**Section 26 33 23**

Three Phase Centralized Emergency Lighting Inverter

 Guide Specification for 58.5KW – 112.5KW Systems

 (Optional Items in Red)

PART 1 - GENERAL

1.1 Description

This specification defines the electrical and mechanical characteristics and requirements for a three phase uninterruptible emergency power supply system. The system as specified herein includes all the components required to deliver reliable, high quality uninterruptible power for emergency lighting illumination and related life safety equipment. The system shall incorporate an on-line, dual conversion, microprocessor DSP controlled, high frequency, IGBT PWM input PFC converter and output inverter. A high speed automatic static bypass switch, battery charger, and an energy storage battery platform shall be included, as well as all the related hardware components and software to facilitate a functional centralized system with automatic system testing. An advanced diagnostic monitor with LCD display shall continuously advise of system status and battery condition. The emergency power supply system shall provide protection from power interruptions, as well as power line disturbances when in on-line mode.

The system shall have the capability to operate in an on-line mode to provide an isolated, voltage regulated power source, or in standby-on mode (ECO-mode) for increased operating efficiency. A smart active mode shall be available to automatically define whether to operate in on-line or standby-on mode based on the quality of the incoming power source. In addition, a standby-off mode shall be available for compatibility with normally off emergency lighting fixtures. Each mode of operation shall be user-selectable via the inverter’s LCD display panel.

1.2 Standards

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

1. American National Standards Institute (ANSI C57.110)
2. American National Standards Institute (ANSI C62.41 Category B-3)
3. Institute of Electrical and Electronic Engineers (IEEE 519-1992)
4. National Electrical Manufacturers Association (NEMA PE 1-2003)
5. National Electric Code (Latest Revision of NEC Article 700 – Emergency Systems)
6. National Fire Protection Association (NFPA 70) (NFPA 101) (NFPA 111) (NFPA 99)
7. NFPA 101 Section 7.9.3.1.2 – Periodic Testing of Emergency Lighting Equipment
8. FCC Part 15, Subpart J, Class A
9. Listed UL Standard: ANSI/UL 924 Emergency Lighting and Power Equipment rated with 90 minutes of battery backup time, for use in accordance with NEC Article 700 (ANSI/NFPA 70), the Life Safety Code (ANSI/NFPA 101), and the International Building Code (IBC).

Or specify:

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

(C-UL listed to CSA C22.2, No. 141-15, Emergency Lighting Equipment with 30, 60, or 90 minutes of battery backup time.)

Inverter systems shall be seismic-rated and tested in accordance with applicable portions of the following additional standards:

1. ICC - AC156: “Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components and Systems”
2. ASCE 7-10
3. International Building Code – IBC 2015
	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 have 15 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 system, including wiring diagrams and cabinet outlines showing dimensions, weights, BTUs, input/output current, input/output connection locations and required clearances.
2. The supplier shall furnish (6) equipment submittal copies. Submittals shall be specific for the equipment furnished and shall include as-built information.
3. The manufacturer shall supply a seismic testing certificate of compliance to validate that the system was shake-table tested and met the code requirements specified.

PART 2 - PRODUCTS

2.1 Manufacturers

The equipment specified shall be the TrueLITE Model ELS centralized emergency lighting inverter system, supplied by Trystar.

2.2 Manufactured Units

* + 1. The system shall be designed and manufactured to assure maximum reliability, serviceability and performance. All control devices and system electronics shall be accessible via the front of the inverter cabinet for rapid service or replacement. The system’s advanced monitor shall be mounted on the front of the inverter cabinet for easy observation of system status, electrical measurements and battery condition. The system shall be furnished with input and output power switches, a static bypass input switch, and a mechanical bypass switch. System batteries shall be provided in a separate standalone front access battery cabinet or cabinets. The batteries and DC conductors shall be DC circuit breaker protected. Cabinets shall be floor mounted, constructed of steel, powder-coated, and NEMA 1 rated for indoor use. The inverter controls and switches shall be front accessible through a hinged, key lockable door. The inverter cabinet shall be provided with a protective dead front panel that allows the operation of all switches, including the mechanical bypass, while preventing physical contact with live electrical connections. Seismic-rated inverters shall be provided with floor mounting brackets.
		2. The system shall operate in accordance with requirements as specified herein to support any combination of LED lighting, fluorescent ballast fixtures, incandescent lamps, electronic and high power factor fluorescent ballasts, quartz re-strike HID fixtures, halogen, or other approved loads up to the output rating of the system. The AC output of the inverter shall be 100% rated in all modes, and limited only by the system’s maximum KVA/KW output rating.

2.3 Modes of Operation

* + 1. ON-LINE MODE
1. Normal Operation: The load shall be supplied with regulated power derived from the normal AC power input terminals through the input PFC AC/DC converter and output DC/AC inverter. A full load rated DC/DC battery charger shall be used to charge the batteries.

1. Uninterrupted Emergency Operation: Upon the failure or unacceptable deviation of commercial AC power, power shall be supplied by the battery through the output DC/AC inverter and shall continue to supply power to the load without transfer loss or disturbance. When power is restored at the AC input terminals of the system, the input AC/DC PFC converter shall supply power to the load through the output DC/AC inverter. Simultaneously, the DC/DC battery charger shall recharge the batteries. There shall be no break or interruption of power to the load upon failure or restoration of the commercial AC power.
2. Automatic Bypass: The system shall include an automatic static bypass for fault clearing, instantaneous overload conditions that exceed specified levels, and/or to connect the load to the bypass power source in the event of a system fault or failure. The static bypass switch shall transfer the load from the inverter output to the bypass power source under the following conditions.
3. Output overload capacity exceeded
4. Inverter failure
5. Over temperature
6. DC voltage out of limits
7. Transfer to static bypass manually initiated
8. Automatic Bypass Inhibited: The static bypass switch shall not transfer the load from the inverter output to the bypass source if that source is not within limits when a fault condition occurs. If the bypass source is out of limits, factory set at +10%, -15% (adjustable to +/-15%) of nominal voltage and +/-5% (adjustable from

+/-1% to +/-6%) of nominal frequency, the inverter system shall shut down and an alarm shall sound.

1. Automatic Retransfer from Bypass: The retransfer of the load from the bypass power source to the inverter output shall be automatically initiated when the voltage and frequency of the inverter are within acceptable limits and capable of assuming the load.
2. Automatic Retransfer Inhibited: The retransfer of the load from the bypass power source to the inverter output shall be inhibited if any of the following conditions exist.
	1. Inverter output not in sync range with bypass power source
	2. Voltage difference between inverter output and bypass power source exceeds limits
	3. Inverter system failure
3. Load current exceeds output rating of the inverter

* + 1. STANDBY-ON MODE (ECO-MODE)
1. Normal Operation: The load shall be supplied with power from the static bypass source as long as the AC power is within preset voltage and frequency limits. An operating efficiency of up to 98.5% shall be achieved. In this mode, the normal AC power input shall feed the AC/DC converter, and the DC/DC battery charger shall be used to keep the batteries charged.
2. Emergency Operation: Upon the failure or unacceptable deviation of power from the static bypass source, power shall be supplied by the battery through the output DC/AC inverter, and shall continue to supply power to the load. When power is restored to the static bypass source and within preset voltage and frequency limits, the load shall return to being powered from the static bypass source. Simultaneously, the DC/DC battery charger shall recharge the batteries. There shall be no more than a 2-5 msec switching time at the inverter output upon failure or restoration of the static bypass power source.
	* 1. SMART ACTIVE MODE

Smart active mode shall automatically define whether to operate in standby-on (eco-mode) or on-line mode based on the quality of the incoming power source. Smart Active mode shall allow for an operating efficiency of up to 98.5%, as long as the incoming power source is within preset limits and stable.

1. Standby-On Operation: The load shall be supplied with power from the static bypass source as long as the AC power is within preset voltage and frequency limits. An operating efficiency of up to 98.5% shall be achieved. In this mode, the normal AC power input shall feed the AC/DC converter, and the DC/DC battery charger shall be used to keep the batteries charged. If the static bypass source preset voltage or frequency limits are exceeded, but power to the input PFC AC/DC converter is acceptable, the system shall transfer to on-line mode.
2. On-line Operation: The load shall be supplied with regulated power derived from the normal AC power input terminals through the input PFC AC/DC converter and output DC/AC inverter. A full load rated DC/DC battery charger shall be used to charge the batteries. The static bypass source shall then be monitored for a defined timeframe (programmable 30 seconds to 4 minutes). If during this time, the voltage and frequency have remained within the preset limits, the system shall transfer to standby-on mode; otherwise the system shall remain in on-line mode while the static bypass source continues to be monitored. If 2 or more out of limit events occur within the defined timeframe, the system shall remain in on-line mode for 60 minutes from the time of the last out of limit event.
3. Emergency Operation: Upon the failure or unacceptable deviation of commercial AC power, power shall be supplied by the battery through the output DC/AC inverter and shall continue to supply power to the load. When power is restored at the AC input terminals of the system, the system shall operate in on-line mode for the defined timeframe. When the static bypass source is within preset voltage and frequency limits, the load shall be transferred to standby-on operation.
	* 1. STANDBY-OFF MODE

Standby-off mode shall be used when the output of the inverter is meant to be normally off. It shall be selected if exclusively feeding normally off emergency lighting that is only meant to be energized in the case of a power outage.

1. Normal Operation: When present, the normal AC power input shall feed the AC/DC converter, and the DC/DC battery charger shall be used to keep the batteries charged. However, the output DC/AC inverter shall be switch off and no power shall be supplied to the load. This provides compatibility with normally off emergency lighting loads.
2. Emergency Operation: Upon the failure or unacceptable deviation of commercial AC power, the AC/DC converter shall be switched off and the output DC/AC inverter shall be switched on within 200 msec. Power shall then be supplied by the battery through the output DC/AC inverter to provide emergency power to normally off emergency lighting loads. When power is restored at the AC input terminals of the system, the AC/DC converter shall be switched on, and the output DC/AC inverter shall be switch off. Simultaneously, the DC/DC battery charger shall recharge the batteries.

2.4 Inverter Restart

* + 1. Automatic Restart: If the loss of AC input power exceeds the available battery run time, a low battery shutdown shall occur to protect the batteries. When automatic restart is enabled, the inverter shall automatically restart once the AC input power returns and is within acceptable voltage and frequency limits.

* + 1. Manual Restart: When manual restart is enabled, the inverter system shall require a manual restart from a shutdown resulting from the following events.
1. Remote or local emergency power off activated
2. Inverter system failure
3. Low battery shutdown, if manual restart option is selected

2.5 Manual Bypass Operation

* + 1. Internal Bypass Switch: The inverter system shall include a standard internal mechanical bypass switch. This bypass switch shall be physically connected in parallel with the static bypass switch, but it shall be operated via rotation of a manual handle, accessible behind the front door of the inverter enclosure. Rotating the bypass switch handle shall invoke the inverter’s static bypass prior to the switch being in the bypass position. Once in bypass, the inverter can be completely shut down without interrupting power to the load. The system’s input and output power switches, static bypass input switch, and battery disconnect breakers can be opened to fully isolate the inverter system. When the load is supplied from the AC input power source through the bypass switch, the AC supply terminals shall remain energized to permit operational checking of the system. Returning to normal mode shall be accomplished by first closing the input and output power switches, and static bypass input switch. The bypass switch can then be returned to its open position, and the system’s battery disconnect breakers closed.
		2. Make-Before-Break, Wall-Mounted Maintenance Bypass: Anexternal, wall-mounted, 3-circuit breaker wrap-around maintenance bypassshall be provided for field installation, allowing for a make-before-break transition. The main functional components of the maintenance bypass shall be 3 circuit breakers that are used as disconnect switches. The 3 breakers shall be defined as the inverter input breaker [UIB], maintenance bypass breaker [MBB], and maintenance isolation breaker [MIB]. During normal operation, the UIB shall be closed and supply power from the utility source to the bypass input of the inverter. The MIB shall also be closed and connect the output of the inverter to the load. The MBB shall be open. When in maintenance bypass, the MBB shall be closed and the MIB shall be open. This shall connect the load directly to the utility power source and isolate the load from the output of the inverter system. To service the system, the UIB breaker shall be opened to remove power from the inverter input. There shall be signals that support an interlock function to prevent the MBB from being closed unless the MIB is open or the inverter is in bypass mode. A Kirk Key interlock system shall protect the breakers. In addition, an SKRU [solenoid key release] shall be provided for added security. The maintenance bypass shall have a (14K) (35K) (65K) AIC rating. (Adjustable electronic trip circuit breakers shall be provided.)

**Engineer’s Note:** See Engineer’s Reference at the end of this specification for circuit breaker types and ratings.

2.6 Output Power Rating

System Power Output Capability: The stored emergency power supply system output power rating shall be (58.5kW) (72kW) (90kW) (112.5kW).

2.7 Battery Backup Time

Battery Time Reserve Capacity: Battery shall be capable of producing emergency power for (30) (60) (90) (120) minutes at full rated watts.

 2.8 Input Specifications

1. Input Voltage: 480/277 VAC, three phase (wye), 60Hz.

**Engineer’s Notes:** See Engineer’s Reference at the end of this specification for recommended input circuit breaker ratings. If an output neutral is not required, the input / output may be 480 VAC, three phase (delta), 60Hz.

1. Input Configuration: (Single input feeding the AC/DC converter and static bypass) (Dual input with one source feeding the AC/DC converter and a second source feeding the static bypass input).

**Engineer’s Note:** In a dual input configuration, the AC/DC converter input connection does not require a neutral conductor.

1. Input Voltage Operating Range: +15% to -10% at full load without battery usage. +15%, -30% voltage tolerance, load dependent or with battery assistance.
2. Frequency Range: 57 hertz to 63 hertz.
3. Power Factor: 0.99 at nominal voltage and battery charge from 25% to 100% of the load.
4. Input Current Harmonics: < 3% THD (total harmonic distortion) at 100% load.
5. Rectifier Power Walk-In: Progressive from 0 to 30 seconds (programmable). Factory preset at 5 seconds.
6. Rectifier Power Walk-In Start Delay: Progressive from 0 to 120 seconds (programmable). Factory preset at 0 seconds.

2.9 Output Specifications

1. Output Voltage: 480/277 VAC, three phase (wye), 60Hz.

**Engineer’s Notes:** See Engineer’s Reference at the end of this specification for recommended output circuit breaker ratings. If an output neutral is not required, the input / output may be 480 VAC, three phase (delta), 60Hz.

1. Frequency: 60 Hz, +/- 0.05% when free running (on battery).
2. Line Synchronization Range: 60 Hz, +/- 5% (adjustable from +/-1% to +/-6%) with inverter synchronized to bypass input.
3. Slew Rate: 1 Hz/second
4. Voltage Regulation: +/-1% with balanced load; +/-3% with 100% unbalanced load.
5. Voltage (Step Load) Response: +/- 5% for a 100% step load change.
6. Voltage Recovery Time: 20 msec to within +/-1% of nominal output voltage.
7. Voltage Distortion: 2% THD maximum with linear load; 3% THD with non-linear load.
8. Crest Factor (Ipeak/Irms): 3:1
9. Phase (Angle) Imbalance: 120° +/- 1°
10. Output Power Rating: KVA at 1.0 power factor (unity). KVA = KW
11. Load Power Factor Range Permitted: 0.7 leading to 0.7 lagging (not exceeding full kVA/KW output rating).
12. Overload Rating (without use of static bypass): Up to: 110% for 60 minutes, 125% for 10 minutes, 150% for 1 minute.
13. Short Circuit Current (On Battery): 180% phase to phase for 1 second with current limiting, 300% phase to neutral for 1 second with current limiting.
14. LED Inrush Rating (without use of static bypass): Peak overload capability of 1200% 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.
15. Efficiency: On-Line Mode 93%; Standby-On / Smart Active Mode 98.5%.

2.10 Battery Specifications

1. Battery Time:

(90 minutes at full rated kilowatt output, listed ANSI/UL 924 Emergency Lighting and Power Equipment.)

(30) (60) (120) minutes at full rated kilowatt output, listed UL 924 Auxiliary Lighting and Power Equipment.)

(30) (60) (90) minutes at full rated kilowatt output, listed C-UL to CSA C22.2, No. 141-15 Emergency Lighting Equipment.)

**Engineer’s Note:** Consult factory for other C-UL listed battery run times.

1. Battery Type: Integral, valve regulated, sealed lead acid, maintenance free.
2. Charger: 3-stage, temperature-compensated, smart charge.
3. Recharge Time: 24 hours recharge for runtimes not exceeding 90 minutes, UL 924 and CSA compliant.
4. Bus Voltage: 480VDC.

2.11 Environmental Specifications

1. Operating Temperature:

(20°C to 30°C for ANSI/UL 924 Emergency Lighting and Power Equipment listed 90 minute models.)

(20°C to 30°C for (30) (60) (90) minute models C-UL listed to CSA C22.2 No. 141-15, Emergency Lighting Equipment.)

(0°C to 40°C for models listed to UL 924 Auxiliary Lighting and Power Equipment, UL 1778, and C-UL listed to CSA C22.2 No.107.1-0. Maximum temperature shall be 40°C for 8 hours a day; 35°C average temperature for 24 hours. Optimum battery performance and life shall be achieved at 25°C.)

1. Inverter Storage Temperature: -20°C to 50°C.
2. Battery Storage Temperature: 25°C for 6 months before charging is required. For each 9°C rise, reduce storage time by half.
3. Relative Humidity: < 95% non-condensing.
4. Elevation: 0 to 1000 meters (3,281ft). Systems installed at elevations greater than 1000 meters require de-rating of 1% for each 100 meters between 1000 and 4000 meters.
5. Audible Noise Level (ECO-mode): (< 65) (< 68) dba at 1 meter.

**Engineer’s Note:** Specify < 65 dba for 58.5kW – 90kW models, or < 68 dba for 112.5kW model.

2.12 Mechanical

Cabinet Dimensions (Bottom Cable Entry): (71.5”W x 33.5”D x 78.7”H) (111.5”W x 33.5”D x 78.7”H) (163.5”W x 33.5”D x 78.7”H) (203.5”W x 33.5”D x 78.7”H)

**Engineer’s Note 1:** Specify dimensions using guide below.

|  |  |  |  |
| --- | --- | --- | --- |
| 90 Minute Runtime | # of Battery Cabinets |  | Total Weight |
| 58.5kW: 111.5”W x 33.5”D x 78.7”H | 2 |  | 10,460 |
| 72kW: 163.5”W x 33.5”D x 78.7”H | 3 |  | 15,210 |
| 90kW: 163.5”W x 33.5”D x 78.7”H  | 3 |  | 15,320 |
| 112.5kW: 203.5”W x 33.5”D x 78.7”H | 4 |  | 19,932 |
|  |  |  |  |
| 60 Minute Runtime |  |  |  |
| 58.5kW: 111.5”W x 33.5”D x 78.7”H | 2 |  | 8,540 |
| 72kW: 111.5”W x 33.5”D x 78.7”H | 2 |  | 10,460 |
| 90kW: 163.5”W x 33.5”D x 78.7”H  | 3 |  | 12,440 |
| 112.5kW: 163.5”W x 33.5”D x 78.7”H | 3 |  | 15,452 |
|  |  |  |  |
| 30 Minute Runtime |  |  |  |
| 58.5kW: 71.5”W x 33.5”D x 78.7”H | 1 |  | 5,980 |
| 72kW: 71.5”W x 33.5”D x 78.7”H | 2 |  | 7,190 |
| 90kW: 111.5”W x 33.5”D x 78.7”H  | 2 |  | 8,650 |
| 112.5kW: 111.5”W x 33.5”D x 78.7”H | 2 |  | 10,702 |

**Engineer’s Note 2:**

A field-installed DC landing cabinet is included whenever 3 or 4 battery cabinets are provided, and reflected in the above dimensions and weights. The DC cable connections from each battery cabinet’s circuit breaker are landed on the positive and negative bus bars within the landing cabinet. A single DC connection is then made from the landing cabinet to the inverter’s DC input.

An optional 12” wide side cabinet is available for installations requiring top cable entry.

Enclosure: Powder-coat painted steel construction, NEMA 1 rated for indoor installation.

2.13 Control Panel and Display Monitor

Control Panel: The control panel located on the front of the inverter shall be used to monitor and control all the parameters of the system. The operating status of the inverter shall be shown on a liquid crystal display (LCD), with two rows of 40 characters. In addition, status LEDs shall be provided with three operating states: On (steady), On (flashing), and Off. The LED status indications shall include main input power present, bypass input power present, output normal, on battery, on bypass, and alarm condition. Eight (8) function selection keys shall be provided below the display for easy navigation through display screens.

Display Monitor: A wide graphic display shall be located on the inverter door, which allows the user to have a close-up, detailed overview of the inverter status in real-time, and shall feature a one-line operational diagram. The user shall be able to switch the inverter on and off, view electrical parameters and battery measurements, and access user-programmable settings. The display shall indicate operational status and alarm messages, % load, % battery charge, audible alarm status, and identify the model inverter and rated kVA.

* + 1. Emergency Power Off (EPO) – A guarded EPO push button shall be standard and located directly below the control panel and display monitor.

Electrical Parameters – The three phase monitor shall display the following electrical parameters:

Input Voltage L-N (% of rated voltage)

Input Voltage L-L

Input Frequency

Input Current (% of rated current)

Input Bypass Voltage L-N, L-L

Output Voltage L-N, L-L

Output Frequency

Output Current (% of rated current)

Output Peak Current (% of rated current)

Output Watts (% of rated watts)

Battery Voltage

Battery Charge/Discharge Current

Sinewave view of the following signals :

Input Current /Output Current

Input Voltage/ Output Voltage

Temperature Measurements – The three phase monitor shall display the following temperature measurements:

System Board Temperature

Rectifier Heatsink Temperature

Inverter Heatsink Temperature

Battery Cabinet Temperature

Event/Alarm Messages – The three phase monitor shall display the following status and event/alarm messages:

Disturbance On Bypass Line

Manual Bypass Switch Closed

Incorrect Bypass Voltage (or static bypass input switch is open)

Incorrect Voltage Supply (to main input, or input power switch is open)

Low Battery Warning (adjustable)

Battery Test Active

Battery Test Passed

Battery Test Failed

Battery Supply Voltage Low (factory preset limit)

Output Overload

Internal Fault (fault code provided)

Load Temporarily On Bypass (due to inrush current or inverter startup)

Load On Bypass Due To Output Overload (steady state)

Bypass Command Active (static bypass manually initiated)

Remote Bypass Command Active (static bypass remotely initiated)

Over Temperature Warning (or fan failure)

High Battery Temperature

Input Phase Sequence Incorrect

Missing Output Voltage (no voltage present, or output power switch and bypass switch are open)

Inverter Service Required

Battery Service Required

Operational Conditions – The three phase monitor shall display the following operational conditions:

System Normal

System Alarm

System On Battery

Battery Test Active

Mode of Operation (on-line, standby-on / smart active, standby-off )

System in Manual Bypass

System in Static Bypass

System Off

Operational History – The three phase monitor shall display the following historical operating conditions:

Hours of Normal Operation

Hours of Operation On Bypass

Time Spent Operating On Battery

Number of Battery Discharges

Number of Battery Full Discharges

System Control – The three phase monitor shall allow for the following system control via the control panel:

Start Up

Shutdown

User-programmable Set Points – The three phase monitor shall allow for the following user-programmable settings:

Bypass voltage and frequency range

Mode of operation selection: on-line, standby-on / smart active, standby-off

Voltage and frequency range for eco-mode (standby-on / smart active) operation

Low battery warning (minutes remaining)

Time and date of periodic battery test in compliance with NFPA 101 and C22.2 No. 141-15

Periodic Testing – The three phase monitor shall incorporate system diagnostics and provide for automatic and manual testing of the system/batteries as follows:

Feature a factory-set 2 minute battery discharge test every 30 days. Date and time of tests shall be user-programmable.

Report the battery test results with a pass/fail indication, time and date stamped, via the local monitor panel and via (Ethernet TCP/IP) (BACnet/IP) (MODBUS TCP/IP) (MODBUS RS485).

A manual test feature shall be provided to initiate NFPA 101-compliant system test. An “abort test” feature shall be included.

Data-Logging – The three phase monitor shall provide the following data-logging:

Maintain a historic log that sequentially records 120 of the most recent events/alarms, indicating the time and date of each occurrence. The log shall be available through the local monitor display and via (Ethernet TCP/IP) (BACnet/IP) (MODBUS TCP) (MODBUS RS485) communications.

2.14 Communications Interface

1. System shall include an RS232 serial communications port for authorized access to electrical parameters, system status, alarms, system set point programming, and the events/alarm log.
2. Three (3) user-programmable (Form C) output relay contacts shall be accessible via a terminal strip for customer’s hardwired connection to building monitoring and security systems. Contacts provided shall be dry type and rated for 1A at 24VDC. Output relay contacts shall be factory programmed to reflect On Static Bypass, Battery Discharging, and End of Battery Discharge. Relay contacts shall be user-programmable to reflect any 3 of the event/alarm messages listed in 2.13F of this specification.
3. A Remote Emergency Power Off (REPO) input shall be available for customer’s dry type normally closed relay contact or push button, which will shut down the inverter system when the relay contact opens. An “inverter off command” input shall be available to shut off the inverter output and send the system to static bypass. The input signal provided must be a dry type isolated relay contact, rated for a minimum 12V DC, 80mA.
4. An Expansion Relay Card shall be included to provide six (6) user-programmable (Form C) output relay contacts. Contacts provided shall be dry type and rated for 5A at 250V. Relay contacts shall be user-programmable to reflect any 6 of the event/alarm messages listed in 2.13F of this specification. The card shall also accommodate two (2) input command relay contacts which must be dry type and isolated, rated for a minimum of 12V DC, 80mA. Contacts may be normally open or normally closed. Input command functions shall be user-programmable via the control panel display.

**Engineer’s Note:** Up to two (2) Expansion Relay Cards can be added.

1. Remote monitoring and reporting of electrical parameters, system status, alarms, event logs, and automatic battery test results shall be available via (Ethernet TCP/IP) (BACnet/IP) (MODBUS TCP) (MODBUS RS485) communications.

2.15 Accessories (Optional Equipment)

* + 1. Wall Mounted Maintenance Bypass: An external, wall mounted, 3-circuit breaker wrap-around maintenance bypass shall be provided for field installation, allowing for a make-before-break transition as defined in section 2.6 B of this specification.
		2. Top Cable Entry: A field-installed side cabinet shall be provided, allowing for top cable entry of input and output AC conductors. Cabinet dimensions: 12”W x 32.8”D x 78.7”H; Weights: 185 lbs.
		3. Expansion Relay Card: A relay card providing six (6) user-programmable (Form C) output relay contacts and two (2) input command functions shall be provided as defined in section 2.14 D of this specification.
		4. Remote Monitoring Communications – Ethernet connection: A slot card shall be provided, allowing for remote monitoring and reporting of electrical parameters, system status, alarms, event logs, and automatic battery test results via (Ethernet TCP/IP) (BACnet/IP) (MODBUS TCP).
		5. Remote Monitoring Communications – Serial connection: A slot card shall be provided, allowing for remote monitoring and reporting of electrical parameters, system status, alarms, event logs, and automatic battery test results via MODBUS RS485.

2.16 Warranty

* + 1. The supplier shall guarantee the inverter’s power components and system electronics to be free from defects in material and workmanship during the warranty period. Inverter systems installed within the contiguous United States (lower 48 states) and Canada shall include a factory-authorized start up service, after which a (2 year parts and first year) (2 year parts and 2 year) (3 year parts and 3 year) factory-authorized on-site labor warranty shall be provided.
		2. Battery warranty is 1 year full replacement, 14 year prorated.

End of Guide Specification

(See Engineer’s Reference next pages)

Engineer’s Reference

1. Recommended Input / Output Circuit Breaker Ratings

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Unit | Input Voltage Rating | Recommended Input Circuit Breaker Ratings | Output Voltage Rating | Recommended Output Circuit Breaker Ratings |
| kVA/kW | Amps | Amps |
| 58.5 | 480 | 125 | 480 | 90 |
| 72 | 480 | 150 | 480 | 125 |
| 90 | 480 | 175 | 480 | 150 |
| 112.5 | 480 | 200 | 480 | 175 |

Note: External input and output circuit breaker are provided and installed by others.

1. System Weights and BTUs/Hour

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| kVA / kW | Battery  | Inverter  | Total Battery | BTU / HR (Full Load) ³ |
|   | Runtime | Weight (lbs.)  | Weight (lbs.) ¹  | On-Line Mode | ECO-Mode |
| 58.5 | 90 | 1500 | 8,960 | 13,964 | 2,992 |
| 58.5 | 60 | 1500 | 7,040 | 13,964 | 2,992 |
| 58.5 | 30 | 1500 | 4,480 | 13,964 | 2,992 |
| 72 | 90 | 1500 | 13710 **²** | 17,186 | 3,683 |
| 72 | 60 | 1500 | 8,960 | 17,186 | 3,683 |
| 72 | 30 | 1500 | 5,690 | 17,186 | 3,683 |
| 90 | 90 | 1610 | 13710 **²** | 21,483 | 4,604 |
| 90 | 60 | 1610 | 10830 **²** | 21,483 | 4,604 |
| 90 | 30 | 1610 | 7,040 | 21,483 | 4,604 |
| 112.5 | 90 | 1742 | 18190 **²** | 26,854 | 5,754 |
| 112.5 | 60 | 1742 | 13710 **²** | 26,854 | 5,754 |
| 112.5 | 30 | 1742 | 8,960 | 26,854 | 5,754 |

¹ Total battery weight includes all battery cabinets with batteries installed. Add total battery weight

 and inverter weight together for a total system weight.

² Total battery weight also includes the DC landing cabinet. Reference Engineers Note 2 for DC landing

 cabinet description under Section 2.12 A.

³ Only On-Line Mode and ECO-mode BTU/HR are shown above. ECO-mode BTU/HR reflects

 Standby-On Mode. BTU/HR in Smart Active Mode may be higher, depending on the quality of the

 incoming power source. BTU/HR in Standby-Off Mode will not exceed ECO-mode levels. Reference

 Section 2.3 for descriptions of each of mode.

1. Optional Wall-Mounted Maintenance Bypass Breakers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Inverter kW | CB Trip Unit Type | K AIC Rating | Amperage Rating | Breaker Model |
| 58.5 | Thermal Magnetic | 14 | 125A | FDB3125 |
| 58.5 | Thermal Magnetic | 65 | 125A | HFD3125 |
| 58.5 | LS | 35 | 125A (adjustable trip) | FDE316033L |
| 58.5 | LS | 65 | 125A (adjustable trip) | HFDE316033L |
| 72 | Thermal Magnetic | 14 | 150A | FDB3150 |
| 72 | Thermal Magnetic | 65 | 150A | HFD3150 |
| 72 | LS | 35 | 150A (adjustable trip) | FDE316033L |
| 72 | LS | 65 | 150A (adjustable trip) | HFDE316033L |
| 90 | Thermal Magnetic | 35 | 175A | FD3175 |
| 90 | Thermal Magnetic | 65 | 175A | HFD3175 |
| 90 | LS | 35 | 175A (adjustable trip) | FDE322533L |
| 90 | LS | 65 | 175A (adjustable trip) | HFDE322533L |
| 112.5 | Thermal Magnetic | 35 | 200A | FD3200 |
| 112.5 | Thermal Magnetic | 65 | 200A | HFD3200 |
| 112.5 | LS | 35 | 225A (adjustable trip) | FDE322533L |
| 112.5 | LS | 65 | 225A (adjustable trip) | HFDE322533L |

Note: All wall-mounted bypass enclosures are 30"W x 10"D x 36"H, and weigh 110 lbs.