minor, Level 2 - Medium and Level 3 - Major.

M. Service Agreements:
Multi-level service and maintenance agreements shall be available.

PART 3 EXECUTION

3.1 FACTORY TESTING

Before shipment, the manufacturer shall fully and completely test the system to factory standards to assure compliance with the specification. Each subassembly shall undergo thorough testing prior to installation in the system. The total system shall be exposed to a functional load test and shall be subjected to a minimum of 24 hours "burn-in" test prior to shipment.

A complete test report shall be available for each unit and kept on file for future reference.

3.2 SITE START-UP

Site start-up PHONE assistance shall be provided by the manufacturer's field service representative during normal working hours (M/F-8/5).

3.3 FIELD ENGINEERING SUPPORT

The ELI manufacturer shall have available a nationwide field service organization staffed by factory trained Field Service Engineers dedicated to the start-up, maintenance and repair of UPS equipment. The manufacturer shall have a toll free service telephone number answered 24 hours a day / 365 days a year

3.4 MAINTENANCE TRAINING

The manufacturer shall make available to the customer various levels of training ranging from basic ELI operation to ELI maintenance.

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