STACO ENERGY PRODUCTS SEL
Emergency Lighting Inverter System (ELIS)
0.675 kW - 2.7 kW Models
Guide Specification

Part 1. GENERAL

1.1. SUMMARY

The Staco Energy Products Company Ltd SEL Emergency Lighting Inverter System (ELIS) 0.675 kW – 2.7 kW specification describes a single phase, line interactive, solid state Lighting Inverter System. The ELIS shall operate in conjunction with an existing building electrical system to provide high quality power conditioning, backup power protection and distribution for lighting loads and other critical loads with efficiencies up to 97%
The ELIS comprises a solid state inverter, temperature compensated battery charger, a 100% rated static switch for continuous duty, an internal maintenance bypass switch, battery array, multi-tap transformer to stabilize and regulate incoming voltage with buck and boost modes. The ELIS will also feature a touch screen, status/control user interface panel and synchronizing circuitry as described herein. System will conduct NFPA 101: 7.9.3.1.3, Option 3 Automatic Testing with computer-based report storage for accessing history.

1.2. SUBMITTALS

a. Submittals for engineering approval shall include the following documentation:

1. Installation Drawings. Including electrical characteristics and connection requirements. Including cabinet dimensions, battery type, size, weights, location of conduit entry and exit. Including single line diagram, wiring requirements, heat and airflow requirements and controls.
2. Product Data. Including technical data sheets to indicate physical specifications, electrical performance, electrical characteristics and connection requirements.

b. Delivery of the ELIS system shall include the following documentation:

1. Operating Manual including instruction for the safe and correct operation of the ELIS and associated functions
2. Operating Manual including instruction for the installation and operation of support software OS to provide base monitoring and remote or local safe shutdown of the ELIS.

1.3. QUALIFICATIONS AND QUALITY ASSURANCE

a. Manufacturers Certification: The manufacturer shall specialize in the design and manufacturing of line interactive single phase Emergency Lighting Systems and associated power protection devices, exhibiting a minimum of twenty years documented experience. The manufacturer will

support the ELIS with a nationwide authorized service network. The manufacturer shall comply with ISO 9001.

b. Factory Testing: Prior to shipment, the manufacturer shall complete a documented test procedure to verify the correct functionality of the ELIS module and batteries to guarantee compliance with the product specification. A copy of the manufacturer test report shall be available on request.

c. Materials and Assemblies: All materials and parts comprising the ELIS 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 may not exceed the manufacturer's 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, assemblies and final products.

1.4. DELIVERY, STORAGE AND HANDLING

a. All products shall be packaged in a manner to prevent penetration by debris, and to accommodate safe delivery by all modes of ground transportation (or air transportation when specified)

b. Prior to shipping, all products shall be inspected at the factory for visible damage.

c. Equipment shall be protected against extreme temperature and humidity, and shall be stored in a conditioned and controlled environment.

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

1.5. ENVIRONMENTAL REQUIREMENTS

a. Temperature:
1. Operating Temperature: 32°F to 104°F (0°C to 40°C)
2. Storage Temperature: 32°F to 104°F (0°C to 40°C)
3. Battery optimum operating temperature: 68° to 86° F (20° to 30°C)

b. Relative humidity:
1. Operating Humidity: 5-95% non-condensing (32°F to 104°F)
2. Storage Humidity: 5-95% non-condensing (32°F to 104°F)

c. Barometric Pressure:
1. Operating: Up to 1000m without derating
2. Operating: Up to 2000m with derating (1% deration per 100m >1000m)
3. Storage: Up to 12000m

d. Audible Noise: less than 65 dBA at 1m

1.6. WARRANTY

a. ELECTRONICS: A full Year with Telephone Startup is standard. Two Years with purchase of Factory Field Startup.

b. BATTERY: The battery manufacturer's warranty shall be passed through to the customer and hold a minimum period of one year.

1.7. SERVICE AND SPARE PARTS

a. The manufacturer shall, upon request, provide spare parts kits or system assemblies for the ELIS. Parts will be supplied in a timely manner, and the manufacturer shall provide access to qualified, factory trained service personnel to support with preventative maintenance and service for the ELIS when required.

1.8. MAINTENANCE, ACCESSIBILITY AND SELF DIAGNOSTICS

a. The ELIS subassemblies and battery shall be accessible for serviceability. The product design shall provide maximum reliability and minimum MTTR (Mean Time To Repair). The control and monitoring design shall be microprocessor-based.

b. The ELIS shall be repairable by replacing standard subassemblies. Communication via serial port shall be available.

Part 2. PRODUCT

2.1. ACCEPTABLE MANUFACTURER & PRODUCT

a. Staco Energy Products / Staco 924 ELIS Emergency Lighting Inverter System.

2.2. PRODUCT SPECIFICATION

a. ELIS Design Requirements:
1. Output power continuous rating: the continuous output power rating of the ELIS shall be _____kW (refer to product technical datasheet or Part 5 for power ranges)
2. Input voltage: _____ VAC, single phase, 2-wire plus ground
3. Output voltage: _____ VAC, single phase, 2-wire plus ground
4. Battery autonomy: The ELIS shall be capable of operating at full load for 90 minutes at a temperature of 77°F (25°C) on battery power.
5. Design topology: Voltage and Frequency Independent (VFI) line interactive

b. AC Input Characteristics:
1. Input frequency: 60 Hz
2. Magnetizing inrush current: less than nominal input current for less than one cycle @ 120 VAC Input
3. Frequency range: 54-66 Hz

c. AC Output Characteristics:
1. Voltage regulation: +/- 10%
2. Frequency synchronization range (Battery Mode): 60 Hz +/- 1%
3. Frequency synchronization range (Normal Mode): 54-66 Hz
4. Overload capabilities: 100%-110%: 20 sec; 110%-125%: 10 sec; > 150%: 1 sec
5. Output waveform: pure sinewave
6. Transfer time: ≤ 6 ms
7. Harmonic distortion: ≤ 5% linear load; ≤ 5% non-linear load
8. Current crest ratio: 3:1

d. Battery Characteristics:
1. Battery type: Valve regulated sealed lead acid
2. Battery quantity: 0.675-0.900 kW: 3ea; 1.35-1.80 kW: 6ea; 2.7 kw: 12ea
3. Charge current: 3A
4. Temperature compensated charging: the battery charger will compensate for temperature changes in accordance with the battery manufacturer's requirements

e. Physical & Environmental Characteristics:
1. Dimensions (W" x D" x H"): 25.2" x 25.11" x 58.31"
2. Maximum Weight* (lbs): 0.675 kW: 700; 0.900 kW: 755; 1.35kW: 805; 1.80 kW: 965; 2.70 kW: 1060
   *weight for fully configured system. Actual system weight will be lower depending on input/output voltage selection when not utilizing multiple transformers
3. Operating temperature: 32°F - 104°F (0°C - 40°C)
4. Operating humidity: 0-95% non-condensing
5. Noise level: < 65 dBA
6. Graphical User Interface: Touch screen display

7. Feet and forklift and weight dispersion – no casters or leveling feet

2.3. MODES OF OPERATION

a. The ELIS shall be designed to operate as a line interactive system in the following modes:
1. Normal. When the input voltage is within acceptable range and the ELIS is switched on (the inverter is running), the ELIS will provide a pure and stable output AC sinewave voltage. The ELIS will also charge the battery in this mode. Normal operation will also be supplemented by boost and buck operations of internal, two stage transformers for brown out and surge AC power conditions.
2. Emergency. When the input voltage is outside acceptable range or when there is total power loss and the ELIS is switched on (the inverter is running), the ELIS will provide backup power from the battery. Transfer to battery shall be ≤ 6 msec
3. Recharge. When the input AC voltage is restored and within acceptable range, the battery charger shall power the inverter and simultaneously charge the battery.
4. Manual Bypass. A manual make-before-break internal/maintenance bypass switch shall be available as an option, to isolate the ELIS inverter and static bypass output and connect the load directly to the utility.

2.4. COMPONENT DESCRIPTION

a. Battery Charger: Incoming AC power shall be converted to a regulated DC output voltage. The 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 Limitation. The ELIS shall be equipped with a system designed to limit the battery recharge current in accordance with the UL924 standard.
2. Modular assembly. The battery charger assembly shall be constructed in a modular design to facilitate easy access and rapid maintenance.
3. Charging levels. The battery charging circuitry shall be programmable for automatic battery recharge operation, float service and equalizing operation.
4. Capacity. The battery charger shall have sufficient capacity to support a fully loaded inverter and recharge the battery to full capacity in accordance with the UL924 standard.

b. Inverter: The ELIS 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.

c. Microprocessor Controlled Logic: The entire ELIS 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 may be isolated to PCB level.
   a. Multifunction LCD User Touchscreen Interface: The touchscreen interface shall display immediate operational data including voltage, frequency, load, and battery status. Navigation and programming will be intuitive, adjustable for site specific conditions and/or load requirements.
   b. Intuitive access to NFPA 101 Automatic Testing results

2.5. SYSTEM CONTROLS AND INDICATORS

a. Front Panel LCD Display. The ELIS control panel shall provide a 3 inch LCD display indicating ELIS operational status, metering, battery status, load status and alarms.

b. System Parameters Displayed. The LCD will display the following system parameters based on true RMS metering:

1. Measurements.
    a. Input Voltage
    b. Input Frequency
    c. Output Voltage
    d. Output Frequency
    e. Battery Voltage
    f. Output Current
    g. Output Power
    h. Total Load
2. Status Indicators.
    a. Overload
    b. Short circuit
    c. Low battery
    d. Battery fault
    e. General alarm
3. Operating Mode Indicators.
    a. Green: Normal Mode
    b. Yellow: Warning
    c. Red: Alarm

c. Time Stamped Historical Events. Status changes, warnings and faults shall be recorded and time stamped. Up to 999 events may be stored. Event log may be reviewed by user and by service personnel.

d. Remote Emergency Power Off Option. The ELIS may be switched off instantly without having to open the breakers. All power to the ELIS output is lost and the connected load receives no power. When activated, AC power from the utility may still be present on the terminal block, but the inverter is switched off.

e. RS232 Connector. One DB-9 connector utilizing RS232 communication protocol shall be available for field diagnostic actions.

f. USB Connector. One USB connector shall be available to allow for service interface to a local or networked PC. A USB communication cable shall be delivered with the ELIS.

g. Automatic Shutdown Software. An automatic shutdown software platform shall be available, as downloadable from the web, to allow the user to program shutdown and/or ELIS status.

h. SNMP. An SNMP card shall be available as an option to allow the user to monitor and control the ELIS across a network. The SNMP card shall be web-enabled and has MODBUS and BACnet compatibility

i. Form C Contacts. A dry contact card shall be available as standard. The contacts shall be set for Active-Open or Active-Closed. The (6) preprogrammed contacts shall be rated at 2.0A (30 VDC or VAC) and are programmable for various operating modes and alarms:

    a. Normal Mode
    b. On Bypass
    c. On Battery

    d. Low Battery
    e. Over Temperature
    f. Alarm Present

j. Fully Automatic NFPA 101 Self Diagnostics and Testing
    a. The SEL inverter system shall conduct fully automatic self tests, annually and monthly, to exceed the Level 3 test requirements for NPFA 101.
    b. The test results shall be stored locally
    c. Test can be manually initiated at the integrated touch screen / HMI

2.6. MECHANICAL DESIGN AND VENTILATION

a. The ELIS enclosure shall be housed in a freestanding enclosure. The mechanical structure of the ELIS shall be sufficiently strong and rigid to withstand handling and installation without risk. Access to the ELIS subassemblies shall be via the front only.
b. Cable Access. The standard ELIS enclosure shall allow for top, side, and rear cable access.
c. Top of system will have a gland plate for ease of cable and conduit installation and entry
d. Ventilation and Heat Rejection. The ELIS shall be designed for convection cooling. Air inlets shall be provided via the front of the enclosure. Air exhaust shall be via the rear of the enclosure.

2.7. BATTERY

a. The ELIS system shall utilize a Valve-Regulated Lead Acid (VRLA) battery designed for auxiliary power service in an ELIS application. The primary battery shall be furnished with an impact-resistant plastic case and fully housed in the ELIS enclosure.
b. The ELIS shall incorporate a battery self-test, programmable by the user via the LCD.

2.8. OPTIONS

a. Internal Maintenance Bypass. The maintenance bypass provides an internal bypass configuration for keeping loads energized during routine service and maintenance. The transfer to bypass shall be without interruption and contain mechanical interlocks to protect the ELIS from damage in the event of out-of-sequence transfer.
b. Normally-OFF Output Circuit. No power is delivered from the ELIS except in the event of AC power loss. In the event of a power failure the fixtures, lumens and other loads connected to the ELIS will immediately begin operating at full-light output.
c. Normally-OFF Hold-On Output Circuit. Similar to Normally-OFF for power in case of emergency. However, when AC power is restored the attached loads remain energized via the ELIS for a user-defined period before transferring back to utility.
d. Integrated Output Circuit Breakers. Up to 10 EA 1-pole (5 EA 2-Pole) Output Circuit Breakers (OCBs) shall be available for separating and controlling the load on the ELIS. Controlling individual branches that constitute the load may be done while the ELIS is in normal operation.
e. Spare Parts. Spare parts shall be made available.
f. Alternate Runtimes. The inverter shall be specified to allow for lesser or greater than 90 minute runtime capability which will give the inverter a UL 924 OUST listing.
g. NEMA 3R, 4X, and 12. Cabinet options available for outdoor and harsh environments.
h. Seismic Kit. Complies with IBC and Category D applications via calculations
i. Service Agreements. Preventative Maintenance inspections, Extended Warranty and Service Contracts shall be made available.

Part 3. STANDARDS

3.1. STANDARDS AND CONFORMITIES

a. The ELIS shall meet compliance to the following:

a. UL924 (10th edition)
b. UL1778
c. NFPA 101, NFPA 70, NFPA 111
d. NEMA PE 1 (National Electrical Manufacturers Association) – Lighting Inverter Systems
e. NEMA 250 (National Electrical Manufacturers Association) – Enclosures for Electrical Equipment
f. NEC and OSHA regulations
g. City of New York requirements
h. City of Chicago requirements
i. ISO 9001
j. Buy America Act

Part 4. EXECUTION

4.1. FACTORY TESTING

- **a.** Prior to shipment, the manufacturer shall fully inspect and test the ELIS to ensure compliance with specification. Each subassembly shall undergo thorough testing prior to full system assembly. The completed ELIS shall be exposed to a functional load test.
- **b.** A test report shall be completed for each unit. The report must be stored and made available to the user on request.

4.2. START UP AND COMMISSIONING

- **a.** The user may request a Start Up and Commissioning service to be provided by the manufacturer at the user's discretion. It is not required for the manufacturer to perform the start up.
- **b.** Start-up telephone assistance shall be provided by the manufacturer during normal working hours (Mon-Fri 8-5EST) free of charge.

4.3. FIELD ENGINEERING SUPPORT

- **a.** The ELIS manufacturer shall make available a nationwide field service organization staffed by factory-trained Field Service Engineers to support the start-up, maintenance and repair of ELIS equipment.