

**CHAPTER 6**  
**Malcom Company RECHARGEABLE BATTERY BB-390A/U**  
**Part #: BT-70290 NSN#: 6140-01-419-8187**

**6-1. SCOPE**

This state-of-the-art, high performance Nickel Metal Hydride Battery is manufactured for Malcom Company in the United States by Bren-Tronics. This battery has been used for SINCGARS Radio Set AN/PRC-104 and various other battery powered equipment. It was designed for the U.S. Department of Defense and its friendly allied nations. The battery is manufactured in accordance with U.S. military specifications and ISO 9000 requirements.

**6-2. FEATURES**

- High reliability due to all-welded construction.
- Durable high impact plastic housing and connector enclosure.
- Gold Plated brass contacts for extended electrical hookup without corrosion.
- 100% final testing & individually coded with manufacturing date and serial number.
- State of charge display with LCD readout.
- Protection against possible cell reversal.
- Rechargeable with up to 500 cycles, depending on use, and a shelf life of up to five years depending on storage conditions.
- Improper charging prevented by built in temperature sensors.
- Automatically displays remaining capacity of battery.
- Precise discharge and low voltage control with patented safety circuit.
- Power to the heat gun will automatically shut off when voltage drops below 35 volts.

**6-3. OPERATION**

The **MCH-100-A** is a robust tool that subjects the BB390A/U battery power source to rapid discharge. Accordingly, the batteries must be 100% charged to ensure a long life for the batteries and peak performance from the tool. Starting with a fresh charge and 75 degrees ambient temperatures, the tool should operate continuously for 26-28 minutes. Continual run generates greater internal heat, and combined with high ambient temperatures will ultimately cause the thermal protective circuitry to shut down the tool prematurely. Using the tool in short bursts will not generate that much heat, and the tool may be operated for an extended period before re-charge is necessary.

The batteries incorporate two LCD readouts for a visual state or charge display. A full battery will display five LED segments in each of the two displays on the top of the battery. As the battery is used, during the heat gun operation, the LCD will display a decreasing number of segments. Each segment represents about 20% (5 min) of run time of the heat gun. (See section 6-8) The two LCD displays should be identical when they are calibrated. The last segment usually remains on the longest.

The BB-390-A batteries are fully charged as part of standard procedure before final test and assembly. However, it must be fully understood that all rechargeable **batteries lose 1 percent of their charge in 24 hours of shelf time**. Thus, when the tool is unpacked for use in the field, the batteries may be well below charge levels at manufacture. They might even have gone into “sleep mode”. Therefore it is recommended that each battery be pre-conditioned before initial use.

**NOTE:** Even though the battery manufacturer rates the BB390A/U battery for 500 cycles, the actual cycles of these batteries when used in the MCH-100-A tool will most likely be less than 500. How much less will depend on the way the tool is used and the environmental conditions it is subjected to.

#### **6-4 USE OF THE BB-390A/U BATTERIES IN THE MCH-100-A**

1) Prior to first use, each individual BB390A/U battery must be pre-conditioned which involves two (2) full discharge and recharge cycles. Follow the discharge procedures outlined in section 6-6 and 6-7 of this manual. This prepares the battery for optimal performance. This is critical to the longevity of the battery in actual operation. Failure to conduct these charge/recharge procedures may shorten the life of the battery.

**NEW BB-390s!** If the date code on the BB-390s is within 6 months of opening the box then. ...Just charge it up and use it. Then after the first days use, discharge and charge the batteries twice following the procedures outlined in section 6-6 and 6-7 of this manual. This will properly condition the batteries for use with the MCH-100-A.

2) Always ensure that the batteries are carrying a charge prior to going out on the job. Using a standard volt/ohm meter, measure the voltage of each side of the battery section to be sure that it is a minimum of 13.25 Volts. And/or, check the LED indicators for charge condition. Each segment indicates about 5 minutes of operating time. If this is not the case, re-charge the batteries.

If there is any doubt that the batteries are not fully charged, replace them with batteries that show full charge and operational readiness. This can only occur by following good maintenance practice. If only one set of batteries are available, they must be routinely cycled for charge/discharge freshening.

3) The MCH-100-A uses two BB-390A/U batteries. Always use batteries from the same lot. Try to avoid mixed batteries from different lots and date codes. It is essential for optimal performance that the batteries share equally in the operational requirements of the heat gun tool. A weak battery will be the limiting factor in tool run time.

While it maybe necessary to use whatever battery is available, proper mating within the circuitry is good practice. Whenever possible, replace both batteries with matched performance pairs. Check the date codes for warranty. Do not mix BB-390-A/U older batteries with the newer version BB-390-B/U. Both versions will operate the MCH-100-A, but do not mix the types.

4) Never attempt to force charge a warm battery. Batteries should be cooled to room temperature prior to process. If it is available, place the batteries in a refrigerator or a cooler to speed the process. Upper and lower extremes in temperature are damaging to any battery, and rechargeable type batteries need to be handled with attention to longevity

5) The MCH-100-A Battery Powered Heat Gun depends on the proper treatment of the power source. Current versions of the tool, that are using the 300 watt element, will operate for approximately 26-28 minutes before thermal protection or low voltage shuts the tool down. This is a protective circuit built into the battery pack. The battery will then require a cooling down period, and normal recharge on the standard military PP-8444A/U Universal Battery Charger with the BB-390 adapter plate.

6) In a very hot operating environment, run time of the heat gun may be less. Protect the Power Pack from extremes of ambient temperatures. Sitting on the tarmac in a desert sun will pre-heat the BB-390s and shorten the run time of the heat gun.

7) Batteries should be cooled to room temperature before they are recharged. AND the batteries should be cooled to room temperature after charging is complete, before using the MCH-100-A.

**The BB-390A/U battery is the only battery that has been approved to be used with the MCH-100-A Heat Gun. The PP-8444A/U Charger manufactured by Bren-Tronics is the only charger that can be used to recharge the BB-390A/U batteries.**

## **6-5. TROUBLE SHOOTING BATTERIES**

### **When should the batteries be replaced?**

Batteries are fully charged when a volt meter shows 13.25 volts or greater. If the voltage in any of the sections is less than 13.25 volts after being charged, then the battery needs to be placed on the charger again. If after the second charge cycle they do not show 13.25 volts then the batteries must be discarded and replaced with a new battery.

***The PP-8497/U (BB-390 self-discharge Cap shown in section 6-7 in this manual); can be used as a quick checker that ensures that both 12 volts sections within the battery are working fully. Thus, in a matter of minutes you could quickly check all your BB-390s stocks to ensure they are good to go on both 12 volt sections***

The batteries are SMART and contain internal printed circuit boards with electronics that control the way the batteries function. The batteries are fully sealed. However, due to mishandling, the case and or the connectors can crack exposing the inside of the batteries to the environment which could effect the performance of the battery. If the case becomes cracked then the battery should be discarded and replaced.

**MALFUNCTION: 1. The batteries are fully charged yet the LCD screens do not indicate a full charge.**

The LCD displays can become out of calibration, thus displaying false LED segments, under two circumstances as described below.

1) Long term storage. If the battery has not been used for a period exceeding two months, then the internal program that controls the LCD displays will indicate less capacity than is actually present in the cells. Some cells could go into “sleep mode”. Follow the procedures in section 6-6 or 6-7 to wake up the sleeping cells.

2) Continuous battery discharge due to the heat gun being on for extended periods of time could cause the battery LCD displays to become out of calibration. If the heat gun is used in the continuous mode, then internal heat will build up within the batteries. The thermal safety switches within the battery will automatically turn the batteries off. They can not be restarted with the heat guns connected in the on position. As a result of thermal switch activation, the internal program that controls the LCD displays will indicate less capacity than is actually present in the cells once the batteries are recharged.

**MALFUNCTION: 2. One 12-volt section shows full charge when checked with a volt-meter and the other 12-volt section does not.**

If one of the 12-volt sections in the BB390 battery does not fully charge while the other section shows a less than full charge, then maybe one of the small cells within the 12-volt section has fallen asleep and needs to be woken up, or it is faulty. Follow the procedures in section 6-6 or 6-7 to wake up the sleeping cells.

1) Long term storage without recharging every two months or so can cause this to happen or improper storage in very cold or very hot conditions can cause this to happen. Before you discard the battery, you can try to reset the internal cells by completely discharging the battery. Follow the discharge procedure outlined in section 6-6 or 6-7 as well as in the corrective action section below.

**MALFUNCTION: 3. MCH-100-A run time is less than 20 minutes even after a fresh complete discharge and recharge cycle.**

- 1) Each BB-390 has two 12-volt sections. Although your BB-390s may charge up well, displaying full State of Charge (SOC) readings, and provide 13.25 volts or better at pins (1-4 & 2-5) after a charge, it may have internal damage to one of the cells or the printed circuit board that will prevent normal use in either or both 12-volt sections.
- 2) One of the internal cells may be “asleep” and needs to be conditioned.

## **CORRECTIVE ACTION:**

1) It is recommended that each battery be first checked with the BB-390 Self-Discharge Device (CAP) PP-8497/U shown in section 6-7 of this manual places a load on each 12 volt section of the BB-390 to provide quick check of each section. (CAP is available from Malcom Company or through your Supply Depot NSN: 6130-01-490-4310)

### BB-390 Quick check instructions using the Self-Discharge Device (CAP) PP-8497/U

A: Ensure the BB-390 has been charged in the last 60 days. If not then charge the battery.

B: Place Self-discharge device (cap) on the BB-390.

- a. If both LEDs light "green".... your battery is ok. Both 12-volt sections are discharging properly. Remove cap and go on to next battery
- b. If one or both LEDs **DO NOT light "green"**; then place BB-390 in "bad" battery pile. Remove cap and go on to the next battery...If the battery is one year old or less then return the battery for warranty after performing the procedures twice that are outlined in 6-6 or 6-7 to try to wake up the sleeping cell. *Note: Ensure Self-Discharge cap is working with known good battery when you first use device. If the battery fails just after a charge, wait 1 hr for the battery low temp cut off to reset and then retest with cap.*

2) Condition Batteries: Batteries must be completely discharged before they are charged again. It is recommended that you do this twice. There are two ways to discharge the BB390 battery outlined in section 6-6 and 6-7 in this manual.

## **6-6. DISCHARGE PROCEADURE USING THE HEAT GUN**

1) Turn on the heat gun fan. Do not turn on the heater.

2) Run the heat gun unit (fan only) until it turns off automatically due to the internal voltage cutoff switch, which protect the batteries and the heat gun from low voltage. This will empty the battery. The time that this occurs will vary depending on how much capacity remaining in the batteries at the time.

3) Remove the batteries from the MCH-100 battery case, let them stand for one hour, and then charge them on the P-8444A/U "Universal Charger". After the charge is complete, the LCD segments should be calibrated. If not, then let them cool and place them on the charger again and let them run through a charge cycle one more time. If after the second charge cycle the SOC's are not filled, ensure voltages at pins 1-4 & 2-5 are at least 13.25 volts. If under 13.25 volts, the charger or adapter maybe damaged. If everything looks ok after the second charge, once batteries have cooled down from charging, they are ready for use again and can be installed into the MCH-100-A battery case.

**NOTE** that the batteries can be used without causing damage to them, even though the LCD's are out of calibration. The batteries will hold a normal charge and all the built in thermal and voltage cutoff system will operate properly. The problem will be that the LCD's will not show the true level of charge until they have been calibrated as explained above.

#### **6-7. DISCHARGE PROCEEDURE USING THE SELF-DISCHARGE CAP.**

(This is the preferred method because it does not require the use of the MCH-100-A heat gun.)

#### **BB-390 Self-Discharge Device (CAP) & Good Battery Quick Check Device PP-8497/U, NSN: 6130-01-490-4310**

Available from Malcom Company or through your Supply Depot



The PP-8497/U device will assist in conditioning and maintaining your BB-390 stock.

#### **Notes:**

The discharge device is not intended to measure how long the battery will run your equipment. The device is intended as a quick sanity check for ensuring both 12-volt sections are working and for discharging the battery. You still must ensure the BB-390 is fully charged prior to use.

**Discharging:** The cap will discharge the BB-390 without requiring a power outlet or running of the heat gun. Discharge times will vary based on the BB-390 state of charge. A fully charged BB-390 currently takes 24 hours with the self-discharge device. Discharge times drop dramatically if discharging BB-390s that had been discharged during use. Discharge is recommended quarterly to ensure good running of the BB-390s.

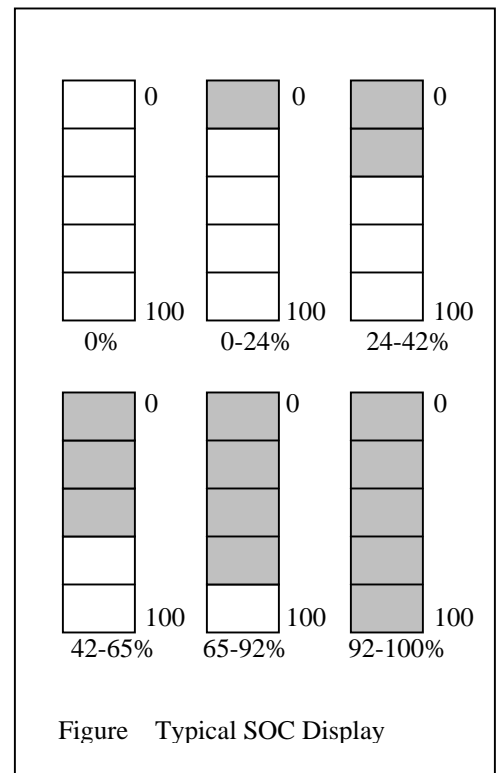
#### **Discharging instructions:**

1. Place Self-discharge device (cap) on the BB-390.
  - a. If, Both LEDs light "green".... your battery is ok. Both 12-volt sections are discharging properly. The discharge will continue until the lights turn off. Then, remove cap and go on to next battery.
  - b. If one or both LEDs **DO NOT light** "green"; then place BB-390 in "bad" battery pile . Remove cap and go on to the next battery. *Note: Please ensure cap is working with known good battery when you first use device.*

## 6-8. STATE-OF-CHARGE (SOC) BATTERY DISPLAYS

The batteries are equipped with state-of-charge displays and indicate battery charge status on a five-segment LCD readout by the number of segments activated, as follows:

Segments	State-of-Charge
0	0% (fully discharged)
1	0 to 24%
2	24 to 42%
3	42 to 65%
4	65 to 92%
5	92 to 100% (fully charged)



- NOTE 1: Batteries have two State of Charge (SOC) Indicators. Both indicators have to be 100% for the battery to be 100%.
- NOTE 2: If batteries have been recharged but State of Charge (SOC) indicators show less than the 100% then the LCD readouts must be recalibrated as outlined in Section 6-5 of this manual.
- NOTE 3: A viewing screen in the battery box is provided so that the operator can monitor the LCD screens through the battery box.

## 6-9. TESTING SPECIFICATIONS

The BB-390A/U has been tested to meet the most current environmental conditions of MIL-B-49436(B)(ER) and proposed U.S. Army specifications for Nickel Metal Hydride Batteries.

Battery Voltage	Mechanical Shock	Retention of Charge
Full capacity Discharge	Vibration	Temperature Cut-off
Cycle Life	Immersion	Over discharge
Overcharge	Electrical Leakage	Low Temp. Discharge
External Short Circuit	High Rate Discharge	High Rate Pulse
Battery Case/Vent	Thermal Shock	Thermistor Test

## 6-10. REPAIR OF BB-390 BATTERIES

BB-390 batteries are not repairable. If a fault occurs the battery must be replaced. Dispose of faulty battery according to local environmental regulations.

## 6-11. BB-390 TECHNICAL SPECIFICATIONS

<i>Cell Chemistry</i>	Nickel Metal Hydride, Sealed
<i>Dimensions</i>	111.76 L x 62.23 W x 127.0 H Millimeters Max 4.40 L x 2.45 W x 5.0 H inches Max
<i>Weight</i>	.75 Kg (3.85 Lbs) Maximum
<i>Nominal Voltage</i>	24.0 Volts, two (2) 12 Volt sections
<i>Capacity per Specification</i>	3.6 Amp Hrs @ 24 V - 7.2 Amp Hrs A 12 V
<i>Typical capacity</i>	4.0 Amp Hrs @ 24 V - 8.0 Amp Hrs @ 12 V
<i>Cutoff Voltage</i>	20.0 Volts DC - 10.0 Volts DC
<i>Connector</i>	Floating Type Per U.S. Army DWG # SC-C-179495
<i>Operating Temperature</i>	-20°C to +500 °C (-4°F To + 130°F)
<i>Storage Temperature</i>	-40°C To +55°C (-40°F To +130°F)
<i>Operational Life</i>	10.0 Hours @ 0.360 Amps, When used in 24 Volt Mode
<i>Applicable Q.A. Specification</i>	MIL-STD-105, MIL-STD-810, MIL-STD-454
<i>Applicable Battery Specification</i>	MIL-B-49436(B)(ER) and Proposed U.S. Army (NMH) Specification
<i>Case Material</i>	Modified ABS (Acrylonitrile Butadiene Styrene) Plastic
<i>Case Color</i>	Olive Drab # 34088 Per FED-STD-595B with white printing
<i>Shipping</i>	Not Hazardous, No Restrictions
<i>Disposal</i>	In accordance with local environmental regulations
<i>Venting</i>	Two (2) pressure relief mechanisms Top & Bottom
<i>Waterproofing</i>	To a depth One (1) Meter, Three (3.3) Feet
<i>Charging</i>	Recommended Charger is "Universal 2 Hour fast Charger"
<i>Standard Charge</i>	Charge at a constant current of 360 mA for 10 - 12 Hrs



Any questions regarding operation, maintenance, repairs, parts, and accessories can be directed to Malcom Company through our toll free number from the US and Canada at 800-289-7505 or from other parts of the world by calling 401-625-5099. We also have a web site at [www.malcom.com](http://www.malcom.com) where you can place orders and email us with questions at any time.