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Total Battery Care

By ReconditionBattery.com

Total Battery Care: A (Secret) Guide to Battery Maintenance By Craig Orell

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An Introduction to Total Battery Care

A battery is often taken for granted, much like electricity. People rarely stop and think about the different kinds of batteries they use until the battery itself stops (working) and forces them to think about it! In this comprehensive guide to battery maintenance, you will learn about how to care for batteries that are specially designed for longevity of service –

- Lead acid (car battery)
- Li-Ion (Laptop battery)
- Ni-Cd (Rechargeable battery)
- Ni-MH (Long life battery)



These four battery types are at the core of human activity. More to the point, they give us the mobility that we would otherwise not have. Without these batteries, we would be “plugged in to the wall” like a child still attached to the mother’s umbilical cord at the age of 16! Our technology has progressed that far, so it’s only natural that our power sources do, too. As our technological abilities progress towards adulthood, it should follow suit that the supporting pillars make that same shift towards adulthood.



Today’s batteries are far more powerful than those that were available even two decades ago. They last longer, they are relatively maintenance free and, most importantly, they are smaller and lighter than ever before. However, – and that’s a big “however” – if we do not take care of the power sources that take care of us, then we still have to deal with their early death...and along with that early death comes recurring expenses.



Why Care for Batteries?

You may have a valid point when you say that batteries are supposed to “do their jobs” and leave us to perform whatever tasks we need to – and you’d be right, too. These four battery types are the workhorses of the ‘stored power’ industry, and they’re designed to perform at peak levels despite the neglect they are subject to as a part of regular use. When you think about it, a battery that isn’t given any kind of care whatsoever will still perform admirably – but only for a while. To truly maximize the performance of a battery, a few simple steps are all that is required.

Here are some interesting reasons to take care of your batteries:

- Batteries are expensive to replace



- Batteries that have poor performance can die out when you need them the most
- Batteries that need to be charged often use up substantial 'socket power'
- It's bad for the environment if your batteries don't last as long as they're supposed to!



So there! Unless you take good care of your batteries, you could be shooting yourself in the foot – as well as...The Earth!

Now let's get down to some brass tacks: let's see how NOT taking care of your batteries can impact your wallet as well as the environment.

The True Cost of Battery Mismanagement

Assuming that a particular Li-Ion laptop battery costs \$50 to buy, you would normally expect it to last about a year. If your laptop lasts for about four years, then under normal circumstances (that is, without any special care whatsoever) you might spend \$200 on batteries. On the other hand, if you took care of your battery – and we'll show you just how to do that – then the original battery can be made to last about 2-3 years. Assuming the worst case scenario, you will be spending \$100 on batteries instead of \$200. Now, a savings of \$100 may not seem like much over a period of 4 years, but if you have a business that uses 20 laptops those savings mount up to \$2,000 – or \$500 a year.

Now that's just the money you save on not buying new laptop batteries that often. If you add that to the power you save by not constantly having to recharge those batteries frequently, that figure might well double over the course of a year.

The point is: you could save up to \$1,000 a year under those circumstances. These figures may vary from battery to battery – or even laptop to laptop – but the bottom line is that you will save money if you learn how to take care of your batteries.

This is what this guide intends to do – “educate” consumers about the high cost of battery mismanagement.

Environmental Impact

This is the other side of the coin, as it were. Several studies have been done on batteries and how they impact the environment, so we'll spare you the spiel about a dying Earth and your part in its slow death! However, a Total Battery Care Guide would be incomplete without at least a few bullet points to make you feel guilty, right? So, here goes:

- 14,000 TONS (yes, that's 28,000,000 lbs.) worth of rechargeable batteries are disposed of EVERY YEAR
- These batteries contain chemicals like lead, cadmium, cobalt and nickel-iron; you don't even want to know what these can do once they get into the ecosystem!

- 15.6 million Laptops were sold in the United States in 2012. A significant portion of them will involve disposing of old batteries. One average laptop battery weighs 0.9 lbs., or 14.4 ounces. Do the math!

Scary enough? Well, we're scared, too; that's why we're so concerned about consumers taking care of their rechargeable batteries so they last longer and reduce their environmental footprint.

A battery that is well-maintained and recharged appropriately can last twice as long as one that isn't.

This is why you need to maximize your battery's natural life. In this guide, you will be given secret tips to lengthen the life of your battery, so you can end up saving money *and* the environment – a double bonus for your efforts!

Battery Basics: Types of Batteries that Require Care

The four main types of batteries that require proper care are (to refresh your memory):

- Lead acid (car battery)
- Li-Ion (Laptop battery)
- Ni-Cd (Rechargeable battery)
- Ni-MH (Long life battery)

Each of these battery types requires a different maintenance regime to ensure their longevity. Taking care of these means:

- Less money out of your pocket during their natural lives, and
- More money into your pocket when they exceed their normal lifespan and still show superior performance

In this Total Battery Care Guide, we will show you exactly what you need to do after your batteries have been reconditioned. These secret tips are also valid for new batteries you may have purchased recently. In either case, the best practices are the same because reconditioned batteries are basically as good as new.

Caring for Lead Acid Batteries

Car batteries typically fall under this category. Through all my years of experience, if I had a dollar for every time I saw a car battery that was tortured or neglected because of lack of knowledge about their care, well, I'd be a gazillionaire by now. People, in general, do not know enough about caring for car batteries. What you



are about to learn are some of my secret tips to keep your lead acid batteries running longer than ever – and stronger than ever.

Most people know about keeping the distilled water level topped up at all times, and all that regular maintenance stuff. I'm going to tell you what most people don't know.

- If you have older unsealed batteries, try mixing a solution of Epsom salt in warm water (about 150F) and topping up the electrolyte in your battery. What it does is reduce the electrical resistance of the battery and stretch out its performance for a few more months. Be sure to mix the solution well, and give it a couple of weeks to actually 'kick in'.
- Keeping your battery terminals free of corrosion is a great idea, especially right before winter starts; but did you know that pouring any kind of soda over them helps dissolve the rust that's built up over time? The carbonic acid in the soda is the magic factor here. Wipe the terminals with a wet sponge to get rid of the sticky stuff and then let it dry. Then follow the next step.
- Petroleum jelly isn't just great for cracked lips – it's also great for smearing on your battery terminals so they don't start rusting again. Do this and you may not have to worry about your car not starting again in the dead of winter.
- For the summer, you need to put a little less water than in the winter because of fluid expansion. Too much and you may have the electrolytes being pushed out.

To extend the life of your reconditioned batteries, these tips above are absolutely essential. You can get months of additional life from a lead acid battery by simply following those four great tips.

But that's not the end of battery maintenance and care. The real deal is about knowing what to look for. If you know how to read these signs, your battery may well last a decade; if you don't, then get ready to spend money replacing it in as little as three to four years.

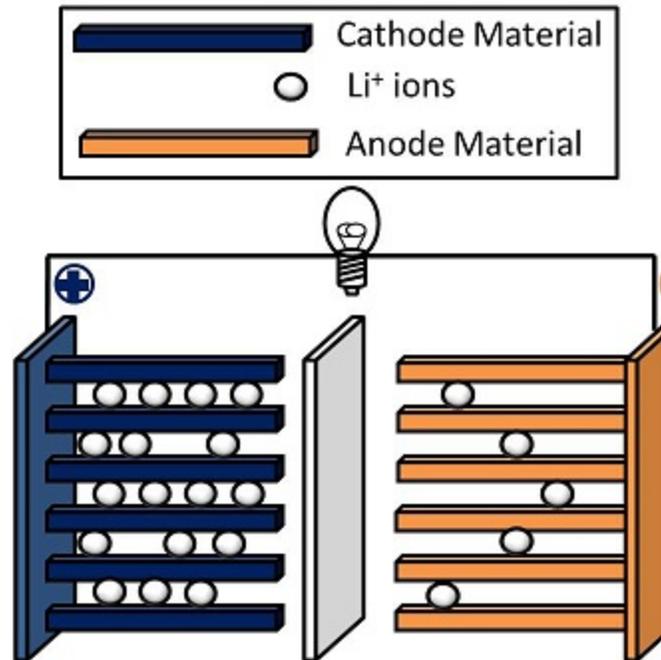
1. Lead batteries need to be charged at least once a week. A 12V battery, for example, should be charged and kept at a voltage that is slightly higher – about 12.7 would be normal for a fully charged battery in good shape. At 11.3, your battery is virtually useless until charged again.
2. The water level is very important. The plates must be completely immersed in it, so be sure to check about every three months. Use ONLY distilled water. Any impurities in the water will only kill your battery – fast!
3. Every three months, make sure you overcharge the battery at between 15.2V and 15.4V. This is called equalization. However, never do this for a maintenance-free battery – only for flooded lead-acid ones.

Caring for Li-Ion Batteries

A Lithium Ion battery – or Li-Ion for short – uses ion movement between oppositely charge electrodes to generate power. Theoretically, this process should generate electric current in perpetuity; however, environmental conditions, high temperatures, cycling of charge and age take their toll on the life of the battery.

As for longevity, these batteries can be recharged about 300 to 500 times, but even that wide range isn't accurate at times. What make it inaccurate are the conditions mentioned above; however, this is where the opportunity to enhance their lifespan presents itself. Taking advantage of factors such as the depth of charge, duration of charge, regular deep cycle charging, etc., the average life of a Li-Ion battery can be extended far beyond the manufacturer warranty stamp on the back of the battery.

According to Cadex, most batteries drop to 78.5% of peak performance after about 250 recharge cycles. However, what most battery users don't know is that their precious Li-Ion batteries often hit as low as 70% within the very first year of use. One reason could be the time spent on the shelf after manufacture; the other reason is far more sinister: a few (unnamed but unscrupulous) manufacturers actually give their batteries a higher rating than the actuals – they are well-aware that most users won't even figure it out, leave alone complain about it.



As with any battery type, Li-Ion batteries can last longer if you follow these not-so-well-known secrets:

1. Never leave the power cable plugged in at all times. Being fully charged all the time and getting heated up with use is the worst condition for a battery to be in.
2. Leaving your laptop in a car parked in direct sunlight is another sure way to slowly kill your battery's capability.
3. If you're storing the battery for long periods without use, keep the charge at about 40%; what this does is allow the battery some leeway for self-discharge while at the same time keeping enough reserve power for the protection circuit to remain active until the battery is used again.
4. Store batteries in a cool and dry place for maximum life.
5. Harsh charge and discharge cycles are not good for your battery, so use a charger that works at 0.7C rather than 1.0C.
6. If your laptop is running off a UPS or the power is reliable where you are using it, then remove the battery when you're plugged in. Be sure that the power does go off suddenly, or you'll lose your unsaved work.
7. Never use the laptop on a soft surface such as a pillow or on the bed. Circulation is cut off – much like a person being smothered when they sleep with a pillow over their face!
8. Use the appropriate power plan on your operating system so you conserve energy and extend battery life.
9. Frequent top-ups are better than allowing the battery to run flat before charging. However, every 3-4 weeks, you need to let it run down completely and then charge it overnight.

Replacing a laptop battery every 1-2 years can be fairly expensive. If you take proper care of your Li-Ion battery, however, it will serve you well for several years more. The trick is to maintain good charging and usage habit right from the beginning, when the battery is new and 'still being trained.' You might argue that you change laptops every 2 years anyway so why bother. Excellent point! But

then, what about the next person who uses it? Are you going to dump the guilt of environmental impact on the person that buys your old laptop? Every year, two billion tons of Li-Ion batteries are dumped; don't you think it's time somebody did something? You can, if you follow these tips religiously. A little effort goes a long way.

Caring for Ni-Cd (Rechargeable) Batteries

Ni-Cd, or Nickel-Cadmium batteries are more temperamental than most other types. While this might sound like something out of a sci-fi movie, it has been documented that these rechargeable batteries have a "memory" of their charge patterns. For example, if you recharge the battery when the power is down to 50%, and consistently do this for a long period of time, the battery remembers this! So after a while, when you use the fully charged battery hoping to run it down all the way, it suddenly stops performing at that same 50% mark.



This Memory Effect was first documented by scientists at GE's Florida research center for batteries. They did retract the original paper, but by then word had already gotten out, and this effect has become the stuff of urban legend. While this may not happen in all cases, information supporting this has come forth from other sources as well.

How to Avoid the "Memory" Curse of Ni-Cd Batteries

If you want to prevent this from happening, your charging habit must be inculcated right in the beginning. Every time you charge the battery, you have to discharge it completely first. There are two ways in which you can do this:

1. Let the device run until there's no power left in the battery, or
2. Use the 'discharge' option on the charger to run it down before recharging.

If you aren't using the battery for a month or more, make sure you charge it fully before storing, and then charge once a month to maintain the health of the battery. The reason you want to do this is: these batteries typically discharge by about 3% every day when not in use, 30 days and you'll be down to about 90% or so.

Overcharging is a common problem with Ni-Cd batteries. Cheaper chargers may not have cut-off functions or may perform poorly in this regard. Therefore, if your batteries are left to overcharge, don't expect them to live out their full lives in top physical condition. When over charged, the hydrogen and oxygen generated in the cell don't have enough time to combine and form water again so a lot of gas is lost. Since the vessel of the battery is designed to contain a fixed amount of electrolyte, this loss of gas is sure to affect the performance of the battery.

Similar to overcharging is charging it too fast. At 4C or 6C charge rate, you may get them fully charged in about 20 minutes, but the pressure venting will ultimately lead to the same problem as with overcharging.

The care needs of this type of battery are very similar to Li-Ions except for the monthly discharge and overnight charge requirement. For rechargeable batteries, overnight charging is never recommended unless the charger unit is a robust one that can detect several overcharge conditions. Overcharging is more of a problem than many people might suspect because it seriously undermines the performance of a battery and reduces its ability to hold a charge for any amount of time.

Caring for Ni-MH Batteries

Nickel-Metal Hydride batteries are generally called long-life batteries. They're not haunted by the urban myth that is associated with Ni-Cd rechargeable batteries. You can charge it up or charge it down to any level you like and it will not affect the future performance of the battery. However, there are some do's and don'ts for this type of battery, too, as we shall see.



- The first thing you know about Nickel- Metal Hydride batteries is that you should not physically discharge the battery down to zero the way you need to do with a Ni-Cd battery every time. However, to preserve and extend the life and performance of the battery, you may do this once a month using the discharge option on the charging unit.
- The best way to charge a Ni-MH battery is to trickle-charge it. That means a constant low current is fed to the battery instead of a stronger one that charges it faster. Some chargers provide this as a special function, as do many devices and applications. They fast-charge it up to a point and then start to trickle-feed the battery until it is fully charged. The battery then lasts much longer and performs better.
- Never charge a Ni-MH battery in a standard charger for Ni-CD. The charging requirements of each type are different from each other, and you'll be doing yourself a disservice if you confuse the two.
- Over-discharging is a major problem with these batteries. Unlike Ni-CD, which have to be discharged fully before each recharge, these batteries can go into what is known as polarity reversal. This can happen with cells arranged in a series; if one cell discharges fully before the others and you continue to use the device, the remaining cells will drive current in the opposite direction in the weakened cell, damaging it permanently. Many devices have safety mechanisms that shut off the device when discharge is reached by any one of the cells in the battery pack, but some, such as toys or flashlights, don't.
- It may not be a good idea to use Ni-MH batteries for devices that consume very little power and would, therefore, be expected to use the same set of batteries for several months or even years. Devices like remote controls and clocks fall in this category. The reason not to use them in such devices is that the self-discharge rate of these batteries is much higher than most other battery types. Often, they can self-discharge up to 25% on the first day and then up to 4% per day. What that means is: they won't last as long as normal batteries and you'll end up thinking that they're performing poorly, when, in truth, they're as good as new. The problem is with the power usage requirement of the device itself, not the performance of the battery.

As with Ni-CD batteries, Ni-MH cells are surprisingly difficult to charge properly. They don't do well with parallel charging because of the absence of a 'float charge' voltage. Their varying impedances make this an unlikely solution. Therefore, the only way is to trickle-charge them overnight at 0.1C, or one-tenth of the capacity of charging per hour. This way, overcharging won't be a major issue and your batteries will last much longer.

Another issue that can crop up when charging at a faster rate is that the battery pack must be discharged fully, which conflicts with the basic rules of maintenance for Ni-MH cells. The only solution is to get a charger that can handle fast-charging for Ni-MH batteries. There are such products on the market, although they may be a little pricey for casual use.

Although these batteries are easily the most efficient in terms of supplying power, they are extremely sensitive when feeding power back to them.

The Real Secret behind Battery Maintenance

Now that you know the 'inside story' about battery maintenance, there are a couple of things you should think about regardless of what type of battery it is:

1. Your primary goal with any maintenance and charging routine should be the right balance between performance and longevity. High performance can be achieved for longer periods ONLY if you follow these routines to the tee. Unless a close watch is kept on your charging habits, all of these batteries may perform below par or not last as long as you would like them to.
2. The other point to consider is the cost of replacement and the impact on the environment when you dispose of a battery. Irrespective of the battery type, the disposal process should involve proper handling and recycling. If any of these chemicals and metals get into the environment, the effects are devastating, as you probably already know.

Passing on the blame to another person by selling your batteries before they die out doesn't help the environment in any way. The only thing it does is reduce your level of guilt in the environmental crime about to be perpetrated. Any way you look at it, batteries are not safe for the environment. They are one of the most useful inventions of man, but they are also double-edged swords at the end of their useful life. Therefore, it makes sense to get the most out of them while they're still 'in the prime of their lives'; in fact, it is our responsibility to make sure that they're in the prime of their lives for a longer period of time – as long as smart techniques will possibly allow them to be.

The first rule of battery care is to start off on the right foot. The very first charge cycle is probably what decides the fate of the battery and how long it will last. Not enough importance is given to this crucial event. If you search the internet, you will probably get conflicting information from non-authority sources – opinions, to put it simply. But opinions do not and will not help you get the best out of your batteries. The absolute best way to ensure a good life from any battery is to let it discharge naturally (self-discharge) or in a device – fully – before the first charge, which should be no longer than 12 hours. This one single rule will make a world of difference to whatever battery you own from this day forward.

You've gained a lot of knowledge from this total battery care guide. It is now time to go and implement what you've learned if you want to truly maximize your money and help defer the detrimental effects of battery disposal on the environment. Don't just stop with reading the total battery care guide; use the invaluable information contained here and spread the word about my

work. I believe that I am performing a useful service to society by sharing my secrets of battery maintenance with everyone I know. If you aren't a lone human being on an island full of batteries, please let your friends, relatives and acquaintances know about this total battery care guide and how it can help them save money and the Earth from the devastating effect of disposing batteries well before their time is up. Simply share the link to my web page and let them decide for themselves. As they say: "You can lead a horse to water but you can't make him drink it."

Batteries are a blessing; let them not become your curse.



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