

Torfino Enterprises, Inc.

An independent study of commercially available 9 volt rechargeable battery technology for implementation and use with the ICE LIGHT & METAL-TEC 1400 Product line



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Use of Rechargeable Batteries with METAL-TEC & ICE LIGHT

Both **METAL-TEC & ICE LIGHT** were originally designed for maximum operating time when using a standard disposable 9 volt Alkaline battery. The chemistry of an alkaline battery will out perform all other types of batteries based upon the terminal voltage and it's milliamp hour capacity which is 980 ma at 9.6 volts when new. Although our products were originally designed to take advantage of an alkaline batteries, it is possible to use a rechargeable 9 volt battery providing the user understands the limitations and results they will obtain. For example, both the **METAL-TEC & ICE LIGHT** contain low battery indicators which notify the user when the battery is coming to it's end of life. The circuitry within each of these products relies on sensing the drop in battery voltage thereby giving a low battery indicator to the user. Due to the varying characteristics of different types of rechargeable batteries, the user may experience varying results when it comes to low battery indication. This may include the unit just turning off when the rechargeable battery requires charging rather than indicating a low battery. Providing the user recharges the battery frequently, this should not pose any operational problems.

Rechargeable batteries have varying short comings compared to an alkaline battery which includes a lower operating voltage, lower current capacity, limited shelf life between charges, and in the case of Ni-Cad (Nickel Cadmium) the terminal voltage is only 7.2 volts @ 150 ma maximum, and are subject to memory issues if not completely discharged before charging. Memory issues will greatly reduce the over all performance when using Ni-Cad batteries. It is for these reasons we have written this document to better help users select the proper rechargeable alternative battery.

Please keep in mind that the **ICE LIGHT** users manual references the typical hours of use you will obtain based on using a new alkaline battery. For example when using an **ICE LIGHT** in the flash pattern mode, a user will typically get 24 hours of use based on a new Alkaline battery, rated at 9.6 volts at 980 ma. If you select a rechargeable battery rated at a lower operating voltage and current capacity, for example a Ni-Mh (Nickel Metal Hydride) rated at 8.4 volts at 250 ma, the maximum capacity of the battery based on the chemistry, the user will receive less than one fifth the operating time, or approximately 4 hours of use. You then have to keep in mind that both Ni-Cad, and Ni-Mh batteries both have limited shelf life which means that both will continue to loose their charge even though they are not being used, it then will require recharging to bring the battery back to it's maximum capacity before prolonged use.

Of all the rechargeable battery technologies available today, the one which will give the user the most operational time, longest shelf life, highest number of recharge cycles, and the lowest cost of operation would be the Lithium Polymer battery, this is the same technology used in today's cell phones. Although Lithium Polymer's chemistry is considered safe and having no flash point, users should be aware first and foremost, that it is imperative that the proper charger "MUST BE" used to charge Lithium Polymer batteries using only the manufacturer's specified battery charger. Failure to do so may result in excessive heating of the battery which can pose a fire hazard to the charger.

Our Test Results:

Of all the different types of battery chemistry we tested in our products, we have found one supplier who can supply a turnkey battery solution for lithium Polymer batteries; I-Power (visit their site at: www.ipowerus.com). They offer a far superior battery to anything else out there both in voltage and current, and have available a fully automatic 4 gang charger capable of independently charging up to 4 batteries at once. The charger contains 4 LED indicators which will show the charge state by indicating constant red for charging, green for fully charged, and flashing red for a bad battery. The charger is an intelligent charger whereby it turns the charge circuit off once that battery has reach it's full potential. Other less expensive units we tested did not turn off automatically and it was up to the user to time the charge and remove the battery when the charge was complete, other wise risking a possible over heated battery which can lead to a fire.

Use of Rechargeable Batteries with METAL-TEC & ICE LIGHT

The I-Power kit includes a universal wall transformer which adapts automatically to world wide power requirements of 100-240 Ac 50-60 Hz (UL, PSE, GS/TUV), and can also supply converter plugs which go between the wall transformer and the wall power outlet of the country of use. They also have available a dedicated transformer with the proper plug molded on for use in the UK. Also included in the kit is a 12 volt cigarette lighter plug for use in mobile charging applications. The kit does not contain the batteries but they can supply you with Lithium Polymer batteries which are closer to a true 9 volt, rated at 500 ma of current.

When used In the **ICE LIGHT**, this battery will last 12 hours between charges, and In the **METAL-TEC**, you will find that the battery will give the user half the amount of searches of an Alkaline battery, or approximately 1,000 searches per charge.

The charger is also a rapid charger which allows you to recharge up to 4 Lithium batteries in less than 2 hours allowing the user to continue to use the product with minimal down time. Based on our tests, we have determined that the I-Power 9 volt 500 ma battery is the only battery which will operate a close second to a new alkaline battery by supplying half the capacity (a new alkaline battery is rated at 980 ma). Please be careful to set the switch on the side of the charger to the "Li-ion mode" or Lithium position to insure proper safety when charging Lithium Polymer batteries.

When selecting a rechargeable battery, please keep in mind a few things in general about rechargeable batteries, a Ni-Cad battery is always lower in voltage and current, it does not last as long, and has memory problems. Ni-Mh (Nickel metal Hydride) batteries are a little bit better, but still only go up to 250 ma max. in a 9 volt package, and also require a specific charger. Also Ni-Cad and Ni-Mh will only recharge about 150 times then start to degrade and hold less charge over time, where as the Lithium Polymer batteries by I-power can be recharged between 400 to 500 times based on their usage, while still maintaining most of there capacity which makes the operational cost of the battery far less over time.

Important!

The only down side to using any rechargeable battery with our products, is that the low battery indicators both on the **ICELIGHT** and the **METAL-TEC** may not show the proper low battery condition. This is due to the discharge characteristics of some rechargeable batteries which will not allow the 5 volt low battery detection threshold to be met during a gradual discharge as characteristic of an Alkaline battery. In the case of the I-Power Lithium Polymer battery, the battery will turn off before it reaches a level below 6.5 volts in order to conserve the battery's cell integrity.

In most cases it means that the **ICE LIGHT** will just turn off when the battery needs charging rather than indicating a low battery condition, and the **METAL-TEC** will completely turn off rather than giving a constant vibration indicating a low battery condition.

I hope the above information has explained the users options and the trade off when deciding to use rechargeable batteries. The products will still function normally but at a reduced rate of usage, and at the loss of low battery detection, but providing the user recharges the battery frequently this should not pose a problem. The following pages give the I-Power specifications of both the charger and the 9 volt 500 ma Lithium Polymer battery should you decide to use rechargeable batteries.

Please Note:

We have no affiliation with the I-Power company, and have published this document based on an independent evaluation of their products. Dealers are urged to contact the company directly to receive any further information or pricing regarding their product line. It is important to review all the information before making an intelligent decision regarding rechargeable battery products.

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The following information was supplied by I-Power and is also available on their web site at: www.ipower9volt.com



Switching dual charge mode:

Li-ion (Li-Polymer) or Ni-MH (Ni-CD).
Independent 4 channels with dual color LED.
Charging different capacity battery at same time.

Package:

9V Battery Fast Smart Charger
Universal power adapter: AC 100V~240V (UL, PSE, GS/TUV)
Car Cord (DC12V)**

Optional items:

4 pcs. DC9V-500mAh Li-Polymer Batteries
4-Bay battery caddy (battery holder case for 4 pcs 9V batteries)
Travel power plug adapter (EU, AU/CN, UK/HK)



9V 500mAh Li-Polymer Rechargeable Battery (Model: IP9V500) Professional Support Pro-Audio & Wireless Device

Highest Real Capacity on the market
Special design with Li-Polymer cell, capacity up to 500mAh.
Lithium-Polymer material, Working voltage 8.4V~6.5V,
Standard output current 1~500mA,
Hi-rate continue output 750mA,
Max. Transient current up to 1500mA/15 sec.
Build-in Protection IC to control over-current and voltage. More safety and long lasting power.

Note for Distributors and Users: For optimum performance:

- * To extend the shelf life of the battery, recharge the battery every 3 months fully in storage.
- * Always charge the battery fully before storage.
- * Please charge this batteries with the specified Ipower US 9V Fast Smart Charger ONLY!!
- * Please setup the specified charger switch on the Li-ion mode.
- * Using other chargers will damage or shorten the battery's life.

Use of Rechargeable Batteries with METAL-TEC & ICE LIGHT

DC9V 500mAh Li-Polymer Battery Specification: *Revision Ver.03 (Feb. 2008)*

Nominal capacity: (Discharging Current 50mA, 0.1C) 500mAh

Min. capacity: (Discharging Current 50mA, 0.1C) 450mAh

Nominal voltage: 8.4V~6.5V (+0.0V/-0.2V) Std. 9V~6V

Discharge End Voltage: 6.5V (+0.2V/-0.4V)

Charging Model: (With iPowerUS DC-9V Fast Smart Charger) CC & CV

Charging Current: (With iPowerUS DC-9V Fast Smart Charger) 150mA~500mA

Charging Voltage: 8.4±0.05V

Nominal Discharging: Current Up to 500mA (1C)

High Rate Discharging Current: Up to 750mA

Max. Discharging Current: Up to 1500mA, 5 sec.

May be short life Over Current Protect: 1.50~2.0A

Over Voltage Protect: 8.50V ±0.05V

Low Voltage Protect: 6.5V (+0.2V/-0.4V)

Internal Resistance: < 450meg Ohm

Storage Temperature: (centigrade degree) 0~40 degree

Std. Charge Temperature: (centigrade degree) 0~40 degree

Std. Discharge Temperature: (centigrade degree) -10~45 degree

Low Temperature Discharge: (-20~-10 centigrade degree) >65% (>325mAh)

Std. Charge / Discharge Cycle Life: (100 times / 3 month) >65% (>325mAh)

Size: 47.5* 25.5* 16.4mm

Weight: 27.5g ± 0.5g

Note:

3 months limited warranty for DC 9V-500mAh Li-Polymer Battery

High Rate Charge & Discharging (over 750mAh) and High Temperature (over 45 centigrade degree) should be losing cycle life.

Li-Polymer physical reaction & chemical reaction limit value:

Li-Polymer damage test (without Protection): electrochemistry reaction (after fully charge) maximum of greatest output current 4~5CmA (2000~2500mA), and maximum of greatest output Voltage 8.4V~5.6V.