

## Lithium Ion Battery Packs

### The Negatives of Lithium Ion Batteries in Perspective

Lithium Ion Battery Specification Sheet (Rechargeable), Lithium Primary (Non Rechargeable) Battery & Charger Design and Assembly!

Below you will see why we, who are not fond of lithium ion, now use lithium ion, but even though we now use primarily lithium ion, you should always be respectful of your lithium ion battery cells and packs.

We will quote to build your volume of rechargeable lithium ion batteries for broadcast or any other market. We will quote only LG Chem, Panasonic, and Sanyo's BEST cell options. We WILL specify the exact cell. No cells used at Rathbone Energy are ever labeled as Name Brand. We strongly practice and encourage "Buy American, Manufactured in the United States". Our employees are not slave labor. They are well trained American mountain craftsmen / women who live modestly at or close to what the US calls our poverty level.

**But Before we start,**

You should be aware and have respect for your rechargeable Lithium Ion batteries. Attributes Lithium and Lithium Ion promoters would rather you not know: We assemble and promote lithium ion battery packs for many industries but we provide this information to encourage you to respect your lithium ion batteries from any manufacturer.

LG Chem, Panasonic and Sanyo very best grade:

LG Chem, Panasonic, and Sanyo "Best Available" lithium ion battery cells offer the highest discharge cycles available at +/- 500 charge - discharge cycles and a consistent discharge performance curve throughout the cycle life allowing more run time per cycle. Low end "Brand Name", Economy, third world and Chinese / South African battery cells offer < 200 charge - discharge cycles but also supply a quick and constant degrading discharge curve, performance, and it is not unusual to see battery cell leakage, especially in Chinese / South African battery cells, which is a danger to the battery, the equipment, and most importantly, the users.

Nickel Cadmium battery cells are environmentally unfriendly. Thanks to International Environmental Concerns and the good laws of other countries,

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our battery cell manufacturers have already started to phase nickel cadmium from their manufacturing lines. Panasonic did so in 2005. Sanyo started their depletion in 2008. You cannot use nickel cadmium battery cells and be green or promote yourself as environmentally friendly. Rathbone Energy is an Environmentally Conscious Company striving to stay Green since 1989. Having our own line of lithium ion broadcast battery packs, Rathbone Energy has phased out battery assembly and also battery rebuilding using nickel cadmium, no longer supporting the rebuild of Original Equipment Manufacturer (OEM) nickel cadmium battery products in any market. Being the only Battery Assembler Worldwide that supports rebuilding battery packs, we understand that this will create a hardship on those invested in nickel cadmium products but we offer our Upgrade and great alternative.

**Nickel Metal Hydride:** Panasonic stopped production of small cell nickel metal hydride cells in 2009 and in a restructure mode, Sanyo Battery followed. If I could find Panasonic or Sanyo nickel metal hydride battery cells through Panasonic, Sanyo, or another Valued Added distributor, (who by the way have \$5,000.00 minimum orders), the date codes on the cells would be too old and unacceptable for premium capacity ratings. Chinese and South African/Chinese battery cells under any private label name have an average 200 discharge cycles, immediate battery cell deterioration, and cell leakage which will damage circuit boards and components. We do NOT do Chinese cells.

- Nickel Cadmium Battery Cells, Best Available: Far Less Than 500 Discharge Cycles
- Nickel Metal Hydride Battery Cells, best Available: Far Less Than 500 Discharge Cycles
- Lithium Ion Battery Cells, Best Available: 500 - 800 Discharge Cycles
- Lithium Ion (Li-ON) Brief followed by detail. September 2008 Update - July 15, 2010.

(Negative points in Red, Positive points in Blue, Information in Black)

1. Lithium Ion Batteries equivalent to Ni-CD and Ni-MH of the same voltage are:
2. Smaller in size
3. Lighter in weight +/- 50%
4. Energy density 1.5 times higher than a Premium Sintered Positive Electrode (PSPE) Ni-CD (03-2008-PSPE Ni-CD is basically no longer available in Panasonic, Saft, or Sanyo)
5. >50% more expensive
6. Slightly lower (1%) internal resistance than a Premium Sintered Positive Electrode type Ni-CD cell from Panasonic, Saft, or Sanyo, allowing it to hold a charge slightly longer. Now a mute issue.
7. Chemical reaction in itself counter acts any lower internal resistance still reducing the shelf life of the Li-ON cell.

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8. Substantially lower charge discharge cycles
  1. Cell temperature, high discharge rates, and charge discharge cycles themselves effect and greatly reduce the cycles of Ni-CD, Ni-MH, and Li-ON making real life charge discharge cycles of Panasonic, Sanyo, Saft, and LG's very best grade cells more accurate at +/- 500 discharge cycles, <300 on lower grade, < 200 on Chinese / South African battery cells.
9. Substantially more expensive per watt hour of run time, Mute.
10. Much more narrow operating temperature range, Mute.
11. Great inability to handle high discharge rates, period
12. Highly susceptible to reverse polarity, proper internal components can make this mute.
13. Sloped discharge rate creating an unexpected sharper cut-off voltage, continues to improve with the above mentioned company products.
14. Higher cut-off voltage, A 14.4V Li-ON will cut off at 12.0V verses a Ni-CD or Ni-MH at 11.0V
15. Additional expense of semi-safe circuitry due to the highly volatile nature of lithium
16. Expense of chargers just for that brand Li-ON battery
17. Even though these Far East babies may be listed as wholesale, factory direct, or by other marketing spin, they are still high volume, mostly Chinese production with Chinese cells, and for what you really get, unknown generic brands are still very expensive due to the
  1. Complexity of the semi-safe circuitry
  2. Special chargers required
  3. Short warranty
  4. Very short number of charge discharge cycles
  5. The actual cost per watt hour of run time
  6. Sloped discharge curve (degrading performance)
18. DOT issues
19. There are more but the above should be enough. [Manufacturers PDF spec sheet links at the bottom of the page](#)
20. What better options do I have? Nickel Cadmium or Nickel Metal Hydride packs using Panasonic, Saft, or Sanyo's "BEST OPTION" battery cells? Not really.
  1. Panasonic and Sanyo Press Negative Nickel Cadmium and Past Negative Nickel Metal Hydride: 500 Discharge Cycles, The Best Lithium Ion Spec's at 500 Discharge Cycles.
  2. Either way, preferably manufactured in the United States of America by Appalachian mountain craftsmen / women.

## Lithium Ion (Li-ON) Detail preceded by our brief

1. According to engineering specification sheets Lithium Ion Batteries \ battery cells: (Negative points in Red, Positive points in Blue, Black-Information
  1. Charge-Discharge Cycles:

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1. Li-ON cells are good for +/- 200 full charge discharge cycles. LG Chem, Panasonic, and Sanyo claim > +/- 500 CD cycles.
  1. Panasonic, Saft, and Sanyo Sintered Positive Electrode Ni-CD cells for 900-1200 charge - discharge cycles.
    1. Europe has new laws which started in 2009 stopping the sell of nickel cadmium in Europe. In 2005 Panasonic dropped manufacture of large nickel cadmium cells followed by Sanyo in 2009.
    2. Sintered Positive technology is basically no longer manufactured by Panasonic and Sanyo only in very low amperage cells.
  2. Panasonic, Saft, and Sanyo Press Negative Cells for 500 charge - discharge cycles are now a mute point.
  3. Cell temperature, high discharge rates, and charge discharge cycles themselves effect and can greatly reduce the charge discharge cycles of Li-ON and Ni-MH making real life charge discharge cycles more accurate at +/- 500 - 300 charge discharge cycles, less for Chinese / third world cells.
  4. August 2007: Now we deal with the Best "Available" battery cell. We do not use battery cells manufactured in Chinese factories under Chinese management.
    2. Panasonic and Sanyo Press Negative Nickel Cadmium Cells: 500 Charge Discharge Cycles. Mute Point.
    3. Panasonic and Sanyo Foam Press Negative Nickel Metal Hydride cells: 500 Charge Discharge Cycles. Mute Point.
    4. January 2008: Panasonic and Sanyo Spec Lithium Ion Cells: 500 Charge Discharge Cycles.
      1. A big reason we now manufacture Lithium Ion Broadcast Batteries, BUT, NO CHINESE BATTERY CELLS!
      2. It is normal for quality nickel cadmium, nickel metal hydride, and lithium ion battery cells from LG Chem, Panasonic and Sanyo to perform at 60% when approaching 500 discharge cycles, in an ideal world.
2. Third world or Chinese and South African battery cells, (Often referred to as "Name Brand"), Both Sintered or Press Negative Ni-CD or Ni-MH cells for +/- 300 charge-discharge cycles or less.
3. Cell Density:
  1. Li-ON cells actually have 1.5 times higher energy density than equivalent Ni-CD or Ni-MH cells producing a lighter battery for the voltage / amperage.
4. Per Cell Voltage:

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1. Li-ON cells are 3.7V each verses 1.25V for Ni-CD and Ni-MH cells, (14.4V /16.8V battery requires 4 Li-ON cells verses 12 Ni-CD or Ni-MH cells.
2. Li-ON Cut-off voltage is 3.0V per cell verses 1.0 on Ni-CD or Ni-NM. Meaning that a 14.4V / 16.8V Li-ON battery will cut off early at 12.0V where a 14.4V Ni-CD or Ni-MH version will cut off at 11.0V
5. Self discharge rate:
  1. Li-ON does have a lower self discharge rate factored at 2% per month shelf time, 1% less than # 1 below.
    1. Panasonic, Saft, and Sanyo
      1. Sintered Positive Electrode Ni-CD, (remember-basically defunct manufacturing technology)
        1. up to 3% discharge rate
      2. Foam Positive Electrode Ni-MH
        1. up to 3% discharge rate,
    2. Panasonic, Saft, and Sanyo
      1. Press Negative Ni-CD cells have 5% or more self discharge.
    3. Third world or Chinese cells (Often referred to as "Name Brand"), Sintered or Press Negative Ni-CD have much greater than 5% self discharge.
6. Chemical reaction:
  1. Chemical reaction in itself counter acts any lower internal resistance still reducing the shelf life of LI-ON
7. Operating Temperature Range
  1. Li-ON has the Most narrow temperature range for proper operation, much more narrow than Ni-CD or Ni-MH.
  2. Sintered Positive Electrode Ni-CD cells show the most durability to heat generated from charging but most importantly from the discharge environment. Now a mute issue.
  3. Ni-MH is slightly higher durability than Li-ON also a mute issue.
8. High Discharge Rates:
  1. Li-ON has a lower conductivity rate producing a great inability to handle high discharge, period.
  2. Highly susceptible to reverse polarity but with proper circuit design and voltage cut-off components, can be removed.
  3. A quality battery pack manufacturer will install component structure to inhibit self discharge of Li-ON cells to a destructive point such as reverse polarity.
9. Cut-off voltage
  1. Li-ON cells have an unexpected sharper cut-off voltage than NI-CD or Ni-MH, and without proper component

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protection, will catch you off guard and can easily cause reverse polarity.

1. Again, Proper circuitry inside the battery pack can prevent this from happening.
2. Even though some manufacturers claim a flat discharge rate when you look at the graphs and test the cells you find a slopped discharge rate similar to the old lead acid battery packs.

#### 10. Chemical Volatility

1. Li-ON is volatile, Ni-CD and Ni-MH are less volatile. But this is respective of the brain using the product.
2. Lithium bombs were produced during the Korean Police Action
3. Spec sheets stat the Li-ON is a compound of Lithium Cobalt Exide and an organic solvent with no actual lithium metal
  1. The question arises: Why then is the DOT involved?
  2. A few years ago, the pallet of lithium ion cells which caught on fire at LAX, the presentation of water by the fire department, the larger explosion and fire, and then the injuries
  3. At trade shows and over the telephone we have been told many horror stories involving lithium ion battery packs involving users that do not bother to read and respect the MSDS sheets of their batteries. In every instance given to us the problem was caused by Operator Malfunction (OMF Problem), an Ignorant Operator (IO Problem), lack of effort to read or respect any instruction manuals, and in broadcast and film, the operator. 99+% are great intelligent guys and gals, but you have to meet some of these geniuses to understand, (<1% still makes a lot of noise). Of course, we used to hear the horror stories of nickel cadmium or nickel metal hydride when used improperly or built new or recelled by an amateur vendor.
4. The organic solvent creates a disadvantage in over charge and over discharge. Thus the strong inability to handle any type high discharge rate.
5. Organic Solvents: Ethyl Acetate; Ethyl Carbonate; DiMethyl Carbonate

#### 11. Storage Life

1. When reading the fine print, and with experience, you will discover that the suggested long storage life is not quite what one may have been lead to believe. It is too complicated to list here but is in the Sanyo Overview link below.

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12. Additional hidden but incurred expenses of Li-ON cells:

1. Even though these distributor or "factory direct" Li-ON batteries are produced in China, high volume does not contain the expensive price tag for Li-Ion battery packs.
  1. Because of their volatile nature, Each individual Li-ON cell requires it's own thermal circuitry which is an additional expense, but less expensive than circuitry installed to create a segregated marriage between a particular OEM brand battery and charger.
  2. Because of their volatile nature you cannot just pull any brand aftermarket charger off of the shelf to charge lithium ion batteries.
    1. The fact that you are stuck with the additional expense of a charger, usually with a Very Short Warranty period, has nothing to do with the practice of some battery and battery smart charger companies who's philosophy is pretty much, "You have to buy my charger to use my batteries / You have to buy my batteries to use my charger".
  3. You must Always use the same brand charger designed for one particular brand Li-ON battery but not with other brands. Most, especially those from China have a very short warranty period.
    1. If you can use another brand it is simply a private label of the same technology! We have our lithium-ion batteries and chargers for particular markets manufactured in China to our specifications using LG Chem, Panasonic and Sanyo very best cells. We place due diligence to the best of our ability into our specifications and require all safety components to protect the battery, but no unnecessary components "dazzle components" that may allow premature failure.

13. DOT issues: These are listed in pretty much the same standard format at any battery web site.

1. There are airline travel restrictions for Lithium Ion batteries which include: (The rules change often so we have placed links at the bottom for more up to date and accurate information. Therefore, items 2, 3, & 4 may be inaccurate at the time your read this article.)
2. Each traveler is allowed an unlimited number Li-ON batteries whose equivalent lithium content per battery is

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less than 8 grams. This fits Lithium Ion batteries manufactured by PAG (Manufactured in England), Anton Bauer (Manufactured in Asia), IDX (manufactured in Asia), and Rathbone Energy 95WH lithium batteries fit into this category. (The last Dionic 90 insert in Dionic 90 packs we opened for rebuild say they were made in Asia.)

3. Saft: If the aggregate lithium-equivalent content of Li-ON batteries exceeds 8 grams but not 25 grams, the number of spares is limited to two per person.
4. Lithium Ion batteries with more than 25 equivalent grams of Lithium Ion - equivalent cannot be carried by passengers aboard aircraft.
5. What better options do I have? Well, my mom says there is an opossum for every tree. Make sure your vendor is using LG Chem, Panasonic, or Sanyo's "BEST OPTION", battery cells. Preferably assembled / manufactured in the United States of America by Appalachian mountain craftsmen / women like us.

Because rebuilding rechargeable batteries is a specialty at rathboneenergy.com we see all the good and all the bad in product design and workmanship. One event we occasionally see in nickel cadmium, nickel metal hydride, and lithium ion battery assemblies is corrosion on the back of the circuit boards. Sometimes all we need to do is remove the corrosion and the battery will work fine. By corrosion I mean corrosion from humidity, exposure, and if using third world or "name brand" low end cells, from those battery cells. If you ever have corrosion between the wrong two points on the back of the circuit board of a lithium ion battery you will have a serious problem.

For example, if in simply welding the weld tab onto a small 4/5Au size lithium ion cell you used too much power, pressure, time length of the weld, or a combination you could easily burn through the battery cell canister. If this happens you will see a flame reach out up to 5 or 6 feet from that one small cell. Then, of course, you will have a domino effect. Manufacturers of lithium ion battery cell packs have done well in keeping these horror stories under the rug. At rathboneenergy.com you can count on one thing for sure. If a user has a problem with a battery pack out of warranty from any manufacturer they call us or visit with us during a trade show and they do tell their horror stories.

We sell Rathbone Energy's Rathbone Broadcast Batteries battery packs for broadcast news, film, and cinema. Besides our self, Rathbone Energy, we consider the PAG building technique and their "spare no expense" attitude and Sony to deliver the only other acceptable option. How do we know? We dissect and evaluate other lines of Lithium ion batteries and we hear end user opinion and complaints about their lithium ion battery packs.

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Like Rathbone Energy, PAG places a poly film over their circuit boards during the manufacturing process to prevent corrosion. The poly film is thick and durable so that if you do use a contact cleaner on your battery packs the cleaner will not break down the poly film used by Rathbone Energy or PAG. You get what you pay for.

[Panasonic Lithium Ion Charging](#)

[Panasonic Lithium Ion Overview](#)

[Panasonic Lithium Ion Precautions](#)

[Sanyo Lithium Ion Overview](#)

[Lithium Ion Battery Supporting Information in Detail](#)

[Air Flight Safety Regulations](#)

[http://www.rathboneenergy.com/About\\_Rathbone\\_Energy/buy\\_american.htm](http://www.rathboneenergy.com/About_Rathbone_Energy/buy_american.htm)

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(Buy American - and "The other side of the coin")

We do not bother with lower grade name brand Chinese and South African battery cells.

If the manufacturer's cell is the very best cell option available their marketing material will list detailed specifications on their battery including the exact battery cell used.

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**BEWARE...**, customer education of the product is NOT in most vendors best interest.

I am uneasy about showing the email address header or naming this foreign company manufacturing batteries for other companies and also to sell direct but below is an Excerpt from a foreign competitor email to me on May 31, 2006:

"dear sir

we are manufacturing lithium ion battery and we put them in battery case then we do water immersion test and put the battery case in water but the anodes which are made of stainless steel get corroded.

would you tellus why the anodes corrode? and what kind of metal we shoud use to prevent corrosion?

"

Sincerely,

Ron L. Rathbone  
President  
Rathbone Energy, Inc.

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865-484-1783

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**Green Since 1989!**

(Due to continuing development all prices & specifications are subject to change without notice).

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