

SECTION 26 33 23 – CENTRAL EMERGENCY LIGHTING INVERTER**PART 1 GENERAL****1.01 DESCRIPTION**

- A. Provide a standby, single-phase, solid-state interruptible central emergency lighting inverter, hereafter referred to as the CELI for the emergency operation of lighting loads, including LED, fluorescent, incandescent, and quartz fixtures. Shall have true output sine wave.

1.02 QUALITY ASSURANCE

- A. The CELI 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 supersede.
 - UL 924 Standard Emergency Lighting and Power Equipment
 - UL924A Auxiliary Lighting
 - ANSI C62.41 (IEEE 587)
 - ANSI C62.42.45 (Cat. A & B)
 - National Electrical Code with State Amendments
 - NFPA-101
 - OSHA and Life Safety Code
- B. Manufacturer Qualifications: A minimum of 25 years' experience in the design, manufacture, and testing of emergency power systems is required.
- C. Factory Testing: Before shipment, the manufacturer shall fully and completely test the system to assure compliance with the specification.

1.03 SUBMITTAL AND RECORD DOCUMENTATION

- A. Shop Drawings: Detailing fabrication, internal and interconnecting wiring, and installation of inverter system. Include dimensioned plan, elevation views, and details of control panels. Show access and clearance requirements, ventilation requirements, and weights. Differentiate between field-installed and factory-installed wiring and components and show field termination locations.
- B. Product Data: Include data on features, components, ratings, and performance. Show compliance with requirements of this specification and the Drawings.
- C. Operating and maintenance data, including instruction manuals with functional description of the equipment, installation, safety precautions, instructions on use, step-by-step operating procedures and routine maintenance guidelines, including illustrations.
- D. Special project warranties specified in this section.

1.04 WARRANTY

- A. The CELI manufacturer shall warrant the CELI against defects in materials and workmanship for 12 months after initial start-up or 18 months after ship date, whichever occurs first. The standard warranty shall be increased to 2 years with the purchase of a factory start-up.
- B. The battery manufacturer's standard warranty shall be passed through to the end user.

PART 2 PRODUCTS**2.01 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with requirements, provide products by the following manufacturers:

1. Myers Power Products, Inc.
2. Emergi-Lite
3. Sure-Lites

2.02 SYSTEM DESCRIPTION

A. Electronics Module

1. Nominal input/output Voltage: The Input and Output voltage of the CELI shall be pre-configured to match the user specified input and load requirements. Available voltages shall be 120V or 277Vac. See Drawings for required voltages.
2. Output Load Capacity: The output load capacity of the CELI shall be rated in kVA at unity power factor, between 500kVA and 2000kVA, and field upgradeable from 500kVA to 2000kVA. The CELI shall be able to supply the rated kW from 0.5 lagging to 0.5 leading. See Drawings for required kVA/kW rating.

B. Battery System

1. Battery Cells: The CELI shall be provided with maintenance-free sealed lead calcium VRLA batteries.
2. Reserve Time: The battery system shall be sized to provide the necessary reserve time to feed the inverter in case of a mains failure. Battery Reserve Time: 90 minutes.
3. Recharge Time: The battery charger shall recharge the fully discharged batteries within a 24 hour period. The charger shall be an integrated 3 step with equalize, microprocessor controlled and temperature compensating.

C. Modes of Operation: The CELI shall be designed to operate with a 50-millisecond transfer time;

1. Normal: The CELI inverter is an off-line stand-by system and the commercial AC power continuously supplies the critical load. The input converter (bi-directional transformer) derives power from the commercial AC power source and supplies to the inverter while simultaneously providing floating charge to the batteries.
2. Emergency: Upon a failure or brown out of the commercial AC power, the inverter, with a maximum of 50-millisecond break, switches its power supply from the input converter to the battery system. There shall be no more than a 50-millisecond loss of power to the critical load upon failure or restoration of the utility source. The system shall come standard with a normally off output (loads that are only powered during an emergency) capable of supporting full system load.
3. Recharge: Upon restoration of commercial AC power after a power outage, the input converter shall automatically restart and start charging the batteries. The critical loads are powered by the commercial AC power again.

E. Performance Requirements

1. AC Input to CELI
 - a. Voltage Configuration for Standard Units: 1-phase, 2-wire plus ground.
 - b. Voltage Range: (+10%, -15%)
 - c. Frequency: 60 Hz (+/- 3Hz)
 - d. Power Factor: 0.5 lagging / leading
 - e. Inrush Current: 1.25 times nominal input current, 10 times 1 line cycle for incandescent loads
 - f. Current Limit: 115% of nominal input current for 5 minutes.
 - g. Current Distortion: 10% maximum from 50% to full load
 - h. Surge Protection: Sustains input surges without damage per standards set in ANSI C62.41 (IEEE 587) & ANSI C62.42.45 (Cat. A&B)
 - i. 65 kAIC fault current rating.
2. AC Output, CELI Inverter

- a. Voltage Configuration for Standard Units: 1-phase, 2-wire plus ground
- b. Static Voltage Stability: Load current changes +/- 2%, battery discharge +/- 12.5%
- c. Dynamic Voltage Stability: +/- 2% (25% step load), +/- 3% (50% step load)
- d. Dynamic Recovery Time to within 1% of nominal: 3 cycles (0-100% load step)
- e. Output Harmonic Distortion: <3% THD (with linear load)
- f. Frequency: 60 Hz (+/- 0.05 Hz during emergency mode)
- g. Load Power Factor Range: 0.5 lagging to 0.5 leading
- h. Output Power Rating: kVA = kW
- i. Overload Capability: to 100% continuous rating
 - 1) to 115% for 10 minutes
 - 2) to 150% for 16 line cycles
- j. Crest Factor: <= 2.8
- k. Efficiency: 98%

2.03 ENVIRONMENTAL CONDITIONS

- A. The CELI shall be capable of operating within the specified design and performance criteria provided that the following environmental conditions are met:
 - 1. Storage/Transport Temperature:
 - a. -4 to 158 deg. F (-20 to 70 deg. C) without batteries
 - b. 0 to 104 deg. F (-18 to 40 deg. C) with batteries
- B. Relative Humidity: 0 to 95% non-condensing
- C. Audible Noise: 45 dBA @ 1 meter from surface of the CELI during emergency mode.

2.04 FABRICATION

- A. All materials of the CELI shall be new, of current manufacture, high grade, free from all defects and shall not have been in prior service except as required during factory testing.
- B. The CELI shall be of modular design with small footprint and lightweight size allowing for wall and floor mounting, with separate inverter module and battery module(s), with steel housing finished in durable powder coat finish. Electrical knockouts for easy contractor connection and installation.
- C. The CELI shall be powder painted with manufacturer's standard color. The CELI shall be constructed of replaceable subassemblies. Like assemblies and like components shall be interchangeable.
- D. Cooling of the CELI shall be force-air in emergency mode with internally mounted fans to minimize audible noise. Fans shall not operate in the standby mode. Fan power shall be provided by the CELI. No air filters shall be required.

2.05 COMPONENTS

- A. The CELI shall be comprised of the following components:
 - 1. Inverter Module – The inverter module shall contain an inverter, an AC distribution module with an input circuit breaker, a transfer switch, control, and monitoring subsystems.
 - 2. Battery Module – The battery module shall contain the battery plant required to produce the reserve energy to supply the inverter during abnormal AC mains conditions.

2.06 BATTERY CHARGER

- A. General: In the standard configuration the charger shall convert ac voltage to dc voltage. With commercial power present, the inverter power transformer shall be powered and the CETI modules shall be microprocessor controlled to recharge the batteries. The temperature

compensated battery charger circuit shall supply constant voltage and constant current to the batteries. Once the batteries have received a full recharge, a constant trickle charge shall maintain batteries at maximum level. Recharge time shall be 24 hours maximum at nominal ac input voltage. The dc output's ripple current shall meet the battery manufacturer specification, thus ensuring the maximum battery lifetime.

- B. AC Input Current: The charger unit shall be provided with an ac input current limiting circuit whereby the maximum input current shall not exceed 125% of the output full current rating.
- C. Automatic Restart: Upon restoration of utility AC power, after a utility AC power outage and after a full CELI automatic end-of-discharge shutdown, the CELI shall automatically restart, performing the normal CELI start up.
- D. DC Filter: The charger shall have an output filter to minimize AC ripple voltage into the battery. Under no conditions shall ripple voltage into the battery exceed 2% RMS.
- E. Battery Recharge: The charger shall be capable of producing battery-charging current sufficient enough to recharge the fully discharged battery bank within a 24-hour period. After the battery is recharged, the charger shall maintain full battery charge until the next emergency operation.
- F. Over-voltage Protection: The charger shall be equipped with a DC over-voltage protection circuit so that if the DC voltage rises above the pre-set limit, the charger is to shut down automatically and initiate an alarm condition.

2.07 INVERTER

- A. General: The inverter shall convert dc voltage supplied by the battery to ac voltage of a precisely stabilized amplitude and frequency that is suitable for powering most sophisticated electrical equipment. The inverter output voltage shall be generated by sinusoidal pulse width modulation (PWM). Shall use a high carrier frequency for PWM and a dedicated ac filter circuit consisting of a transformer and capacitors to ensure a very low distortion of the output voltage (THD < 3% on linear loads).
- B. Overload Capability: The inverter during emergency modes shall be capable of supplying current and voltage for overloads exceeding 100% and up to 150% of full load current for 16 line cycles, 115% for 5 minutes.

2.08 DISPLAY AND CONTROLS

- A. Monitoring and Control: The CELI system shall provide operation monitoring and control, audible alarms, and diagnostics. The front-mounted control panel shall include a digital display and a keypad for user interface. The display shall be menu driven. Monitoring and control shall be microprocessor-based for accuracy and reliability. To ensure only authorized personnel can operate the unit, the system shall be multi-level password protected for all control functions and parameter changes.
- B. Self-testing and self diagnostic with Event, Test, and Alarm logs.
- C. Audible Alarm: Audible alarm shall activate with any of the following conditions and automatically store the 75 most recent events.
 - 1. High battery charger voltage
 - 2. Charger Fault
 - 3. High AC input voltage
 - 4. Low AC input voltage
 - 5. Near low battery voltage
 - 6. Low battery voltage
 - 7. Load reduction fault
 - 8. High ambient temperature
 - 9. Inverter fault

10. Output fault
 11. Output overload
 12. Output overload shutdown
 13. System test failure
- D. RS-232 Interface: The system shall be equipped with an RS-232 serial port (DB9) for remote communications.
- E. Manual and Programmable Testing: The system shall incorporate a manual test function and two automatic test modes. The system shall perform a programmable, self-diagnostic monthly test for 5 minutes, and the user shall be able to program the event date and time of day. The yearly self-diagnostic test shall be for 90 minutes and the user shall be able to program the time of the day the event is to take place. The microprocessor shall automatically record the last 75 test events in its own separate test result log.
- F. Battery Assembly: The batteries shall be front access sealed, lead-acid valve regulated battery cells with a one-year full, and nine year prorated warranty. Batteries shall be interconnected via buss bars and cables shall be provided for shelf interconnects where required. A disconnect means shall be included for isolation of battery assembly from the inverter module.
- G. Other System Features
1. Output Circuit Breaker(s): Distribution circuit breakers for output load protection. Protection for the normally on and/or the normally off loads. A maximum of 24 unsupervised 1-pole and a maximum of 15 supervised 1-pole circuit breakers shall be available. All circuit breakers shall be rated for 15,000 AIC. See Drawings for required circuit breakers.
 2. Output Circuit Breaker Trip Alarm: An audible and visual alarm shall activate when an output distribution circuit breaker is open or has tripped.
 3. Dimmer Bypass: Internal relays with individual overload protection circuit breakers that will allow individual dimmed circuits to be used as emergency circuits.
 4. Email/Fax/Voice Modem: The email/fax/voice modem shall be configured to send a system status report via any combination of email, fax, or voice message upon completion of a preprogrammed monthly or yearly test and upon any customer selected alarm condition. Shall meet NFPA requirements. Bi-directional communications shall allow system diagnostics and data retrieval through the RS-232 serial communications port.
 5. Summary Form "C" Contacts: Form "C" contacts rated at 5 amps maximum at 250VAC/30VDC. Dry contacts shall change state when any system alarm activates. Contacts shall change state with the following alarms: High/low battery charger fault, near low battery, low battery, load reduction fault, output overload, high/low AC input volts, high ambient temperature, inverter fault, system test fault, and with optional circuit breaker trip alarm.
 6. Normally Off Dry Contacts: Form "C" contacts rated at 5 amps maximum at 250VAC/30VDC. Dry contacts shall change state when the system transfers to emergency mode.
 7. Maintenance Bypass Switch: This device shall be internally mounted in the system and shall permit maintenance personnel to easily bypass the protected equipment directly to the AC utility power. The make before break switch shall isolate the system to perform routine maintenance or servicing.

PART 3 EXECUTION

3.01 CONCRETE BASE

- A. Provide concrete equipment base for floor-mounted models.
- B. Construct concrete equipment base 6" larger than footprint of cabinets and 3-1/2" tall.
- C. Form concrete base using framing lumber with form-release compounds. Chamfer top edges and corners.

- D. Install reinforcing bars and place anchor bolts and sleeves using manufacturer's installation template, place concrete and allow to cure before installation of equipment.

3.02 INSTALLATION

- A. Clearance: Minimum 36" in front of unit and additional side clearance if required by manufacturer's installation instructions.
- B. Securely mount to wall. Provide backing in wall as required.
- C. All wiring shall be installed in conduit. Input and output wiring shall enter the cabinet in separate conduits.

3.03 IDENTIFICATION

- A. Identify system and components in accordance with Division 16 Section "Electrical Identification."

3.04 FIELD QUALITY CONTROL

- A. Site start-up and testing/commissioning shall be provided by the manufacturer's field service representative during normal working hours (Mon – Fri 8 a.m. – 5 p.m.). Individual scheduling requirements shall be met with 7 working days advance notice. Site testing shall consist of a complete test of the CELI and accessories by the CELI manufacturer in accordance with manufacturer's standards. Manufacturer's approved service representative shall perform commissioning such that two-year warranty applies.
- B. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.05 CLEANING

- A. Upon completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

3.06 DEMONSTRATION

- A. Training: Arrange and pay for the services of a factory-authorized service representative to demonstrate adjustment, operation, and maintenance of the system and to train Owner's personnel.
- B. Conduct a minimum of two hours of training, and schedule training with at least seven days' advance notification.

3.07 REPLACEMENT PARTS

- A. Parts shall be available through Field Service Centers throughout the country. Recommended spare parts shall be fully stocked by local field service personnel with back-up available from manufacturing location.

3.08 MAINTENANCE CONTRACTS

- A. A complete offering of preventative and full-service maintenance contracts including remote system monitoring for both the CELI system and batteries shall be available. An extended warranty and preventative maintenance packages shall be available. Factory-trained service personnel shall perform warranty and preventative maintenance service. A five-year maintenance contract shall include a unit start-up and site testing.

END OF SECTION