

Installation Manual and Operating Instructions

TRUE BLUE POWER

TS60 SERIES

EMERGENCY BATTERY
POWER SUPPLY

Manual Number
9018972



Revision E • December 27, 2023

FOREWORD

This manual provides information intended for use by persons who, in accordance with current regulatory requirements, are qualified to install this equipment. If further information is required, please send inquiries per the contact information below.

We welcome your comments concerning this manual. Although every effort has been made to keep it free of errors, some may occur. When reporting a specific problem, please describe it briefly and include the manual part number, the paragraph/figure/table number and the page number. Send your comments to:

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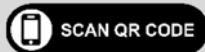


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REVISION HISTORY

Rev	Date	Detail	Approved
A	06/22/2018	Production Release	WVC
B	11/08/2018	Removed '(pending)' from Certification, Table 1.2	DLR
C	02/15/2019	Revised Section 5.2.2 to correct typo and provide alternate charging instructions	WVC
D	05/14/2020	Updated style and brand to meet Marketing and Engineering guidelines.	DLR
E	12/27/2023	Added Section 5.7. Updated Foreword.	BAW

SECTION 1 GENERAL DESCRIPTION

1.1 INTRODUCTION

The True Blue Power TS60 series Emergency Battery Power Supply (EBPS) part numbers 6430060-() are designed to supply DC power for aircraft emergency lighting when aircraft power failure occurs. During normal aircraft operation, the TS60 EBPS will utilize the aircraft's power to recharge or maintain existing charge at full capacity. The TS60 is a sophisticated power system that utilizes state-of-the-art Nanophosphate® lithium-ion battery cell technology which provides improvements in performance, safety, life and weight when compared to traditional or competing aircraft battery systems. Consideration given to key electrical and mechanical design principles yield compliance with regulatory standards and meet or exceed industry expectations. The TS60 is a complete EBPS solution that provides significant value and benefit to an aircraft designer, owner and operator.

The TS60 requires professional use and maintenance to deliver maximum performance and value as designed. This manual contains information related to the specifications, installation, operation, storage, scheduled maintenance and other related topics associated with the proper care and use of this product.

1.2 PHYSICAL ATTRIBUTES

The TS60 EBPS consists of a rugged metal chassis with a 12-pin Mil-Spec circular-style connector for electrical interface. The unit is designed to be mounted with screws or similar fasteners to attach the unit to the aircraft structure.

1.3 UNIT ARCHITECTURE

The unit is comprised of three primary functional pieces:

- Main Board
- Connector Interface Board
- Metal Chassis

Each Main Board consists of four (6430060-1,-2) or six (6430060-3,-4) cells connected in series. The main printed circuit board controls all battery functions (management, charging and discharging). Additionally, the Main Board protects against conditions such as short circuit, over temperature, under voltage and over voltage.

The Connector Interface Board houses the external 12 pin Mil-Spec circular connector used for external controls, charge and discharge pins of the EBPS. It also provides a connection path to the Main Board.

The Metal Chassis consists of a rugged aluminum extrusion housing both Main and Connector Interface Boards. Two aluminum end caps hermetically seal the EBPS unit system.

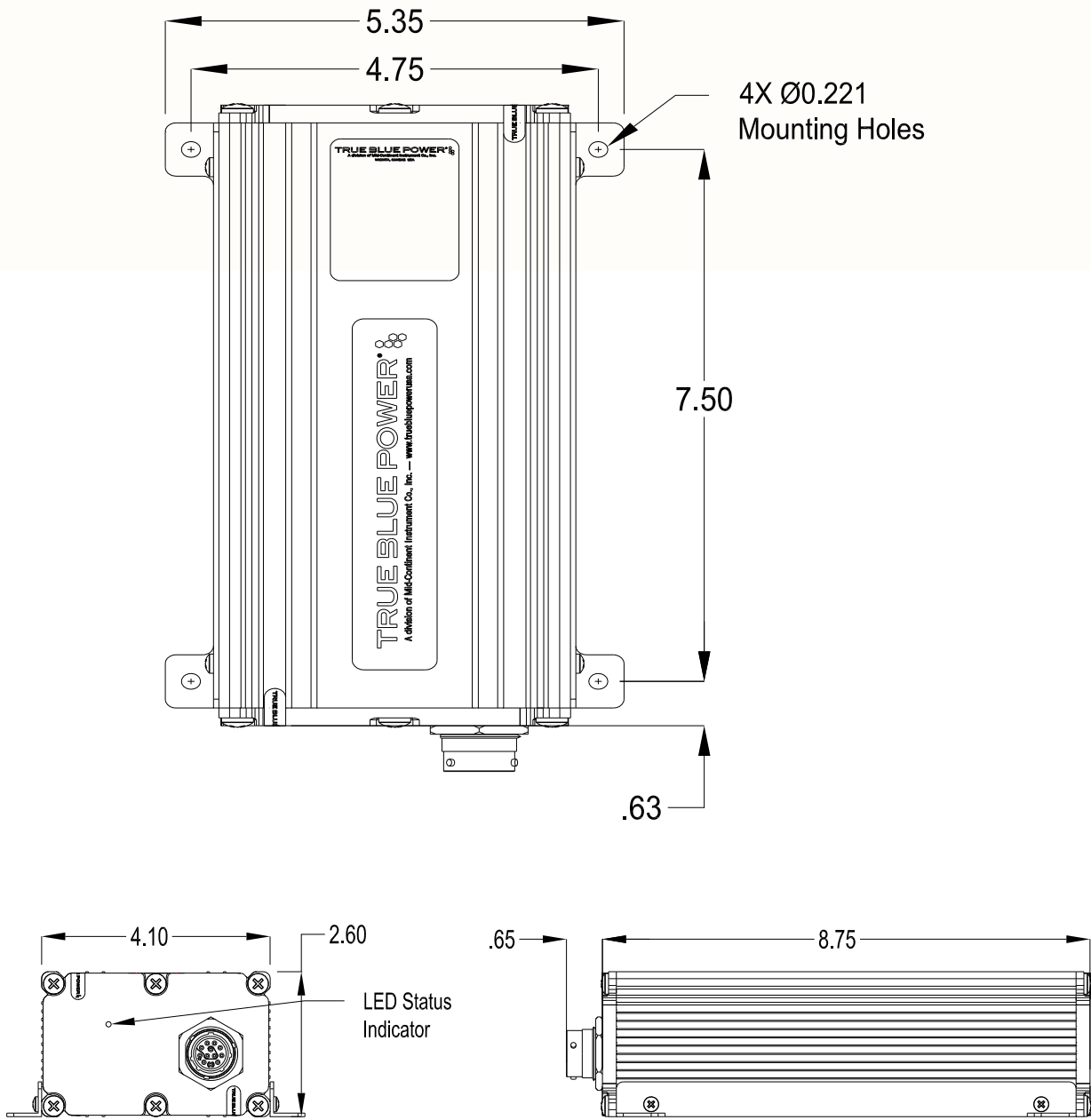


Figure 1.1
Outline Drawing

1.5 IMPORTANT SAFETY INFORMATION

Read this safety information BEFORE maintaining or servicing the battery.

1.5.1 Symbol Definition

This section describes the precautions necessary for safe operations. The following safety symbols have been placed throughout the guide.



Warnings identify conditions or practices that could result in personal injury.



Cautions identify conditions or practices that could result in damage to the equipment.

1.5.2 Handling Precautions



The EBPS energy is high enough to sustain a possible ARC flash. Always wear safety glasses, fire retardant smocks, and use insulated tools when servicing the EBPS.

- Remove metal items such as rings, bracelets, and watches when working with batteries. A battery could produce a short circuit current high enough to weld jewelry to metal and cause a severe burn.
- Always use appropriate Electrostatic Discharge (ESD) protection while working with the EBPS.
- All connections for battery pack testing must include appropriate short-circuit protection.
- The EBPS service area shall be properly ventilated and egress paths shall be unobstructed.
- Specialized breathing filters are not required under normal use.
- Always use insulated tools.
- Never smoke or allow a spark or flame near the EBPS.
- Use caution to reduce the risk of dropping a metal tool on the unit. Dropping a tool could spark or short circuit the EBPS.

1.5.3 Additional Precautions

The following design and operation factors are required for safe use.



- It is not acceptable to combine or use any battery cells or modules other than those approved by True Blue Power.
- There are no limitations in storing or using this EBPS in the vicinity of other battery chemistries. The EBPS does not emit or absorb any gas during storage, transportation or during normal operating conditions.
- Connector terminals must be covered with non-conductive protective devices to avoid any possibility of shorting during handling, shipping or storage.

1.5.4 Shipping

True Blue Power lithium-ion cells and batteries are designed to comply with all applicable shipping regulations as prescribed by industry and regulatory standards. This includes compliance with the UN recommendations on the Transport of Dangerous Goods, IATA Dangerous Goods Regulations, and applicable U.S. DOT regulations for the safe transport of lithium-ion batteries and the International Maritime Dangerous Goods Code. In accordance with IATA and per UN 3480, PI 965, Section 1A and 1B, the TB60 series EBPS will be shipped with a state of charge (SOC) not to exceed 30% of rated capacity. This battery is classified as a Class 9 Dangerous Good. If the battery requires shipment, please contact the manufacturer for additional instructions on proper procedures.



The unit is shipped at approximately 30% state of charge (SOC). Upon receipt, the battery MUST be fully charged using the procedures listed in this manual (prior to storage and again prior to installation/use).

Upon receipt the battery shall be fully charged. Batteries that are stored shall be fully recharged at a minimum every 6 months, following the procedure set forth in Section 5.2.2. For more detailed storage instructions refer to Section 5.4.

SECTION 2 PRE-INSTALLATION CONSIDERATIONS

2.1 COOLING

No internal or external cooling of the unit is required. The unit is designed to operate over a wide temperature range and includes internal thermal monitoring and protection circuits. See Section 4 for more details.

2.2 EQUIPMENT LOCATION

The TS60 Emergency Battery Power Supply is designed for mounting flexibility, allowing for installation with no requirement for temperature or pressure control. Although not required, optimum performance and life can be achieved by mounting the TS60 in a temperature controlled section of the aircraft. In addition to altitude and temperature tolerance, the unit is designed to withstand high levels of condensing humidity. However, installation locations where the unit could be subject to standing or direct water exposure should be avoided. The unit has no limitations regarding mounting orientation.

Failure mode, effects, and criticality analysis of the TS60 has shown that the potential for the release of toxic or flammable gases as a result of any potential condition is extremely improbable as the unit is hermetically sealed. The unit should not be installed in compartments where lines, tanks or equipment containing fuel, oil or other flammable fluids are present. Installation near potential sources of ignition should be avoided.

2.3 ROUTING OF CABLES

Be aware of routing cables near other electronics or with other wire bundles that may be susceptible to high energy flow. Avoid sharp bends in cabling and be cautious of routing near aircraft control cables. Also avoid proximity and contact with aircraft structures, avionics equipment, or other obstructions that could chafe wires during flight and cause undesirable effects. Cables should not run adjacent to heaters, engine exhausts, or other heat sources. The signal cable bundle wires are recommended to be no smaller than 20 gauge.

2.4 LIMITATIONS

The conditions and tests for TSO approval of this article are minimum performance standards. Those installing this article, on or in a specific type or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards. TSO articles must receive additional installation approval prior to being operated on each aircraft. This article meets the minimum requirements of technical standard order (TSO) C179b. Installation of this article requires separate approval. The article may be installed only according to 14 CFR Part 43 or the applicable airworthiness requirements.

See Section 4.3 for Performance Specifications and potential limitations and ratings under various environmental and application installations. Also see Section 2.2 for limitations associated with equipment installation location.

2.5 MODIFICATION

This product has a nameplate that identifies the manufacturer, part number, description, certification(s) and technical specifications of the unit. It also includes the “MOD” or modification number representing notable changes in the hardware design of the unit.

Modification (MOD) 0 is the initial release of the product and is identified on the nameplate by the lack of marking on the MOD numbers 1 through 9 (i.e. 1-9 are visible). All subsequent modifications are identified on the nameplate by the marking/blacking out of that particular MOD number (i.e. for MOD 1, the number 1 is not visible and 2-9 are visible - see Figure 2.1 for examples). MODs do not have to be sequentially inclusive and may be applied independent of each other.

For additional details regarding specific changes associated with each MOD status refer to the product published Service Bulletins at www.truebluepowerusa.com.

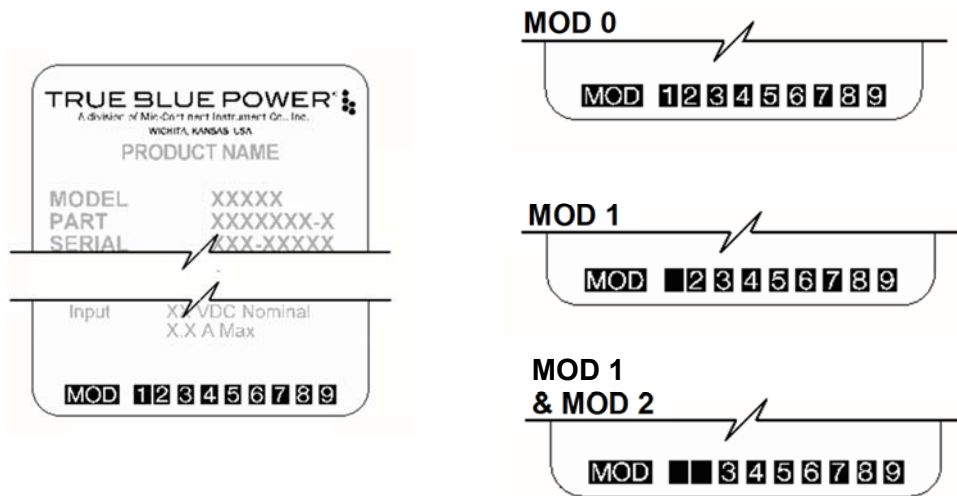


Figure 2.1
Nameplate and MOD Status Example

SECTION 3 INSTALLATION

3.1 GENERAL

This section contains mounting, electrical connections and other information required for installation. These instructions represent a typical installation and are not specific to any aircraft.

3.2 PRE-INSTALLATION INSPECTION

Unpacking: Carefully remove the TS60 battery from the shipping container. The shipping container and packing are designed specifically for the transit of lithium batteries and approved by international transportation agencies. These materials should be retained for use should the unit require future shipment.

Inspect for Damage: Inspect the shipping container and unit for any signs of damage sustained in transit. If necessary, return the unit to the factory using the original shipping container and packing materials. File any claim for damages with the carrier.

3.3 PARTS

3.3.1 Included Parts

- | | |
|--|----------------------|
| A. TS60 Emergency Battery Power Supply | MCIA P/N 6430060-() |
| B. Installation and Operation Manual | MCIA P/N 9018972 |

3.3.2 Available Parts

- | | |
|-----------------------------------|--------------------|
| A. Connector Kit for 6430060-1,-3 | MCIA P/N 9019011-1 |
| B. Connector Kit for 6430060-2,-4 | MCIA P/N 9019011-2 |

3.3.3 Installer Supplied Parts

- A. Wires
- B. Appropriate hold-down hardware

3.4 INSTALLATION



The connector pins of the TS60 are always active and energized.
DO NOT SHORT CONNECTOR PINS AT ANY TIME!

Extreme care and caution should be applied when handling and connecting to the unit. Danger of short circuit and subsequent arc flash, electrical burns or equipment damage can occur if not handled properly.

3.4.1 Harness Preparation

Prepare aircraft wiring with mating connectors in accordance with the proper Wire Size and Type (Table 3.1), Unit Locations (Figure 3.1) and Pin Identification Diagram Table 3.2. Recommended external connections to the aircraft can be seen in Figures 3.4 and 3.5.

Use of PTFE, ETFE, TFE, Teflon or Tefzel insulated wire is recommended for aircraft use. Recommended wire sizes and types are identified in Table 3.1 below.

Wire Size and Type			
Wire Gauge	Wire Type	Connector	Pins
18-20 AWG	Stranded Copper	12-pin	1-12

Table 3.1
Wire Size and Type

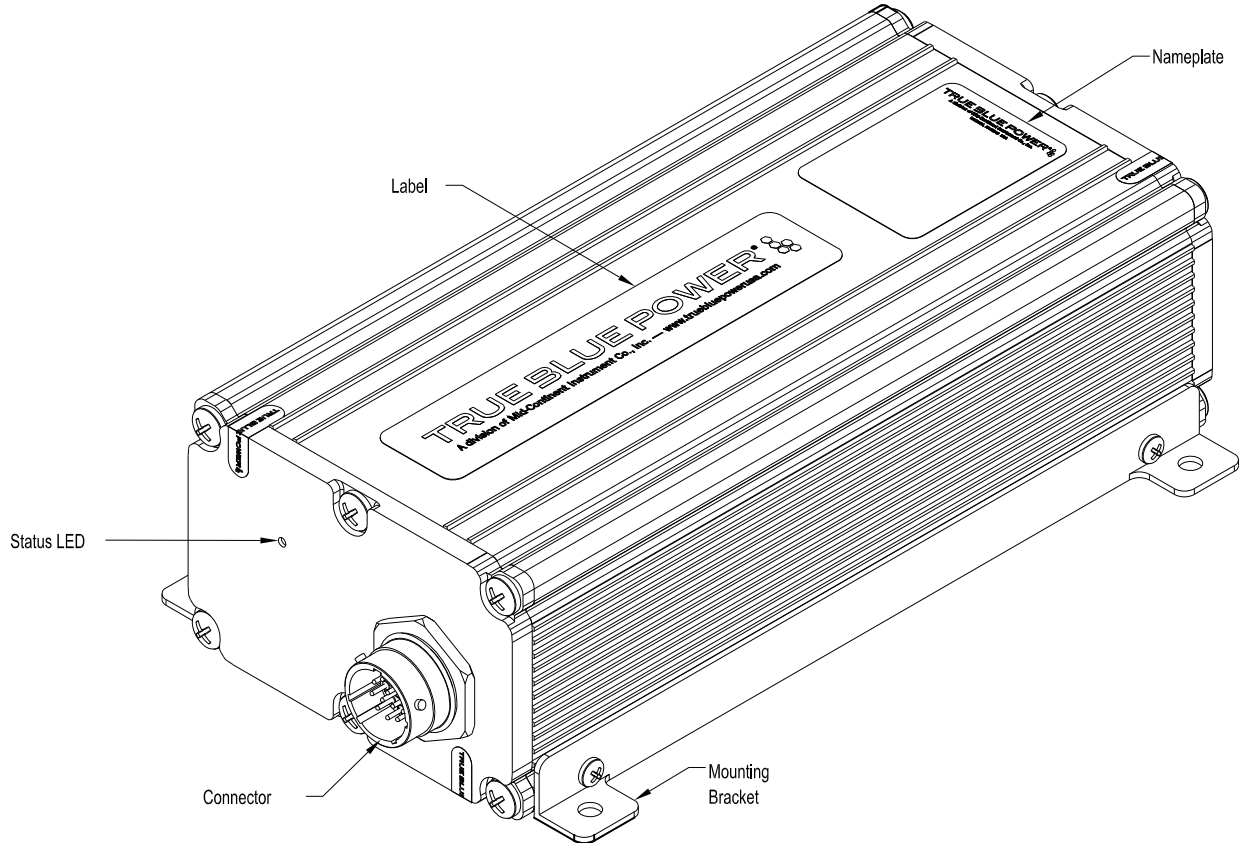
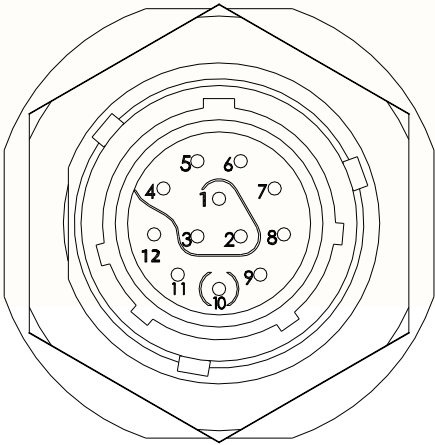
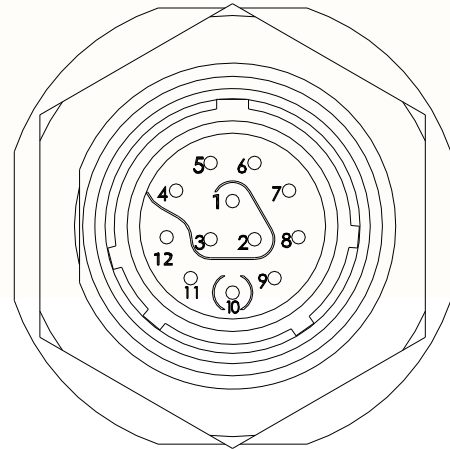


Figure 3.1
Unit Locations



**Figure 3.2 EBPS
Bayonet Connector (-1,-3)**



**Figure 3.3 EBPS
Threaded Connector (-2,-4)**

Emergency Battery Power Supply Connector (12-pin)		
	Bayonet -1, -3	Threaded -2, -4
Pin	Pin Function	Pin Function
1	Unused	Loop Thru
2	Sense/Charge	Sense/Charge
3	Arm	Arm
4	Disarm	Disarm
5	Power Return	Power Return
6	Load_06	Load_06
7	Unused	Load_07
8	Load_08	Load_08
9	Unused	Load_09
10	Load_10	Load_10
11	Unused	Loop Thru
12	Load_12	Battery Check

Table 3.2 Connector Pinout

3.4.2 Securing the Unit

The TS60 is designed to be secured in the aircraft using four (4) #10 screws (or equivalent) located in a 4.75 inch x 7.50 inch square in accordance with Figure 1.1. A lock-washer under the head of each screw is recommended.

3.4.3 Installation and Wiring

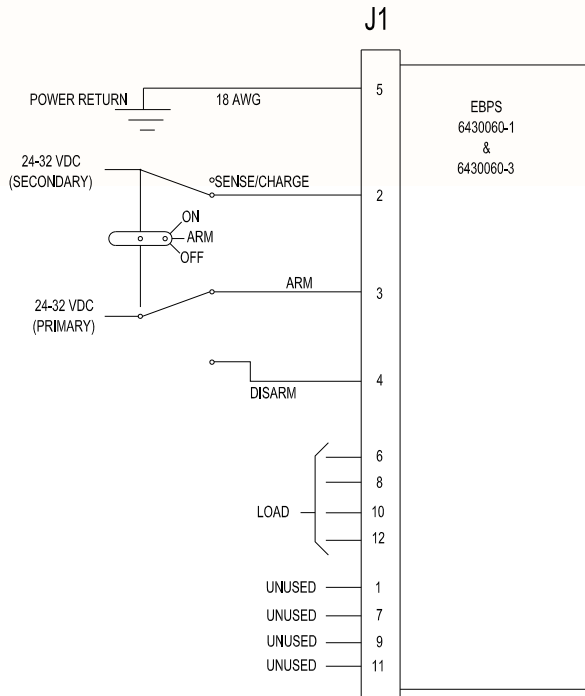


Figure 3.3 External Wiring (-1, -3)

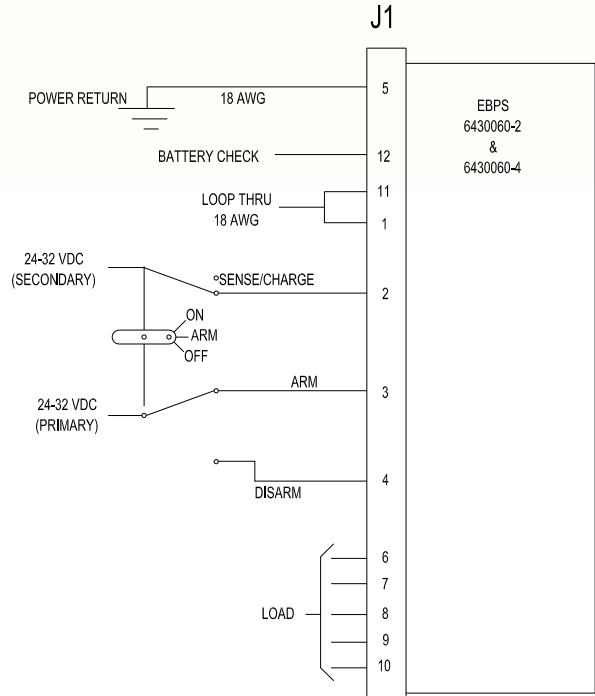


Figure 3.4 External Wiring (-2,-4)

SECTION 4 OPERATION

4.1 DESCRIPTION

The True Blue Power TS60 series Emergency Battery Power Supply (EBPS) is designed to supply DC power for aircraft emergency lighting when aircraft power failure occurs. It utilizes rechargeable lithium-ion Nanophosphate® chemistry to provide output power. During normal aircraft operation, the TS60 EBPS will utilize the aircraft's primary power bus to recharge or maintain existing charge at full capacity.

4.2 THEORY OF OPERATION

The TS60 Emergency Battery Power Supply system provides a nominal voltage output of 6.6 VDC and a maximum power output of 2.0 amps per output line. P/N 6430060-1 and 6430060-3 have 4 output lines, while P/N 6430060-2 and 6430060-4 have 5 output lines. P/N 6430060-1 and 6430060-2 units are designed to receive 17-32VDC input from the aircraft while P/N 6430060-3 and 6430060-4 units are designed to receive 24-32VDC input from the aircraft. Refer to Section 3.4.3 for external connection to aircraft controls.

4.2.1 Armed

To activate or "arm" the system prior to flight, place the three-way activation switch in the ARMED position. When the switch is ARMED the unit will charge from the secondary bus at a maximum input current of 0.5 A. Should the secondary bus then fail, the outputs will be activated powering the emergency lights. Reconnection of secondary power or placing the switch in the OFF position will disable the outputs.

4.2.2 On

To force the outputs on, place the three-way activation switch in the ON position. This activates the outputs by simulating loss of the secondary bus from the ARMED state. Placing the three-way activation switch in the ARMED or OFF position will disable the outputs while aircraft power is present.

4.2.3 Off

By placing the three-way activation switch in the OFF position, the input voltage to charge the unit will be taken from either the primary bus or secondary bus, whichever has a higher voltage. If primary and secondary bus voltages are equal, charging will be shared. When the switch is in the OFF position, the outputs will be disabled, even with the loss of secondary bus power. The activation switch should always be kept in the OFF position when not in use to prevent accidentally discharging the EBPS. The activation switch should always be in the OFF position when the unit is removed from service to prevent accidentally discharging the EBPS.

4.2.4 Dispatch

The unit has a dispatch feature that activates automatically when the outputs are first turned on. At the start of activation the unit determines if the state-of-charge (SOC) is sufficient for minimum requirements for emergency operation. If the unit detects an insufficient SOC, the output will be cycled on/off once per second, repeating 32 times, thus blinking the lights associated with that unit. After cycling 32 times the lights will stop blinking and turn on solid until deactivated by the three-way activation switch or the EBPS capacity becomes insufficient to continue operation.

If the unit determines normal operation, the lights will turn on until deactivated by the three-way activation switch or the EBPS capacity becomes insufficient to continue operation.

4.2.5 Maintaining Charge

When ARMED, the unit continuously monitors the input voltage from the aircraft's secondary bus and only provides EBPS power when the input is lost. The unit uses the secondary bus power to maintain a full charge on the battery cells. When charging, the load on the aircraft system is approximately 0.3A, falling to zero when the cells are fully charged. P/N 6430060-1 and 6430060-2 may not fully charge below 17VDC; P/N 6430060-3 and 6430060-4 may not fully charge below 24VDC. Units begin to discharge when the aircraft voltage drops below approximately 8VDC (and unit is ARMED).

The unit constantly monitors a variety of conditions within the unit and applies protections by automatically disconnecting the EBPS from the charging source if any of the internal or external design thresholds are exceeded. These include two independent levels of over-voltage and over-temperature.

When the three-way activation switch is set to OFF the unit will charge from the primary or secondary bus, whichever is higher to maintain a full charge on the battery cells.

4.2.6 Discharge

In order to produce EBPS power, the unit must be ARMED and then not detect primary input power. Once activated, the internal cell voltage will decay from approximately 14.5VDC for P/N 6430060-1 and 6430060-2 units at full charge to 8VDC at full discharge, but the output voltage is regulated to a constant 6.6VDC for the duration of a full discharge cycle. For P/N 6430060-3 and 6430060-4 units the internal cell voltage will decay from 21.7VDC at full charge to 14.5VDC at full discharge. Similarly the output voltage is regulated to a constant 6.6VDC for the duration of the full discharge cycle. The unit will shut itself off when the internal cell voltage reaches approximately 8VDC (for -1 and -2 units) or 12VDC (for -3 and -4 units). This is to prevent permanent damage to the unit or individual cells. At the end point voltage of 8VDC/12VDC, the battery has approximately 1-2% of remaining energy available. Therefore this precautionary shut off does not significantly detract from the amount of available power that might be supplied to the load in an emergency.

Short circuit protection is through a 3 ampere current limit (4.75A maximum transient) applied to each output. In the event of a shorted output all other outputs will continue to operate. Upon removal of the short circuit the affected output will return to normal operation without requiring a fuse replacement.

4.2.7 LED Status Indicators

A single tri-color LED is located on the TS60 endplate adjacent to the external circular connector – refer to Figure 3.1. Although the LED may not be visible during normal operation (due to mounting location), it can be a useful tool to determine the TS60 unit status:

- No LED displayed: Unit is off and no aircraft voltage is connected to the TS60.
- Green: Ready to dispatch (TS60 has sufficient capacity to support a minimum of 20 minutes of lighting).
- Flashing Green: TS60 is currently armed and outputs are activated.
- Yellow: TS60 is charging and not ready for dispatch.
- Red: Indicates a system over temperature condition or that one or more outputs is disabled.

4.2.8 Software and Complex Hardware

No software or complex hardware is incorporated in the design of this product.

4.3 BATTERY PERFORMANCE AND CAPACITY

Based on nanoscale materials initially developed at MIT, low impedance nanophosphate electrode technology provides significant performance advantages over alternative energy storage options, including lead-acid, nickel cadmium, and other lithium-ion battery chemistries. These lithium iron phosphate cells (LiFePO₄) are ideally suited for aviation applications due to their inherent stability and safety, which is realized with essentially zero oxygen generation and significantly lower temperatures that are present in the event of a cell failure. Other more typical lithium-ion varieties are based on a metal oxide chemistry that is significantly more volatile in a failure condition due to higher temperatures and oxygen release, resulting in flames and the potential for high pressure energy release. A safer cell allows for practical and efficient packaging of the battery product in a way that still retains full containment of a possible cell failure, or 'thermal runaway', preventing any hazard to aircraft, passengers or crew.

True Blue Power's use of lithium-ion nanophosphate cells translates to less long-term maintenance costs. At the rated load, data from the cell manufacturer demonstrates that 80% of the original capacity is retained after 7000+ complete discharge and recharge cycles. While the emergency use of the TS60 system in an aviation application may only experience a few complete discharges in its lifetime, its cycle life also translates to calendar life

The battery cells are stable and perform well over temperature. While comparable technologies suffer significantly from the effects of high temperature, the lithium cells used in the TS60 can support thousands of shallow discharges and more than a thousand cycles with a full discharge, even in high temperatures. The life of the battery is further increased by the extremely low self-discharge of a lithium iron phosphate battery, assuring excellent shelf life and operational calendar life, while maintaining minimum energy requirements of the application.

For specific capacity and EBPS discharge time, refer to Section 1.4.

4.4 MAINTENANCE

Because the cells are designed to maintain their charge-holding capability over time, True Blue Power is recommending a two-year maintenance cycle. The two-year check includes a full charge, discharge, and recharge while evaluating the discharge time against minimum requirements. Additionally, at any time when the capacity of the unit is in question or after being utilized in an in-flight emergency situation, True Blue Power recommends conducting this procedure.

SECTION 5 CONFORMANCE

5.1 DISPATCH VERIFICATION AND IN-FLIGHT MONITORING

The TS60 typically serves to provide aircraft exit lighting upon loss of aircraft power.

- Dispatch for Emergency Backup Power: To verify the TS60 has sufficient power to provide emergency lighting, turn the external control to “ON” to test for the unit’s ability to dispatch. If lighting turns on steady, it is ready for dispatch. However, if the lighting blinks on/off each second for 32 cycles, the TS60 needs to be charged prior to dispatch. Refer to Section 4.2.4 for additional details.

5.2 ROUTINE MAINTENANCE

The TS60 requires scheduled maintenance based on calendar life of the EBPS. Maintenance as described in this section shall be conducted every 24 months from date of original aircraft delivery or subsequent new battery installation. The EBPS battery shall be recharged every 6 months if it is uninstalled.



The connector pins of the TS60 are always active and energized. EXTREME care and caution should be applied when handling the unit. Danger of short circuit, electrical burns or equipment damage can occur if not handled properly. Be EXTREMELY cautious to avoid shorting connector pins, dropping metal objects, hardware or tools on the EBPS unit.

5.2.1 Visual Inspection

- A. Remove the unit from the aircraft. Visually inspect the exterior of the EBPS casing for signs of damage or wear. Verify that both end caps are secure and not loose. Verify that no damage has occurred which would prevent the EBPS from maintaining its air-tight seal. If any wear is apparent which has not compromised the case, inspect the EBPS area of the aircraft for any signs of improper installation.
- B. Visually inspect the connector. Verify that no connectors are loose and there are no signs of damage, wear or corrosion.
- C. If any of the above conditions are present, the unit must be evaluated and tested for repair or replacement by an authorized repair facility.

5.2.2 Charging

In order to charge the unit on the ground for capacity checks, recharges or extending storage, follow the steps listed below:

- A. With a bench type power supply, apply 24 to 32 VDC to the disarm pin (power on pin 4, ground on pin 5) of the EBPS – this prevents the EBPS from arming. Alternatively, the primary input pin (power on pin 2, ground on pin 5) can also be used to charge the unit. Note that the -2 and -4 units need to connect pins 1 and 11 (loop through).
- B. A standard charge (if empty) will take approximately 6 hours. The EBPS will limit charging to 0.5A.
- C. Charge the EBPS until the charge current tapers to less than 0.05A.

5.2.3 Capacity Check

- A. Ensure that the unit is charged per Section 5.2.2 Charging.
- B. Apply known/equivalent external loads to each output pin of the EBPS then enable the EBPS by ARMING the unit (see Section 4.2). It is recommended to utilize similar incandescent bulbs as used in the aircraft to check capacity. For example, GE1619 incandescent bulb is nominally 3.68Ω , which draws approximately 1.8A at 6.6 VDC. Note: Capacity check should be conducted at $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ (64-82°F) for accurate results.
- C. Monitor the time (in minutes and seconds) from enabling the EBPS outputs (e.g. incandescent bulbs) until the bulbs turn off.
- D. The EBPS must be capable of supporting the aircraft's emergency lighting for a minimum of 20 minutes. If the unit does support the emergency load for more than 20 minutes it can be returned to service – see Section 5.2.4 below.

5.2.4 Return to Service

- A. Recharge the unit per section 5.2.2.
- B. Re-install the unit in the aircraft, including securing it via proper mounting and electrical mating connections.
- C. Record service action in aircraft log book.

5.3 COMPONENT MAINTENANCE

The cells, electronics, and other components that comprise the TS60 Emergency Battery Power Supply are not user serviceable or replaceable items. Therefore, data is not available from the manufacturer to conduct field maintenance.

5.4 STORAGE INFORMATION

In normal use, the TS60 utilizes the aircraft power to maintain the proper charge voltage and sustain the battery cells at peak capacity. Although the chemistry of the cells used in the TS60 maintain an extremely low relative self-discharge rate, all batteries will slowly self-discharge if left unused for long periods. In addition, self-discharge rates are directly related to the storage temperature. Higher storage temperatures will result in faster self-discharge rates.

Rechargeable lithium ion batteries must be stored in a dry, well-ventilated area. They must not be kept in the same area as highly flammable materials. The unit can be stored in the same area as other battery chemistries. The TS60 does not emit or absorb any gas during storage, transportation, or during normal operating conditions.



SHELF LIFE: Per domestic and international shipping requirements, lithium-ion batteries may be shipped as low as 30% state of charge (SOC). Therefore, the EBPS is required to be fully recharged upon receipt. Units that are stored shall be fully recharged at a minimum every 6 months, following the procedure set forth in Section 5.2.2.

STORAGE TEMPERATURE: Exposure to temperatures above 30°C (86°F) for sustained periods of time is possible, but may increase the self-discharge rate or result in some permanent loss of capacity. Storage temperatures above 50°C (122°F) are to be avoided.

5.5 END OF LIFE

The following conditions will help maintain or extend the life and performance of your product:

- Avoid significant exposure to high temperatures (above 30°C/86°F) during operation or storage
- Avoid long periods (greater than 7 days) at a state of full discharge
- Avoid long periods of storage (greater than 6 months) without recharge

End of life is represented by the inability of the unit to meet the minimum capacity requirement of the aircraft as tested during capacity verification per Section 5.2.3. In the event that the unit exhibits failure, insufficient capacity or expired life, contact True Blue Power for repair, exchange or replacement. Visit www.truebluepowerusa.com for more information.

5.6 DISPOSAL



NOTE: All lithium ion batteries are classified by the United States government as non-hazardous waste and are safe for disposal as normal municipal waste. However, these batteries do contain recyclable materials and recycling options available in your local area should be considered when disposing of this product. Dispose of in accordance with local and federal laws and regulations. Do not incinerate

5.7 DO-311A COMPLIANCE QUALIFICATION FORMS

MODEL NUMBER: TS60 **PART NUMBER:** 6430060-()
DESCRIPTION: Emergency Battery Power Supply
CERTIFICATION: FAA TSO-C179b, Class A-3A
MANUFACTURER: True Blue Power, a division of Mid-Continent Instrument Co., Inc.
ADDRESS: 9400 E. 34th St. North, Wichita, KS 67226, USA
SPECIFICATION: Test Specification (TS) 731 Test Data Sheet (TDS) 731
STANDARD: RTCA DO-311, Rev A, dated 12/19/2017

SECTION	SUB	TITLE	RESULT	SUMMARY
1	1.4	Battery Categories	Comply	Energy Category 3: 20-200Wh Venting Category A: hermetically sealed Architecture Category: standalone
2	2.1	General Requirements	Comply	Rated Capacity: 4.3Ah or 6.5Ah
	2.2	Equipment Requirements	Comply	Met by passing tests in 2.4.4
	2.3	Environmental Conditions	Pass	Per RTCA/DO-160G; see EQF
2.4.4	2.4.4.1	Physical Examination	Pass	See IM for physical specifications
	2.4.4.2	Acceptance Test Procedure	Pass	ATP per MPS identified above
	2.4.4.3	Insulation Resistance	Pass	1.98GΩ min initial; 1.68GΩ min final
	2.4.4.4	Handle Strength	N/A	(no handles)
	2.4.4.5	Capacity Test	Pass	4.5Ah / 6.8Ah minimum
	2.4.4.6	Capacity Test at Temp	Pass	3.7/5.5Ah @ -20°C; 4.6/6.8Ah @ +70°C
	2.4.4.7	Constant Voltage Discharge	N/A	(only required for 'high rate batteries')
	2.4.4.8	Charge Acceptance	Pass	0.7/1.1Ah @ -20°C; 0.8/1.1Ah @ +23°C
	2.4.4.9	Charge Retention	N/A	(only required for Energy Category 4)
	2.4.4.10	Cycle Test	N/A	(only required for Energy Category 4)
	2.4.4.11	Rapid Discharge Test	Pass	I _{MAX} = 10A @ 70°C; max case temp = 71.5°C
	2.4.4.12	Short Circuit with Protection	Pass	Max current = 4.75A per output
	2.4.4.13	Overdischarge Test	Pass	Protective circuitry prevented charging after over-discharge
	2.4.4.14	Overcharge Test	Pass	Internal protections prevented overcharge
2.4.5	2.4.5.1	Short Circuit Test of a Cell	Pass	No release of fragments, flames or emissions. No increase in case temperature
	2.4.5.2	Short Circuit Test of a Battery without Protection	Pass	No release of fragments, flames or emissions. No increase in case temperature
	2.4.5.3	Overdischarge without Protection	Pass	No release of fragments, flames or emissions. Case temp increase = +3.4°C
	2.4.5.4	Single Cell Thermal Runaway Containment Test	N/A	(not required in lieu of 2.4.5.5)
	2.4.5.5	Battery Thermal Runaway Containment Test	Pass	No release of any material or gases. All cells achieved thermal runaway. Maximum case temp = 136°C
	2.4.5.6	Explosion Containment	Pass	No ruptures in case; no emissions observed
	2.4.5.7	Drop Impact	N/A	(only applicable for portable devices)

