**Section 26 33 23**

Centralized Emergency Lighting Inverter

Guide Specification for 525W – 2.2KW Units

(Optional Items in Red)

PART 1 – GENERAL

1.1 Description

This specification defines the electrical and mechanical characteristics and requirements for a stored electrical energy, fast-transfer, emergency lighting inverter unit. The unit as specified herein shall include all the components required to deliver reliable power for emergency illumination and related life safety equipment. The unit shall incorporate a high frequency IGBT PWM charger, IGBT PWM inverter, and the battery backup time as specified. The unit shall have the capability of being field-wired to provide a normally on AC output and a normally off / switched AC output as described Section 2.4 of this specification. An advanced full diagnostic monitor with automatic system testing and a touchscreen color LCD display panel shall continuously advise of unit status and battery condition. A monitored integral output surge protection device (SPD) shall be included to protect emergency lighting loads.

1.2 Standards

The Emergency Lighting Inverter unit shall be designed in accordance with applicable portions of the following standards:

1. American National Standards Institute (ANSI C57.110) (ANSI C62.41 Category B-3)
2. Institute of Electrical and Electronic Engineers (IEEE 519-2014)
3. National Electric Code (NEC 2017 Article 700 – Emergency Systems)
4. National Fire Protection Association (NFPA 70) (NFPA 101 (NFPA 111) (NFPA 99)
5. Underwriters Laboratories (UL 924)
6. Federal Communications Commission (FCC Class A limits, 47 C.F.R. Part 15, Subparts A, B)
7. Listed UL Standards - ANSI/UL 924 Emergency Lighting and Power Equipment rated for 90 minutes, for use in accordance NEC Article 700 (ANSI/NFPA 70), the Life Safety Code (ANSI/NFPA 101), the International Building Code (IBC), and International Fire Code (IFC).

Or specify:

(ANSI/UL 924 Auxiliary Lighting and Power Equipment for other than 90 minutes battery backup time, for use in conjunction with a facility emergency lighting and power system.)

Or specify:

(C-UL listed to CSA C22.2 No. 141-15 Emergency Lighting Equipment rated for 30, 60, or 90 minutes.)

* 1. Submittals

A. Manufacturer Requirements:

1. The manufacturer shall be ISO 9001:2015 “Quality Assurance Certified” and shall upon request furnish certification documents.
2. The manufacturer shall be a United States based manufacturer with 10 years’ experience or greater in design and fabrication of centralized stored electrical energy emergency and standby power systems.

B. Product Data:

1. The manufacturer shall supply documentation for the installation of the unit, including wiring diagrams and cabinet outlines showing dimensions, weights, BTUs, input/output current, input/output connection locations and required clearances.
2. Factory test results shall be provided to show compliance with the requirements.
3. The supplier shall furnish (6) equipment submittal copies. Submittals shall be specific for the equipment furnished and shall include as-built information.

PART 2 – PRODUCTS

2.1 Manufacturers

The equipment specified shall be the FastLITE Model FST centralized emergency lighting inverter unit, manufactured by Trystar.

2.2 Manufactured Units

* + 1. Construction: The unit shall be designed and manufactured to assure maximum reliability, serviceability and performance. The unit controls and breakers shall be accessible through a hinged front door, requiring a hand tool for access. The diagnostic monitor panel display shall be mounted on the front of the unit for easy observation of unit status and battery condition. The unit shall be furnished with an internally located AC input circuit breaker, and one or more AC (output circuit breakers) (fused and monitored output switches) as specified. The battery and DC conductors shall be circuit breaker protected. All conductors and transformer windings shall be copper constructed.

**Engineer’s Note:** Select “output circuit breakers” for 120 VAC and 277 VAC units. Select “fused and monitored output switches” for 347 VAC units.

* + 1. Enclosure: The unit enclosure shall be constructed of steel; powder-coat painted, and designed to meet NEMA 2 standards.
		2. Dimensions: (Floor-mounted units shall not exceed 26.3”W x 11”D x 53”H.) (Wall-mounted units shall not exceed 26.3”W x 11”D x 24”H.)

**Engineer’s Note:** See Engineer’s reference at the end of this specification for output power ratings and battery runtimes specific to floor-mount and wall-mount units. 525W & 750W wall-mounted units are available with an optional 24”H stand for floor mounting of the units.

2.3 Compatibility

The unit shall be designed for LED fixtures / drivers, and compatible with fluorescent ballast fixtures, incandescent lamps, electronic and high power factor fluorescent ballasts, or other approved loads up to the rating of the unit. “Normally On” and “Normally Off / Switched” AC outputs shall be 100% rated and limited only by the unit’s maximum output power rating.

2.4 Modes of Operation

* + 1. Normally On Output: Lighting fixtures dedicated for emergency egress shall be supplied with power derived from the normal AC power input. The Normally On output shall provide power to emergency lighting fixtures during utility present, utility failures, and test modes. The rectifier charger shall also be fed from the normal AC power input, maintain a charge on the batteries, and rated to recharge the batteries within 12 hours for runtimes not exceeding 90 minutes.
		2. Normally Off / Switched Output: Upon the failure or unacceptable deviation of the normal AC power input, the Normally Off output shall become energized and provide emergency power to lighting fixtures which are required to illuminate only in the event of a utility failure and test modes. This output shall also have the capability of being energized by using an external on/off control device (such as a wall switch or occupancy sensor), to apply the nominal AC input voltage source as a signal to energize the Normally Off output. This shall allow the Normally Off output to be switched on/off when utility power is available. During utility failure and test modes (inverter on battery), this on/off control shall be overridden and the Normally Off output shall be energized. In addition, a remote input “command on contact” (normally closed dry contact that opens) shall be capable of automatically energizing the Normally Off output for applications such as a fire alarm, voltage phase loss monitor, and other controls.
		3. Emergency Operation: Upon the failure or unacceptable deviation of the normal AC power input, power shall be supplied to the emergency lighting load by the battery through the inverter. When the normal AC power input is restored, the emergency lighting load shall be reconnected to the Normally On or Normally Off / Switched Output, and the charger shall automatically recharge the batteries. The transfer time to and from battery shall be < 2 msec under any loading conditions.

2.5 Output Power Rating and Battery Runtime

* + 1. The output power rating of the emergency lighting inverter unit shall be (525W) (750W) (1.1kW) (1.44kW) (1.5kW) (1.7kW) (2kW) (2.2kW).
		2. The full load battery runtime shall be (90) (60) (30) (120) minutes.

**Engineer’s Note:** See Engineer’s reference at the end of this specification for output power ratings and battery runtimes specific to floor-mount and wall-mount units.

2.6 Overcurrent Protection

* + 1. Input Breaker Rating: An integral input breaker shall be provided and sized to accommodate full rated load, low line input, and maximum recharge current simultaneously.
		2. Output Overcurrent Protection: An integral (output circuit breaker) (fused and monitored output switch) shall be provided and sized to accommodate full rated load and protect output conductors.

**Engineer’s Note:** Select “output circuit breaker” for 120 VAC and 277 VAC units. Select “fused and monitored output switch” for 347 VAC units.

2.7 Input Specifications

1. Input Voltage: (120 VAC) (277 VAC) (347 VAC).

**Engineer’s Note:** Input and output nominal voltage must be the same.

1. Input Voltage Operating Range: +10%, -10% (programmable down to -15%) from nominal at full load, without battery usage.
2. Frequency Range: 60 hertz +/-5%.
3. System AIC (Amperes Interrupting Current) Rating: (5k AIC) (65k AIC).

2.8 Output Specifications

1. Output Voltage: (120 VAC) (277 VAC) (347 VAC).

**Engineer’s Note:** Input and output nominal voltage must be the same.

1. Voltage Distortion: Maximum 3% THD while on battery, under linear load.
2. Frequency: 60 hertz +/-0.5% under full load while in the battery operation mode.
3. Voltage Regulation: +/-5% from nominal during the full battery discharge, no load to full rated load.
4. Transfer Time (to and from battery): < 2 msec under any loading conditions.
5. On AC Overload Rating: Determined by unit’s input and output CB ratings and trip curves.
6. On Battery Overload Rating: Up to 110% for 2 minutes, 125% for 30 seconds, 150% for 10 seconds, 400% for 4 cycles.
7. LED Inrush Rating: Peak overload capability of 1500% during a current surge of ¼ cycle, when fed from the AC power source or on battery, to accommodate inrush current from LED fixtures/drivers.
8. Efficiency On AC Power: Up to 98.8%.
9. Output Power Rating: KVA at 1.0 power factor (unity). KVA = KW

2.9 Battery Specifications

1. Battery time: (90 minutes) (30 minutes) (60 minutes) (120 minutes) ( \_\_ minutes) at full rated output.
2. Battery Type: Integral, valve regulated, sealed lead acid, maintenance free.
3. Charger: 3-stage, 3.5 amps, temperature compensated.
4. Recharge Time: 12 hours recharge for runtimes not exceeding 90 minutes. UL 924 and CSA compliant.
5. Battery Voltage: 96VDC or 108VDC, dependent on output wattage rating and runtime.

2.10 Environmental Specifications

1. Operating Temperature: UL, C-UL 924 listed at 20°C to 30°C.
2. Unit (without battery) Storage Temperature: -20°C to 50°C.
3. Battery Storage Temperature: 25°C for 6 months. For each 9°C rise, reduce storage time by half.
4. Relative Humidity: 0 to 95% non-condensing.
5. Elevation: 6,600 feet (2,000 meters) without derating.
6. Audible Noise Level: Not greater than 45 dba at 3 feet.
7. BTU/HR: Not to exceed (\_\_\_).

**Engineer’s Note:** See Engineer’s reference at the end of this specification for BTU/HR.

2.11 Advanced Display Monitor and Diagnostics

Display Monitor: Unit shall include a local, front mounted, sealed, touch screen, color 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. (Output SPD specified shall include status indication on the display, as well as from a separate LED mounted on the unit enclosure. The LED shall illuminate green when the SPD is operational and turn red if the SPD has failed.)

* + 1. Electrical Parameters – The monitor shall display the following electrical parameters:

Input Voltage

Input Frequency

Output Voltage

Output Frequency

Output Current

Output VA

Output Watts

Output Power Factor

Output Percent Load

Battery Voltage

Battery Charger Current

Minutes On Battery

* + 1. Alarm Conditions – The monitor shall display the following status and alarm conditions:

Input Voltage Out of Range

Output Over Voltage

Output Under Voltage

Output VA High (output overload)

Output VA Low On Battery Test

Output Frequency Out of Range

Battery Voltage High

Battery Charger Current 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

Weekly Diagnostic Fail

Output SPD Fail

Battery Test Pass

Battery Test Fail

* + 1. Operational Conditions – The monitor shall display the following operational conditions:

System Normal

System Alarm

Power to Load – Battery Backup Not Available

Battery Time Remaining (expressed in hours and minutes)

Battery Test In Process (including a “countdown” of time remaining in test)

Off Bus Connecting

Off Bus Returning

* + 1. User-Programmable Set Points – The monitor shall allow for the following programmable set points:

Alarm thresholds

Low output VA level referenced during periodic and annual battery testing to verify egress lighting integrity

Off bus transition delays (On delay 0 to 10 seconds; Off delay 0 to 15 minutes)

Date and time of periodic battery test in compliance with NFPA 101 and C22.2, No. 141-15

Date and time of annual battery test in compliance with NFPA 101 and C22.2, No. 141-15

* + 1. Periodic Testing – The monitor shall incorporate system diagnostics and provide for automatic and manual testing of the system/batteries as follows:
1. Feature a factory-set 5 minute battery discharge test every 30 days or 90 days for a 60 minute, 90 minute, or 120 minute runtime, or a 1 minute test for a 30 minute runtime. Feature a user-programmable (enable/disable) annual battery discharge test, factory-set for 30, 60, 90, or 120 minutes. Dates and times of tests shall be user-programmable.
2. Report the battery test results with a pass/fail indication, time and date stamped, via the local monitor display and via optional network communications (remote monitoring).
3. During the battery test, the monitor shall perform a user-programmable egress lighting integrity test. The egress lighting integrity test shall measure the VA load on the output of the system, and if the output load falls below the customer defined value, the inverter shall provide an audible and visual alarm to indicate fixture maintenance or component replacement.
4. A manual, proprietary password protected “Push to Test” feature shall be provided to initiate NFPA 101-compliant system test. An “Abort Test” feature shall be included.
	* 1. Data-Logging – The monitor shall provide the following data-logging:
5. Maintain a historic log that sequentially records up to 25 battery tests which indicate time, date and pass/fail results. The log shall be made available through the local monitor display and via optional network communications (remote monitoring).
6. Maintain a historic log that sequentially records 50 of the most recent alarms, indicating the time and date of abnormal occurrences. The log shall be made available through the local monitor display and via optional network communications (remote monitoring).
7. By plugging in a computer to the unit’s USB port, the battery test log (up to 25 battery test results) and alarm event log (up to 250 alarm events) shall be able to be viewed and electronically saved as a report document to comply with NFPA 101, section 7.9.3.1.3.
	* 1. Weekly Self-Diagnostic – In addition to NFPA 101- and CSA-mandated periodic and annual testing, the unit shall perform a weekly no load test of the inverter, without use of the battery. During this test, no alarm or indication shall be given unless the inverter test fails. If it fails, the unit shall alarm, general alarm contacts shall switch state, and the fault shall be logged. After a test takes place or the unit goes to battery for any reason, the next test shall automatically happen 7 days later.
		2. Optional Network Communications (Remote Monitoring): Unit shall include remote monitoring and reporting of electrical parameters, system status, alarms, event logs, and automatic battery pass / fail test results with time and date stamp via the following protocols: (Ethernet TCP/IP or MODBUS TCP or BACnet/IP ) (MODBUS RTU or ASCII over RS485, or BACnet MS/TP). The desired protocol shall be user selectable (password protected) from the Intellistat’s display. A serial communication connection and Ethernet connection shall be included when this option is ordered.

2.12 Relay Communications Interface

1. Form C “General Alarm” relay contacts shall be provided for remote monitoring. Contact ratings shall be 120 VAC @ .5amps. General alarm contacts shall switch states given any of the following alarm conditions: on battery, low battery, check battery, over temperature warning, charger failure, unit fault, output overload, (SPD failure,) and weekly self-diagnostic failure.
2. Form C “Battery Test Active” contacts shall be provided that switch state during automatic or manual battery testing. The normally closed contact shall be capable signaling one or more UL924 listed shunt relays to bypass local control devices during periodic and annual NFPA-mandated tests, in order to provide emergency power to designated emergency lighting fixtures.

2.13 Accessories (Optional Equipment)

* + 1. Output Breakers (120 VAC) (277 VAC): Include a quantity of (2) (3) (4) (5) (6) (7) (8) (9) (10) pre-installed, (10) (15) (20) (30) amp, single pole, output circuit breakers wired to the (normally on AC output) (normally off / switched AC output).

* + 1. Monitored Output Breakers (120 VAC) (277 VAC): Include a quantity of (2) (3) (4) (5) (6) pre-installed, (10) (15) (20) (30) amp, single pole, output circuit breakers wired to the (normally on AC output) (normally off / switched AC output).

**Engineer’s Note:** Units are provided standard with one (1) output circuit breaker. Input and output breaker(s) comply with selective coordination. See Engineer’s reference at the end of this specification for standard input breaker and output breaker amperage ratings. The amperage rating of any individual output breaker specified cannot exceed the amperage rating of the input breaker.

* + 1. Monitored, Fused Output Switches 347 VAC: Include a quantity of (2) (3) pre-installed, (6) (10) amp fused, single pole, output switches wired to the (normally on AC output) (normally off / switched AC output).

**Engineer’s Note:** Units are provided standard with one (1) fused output switch that is monitored. Units 525W to 1.5kW are fused at 6 amps. Units 1.7kW to 2.2kW are fused at 10 amps. The standard input breaker provided is rated for 15 amps. The selected input breaker and output fuse(s) comply with selective coordination.

* + 1. Output SPD: Include an output SPD with a peak surge current capacity rating of 40kA, UL 1449 4th Edition. The SPD provided shall have a nominal discharge current rating of 20kA, and a short circuit current rating (SCCR) of 100kA. The SPD shall include a fault indicator window and remote signaling of disconnection for use with the lighting inverter’s SPD failure indicator and audible alarm. An SPD status indicator (LED) shall be mounted on the front of the unit enclosure. The LED shall illuminate green when the SPD is operational and turn red if the SPD has failed. The SPD failure shall also be indicated on the touchscreen display, and logged as an alarm event viewable from the display.

**Engineer’s Note:** An SPD should be specified when 2 or more output CBs or fused switches are selected.

2.14 Serviceability

The unit’s power section, including all control cards and system electronics, shall be front-accessible and located behind a secure hinged access door. The inverter cabinet shall be provided with a protective dead front panel that allows the operation of the AC and DC breakers while preventing physical contact with live electrical connections. The optional SPD module’s fault indicator window shall be seen without removing the dead front panel. A DC circuit breaker shall be provided for overcurrent protection, and also serve as a disconnect to facilitate rapid replacement of the batteries via the front of the unit enclosure. No side or rear access shall be required. To facilitate inverter diagnostics and programming, a USB communications port shall be provided for access to electrical measurements, system set points, and system logs. This USB port shall be located behind the unit’s secure hinged front door and accessible without removing the cabinet’s protective dead front panel. The inverter diagnostics and programming shall also be accessible via the Intellistat’s touchscreen display.

2.15 Warranty

1. All power components and system electronics shall be guaranteed to be free from defects in material and workmanship for a period of 2 years following shipment from the factory.
2. Batteries shall be warranted for 1 year full replacement, 9 years prorated.

**Engineer’s Note:** Extended warranty and maintenance contracts are available and may be specified. Consult factory for details. A factory-authorized start up may be specified, after which a (2 year parts and first year) (2 year parts and 2 year) (3 year parts and 3 year) on-site labor warranty may be specified.

End of Guide Specification

(See Engineer’s Reference next pages)

Engineer’s Reference

* + 1. Output Power Ratings and Battery Runtimes:

|  |  |  |
| --- | --- | --- |
|   | Floor-Mounted Units | Wall-Mounted Units |
| kW | Runtime (Minutes) | Runtime (Minutes) |
| .525\* | 90/30/60/120 | 90/30/60 |
| .750\* | 90/30/60/120 | 90/30/60 |
| 1.1 | 90/30/60/120 | 30/60 |
| 1.44 | 90/30/60/120 | 30 |
| 1.5 | 90/30/60/120 | 30 |
| 1.7 | 90/30/60/120 | 30 |
| 2 | 90/30/60/120 | N/A |
| 2.2 | 90/30/60/120 | N/A |

\*525W and 750W wall-mounted units with runtimes up to 90 minutes are available with an optional 24”H stand for floor-mounting. All other models are available in the standard floor-mount cabinet.

* + 1. Weights:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | Floor-Mounted Units |   |   | Wall-Mounted Units |
| kW | 90 Min.  | 30 Min.  | 60 Min. | 120 Min. |   | kW | 90 Min.  | 30 Min.  | 60 Min. |
| .525 | 236\* | 160\* | 178\* | 292 |   | 0.525 | 216 | 140 | 158 |
| .750 | 236\* | 160\* | 236\* | 292 |   | 0.75 | 216 | 140 | 216 |
| 1.1 | 305 | 210 | 268 | 355 |   | 1.1 | N/A | 158 | 216 |
| 1.44 | 355 | 268 | 305 | 452 |   | 1.44 | N/A | 216 | N/A |
| 1.5 | 355 | 268 | 305 | 452 |   | 1.5 | N/A | 216 | N/A |
| 1.7 | 385 | 268 | 331 | 452 |   | 1.7 | N/A | 216 | N/A |
| 2 | 490 | 283 | 355 | 490 |   |   |   |   |   |
| 2.2 | 490 | 283 | 355 | 630 |   |   |   |   |   |

\*These 525W and 750W unit weights reflect wall-mounted units with an optional 24”H stand required for floor-mounting. Above weights reflect 120V models. Add 18 lbs. for 277V and 347V models.

* + 1. Input Breaker Rating: D. Output Overcurrent Protection:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | Input Breaker Amperage |   |   | Output Overcurrent Protection |
| kW | 120 VAC | 277 VAC | 347 VAC |   | kW | 120 VAC | 277 VAC | 347 VAC |
| .525 | 15A | 10A | 15A |   | .525 | 15A | 10A | 6A |
| .750 | 15A | 10A | 15A |   | .750 | 15A | 10A | 6A |
| 1.1 | 20A | 10A | 15A |   | 1.1 | 15A | 10A | 6A |
| 1.44 | 30A | 15A | 15A |   | 1.44 | 15A | 15A | 6A |
| 1.5 | 30A | 15A | 15A |   | 1.5 | 20A | 15A | 6A |
| 1.7 | 30A | 15A | 15A |   | 1.7 | 20A | 15A | 10A |
| 2 | 35A | 15A | 15A |   | 2 | 30A | 15A | 10A |
| 2.2 | 35A | 15A | 15A |   | 2.2 | 30A | 15A | 10A |

 Note: Circuit Breakers use at 120 VAC and 277 VAC.

 Monitored fused switches used at 347 VAC.

* + 1. BTU / HR:

|  |  |
| --- | --- |
|   | BTU/HR |
|   | 120 VAC | 277 VAC & 347 VAC |
| kW | Normal Mode | Battery Mode | Normal Mode | Battery Mode |
| 0.525 | 61 | 316 | 85 | 341 |
| 0.75 | 65 | 416 | 92 | 451 |
| 1.1 | 68 | 611 | 92 | 662 |
| 1.44 | 78 | 799 | 92 | 867 |
| 1.5 | 78 | 833 | 92 | 903 |
| 1.7 | 85 | 944 | 92 | 1023 |
| 2 | 89 | 970 | 92 | 1070 |
| 2.2 | 92 | 1000 | 96 | 1100 |

Note: Above BTU’s / Hour reflect models with the highest heat output.