CRUCIAL POWER PRODUCTS HAZARDOUS ENVIRONMENTAL (HEU) UNIT 3 TO 17 KVA SINGLE PHASE UPS FOR OUTDOOR OR HAZARDOUS ENVIRONMENT (U.L. 924 & 1778 LISTED, New York City Approved)

1.0 Scope

1.1 This HEU Product Specification describes a continuous duty, on-line, solid state, uninterruptible power system (UPS). The HEU shall operate as a line interactive design – utilizing Pulse Width Modulated (PWM) design, battery charger, solid state inverter, fail-safe bypass system, and integral battery subsystem.

1.2 Transfers to and from battery operation shall be uninterrupted. Furthermore, there shall be no mechanical switching when the HEU transfers to and from battery operation.

1.3 The HEU and batteries shall be designed to fit into a **NEMA 3R** enclosure intended for outdoor installations. It shall be of modular construction for ease of servicing in the field.

1.4 Primary application of the HEU is to provide emergency power Hazardous Environmental applications for lighting or HEU systems.

1.5 Primary input power source to the HEU shall be utility power.

2.0 Applicable Documents

2.1 The following documents given below form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered superseding requirements. The following documents shall be for reference purpose only.

2.1.1 UL 1778 Listed Underwriters Laboratories Inc. standard for UPS systems.

2.1.2 UL 924 Listed Underwriters Laboratories Inc. Standards for Lighting Systems

2.1.3 ANSI/IEEE C62.41 “Guideline on Surge Withstandability” – Category “B.”

3.0 System Description and Operation

3.1 System Definition

3.1.1 The HEU shall consist of a Pulse Width Modulated (PWM) design battery charger, inverter, batteries, fail-safe bypass, protective devices, and monitoring circuitry as specified herein which shall automatically assure interruption, upon failure or deterioration of the input AC power source. Continuity of conditioned and regulated power to the critical load shall be maintained when input power is lost and until input power returns within specifications or until the batteries have been charged.

3.2 Modes of Operation

3.2.1 Normal – The PWM shall continuously supply power to the critical load. The charger shall derive power from the charging circuit and supply DC power to the batteries. The charger shall maintain the batteries in a fully charged state even at low input voltage conditions.

3.2.2 Emergency – Upon failure of the input AC power source, the critical load shall be supplied by the inverter, which, without any mechanical switching, shall obtain its power from the battery through the load until the inverter assumes 100% of the load. There shall be no interruption or disturbances to the critical load upon failure or restoration of the input AC power source.

3.2.3 Recharge – Upon restoration of the input AC power source (prior to complete battery discharge), the HEU shall automatically return to normal operation.

If the batteries become completely discharged (batteries have reached the DC cutoff point) before the input power is restored, the HEU shall automatically restart and resume normal operation – including the automatic recharge of the batteries.

3.2.4 Fail-safe Bypass Mode – The HEU shall automatically transfer the critical load to the bypass source in case of an internal HEU failure (HEU output voltage not present).

3.2.5 Downgrade – If the battery only is to be taken out of service for maintenance, it shall be disconnected from the HEU by means of a battery circuit breaker. The HEU shall continue to function as specified, except for power outage protection and dynamic response characteristics.

3.3 Major Components

3.3.1 Ferroresonant Transformer – The PWM shall provide conditioned, regulated, sine wave power to load during all modes of operation (except when the HEU is in bypass). The PWM shall be configured such that there are no direct electrical connections between the input and output. The PWM shall have separate windings for the battery charger section and the inverter section

3.3.2 Charger – The charger shall be of solid state construction. The charger shall rectify AC power supplied by the circuit to regulated DC power for the batteries. This shall be an automatic function. The charger shall be a 3 stage temperature-compensated charger so that the charger level for the batteries is automatically adjusted based on internal ambient temperature.

3.3.3 Inverter – The inverter shall be of solid state construction. In case of the loss of input power to the PWM, the inverter shall convert DC power from the batteries to AC power.

3.3.4 Fail-safe Bypass – The bypass shall consist of a fail-safe design. In case of HEU failure (HEU output power not present), the fail-safe bypass shall automatically transfer power for the load to the bypass source. The fail-safe bypass shall be break-before-make.

3.3.5 Batteries – Upon loss of input power, the batteries shall supply DC power to the inverter.

3.3.6 Monitoring and metering – The HEU shall include HEU status indicators and remote monitoring capabilities. The HEU shall contain the following monitoring and load display functions:

a. HEU Status Indicators for:

"AC Line Present" – green LED
"Battery Charger" – green LED
"UPS Output Power Present" – green LED
"On Battery" – amber LED

b. Remote monitoring capabilities shall be form C dry contacts for the following conditions:

Input Fail
Input power present
UPS on battery operation
Low battery condition
UPS on bypass

c. A latching test switch shall be provided so that battery operation of the HEU may be verified. In case the UPS is left on battery operation and the front door is closed, a door interlock provision shall cause the HEU to return to normal mode operation.

3.37 Protection:

a. The HEU shall have a main input circuit breaker for over current protection.
b. The battery subsystem shall be protected by a circuit breaker.
c. Thermal protection shall consist of temperature sensors located on the inverter heat sink.
First stage, 100 degrees F, shall turn on the cooling fan.
Second stage, 165 degrees F, shall power-down the HEU.

3.4 Options – The following options shall be available:

3.4.1 Event counters and elapsed run time meter. The event counter shall be resettable mechanical counter, which displays the number of times the HEU has transferred to battery operation. A minimum of 9,999 events shall be recorded.
The elapsed run time meter shall totalize the number of hours the HEU has run on battery operation. This meter shall be non-resettable and shall be able to record up to 999 hours in one-(1) hour increments.

3.42 Extended battery – the HEU shall be able to accommodate up to eight- (8) 12 volt, 150 ampere-hour batteries without any dimensional charges.

3.43 A 500-Watt strip heater shall be from the line side of the input breaker.

3.44 A 120 volt NEMA 5-15R duplex receptacle with built-in ground fault protection shall be available. Power for the receptacle shall be from the line side of the input breaker.

3.45 Locks – Standard lock shall be the Best CX Series or equivalent. Other locks from other

manufacturers, which fit the same mounting criteria, shall be available.

3.46 Lifting eyebolts shall be provided.

4.0 System Package and Construction

4.1 Materials and Process

4.1.1 The open frame, supporting the HEU electronics, transformer, I/O connections, logic board, display, etc., shall be steel. Steel parts shall be zinc washed.

4.1.2 The enclosure shall be aluminum with a natural finish.

4.2 Standard Parts

4.2.1 Except as otherwise specified herein or authorized, commercial-grade parts shall be used.

4.2.2 External hardware shall be tamper-resistant.

5.0 Electrical Specifications

5.1 Input Specifications

5.1.1 Nominal input voltage: 120 or 277 VAC single phase.

5.1.2 Input voltage range: +20 to –35% of nominal.

5.1.3 Input frequency: 60Hz +/-3 Hz.

5.1.4 Input frequency slew rate: 3 HZ per second maximum.

5.1.5 Input configuration: 2 wire (“hot and neutral”) plus ground.

5.1.6 Walk-in Delay: The HEU shall wail a minimum of five (5) seconds before returning to normal mode of operation upon restoration of input power.

5.1.7 Input protection: Single pole circuit breaker

5.1.8 Customer connection: Terminal block.

5.2 Output Specifications

5.2.1 **Power rating (continuous):**
3.0 KVA @ .7 P.F. / 17.5 amperes: @ 120
4.4 KVA @.7 P.F. /25.6 amperes: @ 120
5.4 kVA @ .7 P.F. /31.5 amperes: @ 120
8.0 kVA @ .7 P.F. /46.6 amperes: @ 120
10.0 kVA @ .7 P.F. /33.65 amperes: @ 208
15.0 kVA /@ .7 P.F. / 50.48 amperes @ 208
Output power rating shall be the same regardless of whether or not the HEU is in normal mode or emergency mode of operation.
Number of phases: One.

5.2.2 Nominal output voltage: 120 or 277 VAC ±4%.

5.2.3 Output configuration: 2wire (“hot and neutral) plus ground.

5.2.4 Power Conditioning

a. Common-Mode: 120 dB
b. Normal-Mode: 90 dB
c. Grounding: Single Point Ground
d. Shielding: Dual Faraday Shields

5.2.5 Output frequency: 60 HZ ±3 Hz when synchronized with the input power.
60 HZ ±0.5 HZ when HEU is running on internal clock.

5.2.6 Output wave shape: Sine wave.

5.2.7 Output voltage distortion with 100% linear load: 10% maximum THD with any single harmonic no greater than 5%.

5.2.8 Crest factor: 3:1.

5.2.9 Transfer time: Transfers to and from battery operation shall be uninterrupted (no break transfers). Transfers shall be electronically switched – no mechanical switching means shall be used.

5.2.10 Overload capability: 125% for ten (10) minutes; 150% surge.

5.2.11 Fault condition: HEU shall withstand a short circuit on the output with no damage.

5.2.12 Customer connection: Terminal block.

5.3 Battery Specifications

5.3.1 DC bus voltage: 48 volts nominal.
5.3.2 Configuration: Four (4) or eight- (8) 12 volt 100 ampere-hour sealed, lead acid, maintenance-free, types AGM, and batteries.
5.3.3 Low battery cutoff (signal only): 43 volts.
5.3.4 DC under voltage cutoff: 40 volts – factory adjustable.
5.3.5 Battery discharges time: Based on specific battery configuration. Engineering to specify the run times based on actual test data and empirical calculations. Times to be based upon an ambient temperature of between 70 and 80 degrees F.
5.3.6 Battery charger: Current-limited to a maximum of 5 amperes.
5.3.7 The battery charger shall be a 3 stage temperature-compensated charger. The battery charger shall have the following charging characteristics:

<0 degrees F – x.xx volts per cell;
0 to 100 degrees F – y.yy volts per cell;
>100 degrees F – z.zz volts per cell.

The charging voltage shall be based upon the ambient temperature within the HEU enclosure. Actual volts per cell shall be determined by best engineering practice to maximize battery life. This setting shall be factory set.
5.3.8 Protection: Circuit breaker.

5.4 Fail-safe Bypass Specifications
5.4.1 Rating: 8.0kVA / at 120 VAC.
5.4.2 Transfer time: 250 milliseconds maximum. Fail-safe bypass shall be break-before-make.
5.4.3 Power source: Line side of the input circuit breaker.

5.5 Monitoring and Metering Specifications
5.5.1 Contact rating: 125volts (AC or DC) maximum; 1.25 amperes maximum; 50 VA / 30 watts maximum.
5.5.2 Contacts shall be floating.
5.5.3 Customer connection: Terminal block.
5.5.4 LEDs shall be visible in daylight.

6.0 Physical Specifications

6.1 The HEU system shall consist of a single cabinet housing both the electronic sub-assemblies and the batteries.
6.1.1 Maximum dimensions: The overall dimensions shall not exceed 70” H x 39”W x 17”D.
6.1.2 The HEU enclosure shall be weatherproof and shall be NEMA 3R-type construction.
a. The cabinet shall be ventilated. Intake air shall be from the lower area of the front door. Exhaust air shall be through the front and rear near the top.
b. Forced cooling shall be provided.
Screening shall be used to keep insects and debris from entering the UPS through the fan exhaust.
c. Intake air vent shall be screened and shall prevent water from entering the enclosure. Replaceable dust filters, readily available, shall be utilized.
d. The front door shall have a gasket.
6.1.3 The door assembly shall consist of a continuous hinge; three-point door latch with a single keyed locking handle and additional padlock hasp.
6.1.4 The cabinet shall be natural finish aluminum
6.1.5 The cabinet shall be designed such that it can be anchored to a single foundation.
a. The foundation including the anchor bolts shall be provided by others.
b. Skirting with tamper-proof hardware shall be provided so that debris and animals cannot enter through the bottom of the cabinet.
c. The mounting of the HEU to the concrete pad (supplied by others) shall be such that the nuts (holding the HEU to the anchor bolts embedded in the concrete pad) are not accessible from the outside.

6.2 Power and control cable entry: Bottom entry.
6.3 Printed circuit boards shall be conformal coated

6.4 The PWM shall have class H insulation rating.

6.5 Labels – shall be located inside the enclosure.

7.0 Operating Environment

7.1 Temperature:

7.1.1 The HEU shall operate satisfactorily when the ambient temperature outside of the HEU enclosure is at –30 degrees F (-34 degrees C).

7.1.2 The UPS shall operate satisfactorily when the ambient temperature outside of the HEU enclosure is at +136 degrees F (+58 degrees C).

Important note for paragraphs 7.1.1 and 7.1.2: Battery run times are based upon ambient temperatures of 70 to 80 degrees. Outside of this range, battery capacity and/or life shall be affected. The operating range as state is applicable to the HEU electronics systems. The battery manufacturer shall define the battery operating temperature range.

7.2 Relative humidity: 0 to 95% non-condensing.

8.0 Storage Environment

8.1 Temperature: -30 degrees F (-34 degrees C) to +165 degrees F (+73 degrees C).
This storage temperature shall be acceptable only when the batteries are in a fully charged state.

8.2 Relative humidity: 0 to 95% non-condensing.

9.0 Reliability and Maintainability

9.1 Mean-Tune-Between-Failure (MTBF) shall be 30,000 hours. Mission MTBF, including bypass switch, is 150,000 hours.

9.2 The PC/UPS shall be designed for ease of maintenance and serviceability.

9.2.1 All components shall be front-accessible.

9.2.2 Rear wall components shall be accessible.

10.0 Unit Manufactured by:

Crucial Power Products
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Commerce, CA 90040