HOW CAN YOU RECONDITION YOUR BATTERY?

This e-book is intended for informational purposes only. We are not responsible for any injury or damage to property that may take place. Please take the precautions outlined in the next section when working with batteries.

Precautions

- Use a pair of safety goggles and a pair of high voltage gloves when doing any of the procedures with batteries described in this e-book.
- Do not wear jewelry while working on batteries.
- A battery's negative terminal should never be connected directly to its positive terminal. This would cause a “short circuit” and result in a large current flow.
- Be sure that you always connect the positive lead of an instrument to the positive battery terminal and the negative lead to the negative battery terminal. Reversing these connections could damage the instrument.
- Lead-acid batteries contain sulfuric acid, which is very corrosive. Use goggles, acid gloves, and an apron (and great care) when handling them.
- Recharge lead-acid batteries in a well-ventilated area.

A rechargeable battery is an energy storage device that can be charged again after being discharged by applying DC current to its terminals.

Rechargeable batteries allow for multiple usages from a cell, reducing waste and generally providing a better long-term investment in terms of dollars spent for usable device time. This is true even factoring in the higher purchase price of rechargeables and the requirement for a charger.

A rechargeable battery is generally a more sensible and sustainable replacement to one-time use batteries, which generate current through a chemical reaction in which a reactive anode is consumed. The anode in a rechargeable battery gets consumed as well but at a slower rate, allowing for many charges and discharges.

In use, rechargeable batteries are the same as conventional ones. However, after discharge the batteries are placed in a charger or, in the case of built-in batteries, an AC/DC adapter is connected.

While rechargeable batteries offer better long term cost and reduce waste, they do have a few cons. Many types of rechargeable cells created for consumer devices, including AA and AAA, C and D batteries, produce a lower voltage of 1.2v in contrast to the 1.5v of alkaline batteries.

Though this lower voltage doesn't prevent correct operation in properly-designed electronics, it can mean a single charge does not last as long or offer the same power in a session. This is not the case, however, with lithium polymer and lithium ion batteries.

Some types of batteries such as nickel cadmium and nickel-metal hydride can develop a battery memory effect when only partially discharged, reducing performance of subsequent charges and thus battery life in a given device.

Types of rechargeable batteries

Nickel Cadmium (NiCd) — mature and well understood but relatively low in energy density. The NiCd is used where long life, high discharge rate and economical price are important. Main applications are two-way radios, biomedical equipment, professional video cameras and power tools. The NiCd contains toxic metals and is environmentally unfriendly.

Nickel-Metal Hydride (NiMH) — has a higher energy density compared to the NiCd at the expense of reduced cycle life. NiMH contains no toxic metals. Applications include mobile phones and laptop computers.

Lead Acid — most economical for larger power applications where weight is of little concern. The lead acid battery is the preferred choice for hospital equipment, wheelchairs, emergency lighting and UPS systems.

Lithium Ion (Li-ion) — fastest growing battery system. Li-ion is used where high-energy density and lightweight is of prime importance. The technology is fragile and a protection circuit is required to assure safety. Applications include notebook computers and cellular phones.

Lithium Ion Polymer (Li-ion polymer) — offers the attributes of the Li-ion in ultra-slim geometry and simplified packaging. Main applications are mobile phones.

Proper TLC for Your Rechargeable Batteries

What is the proper "tender loving care" that you should give your rechargeable batteries in order to make them last longer? There are indeed some things that you can do, but they are not quite the same for all types of batteries, so each will be discussed separately.

Ni-Cd batteries suffer from the memory effect, so the care that should be given to them is mainly about counteracting that effect. Following are some things to do to prolong the life of a Ni-Cd battery.

- As often as practical, use a device powered by a Ni-Cd battery until the battery is completely drained or at least nearly completely drained, before recharging it.
- Perform a "deep discharge" cycle on your Ni-Cd battery once a month, by operating the device until it completely stops operating. Then recharge the battery completely. NOTE: The first three discharge cycles for a Ni-Cd battery, when it is first put into use, should be "deep discharge" cycles.
- Don't leave a Ni-Cd battery on the charger for more than 24 hours. Ideally remove from the charger when it becomes completely charged. Overcharging will result in shorter battery life.
- Use a good quality charger that doesn't continue to deliver current to the battery after it is completely charged. This is also to avoid overcharging.
- Don't leave a Ni-Cd battery in a device that is turned on after the battery is completely run down. A continued drain on a discharged battery for as much as a few weeks can cause the battery to reverse polarity and not work. A good precaution is to remove the battery from a device that will not be in use for an extended period of time.
- Avoid high temperatures for a Ni-Cd battery. Room temperature is ideal. Ni-MH batteries don't suffer as much from the memory effect, as Ni-Cds, but they discharge more rapidly when not in use, so the care that should be given to them is somewhat different. Following are some things to do to prolong the life of a Ni-MH battery.
- Don't leave a Ni-MH battery in a device that is turned on after the battery is completely run down. A continued drain on a discharged battery for as much as a few weeks can cause the battery to reverse polarity and not work. A good precaution is to remove the battery from a device that will not be in use for an extended period of time.
- If a Ni-MH battery is to be stored unused for more than two weeks it should be discharged nearly completely and then charged to about 50% of its full capacity.

- Ni-MH batteries should not be overcharged. Use a good quality charger intended for Ni-MH and don't leave the batteries in a charger for an extended time after they become fully charged.
- Ni-MH batteries are even more susceptible to temperature damage than Ni-Cads, so avoid high temperatures. Be sure that Ni-MH batteries are cool before starting to charge them.
- Occasionally perform a "deep discharge" cycle on your Ni-MH battery, by operating the device until it completely stops operating. Then recharge the battery completely. Li-Ion batteries don't suffer at all from the memory effect, but the battery life depends on the number of discharge cycles, so the care of Li- Ion batteries is quite different from Ni-Cad and Ni-MH batteries. Following are some things to do to prolong the life of a Li-Ion battery.
- Keeping your Li-Ion battery on the charger as much as possible and keeping it fully charged is helpful, because this avoids discharge cycles and prolongs the battery life. It does not harm a Li-Ion battery to leave it on the charger, even if it is fully charged.
- Condition your Li-Ion battery once a month by fully charging the battery (overnight). Then operate the device until it shuts down. Then recharge again. NOTE: For Li-Ion batteries, this process is also called "calibrating" the battery.
- Avoid high temperatures for a Li-Ion battery. Room temperature is ideal.
- For storage, a Li-Ion battery should be charged to about 40% of its full capacity.
- Use a charger that is intended for use with a Li-Ion battery.

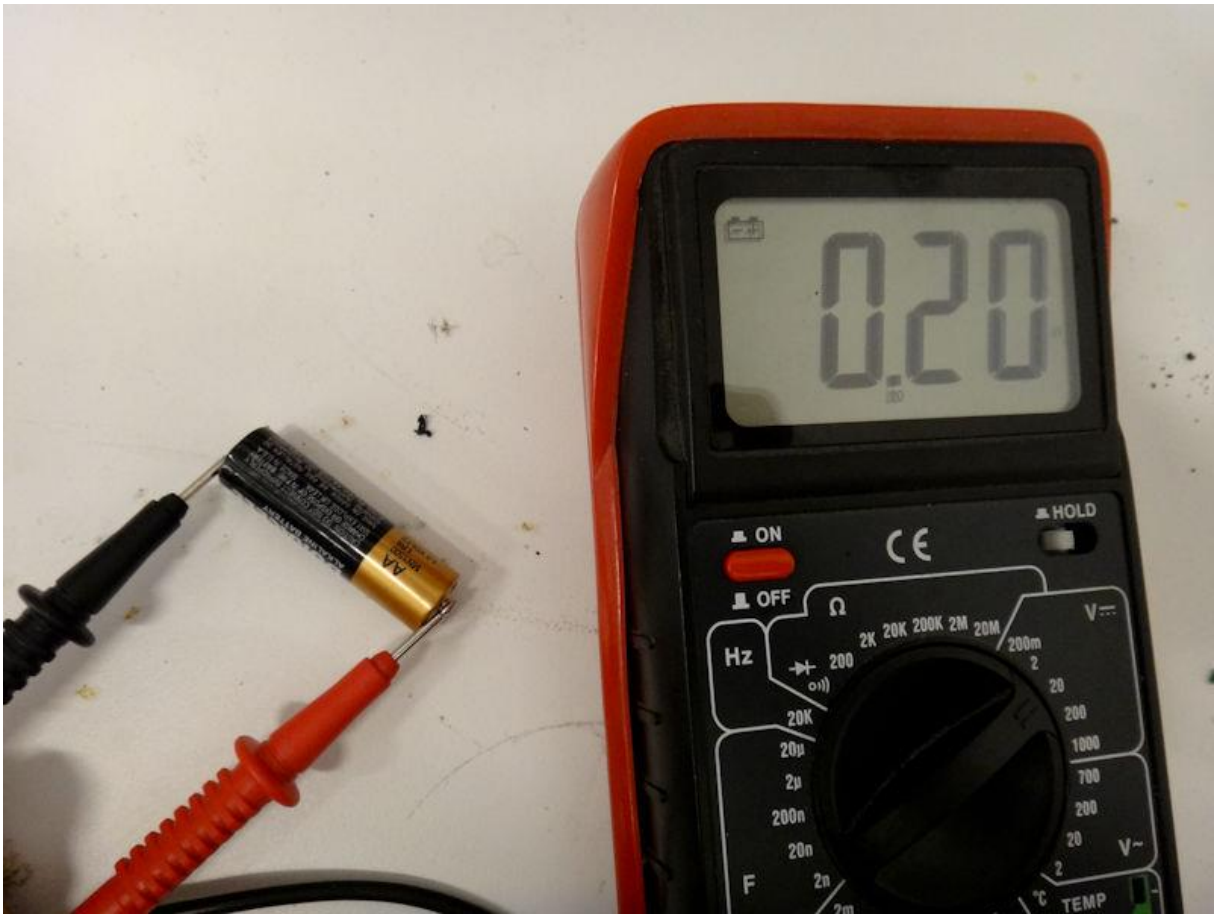
How to test batteries

1. Multimeter

Set up the multimeter by turning it on. Plug the black probe and red probe into the spots shown in the photo. Turn the knob to 20 V- as shown in the photo.

To test a battery, hold the probes, one in each hand. Touch the metal tip of black probe to the battery's ground or negative end, marked with "-". Touch the metal tip of the red probe to the battery's positive end, marked with a "+". Make sure the probes have good contact with the ends. You can use your fingers to press the metal tips of the probe to the battery.

The voltage read out will display on the multimeter.



2. Testing Batteries with a Battery Tester

A battery tester provides different information than the multimeter measurements that we just discussed. A battery tester measures one thing, the remaining useful charge in the battery. They can be used for testing disposable batteries to see if there is still useful charge in the battery or if it is ready to be discarded. They are also now widely used with rechargeable batteries. In fact most devices like cell phones and laptop computers have a built in battery tester that shows how much charge is left in the battery. It shows up on the screen somewhere with a visual indication of the remaining battery charge, so you know when to recharge the battery.

Battery testers measure the voltage of the battery while a load is being applied. For the built in cell phone/laptop type battery testers, the device is on when you can see the battery icon on the screen, so it is drawing a load from the battery. For free standing battery testers, an appropriate resistance (load) is applied when the battery is tested so that it is being tested under load. Some battery testers are made to test only one type and size battery and the appropriate resistance for that battery is in the tester. Some testers are made to test a variety of types and/or sizes of batteries. They need different resistors built in to use with each battery type or size. Following are some examples of the types of battery testers available over a range of prices.

Battery Tester, about $5

Battery tester, about $12

Battery Tester, about $60

Battery Tester, about $130

The use of any of these battery testers is quite straightforward. You typically need to find the correct way to connect up the type and size battery you are testing, perhaps set the instrument for the right type and size battery, perhaps press a button to start it, and take a reading from a LED screen or a dial. The reading may simply say whether the battery is still good or not, and it may give a reading of % capacity remaining. If a rechargeable battery has just been charged up and doesn't measure at the top of the scale, it is a candidate for reconditioning.

Reconditioning Rechargeable NiMH Batteries

What is reconditioning of a rechargeable battery?

Reconditioning of a rechargeable battery is a process by which you regain the lost performance of a battery. If your rechargeable battery is not holding the power it used to you can mostly get the lost performance back by reconditioning the battery (exercise the battery) to restore the optimal performance of a battery, generally NiCD batteries required conditioning with every charge, but it's not the case with NiMH batteries.

To recondition a battery you need to simply discharge it completely and then recharge the same, you might need to do this cycle 3-4 times to get the full capacity back, or if you have one of the smart chargers that has conditioning / refresh option that you can use that to condition your batteries, do note If even after conditioning your NiMH batteries you don't get the juice out of your batteries or your batteries seem to not power up your devices as expected or drain out very quickly it might be time to retire the rechargeable battery as the battery might have developed high internal resistance.

How frequently do you need to condition NiMH batteries

NiMH don't need regular conditioning like NiCD batteries but I have generally noticed that after a dozen or so charges done of a NiMH batteries with intermediate usage or batteries that are stored for more than 6 months the capacity tends to wear off a bit and it's good idea to condition your NiMH batteries once in about 6 months or after around 12 regular charge cycles to get the most out of them.

I have also found that recondition might be needed more for lower grade cheap non branded NiMH cell. Quality NiMH batteries like Sanyo Eneloops don't need that much reconditioning compared to low quality NiMH non brand cells, I recondition my Eneloops only once is about 20 or so cycles or once per year if they are not used much.

I don't have a special charger with recondition / refresh / discharge option how can I recondition my batteries?

The smart chargers like La Crosse BC 900 series or the Maha Powerex C9000 chargers that have recondition options like refresh / discharge make it very easy to recondition your batteries but you can also recondition your batteries without these special chargers, to recondition your batteries you just need to discharge them and charge them and you need to do this 3-4 times, to do this with your normal charger follow these steps.

First drain your NiMH batteries completely, a very easy way to do the same, if you have a LED based torch light is to load the NiMH batteries and switch on the torch light and wait until it it dies, after it dies wait for about 30 minutes and then load these batteries into the charger and charge them fully, repeat this process 3-4 times and your NiMH batteries should be conditioned good as new.

Do note that you should not use a regular torch bulb incandescent type to discharge the NiMH batteries as it may over discharge the battery below .9V threshold which is bad for NiMH batteries, you can also use a high drain device to discharge the battery.

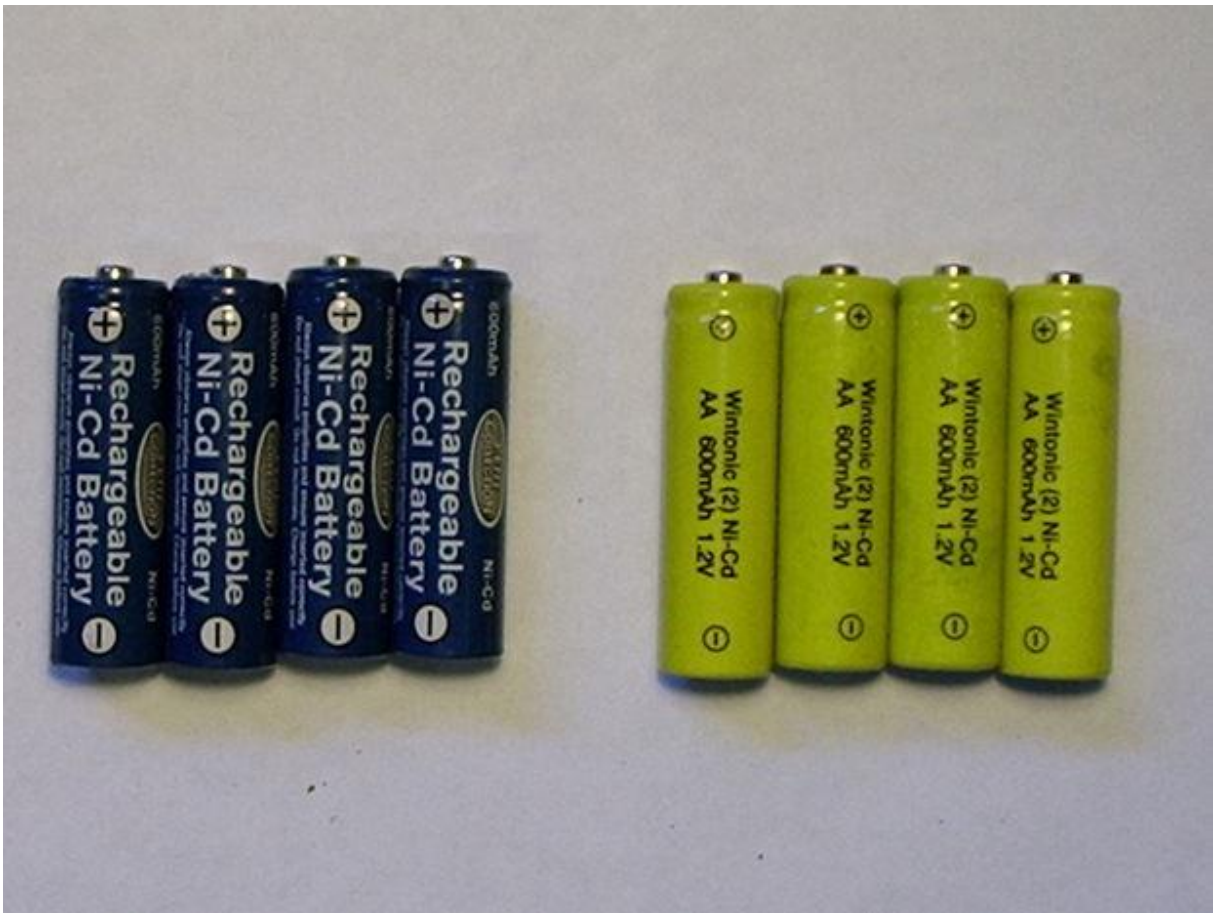
Also it is a bad idea to condition brand new NiMH cells, brand new NiMH will not give you the rated capacity but after 3-4 cycles of regular usage, they should give you the rated capacity.

Bring Dead Ni-Cad Batteries Back To Life

So what do you do with them when they die?
Just throw them in the trash - which harms the environment?
Or just take them to a recycling facility for them to be recycled?

Well, here is the best solution, bring your dead batteries back to life that can save you a chunk of change - By zapping them!

Step 1: So, Why do Ni-Cad batteries die?



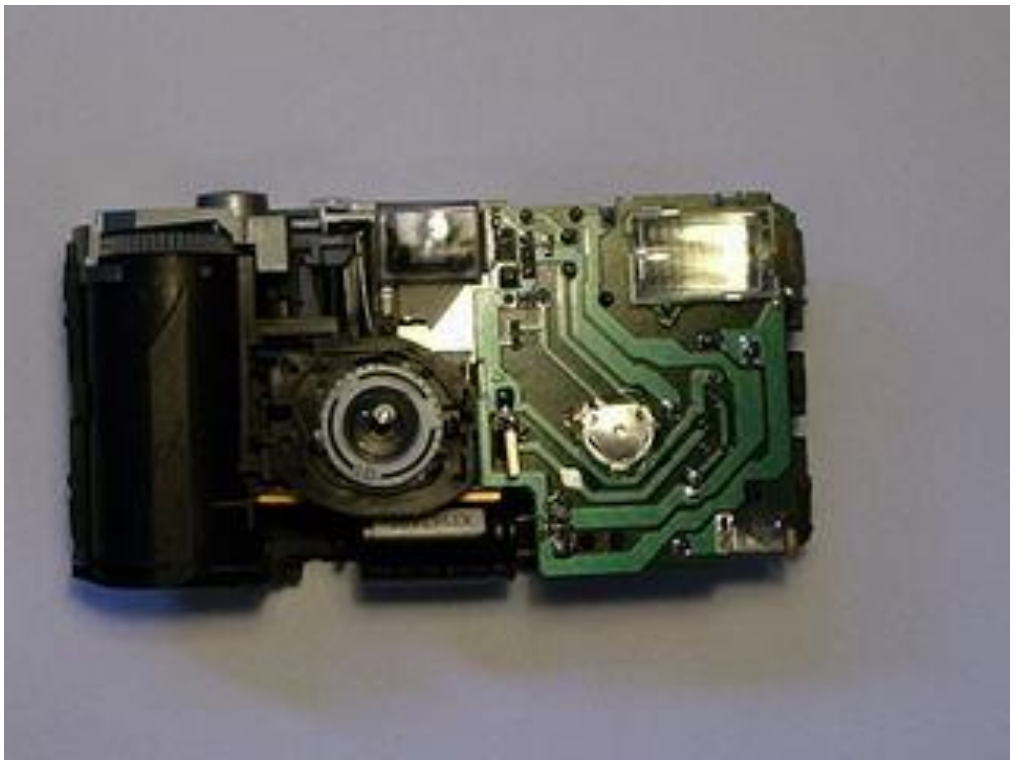
They don't exactly 'die', it is the sulfur crystals that is causing the problem.
The crystals are formed and begin growing caused by:

- Overcharging the cell
- Leaving the cell in the discharge state for a long time
- Memory effect
- Being exposed in high temperature

After the crystals have begun growing inside the cell, it eventually touches both ends of the cell terminals. This shorts out the cell and preventing it to be recharged again.

But, the good thing is the sulfur crystals can be easily destroyed, by putting a hefty surge current through the cell. This vaporizes the crystals and the battery should be good as new again!

Step 2: What you will need for battery zapping...




rolson

I recommend using capacitors as they give a powerful pulse discharge.

Other power source like car batteries and welders are not a good option. Because as they give out a continuous discharge, the wire can accidentally get welded to the battery terminal and cause them to overheat and possibly explode. You can use car batteries or welder, just be careful what you are doing.

The capacitor type you should use is somewhere about 100,000uF 60v. Unfortunately, that capacitor with an extreme ratings are just way too expensive.

So in this case, to avoid paying a chunk of change for a big capacitor, I use disposable flash camera's capacitor instead for this project. Why? Because they are suitable for pulse discharging, and best of all, they are FREE! But they are more dangerous.

So, what you will need for this project is...

- A disposable flash camera
- Dead Ni-Cad batteries
- Wires
- Battery holder for the dead Ni-Cads (You can use size AAA, AA, C, or D, depending what battery you want to zap. I am going to use an AA battery holder)
- Small switch (I used a slide switch)
- High power switch (I used a push-button switch)

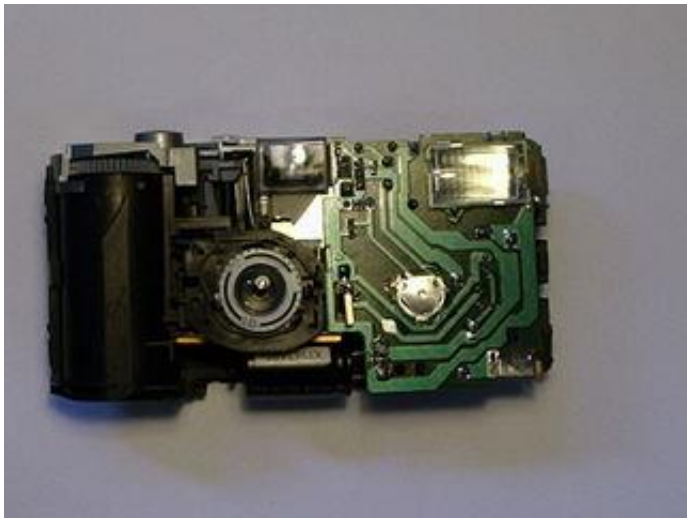
You can get free disposable flash cameras from photo developing places like Wal-Mart and such.

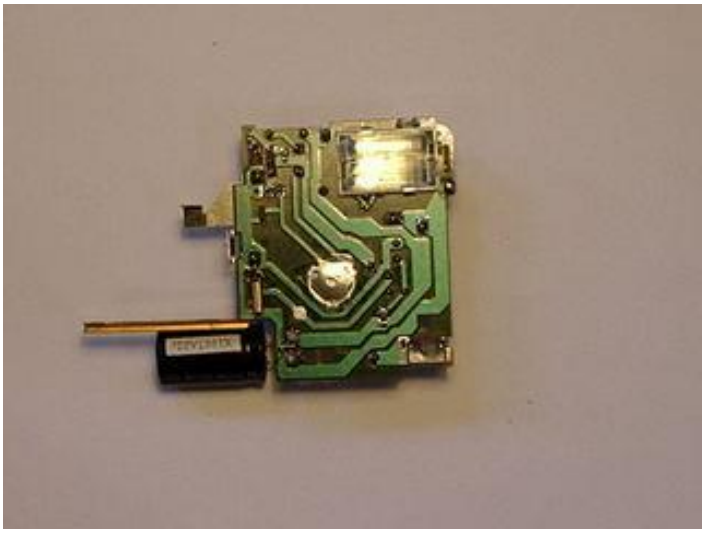
And for the tools, you will need:

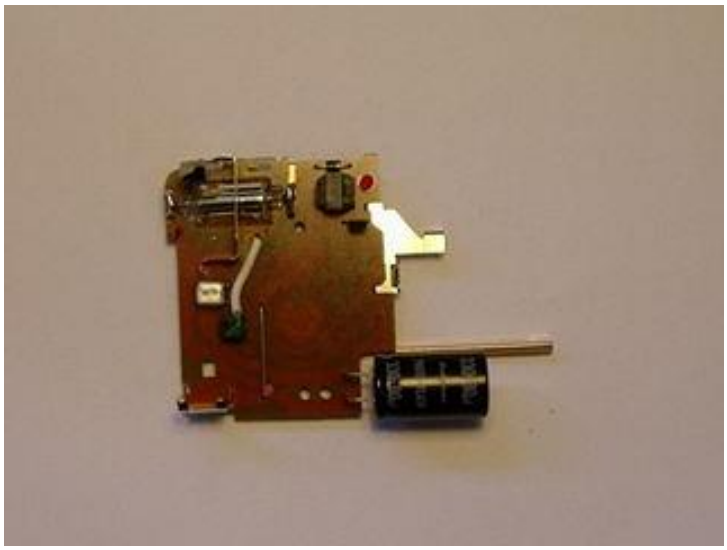
- Soldering iron (You might be able to get away without doing any soldering by twisting wires in place.)
- Wire cutters
- Wire strippers
- Flat head screwdriver
- Pliers

Step 3: Dissasemble the camera.


Kodak





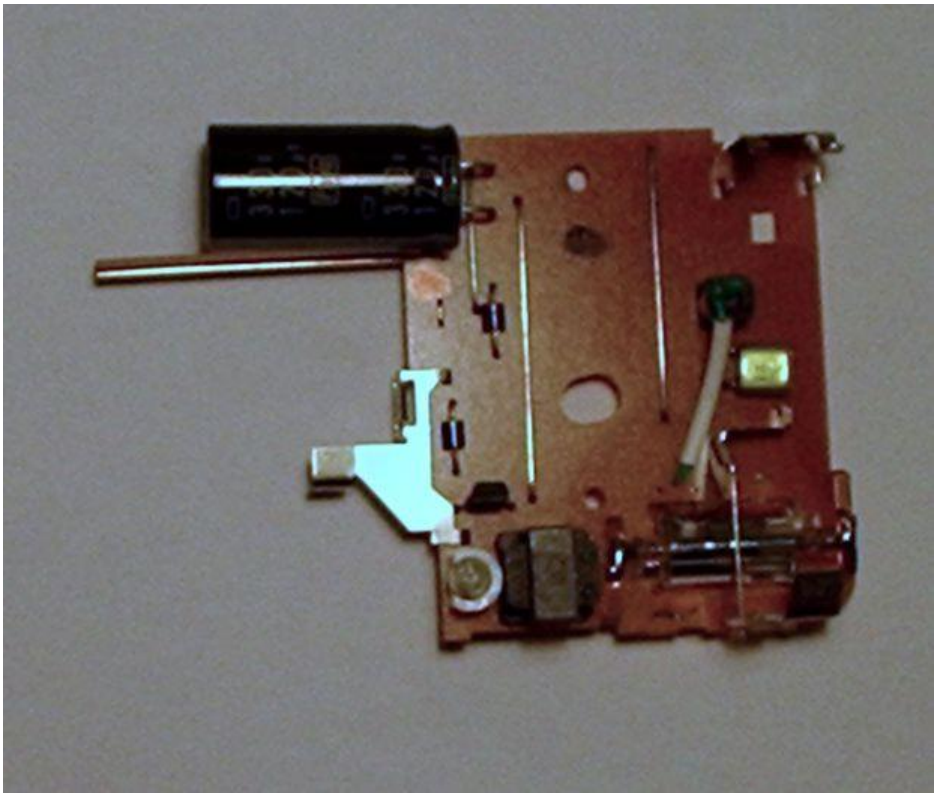


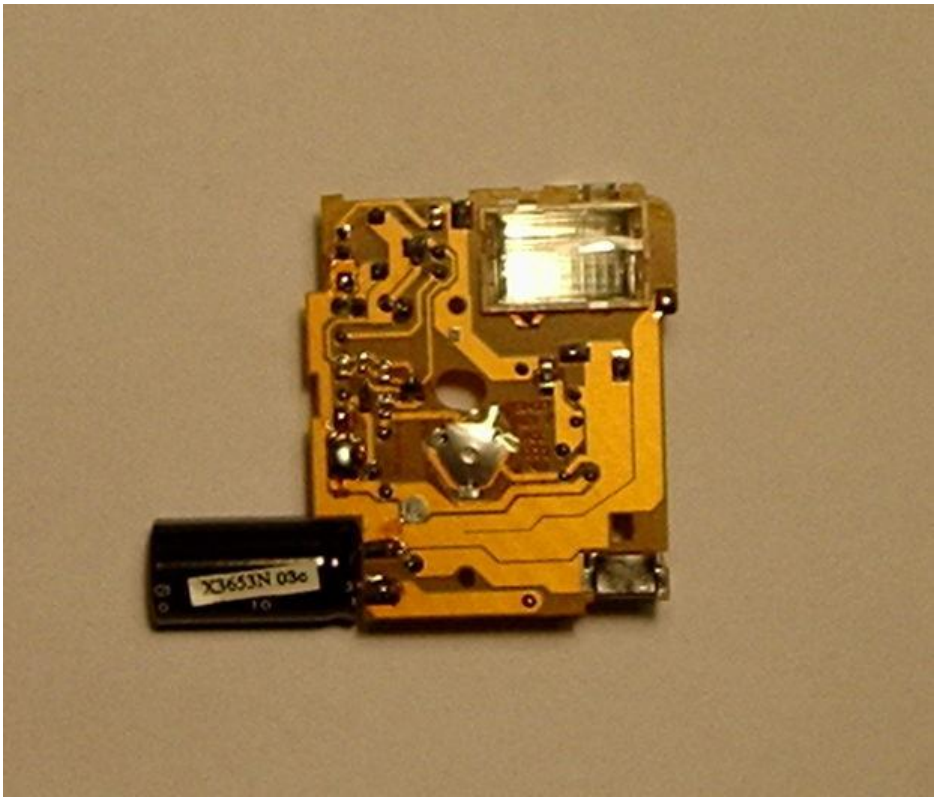
Be extra careful as this is going to be a fairly dangerous part, open up the camera and get the circuit out safely without getting shocked by the capacitor. (The capacitor in the camera is a large black cylinder thing; it is used for making flashes for the camera.)

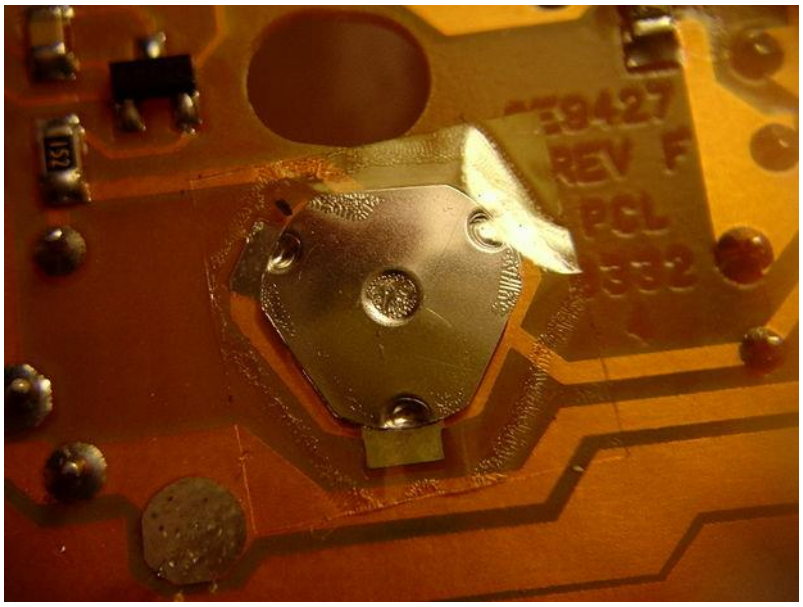
First, pry open the camera's case apart with a flat-head screwdriver or just use your hands if you like, but you are more likely to get shocked by the capacitor.

After you taken the camera's case off, discharge the capacitor with an insulated screw driver, and you may get a big loud spark, and after that, the capacitor is discharged. (Use a screwdriver you do not need, because a fully charged capacitor will leave a scar on the metal part of the screwdriver).

Step 4: Remove and add switch



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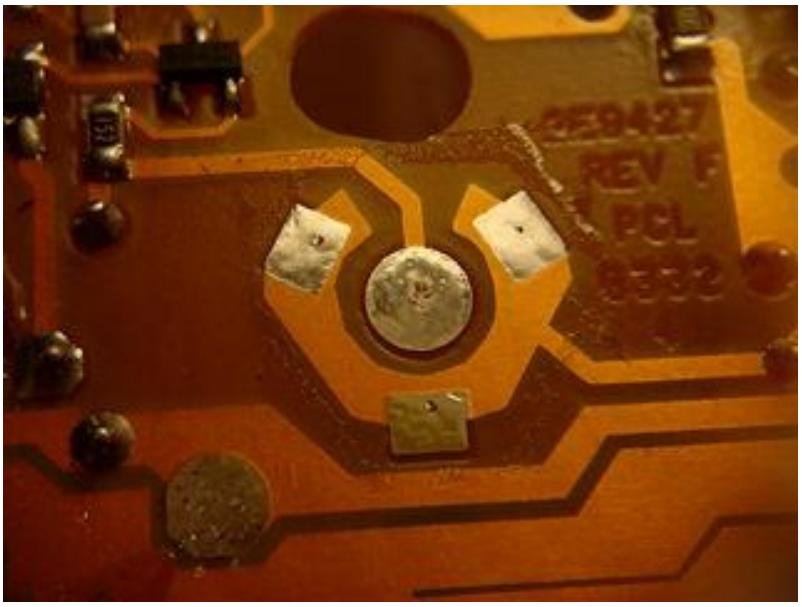
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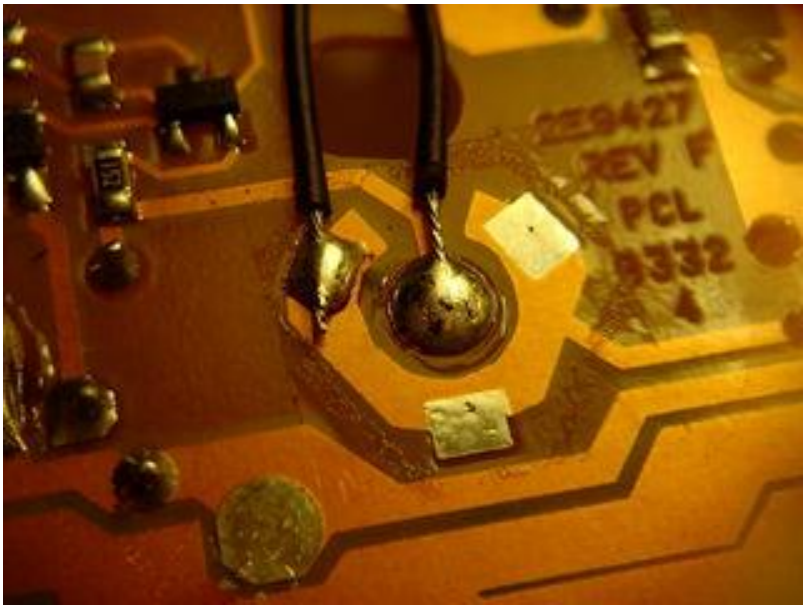
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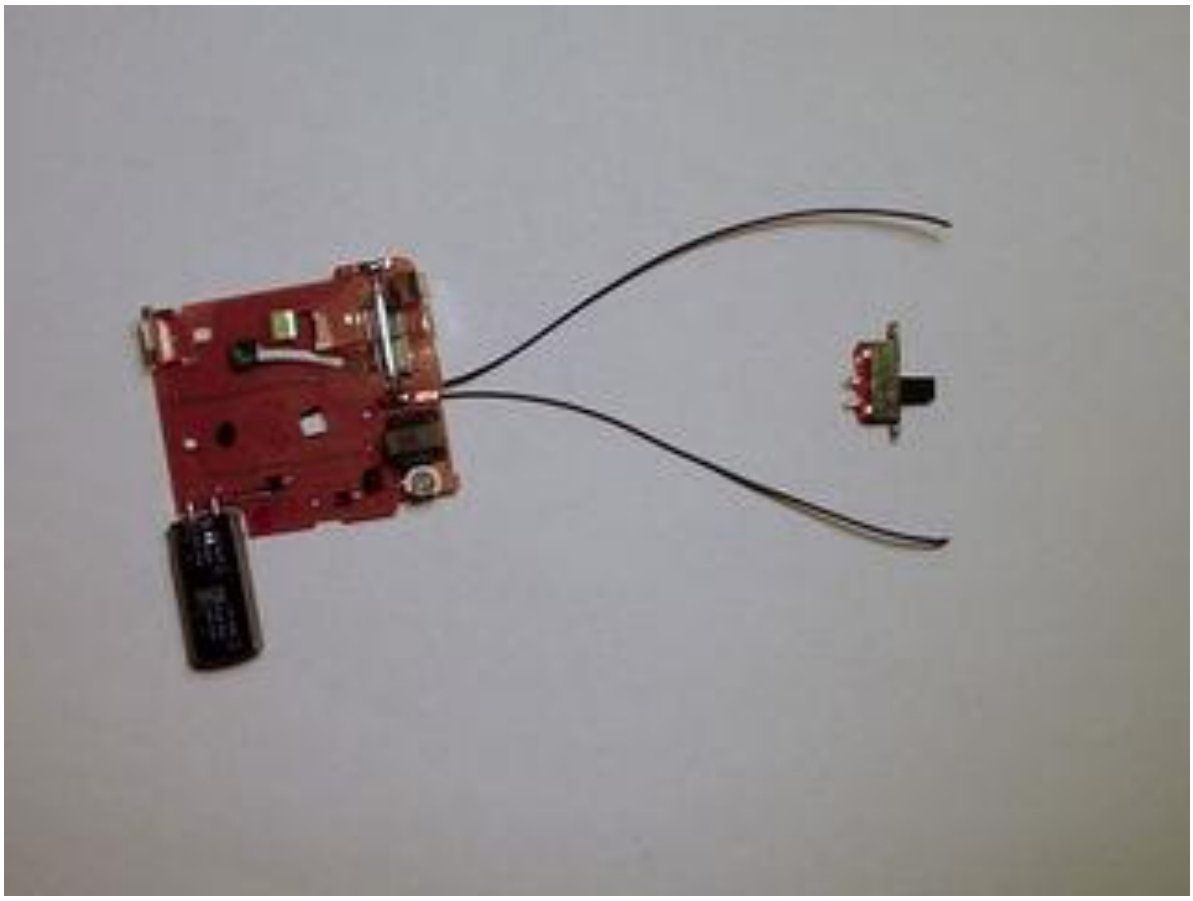
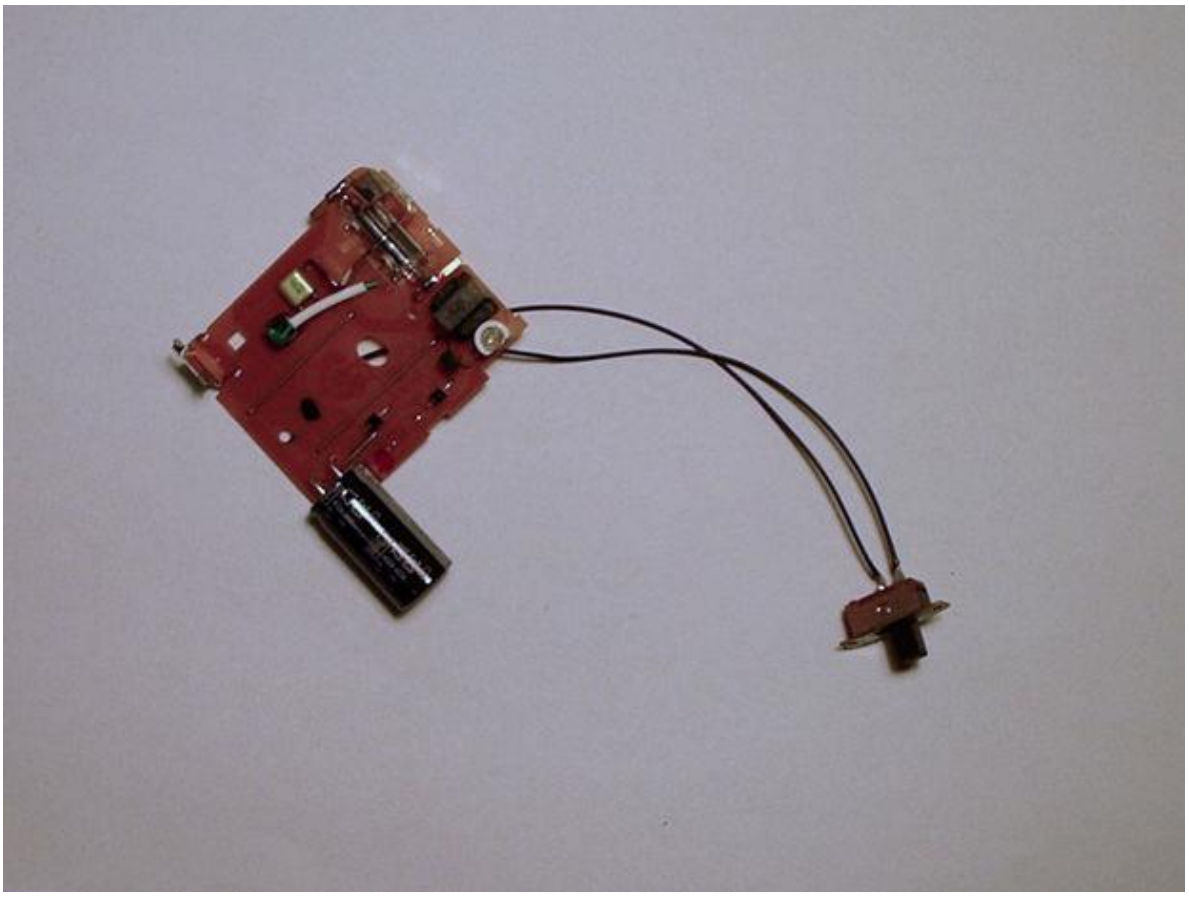


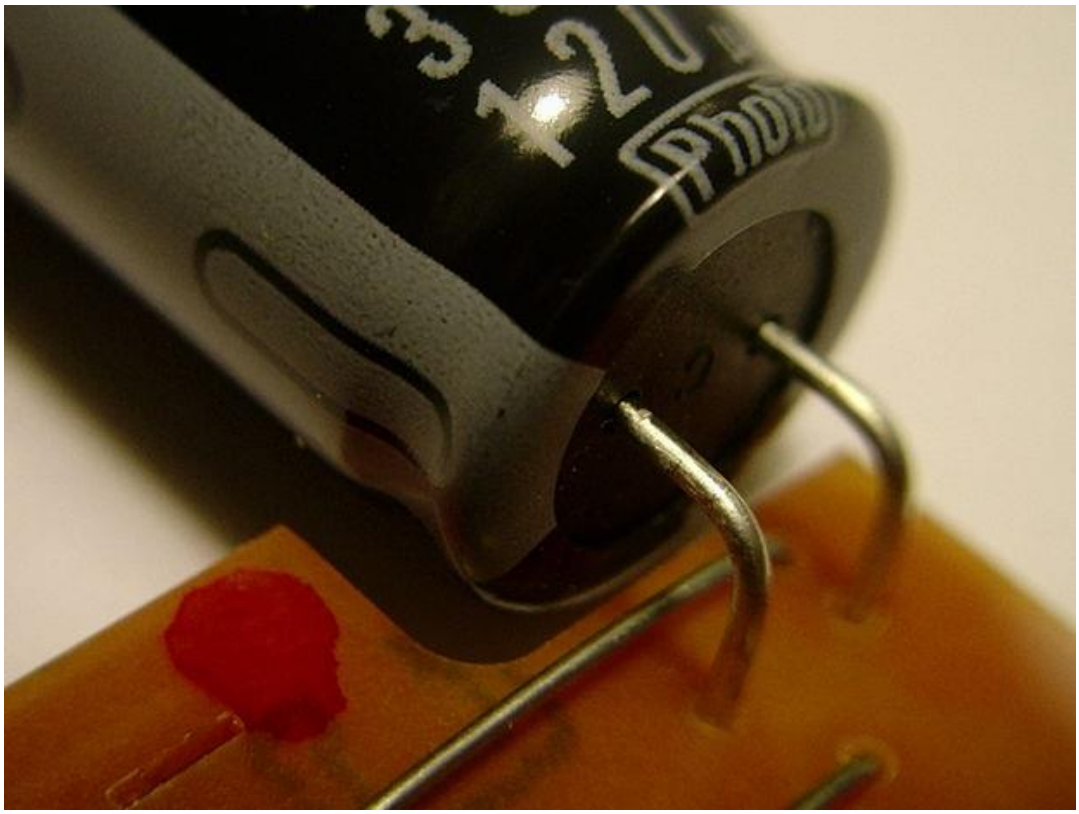


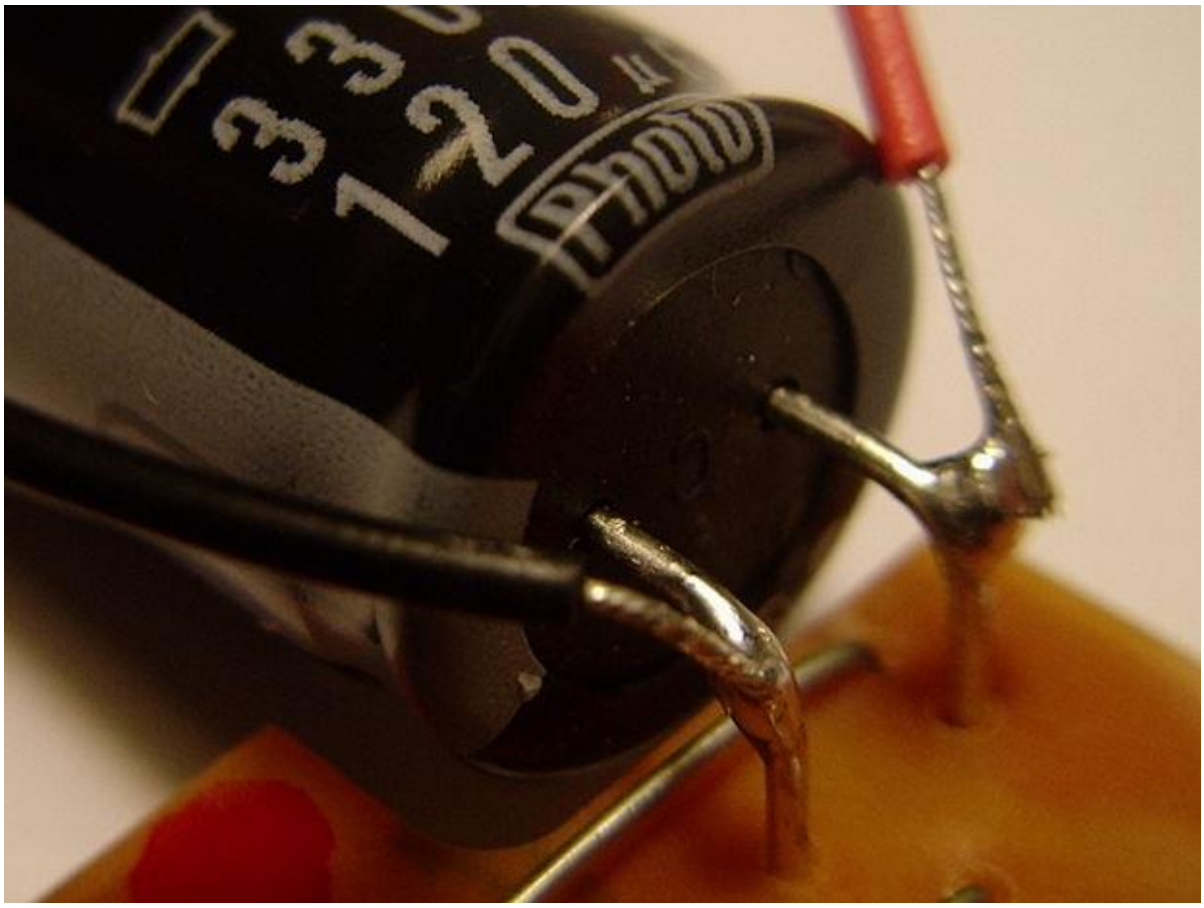
After the camera's circuit is removed from the frame, we need to remove the surface-mounded charge switch and add an external switch. Doing so, you will have easier control of the circuit.

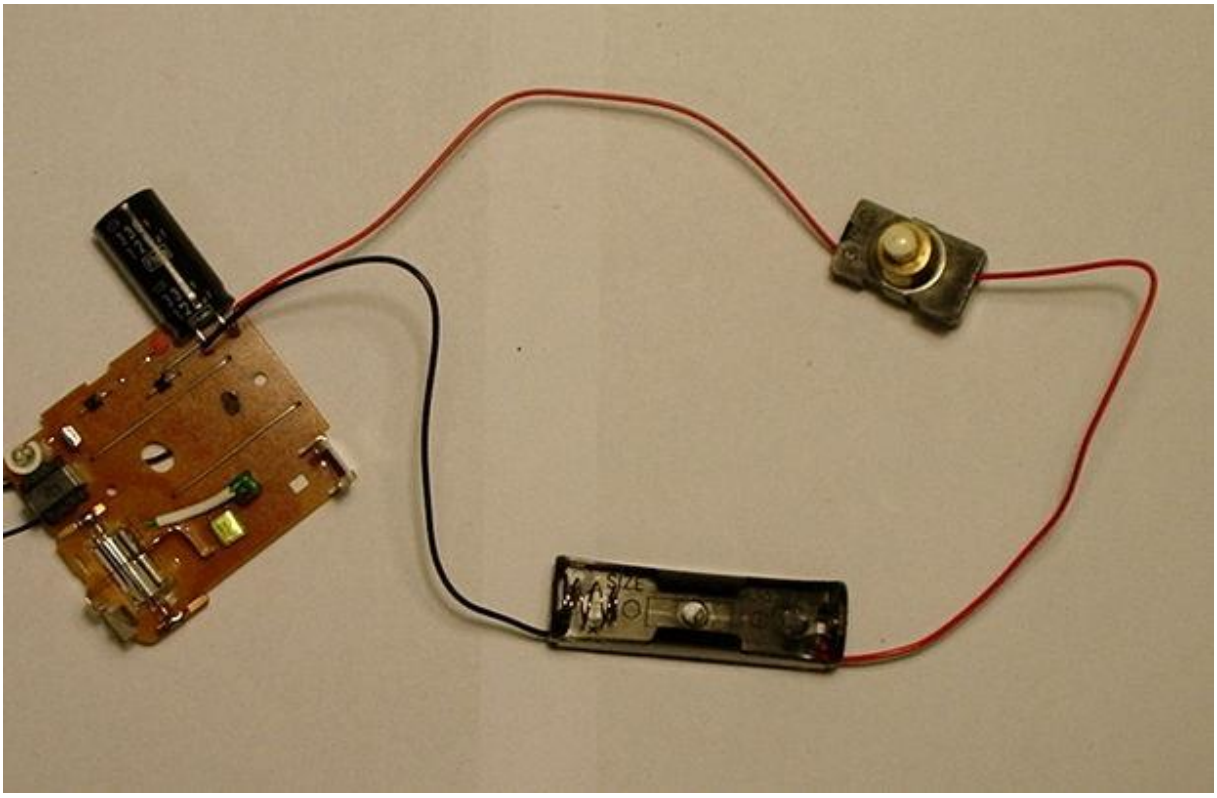
Remove the top bit of the charge switch. It will have some tape on the top, so it shouldn't be too hard to remove.

Then solder two pieces of wire on both exposed metal tabs. And solder a 'new' charge switch onto the other ends of the wires.

Step 5: Add the battery holder and the switch







Then we need to solder the battery holder and the high power switch together with the black capacitor.

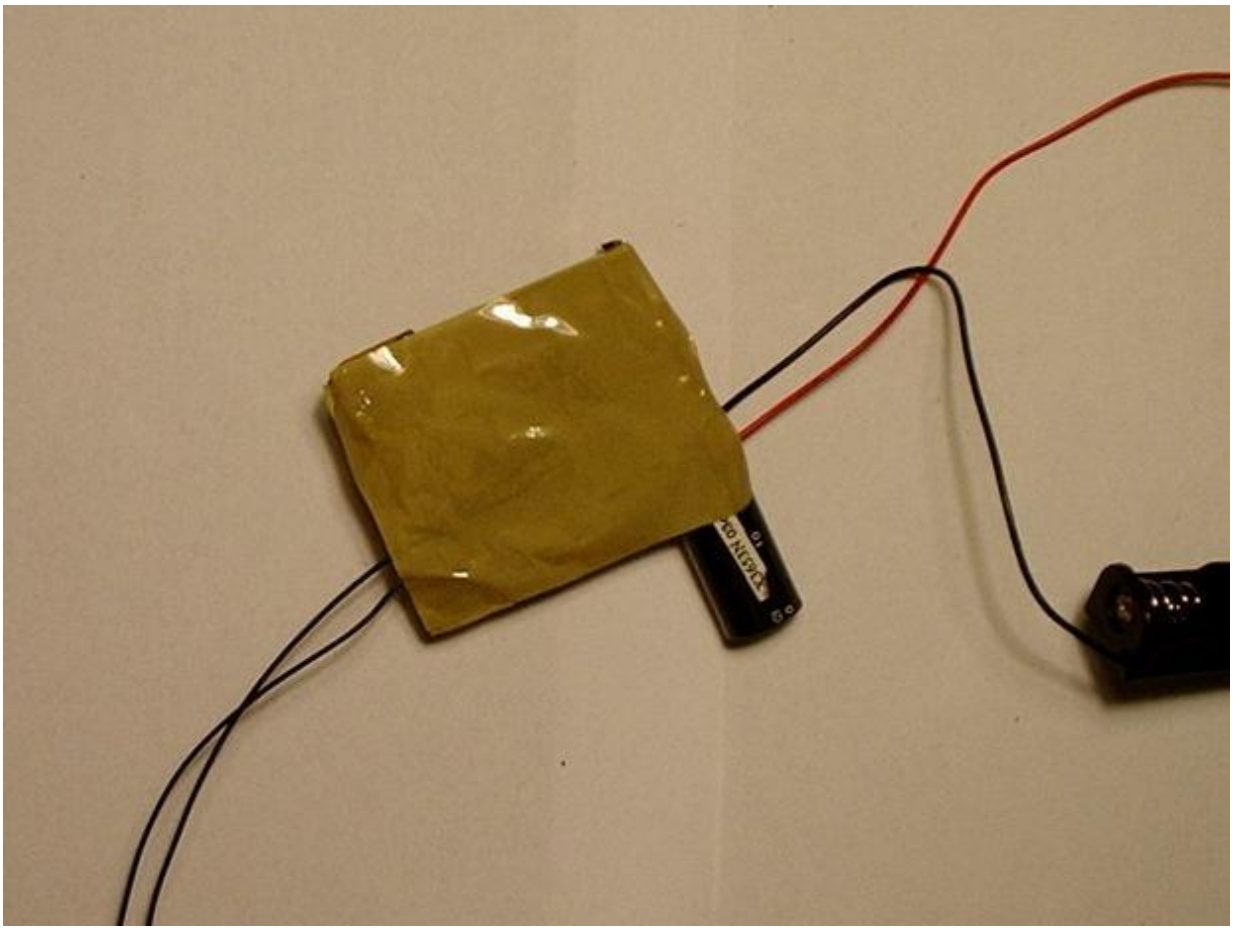
Solder the black wire of the battery holder to the lead of the capacitor that is the closest to the grey stripe.

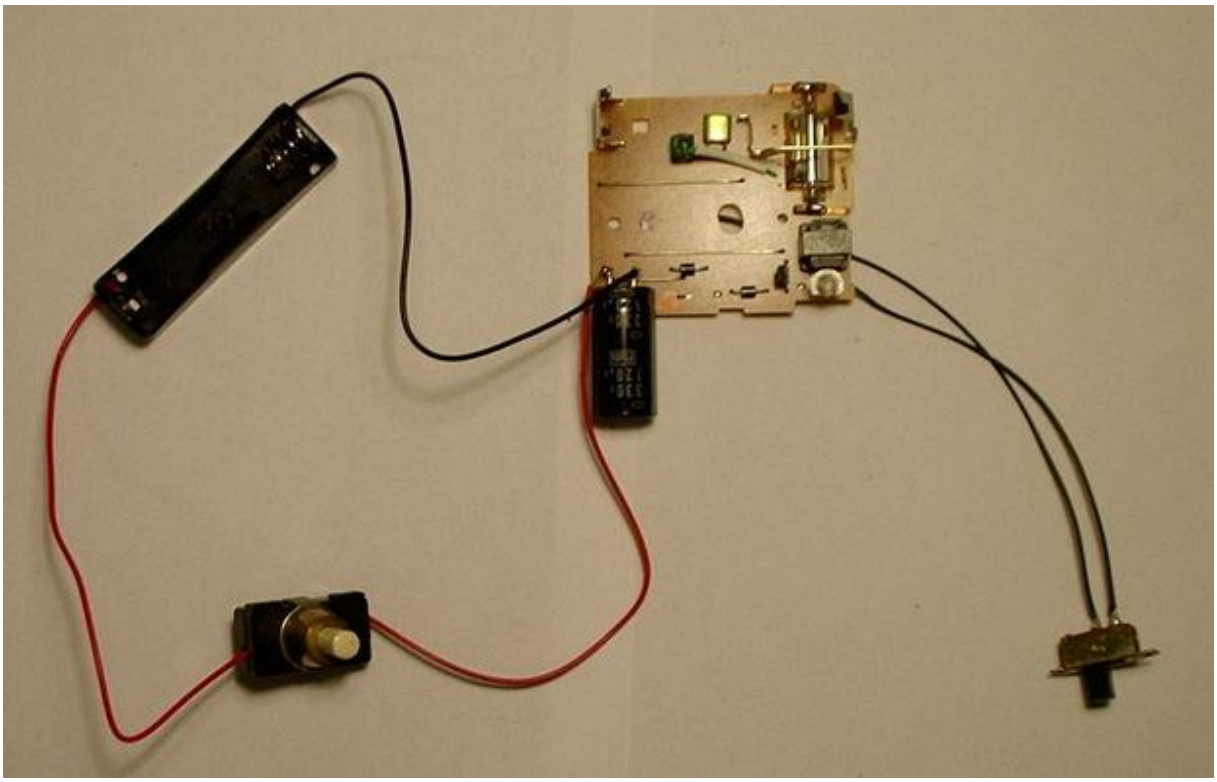
Solder a piece of wire to the other lead of the capacitor.

Then solder the push-button switch to the red wire of the battery holder and the other wire.

Also, the battery holder you just added, that is where you put the dead Ni-Cad battery to zap them.

Step 6: Insulate the high voltage



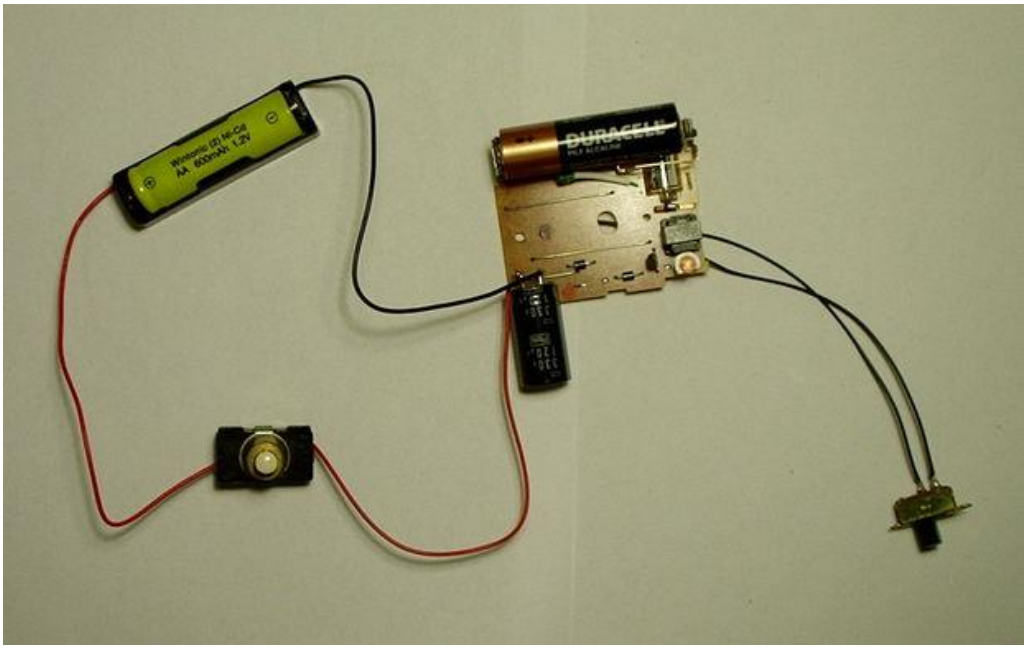


Okay, you are almost done! All you need to do is somehow insulate all the high voltage parts.

You could put it in a nice project box. But I don't have a project box available, so I just put tape on all of the bare metal parts and taped the bottom of the camera's circuit.

And you are done!

Step 7: Zap the battery.



To zap a dead Ni-Cad battery back to life, put the Ni-Cad battery into the 'zapping' battery holder and a good alkaline battery into the battery holder on the camera's circuit.

The turn on the charge switch and wait for the neon/LED to glow. When it starts glowing, push the push-button switch and you may hear a loud 'POP'. That is OK for it to pop, it shows the battery has been zapped and it is alive! But to be sure the sulfur crystals are really vaporized zap the Ni-Cad battery one more time.

After zapping the Ni-Cad battery, charge it in its charger to really get it working again.

Restoring Lead Acid Batteries

This page will guide you through process of restoring an old, sulfated lead acid battery to like new conditions with almost no investment. The only required materials are a dead battery, distilled water and a homemade battery rejuvenator.

This process should restore any lead acid type battery that is sulfated due to old age or use. Inspect the battery for any physical defects. Burnt connectors, melted plastic housing, warped battery sides or visibly warped or badly damaged plates inside are signs that a battery cannot be restored.

If no visible signs of damage are present, then most likely the battery can be restored using this method.

The battery pictured at the right was taken from under the hood of a car. The battery was ten years old and still in the car. It could barely hold a charge beyond 10.5 volts and was no longer able to start the engine.

First, wash the battery thoroughly with lots of water and baking soda. A soft brush is useful for any oil or dirt stuck on the battery. Dish soap can also be used to clean very dirty batteries. The baking soda reacts with the battery acid, rendering it harmless.

Next, carefully pry off the battery cell covers with a screwdriver. Wear old clothing or an apron to protect your clothes from battery acid. Acid will quickly eat through clothing. See the first photo below. Set the covers aside. Now you may want to use a shop vac to clean out any larger dirt particles. Be careful not to let any dirt fall into the battery cells. Take a damp paper towel and clean the area around the cell holes (See third photo).


84 Month Limited Warranty
KIRKLAND
665
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ITEM # 297110


84 Month Limited Warranty
KIRKLAND
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ITEM # 297110


84 Month Limited Warranty
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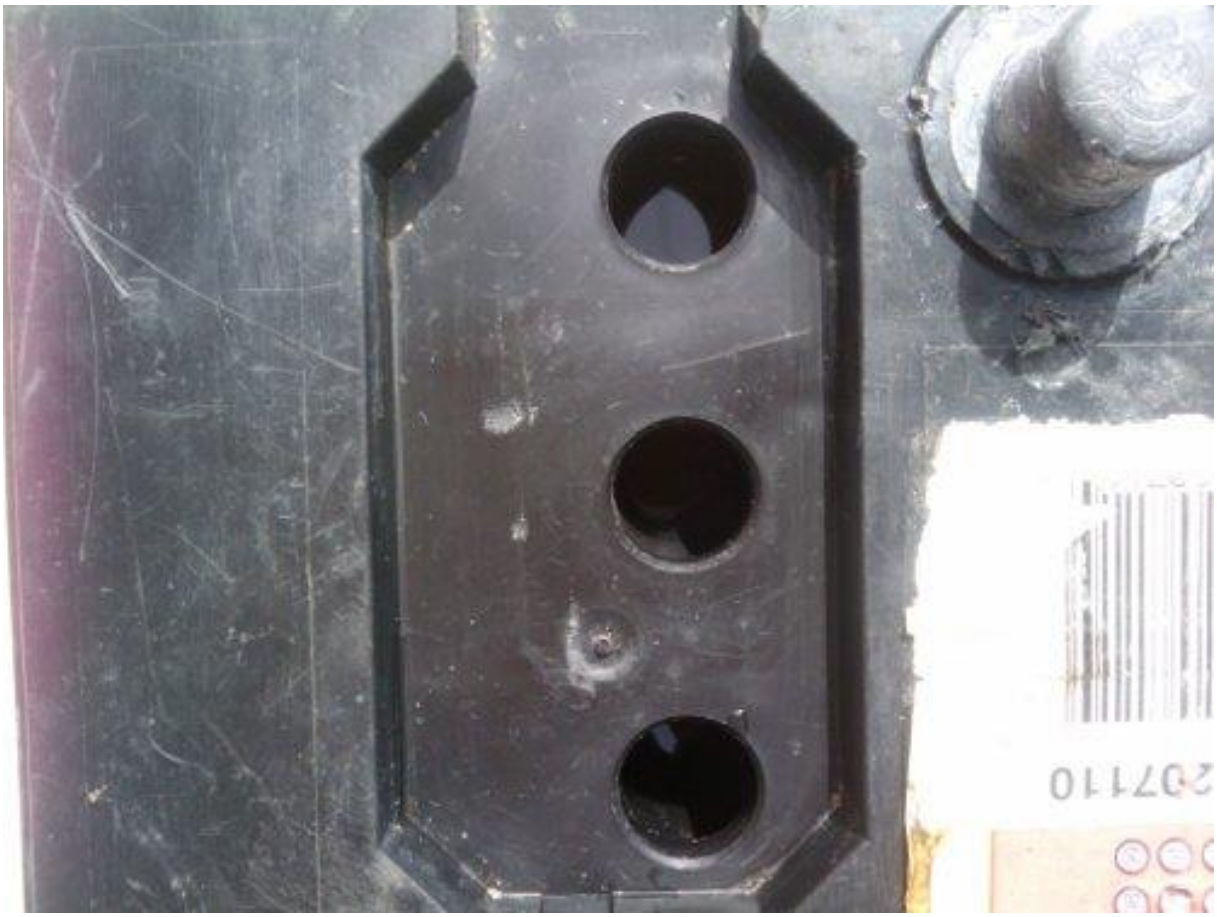
ITEM # 2977110

In the photo below, you can just make out that the cells are bone dry. It was hard to get a good picture inside the cells. Fill the cells to just above the plates with distilled water. Do not use anything except for distilled water. Tap water has minerals that will corrode your battery. Some batteries, like this one, have a plastic cover over the plates. Fill to just above the top of the plastic cover. It is easier to use a smaller bottle to avoid messes when pouring. Pour slowly to prevent over filling. In the third photo below you can see the water level in the cells.

The battery is now ready for charging. This battery actually took over 20 ounces of distilled water! It is amazing this battery was even still in use.


ITEM # 207110
Warranty



In the last photo above, the battery is being restored with a professional radiant energy battery desulfator.

The special pulsed radiant energy used in the rejuvenators listed here break up the sulfation on the battery plates and restore the battery to full power. It may take multiple cycles on the charger to restore a very old or heavily sulfated battery. Often, as the battery nears its top charge level, you may want to slowly discharge the battery and recharge it on the rejuvenator again. With each cycle the battery will gain usable energy until it is fully desulfated. An auto light bulb and some wires are useful to slowly discharge the battery. Be careful and monitor the voltage while doing this. Do not discharge the battery below 11.5 volts so as not to cause any harm to the battery. Recharge the battery and repeat as needed until the battery is fully topped off. A fully charged auto battery will sit between 13.5 volts to 14.5 volts when finished.

FAQ

1. Do NiMH batteries need to be charged when first used?

   Yes, NiMH batteries are shipped in a discharged state and need to be charged before use.

2. Why do batteries become warm when charging?

   The battery has a resistance, so if you draw a current from that battery then you're pushing that current through a certain resistance and so, it will heat up.

3. How long can I store NiMH batteries?

   Typically between 3 and 5 years if stored at room temperature. It is recommended that NiMH batteries stored in a charged state. To attain full capacity after extended storage may require a few charge/discharge cycles to obtain maximum performance.

4. Can non-rechargeable Alkaline, Heavy Duty or Lithium batteries be used in an any charger?

   No, non-rechargeable batteries cannot be placed in any charger. Charging of non-rechargeable types may cause the batteries to explode or leak.

5. Why are rechargeable batteries 1.2 Volts?

   Every battery chemical system has an open circuit voltage based on their internal active materials (fuel). For example, alkaline batteries have a voltage of approximately 1.5 volts due to the reaction between the anode and cathode materials. The reactions of the anode and cathode materials in NiMH batteries produce approximately 1.2 volts.

6. How can I recycle my rechargeable batteries?

   Rechargeable batteries can be recycled free of charge at any Rechargeable Battery Recycling location.

7. What is memory effect?

   This is a loss of battery capacity due to partially discharging and recharging repetitively without the benefit of a full discharge. This was evident with early nickel cadmium (NiCd) rechargeable batteries and is not found in nickel metal hydride batteries (NiMH) currently manufactured.

8. What is the difference between nickel cadmium and nickel metal hydride batteries?

Both types of batteries are rechargeable but NiMH batteries have a higher energy density (ratio of energy to volume). NiMH batteries are also considered more environmentally friendly than NiCd batteries.

9. How long will a nickel metal hydride battery hold its charge?

When not in use, nickel metal hydride batteries will lose 20% to 50% of their charge within six months due to self-discharge. Several factors such as cell size, construction and storage temperature can impact the self-discharge rate. NiMH batteries that have not been used for an extended period of time should be recharged before being put into use to obtain maximum performance.

10. What is a smart charger?

Smart chargers use microprocessor circuitry to monitor battery parameters such as temperature, voltage and state of charge. This information is used by the charger to determine when to terminate the charge.

11. What is a trickle charge?

This is a low rate charge used to replenish capacity lost due to self-discharge.

12. Can I use an old NiCd charger with new NiMH batteries?

It is not recommended since the older NiCd chargers were not designed for the higher capacity NiMH batteries.

13. Should chargers be removed from household AC power when charging is complete?

We recommend that the chargers be unplugged from the wall outlet and the batteries be removed after the charging sequence is complete unless the charger has an on/off switch. This allows the charger to reset prior to the next usage.

14. Can a NiMH battery be overcharged?

NiMH batteries are sensitive to continuous over charge. A smart charger monitors the cell condition during charge and prevents overcharging and subsequent negative impact on battery cycle life.

15. How many times can I recharge nickel metal hydride batteries?

    In normal use, NiMH batteries can be recharged hundreds of times. Many factors effect cycle life. Some of these factors include depth of discharge, charge and discharge current, method of charge control, storage and operating conditions and shelf life. Typically batteries with a higher mAh capacity will have a lower cycle life than lower mAh capacity batteries.

16. Can only one battery be charged at a time?

    Refer to the charger instructions. Some chargers will only charge pairs of batteries at a time (2 or 4). If one or three batteries are installed in these chargers, the single battery (not in a pair) will receive no charge.

17. Can batteries of different capacities be used together?

    No, it is recommended that batteries of different capacities not be mixed together. Mixing batteries of different capacities can result in lower than expected performance and reduce cycle life of the lower capacity battery.

18. How can I test NiCd or NiMH batteries to see if they’re still good?

    Due to their flat discharge profile and recharge ability, it is difficult to define a simple quality check for NiCd or NiMH batteries. For fully charged batteries, a battery tester which measures closed circuit voltage can be used as a general guide to determine if the battery is “good” or “defective”. A voltmeter which measures open circuit voltage is not a reliable method for evaluating rechargeable batteries and is not recommended for this purpose. The most accurate way to measure the performance of rechargeable batteries is to monitor time and operating voltage during controlled discharge.

19. How do chargers detect the end of the charging cycle?

    During charging, the battery will reach a peak voltage near the end of a charge, followed by a slight drop in voltage. Smart chargers are able to detect this voltage drop (-delta V), which will typically range from 5mV to 20mV. Smart chargers stop the charging process when they detect the drop in voltage. Some chargers simply use a timer to control the charge. However, if a fully charged battery is put back in, the timer can reset and give the battery another

full charge, resulting in overcharge. Some high-end chargers have back up timers in case the -dV (-delta V) does not work.

20. How is the capacity of a rechargeable battery determined?

    Capacity is how much charge a battery can hold often measured in units of mAh. The American National Standards Institute (ANSI) procedure is as follows: Step 1 discharge new cells at 0.2 C to 1 volt. Step 2 Charge cells at 0.1 C for 16 hours. Step 3 rest cells for 1 hour. Step 4 discharge cells at 0.2 C to 1 volt. Battery capacity is determined by the hours of service to 1 volt times the discharge rate (mA x hours = mAh).