g GE Energy ***Parts & Repair Services*** ***Louisville, KY***	**Functional Testing Specification** **LOU-SSB-BAT174**

Test Procedure for SSB Convertec BAT174 Battery Charger

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1. SCOPE

1.1 This is a functional test procedure for a SSB Convertec BAT174 battery charger module.

2. STANDARDS OF QUALITY

2.1 Refer to the current revision of the IPC-A-610 standard for workmanship standards.

3. APPLICABLE DOCUMENTS

3.1 The following document(s) shall form part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue shall apply.

3.1.1 Original SSB operating instructions for test equipment battery charger BAT174 and L1027(A) document Art. No. 88-80-61*000010 Rev.0.0, for reference only.

3.1.2 L1014A/L1027A user manual. PDF

4. ENGINEERING REQUIREMENTS

4.1 Equipment Cleaning

4.1.1 Equipment should be clean and free of debris prior to applying power unless performing an initial check. Refer to site specific SRA's for cleaning guidelines.

4.2 Equipment Inspection

4.2.1 Equipment should be visually inspected for any defects prior to applying power. This inspection should include the following as a minimum:

4.2.1.1 Wires - broken, cracked, or loosely connected

4.2.1.2 Terminal strips / connectors - broken or cracked

4.2.1.3 Components - visually damaged

4.2.1.4 Capacitors - bloated or leaking

4.2.1.5 Solder joints - damaged or cold

4.2.1.6 Circuit board - burned or de-laminated

4.2.1.7 Printed wire runs / Traces - burned or damaged

5. EQUIPMENT REQUIRED

5.1 The following equipment is required to perform the process requirements. Equipment may be substituted provided that all accuracy's and test ratios are equivalent or better.

Qty	Reference#	Description
1	H188816	SSB Test Fixture for L1027(A) and BATT174 battery chargers. 0541 626 5 /501
2		Digital multi-meter (Fluke 85 or equivalent)

Special Note 1: COMPONENT IMPROVEMENTS TO MAKE THE BAT174 CHARGER MORE ROBUST

Each unit in for repair will have all electrolytic capacitors replaced with new ones that are completely sealed and have an improved operating temperature range of –40 to 105 degrees C.

Special Note 2: Some indicator lamps on top of the fixture are labeled with two names. The names in parenthesis correspond to testing the BAT174.

6. TESTING PROCESS

6.1 Theory Of Operation – Charger and Test Fixture Cabinet

The charger operates in four different states, i) constant current mode, ii) constant voltage mode, iii) open circuit rest mode, and iv) diagnostics mode. The nominal charge current in constant current mode is 1.0A. The nominal charge voltage ranges from 163 to 178 VDC. As the operating temperature of the batteries varies the constant voltage charge period is limited to 2 to 5 minutes.

Electrical Specifications

Input Power:

AC Power Supply:	115 - 230Vac
Input AC voltage range:	+/-20%
Nominal Input Frequency:	50/60Hz
Inrush current:	< 30 A
Input power quality:	no power factor specified
Efficiency:	> 85% (at 230 V_{AC})

Charging Unit:

Maximum output voltage**:**	185.0 VDC (voltage limit in constant current mode)
Nominal constant charge current**:**	1.0 A (I_{CC})
Nominal float voltage:	see V_{CV} in Table 1
Float voltage range**:**	163VDC to 178VDC adjustable
Float voltage factory setting:	173VDC
Minimum Control Accuracy**:**	+/- 0.5 % (load change from 10% to 90%) (line change from –20% to +20%)
Over voltage protection**:**	none
Output Voltage Ripple**:**	max. 0.5% of V_{out}
Output Voltage Spikes**:**	max. 1Vpp

Short-circuit protection**:**	Typ. 1.3 A
Power-back immunity**:**	0 to 200VDC
Output Voltage Isolation:	Galvanic isolation to source and enclosure

The BAT174 has a temp sensor input with 3 LED indicators; mains ok, battery ok and sensor ok.

The BAT174 is adjustable power supply with a nominal charge current of 1 amp current output. It has three adjustment pots on the back to set the nominal charge voltage of 173VDC **(POT 1 next to the 10-pin connector)** adjustable range is 163V to 178VDC, output max voltage limit in constant current mode to 185VDC **(POT 2 middle pot)**, and battery ok threshold voltage range 129.6 to 154.8 nominal is 151VDC **(POT 3 pot furthest from connector).** The BAT174 has a short-circuit protection current limit, typical is 1.3 amps. The max pulse current is 1.6 amps (100 ohm load).

Charger Output Signals

The power supply shall provide a relay contact indicating a failure in the mains supply. When the mains voltage disappears the relay contact opens and turns ON the red (MAIN/BATERY FAULT) lamp. When the mains returns, the relays contact closes again and turns ON the green (MAIN/BATTERY OK) lamp on the fixture.

The power supply provides a relay contact indicating the battery voltage ok as a result of a single successful battery test. Contact (low voltage relay) opens after the second diagnostic events showing the battery voltage below the “battery test okay” threshold. A successful second test resets any potential negative previous flag bit set in the controller. The relay contact is open until the next successful battery test is executed.

Battery OK signal threshold (VPT *12): 130 … 155 V (Adjustable by Potentiometer).

Threshold tolerance	1.0 %
Battery OK relay rating:	30.0 VDC/1.0A
Battery OK indicator	LED

Charger Input Signals

A temperature sensor (LM335) is used to define the maximum float charge Time (CV mode). The sensor shall be monitored for its presence. If the sensor is unplugged from the charger, the float charge time corresponds to the 20°C value as specified in the timing vs. temperature diagram. The green sensor monitor LED is off. A green LED indicates that the sensor is connected and the sensor voltage is in the operating range. The operating range is defined from -10°C to +50°C. A flashing green LED indicates that the sensor is out of range or there is a potential failure (short or open lines) in the sensor connections.

The BATT/MAINS OK relay in the charger remains on as long as the charger detects a battery is connected and the main AC power to the unit is present. This causes a relay contact to close and turn ON the green (MAIN/BATTERY OK) lamp on the fixture and open a contact to turn OFF the red (MAIN/BATERY FAULT) lamp.

When the battery is disconnected or with the absence of main AC power, the BATT/MAINS relay in the charger will de-activate and open a contact to turn OFF the green (MAIN/BATTERY OK) lamp on the fixture and close a contact to turn ON the red (MAIN/BATERY FAULT) lamp.

The MAIN switch on the test fixture is used to apply power to the entire test fixture cabinet.

The white SYSTEM ON lamp is used to indicate power to the entire test fixture cabinet.

The red CHARGER OUT POS, BATT PACK POS, and LAMP LOAD POS banana jacks allow the output of the charger to be connected to either the battery pack inside the fixture or to the external lamp load. You can also connect the lamp load directly to the battery pack in order to discharge it some. Sometimes it’s nice to have a partially discharged battery pack in order to test and troubleshoot certain features of the supply.

The BATTERY / LAMP switch applies the output of the charger to the battery pack inside the fixture or to the external lamp load depending on which of the two has been patched-in via the banana jacks on top of the fixture

The TEST ON button commands an AC interlock circuit in the fixture to apply 120VAC to the AC input terminals of the charger. The charger then turns on and begins to charge the batteries inside the fixture or power the lamp load. The TEST ON button also lights up green for the occasion.

The purpose of the AC interlock circuit is to prevent power from being re-applied without first cycling the MAIN switch off and back on again.

The TEST OFF button trips the interlock circuit to kill AC power to the charger.

The ESTOP button is a NC switch in series with the TEST OFF button. When activated, it will also kill AC power to the charger and trip the interlock circuit. The main difference is that the ESTOP button has to be manually pulled back up and the MAIN power recycled again to get things rolling.
The Charging Voltage meter is simply used to display the output voltage level of the charger.

The Charging Current meter is simply used to display the amount of current being drawn from the charger by the battery pack or the lamp load.

6.2 Test Setup

6.2.1 Turn the MAIN switch on the SSB test fixture OFF.

6.2.2 Shunt load switch should be in the “OUT” position.

6.2.3 Pull the ESTOP button on the fixture OUT.

6.2.4 Turn the BATTERY/LAMP switch OFF.

6.2.5 Plug the power cord of the fixture into an AC outlet.

6.2.6 Lift the Lexan shield on the fixture and slide the UUT into the metal holding bracket.

6.2.7 Connect the 3-pin cable to the front of the unit the 10-pin cable to the back and the 3-pin temp sensor on the back also.

6.2.8 Lower the Lexan shield.

6.2.9 Connect the CHARGER OUT POS jack to the BATT PACK POS jack on top of the test fixture. Connect current meter in series to monitor panel meter.

Special Note 2: Some indicator lamps on top of the fixture are labeled with two names. The names in parenthesis correspond to testing the BAT174.

6.3 Test Procedure

6.3.1 Connect the Fluke 85 (or equiv) multi-meter to the DMM jacks just above the Charging Voltage meter to get a very accurate reading of the output voltage.

6.3.2 Set the range on the meter to read XXX.X DC voltage, press the min max button.

6.3.3 Ensure the SHUNT toggle switch is in the “OUT” position.

6.3.4 Turn the BATT/LAMP to OFF.

6.3.5 Turn the MAIN switch ON.

6.3.6 Verify the white SYSTEM ON lamp is ON.

6.3.7 Verify the red (OVER-/UNDER-VOLTAGE FAULT) lamp is ON.

6.3.8 Verify the red (MAIN/BATTERY FAULT) lamp is ON.

6.3.9 Push the TEST ON button.

6.3.10 Verify the green TEST ON lamp is ON.

6.3.11 Verify the DMM measures 185VDC max. (If not 185V needs adjustment) the meter should capture the max voltage.

6.3.12 Verify the BATTERY OK (Main/battery ok) led comes on

6.3.13 Wait up to 20 sec for the green (OVER-/UNDER-VOLTAGE OK) lamp to come ON.

Special Note 3: It’s normal for the Charging Current to be 0 amps with no battery connected and no shunts connected.

6.3.14 After 5 seconds Verify 173VDC (+-5%) on the DMM, (if not 173VDC needs adjustment)

6.3.15 Adjustment of 173VDC Charging Voltage and the 185VDC max voltage.

6.3.16 Adjust the pot **(POT 1)** on the back of the charger next to the 10-pin connector for exactly 173VDC on the Fluke meter.

6.3.17 Next take the max voltage that the meter captured if the max captured voltage is above the set-point voltage subtract 185VDC from the max captured voltage.
Example: Max captured voltage = 190VDC Set point voltage 185VDC
190VDC - 185VDC = 5**VDC OFFSET voltage.**

6.3.18 Now take the 173VDC and subtract the OFFSET voltage
Example: 173VDC- 5**VDC OFFSET voltage =** Adjustment voltage.

6.3.19 Adjust the middle pot **(POT 2)** until the voltage on the DMM equals the Adjustment voltage.

6.3.20 Adjust the pot **(POT 1)** next to the 10-pin connector again for exactly 173VDC on the Fluke meter.

6.3.21 If below take 185VDC and subtract the max captured voltage.
Example: Max captured voltage = 180VDC
185VDC - 180VDC = **VDC OFFSET voltage**

6.3.22 Now take the 173VDC and add the OFFSET voltage
Example: 173VDC + **VDC OFFSET voltage =** Adjustment voltage.

6.3.23 Adjust the middle pot **(POT 2)** until the voltage on the DMM equals the Adjustment voltage.

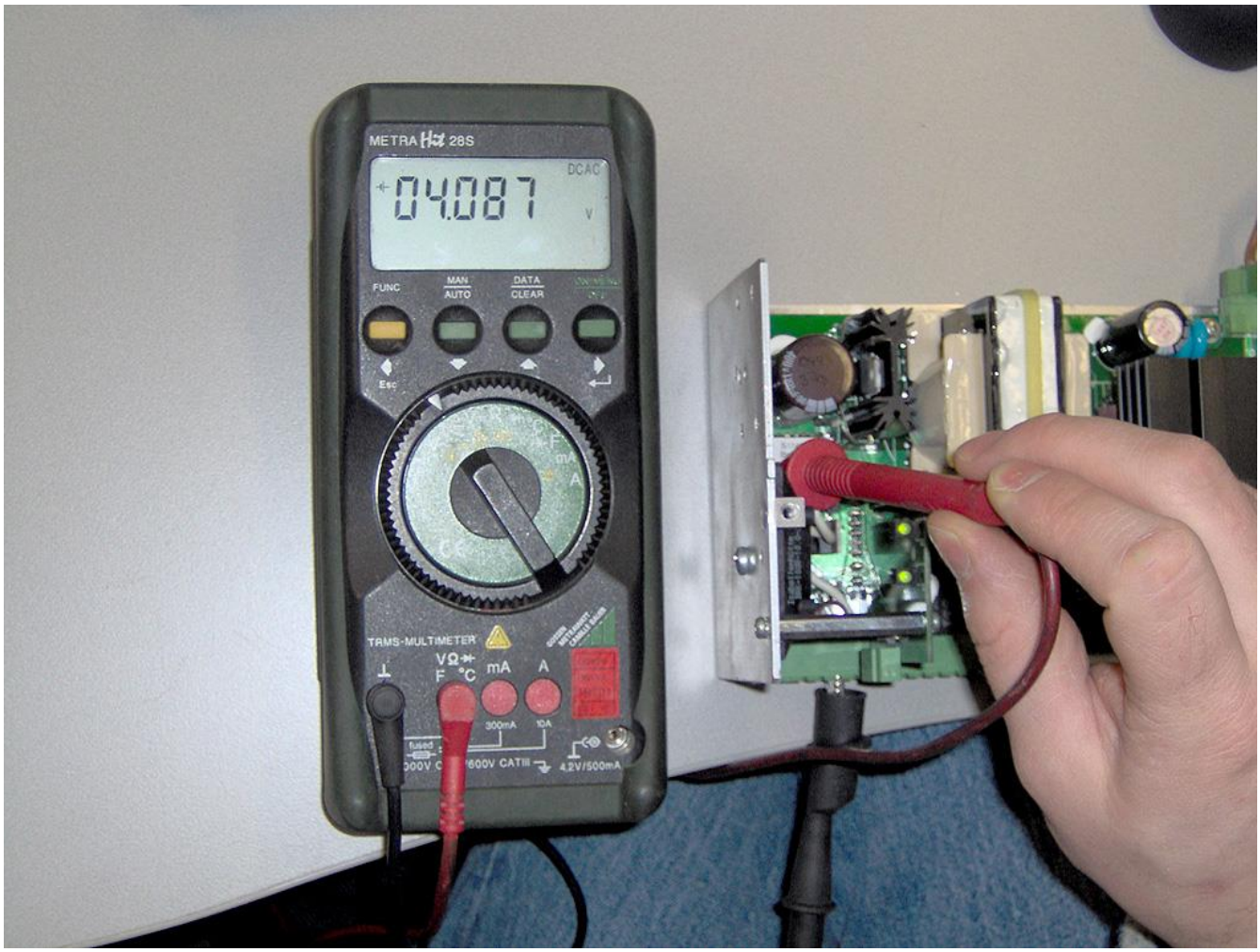
6.3.24 Adjust the pot **(POT 1)** next to the 10-pin connector again for exactly 173VDC on the Fluke meter.

6.3.25 Turn of power and wait until power charger shuts down all led's.

6.3.26 Turn on power and press the test on button, check the max voltage of 185VDC and the charge voltage of 173VDC.

6.3.27 Battery "ok" voltage adjustment.

6.3.28 Connect the positive lead of the meter to J19 or pin 1 of the IC. **Caution not to short any pins together this will blow the supply.**



6.3.29 Adjust **(pot 3)** until the voltage is equal to 4.087VDC. **This measured voltage is equal to the threshold of 151VDC.**

6.3.30 Turn off the main switch and remove jumper lead off of J19.

6.3.31 Connect the Fluke 85 (or equiv) multi-meter to the DMM jacks just above the Charging Voltage meter.

6.3.32 Power the test station back up and press the TEST ON button.

6.3.33 Wait up to 20 sec for the green (MAIN/BATTERY OK) lamp to come ON.

6.3.34 In about 2 minutes the supply will check for the battery. Battery test every two minutes. The voltage will measure approx. 42VDC while checking the battery then jumps to the max voltage of 185VDC.

6.3.35 Wait 2 more minutes the supply again will check for the battery and set the flag bad or low battery. After the second time the BATTERY OK LED will lite on the tester, BATT OK LED will turn off, and BATTERY/FAULT LED will come on.

6.3.36 Verify 173VDC volts on the Charging Voltage meter with battery fault.

6.3.37 Turn the BATTERY/LAMP switch on to enable the battery pack.

6.3.38 Verify 0 - 1.1 amps on the Charging Current meter. This will vary depending on how well the batteries are charged.

6.3.39 Wait 2 minutes if the battery packs are charged enough the battery fault will clear. The Battery ok LED on the test station and BATT OK LED on the unit will turn on.

6.3.40 Verify –1.1 amps of current. Hold for 2 seconds.

6.3.41 After 2 seconds the current will go to zero amps. Hold for 1 second.

6.3.42 After 1 second the current will go to 1.1 amp and hold for three seconds.

Special Note 4: MONITOR THE CURRENT WHILE NEGATIVE IT SHOULD SWITCH TO ZERO AMPS IN APPROX 2 SECONDS AS THE BATTERY FAULT IS CLEARED. IF IT STAYS NEGATIVE THE SUPPLY IS DEFECTIVE AND WILL OVER HEAT.

6.3.43 Switch off the main power switch.

6.3.44 Switch the SHUNT load switch to the “IN” position.

6.3.45 Power up test station.

6.3.46 Wait up to 20 sec for the red (MAIN/BATTERY FAULT) lamp to come ON.

6.3.47 Verify approx 173VDC (+-5%) on the Charging Voltage meter.

6.3.48 Verify 1.1 amps on the Charging Current meter.

6.3.49 This will keep the supply in constant current mode.

6.3.50 Wait up to 10 sec for the red (MAIN/BATTERY FAULT) lamp to go OFF.

6.3.51 Every two to four minuets the supply will cycle to charge the battery packs but the shunt load will discharge them.

6.3.52 The voltage will Cycle from 148VDC to approx 180VDC as the charger charges and measures the battery packs.

6.3.53 Let unit cycle on this test for 10 minuets.

6.3.54 Turn the MAIN switch back OFF.

6.3.55 Disconnect the BATT PACK POS jack and move it over to the LAMP LOAD POS jack to allow the charger to power the lamp load.

6.3.56 Add in parallel the 100w light bulb across the 75w bulb to draw enough current to lower the output voltage enough to enable the short circuit protection, this will limit the current to 1.3 amps and the voltage output will drop to approx 100VDC.

6.3.57 Turn the MAIN switch back ON.

6.3.58 Press the TEST ON button.

6.3.59 Verify the output current is 1.3 amps at 100VDC.

6.3.60 Press the TEST OFF button, after 20 seconds verify the OVER-/UNDER-VOLTAGE FAULT lamp comes on and the BATTERY/FAULT comes on.

6.3.61 Turn the MAIN switch back OFF

6.3.62 Disconnect the LAMP LOAD POS jack and move it back over to the BATT PACK POS jack. This will connect the charger back to the battery pack.

6.3.63 Flip the BATTERY switch back to the OFF position.

6.3.64 Turn OFF the MAIN switch

6.4 ******TEST COMPLETE ******

7. NOTES

7.1 None at this time.

8. ATTACHMENTS

8.1 None at this time.