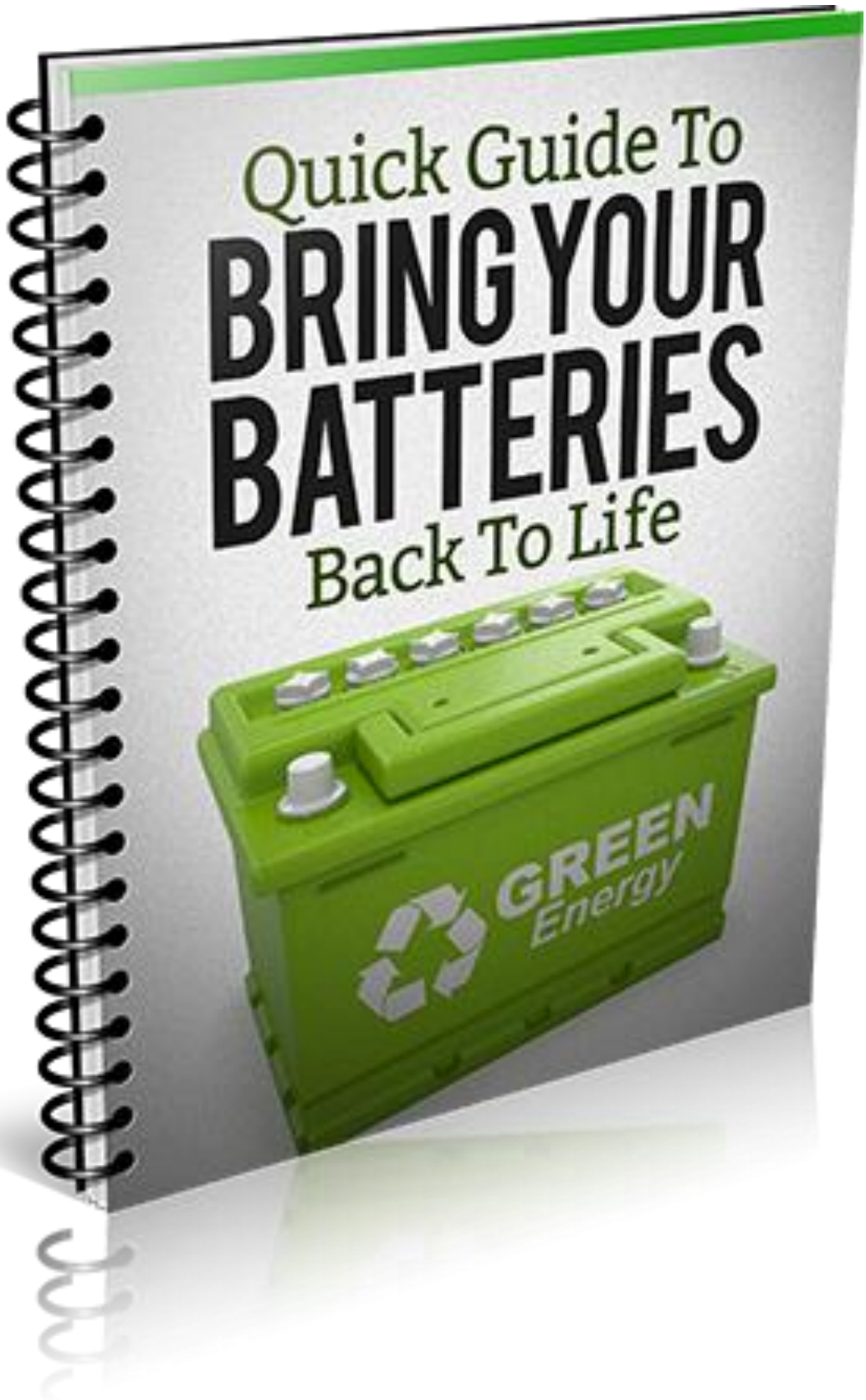


Copyright

*** Please Remember ***

Safety First! Everything you do that is related to your DIY project is at your own risk. Please use safety precautions at all times. If you do not understand something or do not feel comfortable doing something - consult a professional.

TO MORE GREEN ENERGY

Ryan Tanner

Table of Contents

CHAPTER 1. LEAD ACID BATTERIES

Background of Lead Acid Batteries

The 12 Volt or lead acid battery is the original rechargeable battery. This type of battery was first introduced in France in 1859. Since then, it has been widely used for a variety of purposes. The vehicle/car industry regularly uses these types of batteries in vehicles. Other industries often use these batteries as well - like in marine applications, RVs, golf carts, alternative energy applications/battery banks, or scooters.

Since a huge number of lead acid batteries are being used in the world today, inevitably many are getting out of use, old and corroded, or discarded. However, many of these batteries that are just thrown away or no longer used can be tested and reconditioned. Doing this can save you a ton of money - especially if you plan on using a lot of 12 volt batteries (like in an alternative energy bank). The proper methods of doing this will be discussed in this guide. We will also go over many useful ideas and methods to help you take care of these batteries over the years to make them last longer.

Personal Safety Measures

As the name suggests, a lead acid/12 Volt battery contains lead and acid. The plates inside the battery are created using lead and the liquid portion in the battery is nothing but a weak solution of sulfuric acid. Due to relatively low concentrations of sulfuric acid, the solution is considered weak. However, just because it is considered a “weak” sulfuric acid solution; this doesn’t mean it can’t harm you - because it can and you should use the cautions we discuss in the guide when dealing with this solution and 12v batteries in general. For example, your skin may bum if it touches the acid solution and if it is spilled on your clothes, it will damage them. Because of this, you have to be extremely careful when dealing with lead acid batteries - especially when you open them up like we will be doing.

For the safety of your skin and clothes, you must wear gloves and a rubber apron. You should also wear safety glasses at all times. The safety glasses that you should use must possess both front and side protection. In fact, we recommend taking it one step further and wearing a full-face shield *(we do).*

You must also avoid smoking around lead acid batteries, especially while you are charging them. It is possible that an explosion could occur if the gas produced during charging gets in contact with the flames or sparks of what you are smoking.

Also, when you are connecting or disconnecting the cables from a 12V/lead acid battery, you have to ensure that the negative or ground terminal is connected or disconnected first and then the other terminal (i.e. the positive or live terminal). This will help prevent sparks that could lead to an explosion.

Precautions Regarding Environmental Safety

There is also an environmental concern when you are working with 12 volt/lead acid batteries. If you do discard of any bad lead acid batteries that you can't restore you should follow your local government's guidelines and take them where hazardous materials are discarded in your area. The reason you want to do this is because the lead in lead acid batteries is a toxic material and is considered a Hazardous waste (discarding of these improperly in some areas is against the law too).

To get proper guidance for disposing of these batteries go to the website: www.EHSO.com/battery.php for a lot of useful information.

Lead Acid Battery Types

Before we get into the specifics about how to restore batteries, we want to make you more familiar with them. So in this short chapter we will go over the different types of lead acid/12 volt batteries you will typically find (and can restore).

Starting Lighting and Ignition (SLI) Batteries

These batteries are mainly used in cars. They are designed in such a way that they will be fully charged when you turn your car on and start it. Nearly 2%-5% of the charge is used while starting the car. After that, it is switched to the alternator which ensures that the battery is always fully charged. One important distinction about these types of batteries is that if you discharge them below 50%, it will ruin the plates in the battery and shorten its lifespan.

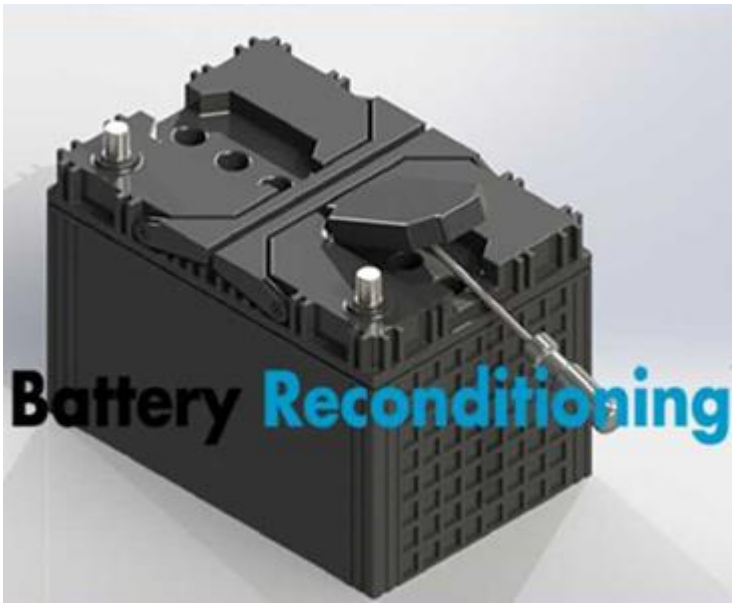
Deep Cycle Batteries

These are generally used in golf carts, electric vehicles, fork-lift trucks, and in some marine/alternative energy applications. This type of batteries cannot be kept fully charged like car batteries. These are designed in such a way that they are discharged completely prior to recharging (SLI and deep cycle batteries can be either vented or sealed).

Vented Batteries

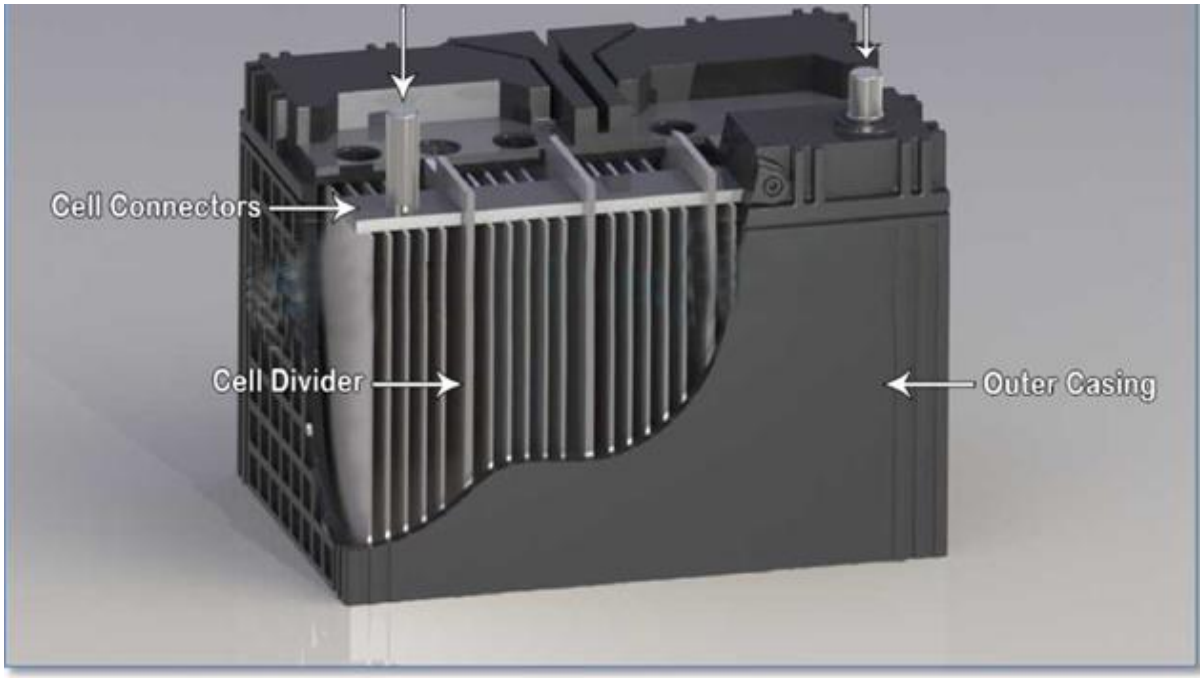
On vented batteries, there is a one or more removable caps that you can pop off with a screw driver to get access to the battery cells inside. When vented batteries get hot while they are charging; oxygen and hydrogen gas (or water vapor) comes out through the vents. So, for vented batteries, you have to add distilled water at particular intervals so that the plates remain covered in the electrolyte liquid inside of them at all times.

Sealed Batteries



These types of batteries do not possess caps that give easy access to the battery cells. They don't have these caps because they have less gassing and not nearly as much water vapor loss like vented batteries do. So they really don't require a lot of maintenance typically.

However, in sealed batteries, if you want to add water or get access to the cells inside the battery, you have to drill holes. These batteries typically will have marks where the cells are located so you will know where they are. And once you finish adding water (or restoring them like we will show you), you have to use plugs made of plastic to



seal the holes you drilled *(We will discuss drilling/sealing these holes in more detail later).*

Next, we want to teach you a little more about the inside of a typical 12v, lead acid battery. It may be possible for you to test and recondition a lead acid battery without having any knowledge about what it looks like inside. However, some "inside" information about the battery might be useful - which we will go over in this section.

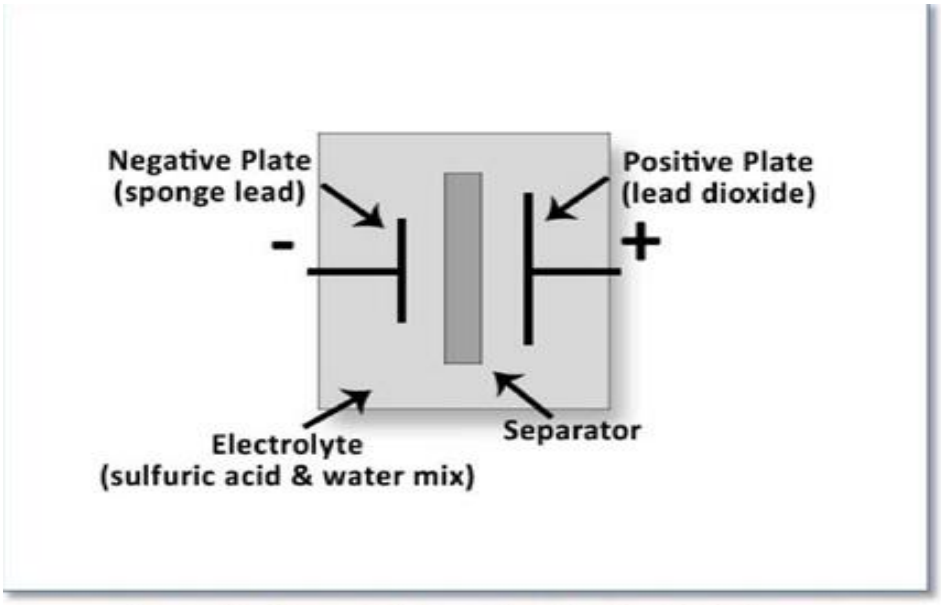
Basic parts/areas in a 12V battery

The battery cell of a lead acid battery is built with two plates, one of which is connected to the negative terminal of the battery and the other is connected with the positive terminal (These two plates are separated by an insulating material).

This entire device is in a container, which is normally a plastic box.

This battery container is filled with a special liquid - which is a diluted sulfuric acid (this is an electrolyte).

There are generally 6 cells in a 12 volt battery. Inside each lead acid cell there is one positive and one negative plate that will possess 2 volts *(see diagram below for a visual of a 2 volt cell).*

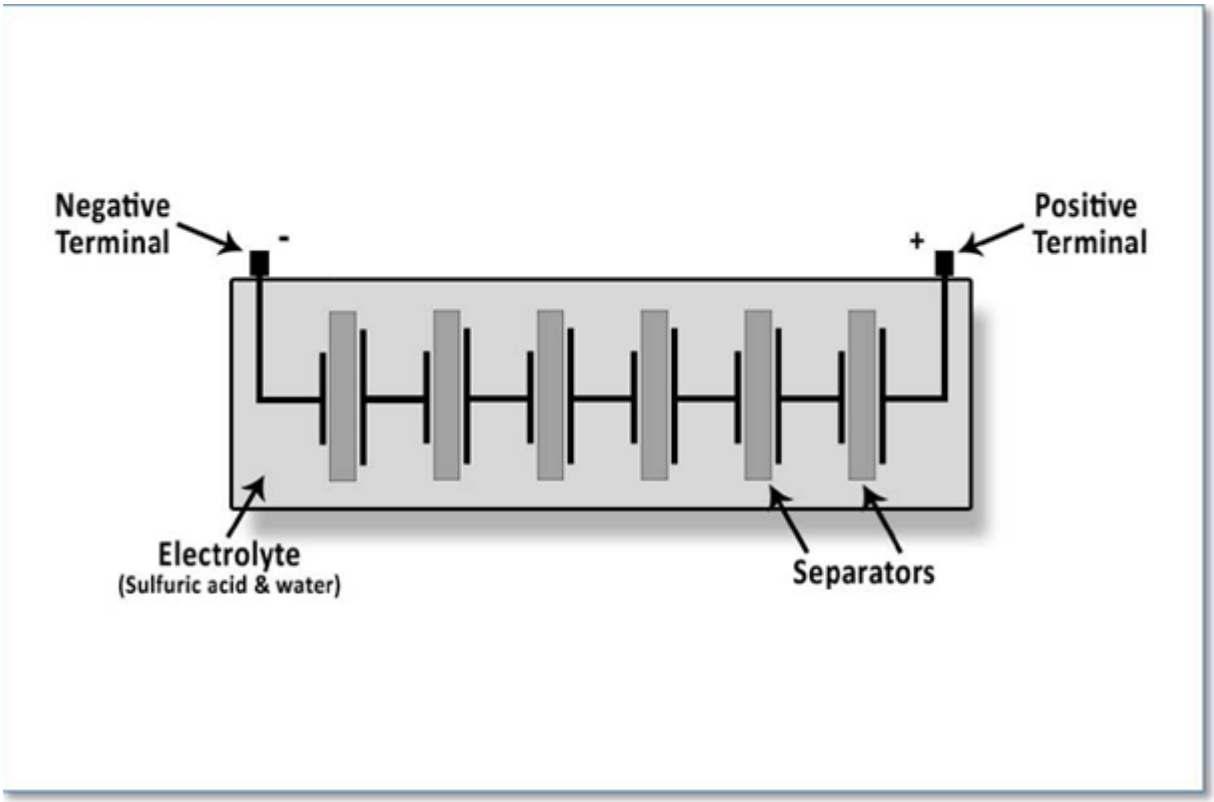


Description: Schematic diagram of a cell inside a 12v battery.

When electrical current is sent through the battery in a backwards manner, the battery will be charged. After that, it will generate an electrical current with an electrical device that is connected between the two terminals in the battery. If the lead acid battery is not properly charged, it will not be able to produce electrical

energy. *note: this is why these types of batteries are sometimes referred to as "storage batteries."

Furthermore, when you are obtaining used or old lead acid batteries you may run into a few rare batteries - like some that were built with only a single cell. Other lead acid batteries use just three cells connected in series - which generate 6 volts in total. However, the most common lead acid battery you will find is the 6 cell, 12 Volt kind. The schematic diagram of a 12 Volt lead acid battery is shown below.



Description: Schematic diagram of the inside of a 12v battery.

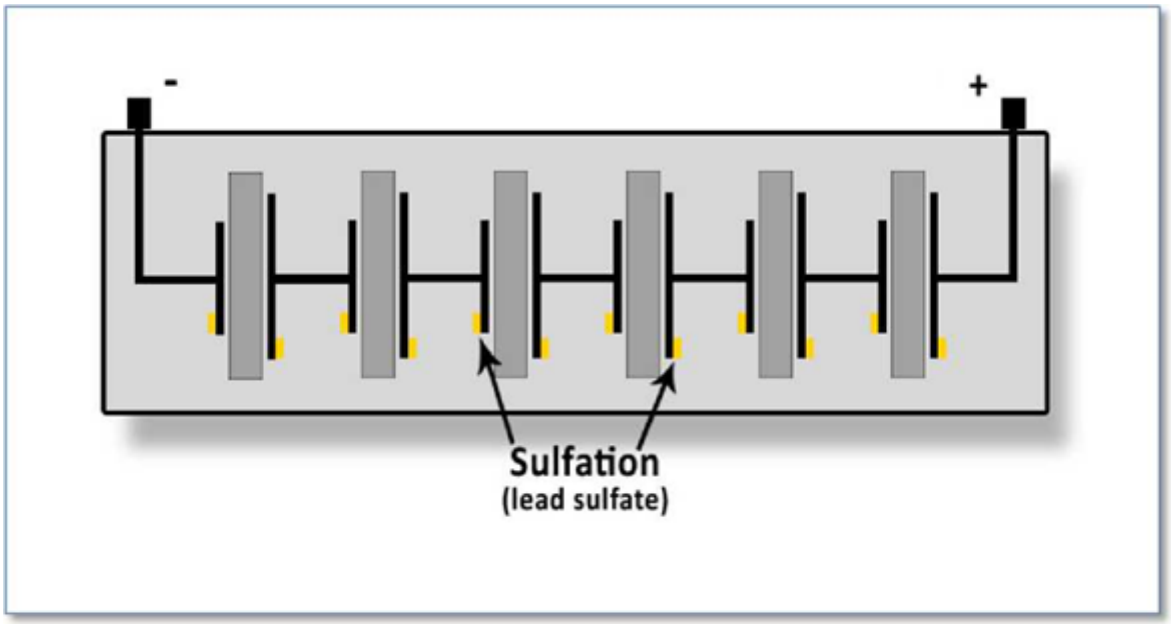
From the diagram, you can see that lead acid batteries can basically have any voltage that is a multiple of two - it just depends on the number of cells that are connected in series. However, in most cases, you will find either 6 volt or 12 volt batteries.

Sulfation, and Its Effect on a Battery

Whenever you are dealing with the testing and reconditioning of lead acid batteries, you will have to have a clear understanding about what sulfation and sulfating are and how they affect the battery.

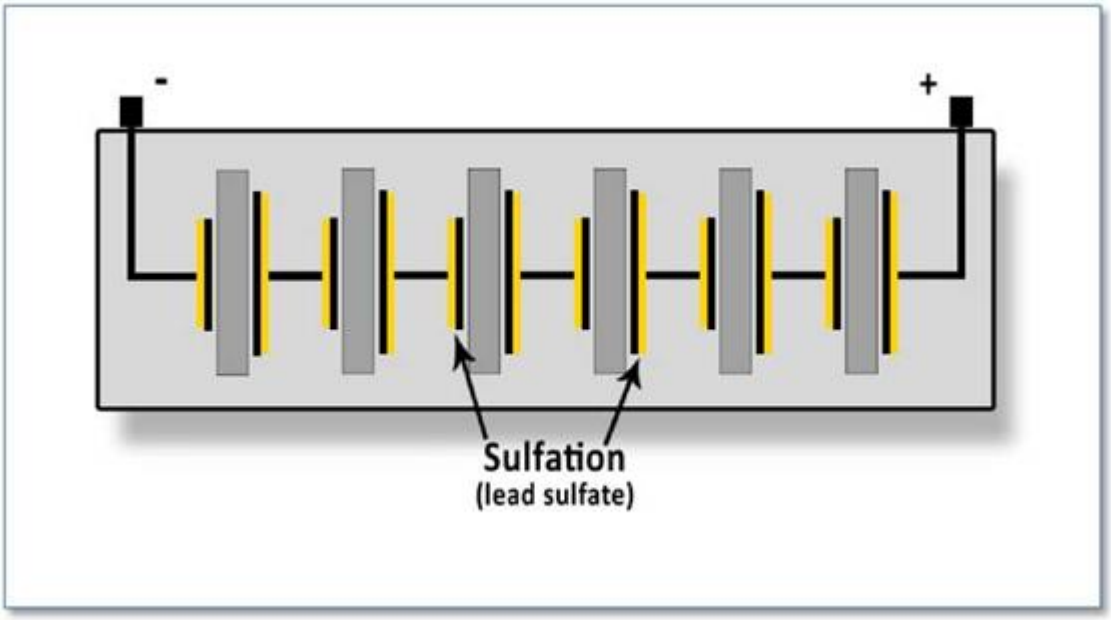
During the batteries discharging period, the positive and negative lead plates react with the sulfate present in the electrolyte - which leads to a lead sulfate being created; in addition to water and electrical energy. This lead sulfate then typically clings to the plates in the battery.

In the earlier stage of the discharge process, only a small amount of soft lead sulfate will be on the plates - as the following diagram shows *(*note:* In the diagram below the battery is fully charged at 12.7 volts):



Description: Schematic diagram of the inside of a 12v battery that is fully charged (with minimal sulfation on the plates).

But as the discharging process continues down to its minimum safe level of 10.5 volts, then soft lead sulfate will cover the plates and will look like the diagram below:



Description: Schematic diagram of the inside of a 12V battery that is discharged down to 10.5V

While recharging, the lead sulfate and water are turned again into a lead, lead dioxide, and sulfate solution. **note:* if the battery is not allowed to discharge very deeply and is recharged quickly - then the lead sulfate will typically all return into the solution again during recharging without any problem. You can see this depicted in the diagram below.

In the following diagram you can also see gassing depicted. This is the hydrogen and oxygen gases that are given off while recharging - and these are the dangerous gasses that we mentioned earlier that can cause an explosion if they come in contact with a flame or spark.

To maintain your batteries properly, you have to ensure that they are always promptly recharged. If they are instead left partially charged or left deeply discharged for too long then soft lead sulfate will harden on the plates

of the battery and becomes lead sulfate crystals. When this happens they may not return again into lead oxide and soluble sulfate during recharging (like they normally would). This process of accumulating lead sulfate crystals on the battery plates is commonly known as sulfating or sulfation. Due to this factor, it becomes difficult for the battery to recharge properly.

So, now that you know how and why older batteries get Sulfation problems - we will show you the equipment and steps to restore these batteries to their prime. In the next (short) chapter we will discuss some of the common equipment you will have to use when working with 12v/lead acid batteries. Then we will show you exactly how to test each battery to make sure they are restorable - and then we will restore them (with 1 of the 4 methods we will walk you through).

Tools and Equipment Required for Working with Lead Acid Batteries

When you are working with (and restoring) lead acid and car batteries, you will typically have certain pieces of equipment and supplies that you will have to regularly use. These include: a multimeter, battery hydrometer, battery load tester, terminal cleaner, and a specially designed smart charger for 12v/lead acid batteries. We also find that using a plastic funnel helps us pour the chemical additives (that we will talk about later) into the battery cells more easily.

Below are the parts we use repeatedly when working with and restoring lead acid/12v batteries. In case you are not familiar with these pieces of equipment, we have included photos (you will also see us working with these part/tools/equipment in the "Restoration" chapter):

1. Battery Load Tester

We like using this one:

http://DIYhomeEnergy.com/go/batterv-load-tester

2. **Battery Terminal Cleaner**

You can find them here:

http://DIYhomeEnergy.com/go/batterv-terminal-cleaner

3. **Battery Hydrometer**

We like this one:

http://DIYhomeEnergy.com/go/battery-hydrometer

4. **Charger for 12v Lead Acid Batteries**

This one is fantastic:

http://DIYhomeEnergy.com/go/battery-charger

5. Multimeter

http://DIYhomeEnergy.com/go/multimeter

6. Funnel

Here is the funnel we use with batteries:

http://DIYhomeEnergy.com/go/funnel

Testing 12 Volt/Lead Acid Batteries

Now that you are familiar with the basic equipment that we will be using, we are going to teach you how to test each battery to make sure they are restorable (so you don't try to restore a battery that can't be "fixed").

The good news is that, no matter where you got your old battery from (whether it was from a car or other application); these 12V/lead acid batteries can typically be returned to working conditions through one of the reconditioning methods we will show you in the next chapter. But like we said, some batteries cannot be recovered (generally ones with a bad cell in them) and we will show you how to test each battery and cell in this chapter to figure out if they are restorable or not.

There are Four main tests that we like to use to identify whether a battery can be brought back to life or not. The 4 tests are the following:

(1) Battery (no load) Voltage testing,

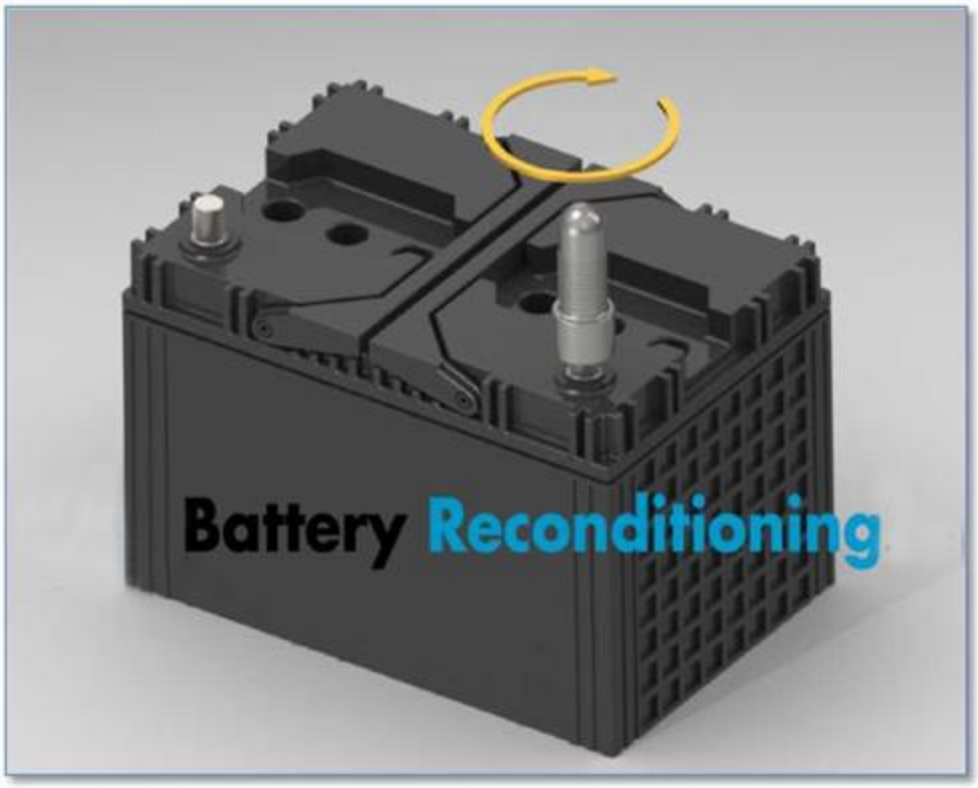
(2) Battery Load testing,

(3) Hydrometer testing - this tests each individual cell,

(4) Individual Cell Voltage Testing

Prior to doing any of these tests, you should do three things. First, clean the battery posts, then recharge the battery, and lastly, remove the surface charge from the battery. To do these three things, follow these steps:

a) Clean 1st Post - to clean the posts of the battery use a battery post cleaner. To use one of these, just place it on the first post of the battery and turn it several times so the bristles in the post cleaner can scrape and clean the battery post. This will remove the corrosion and dirt from the post. **see the 3-D model below for a visual reference*



Description: **Cleaning the 1st post with a battery post cleaner.**

b) **Clean the 2nd Post:** Then you have to do the same for the other battery post.

**see the 3-D model below:*

Description: Cleaning the 2nd post with a battery post cleaner.

c) Recharge the Battery and Remove the Surface Charge - Next, you should ensure that the battery is charged to its max. And once you recharge the battery you need to allow the surface charge to be removed - which you can do by allowing the battery to sit idly for about 12 hours after charging. You can also remove the surface charge by using the battery to turn on car headlights (or something that has a load of at least 20amps) for about 3 minutes. After this surface charge is removed you are now ready to do the 4 tests to make sure the battery is restorable.

A. Test 1) Voltage testing with No Load

This first test is to check the voltage of the battery without any load on it.

To do this type of test you need a multimeter (or a battery load tester without the load option turned on). In order to determine each batteries overall voltage (without a load on it), you have to touch the multimeter's red probe to the positive battery terminal and the black probe to the negative terminal - then record the voltage reading your multimeter gives you.

**You should test your battery like the 3-D model below shows:*

Now, compare the voltage you get to the figures in the table below to get an idea of what these figures mean:

Level of Charge	Voltage	Gravity
Totally discharged	11.9	1.120
25%	12.0	1.155
50%	12.2	1.190
75%	12.4	1.225
100%	12.7	1.265

Next, if this test gives you a voltage reading (from your 12v battery) that is lower than 12 volts, then there may be a dead battery cell in the battery and we need to check each cell (which we will do in Test 3 and 4). Remember, we recharged the battery in the preliminary steps - so it should have a voltage of 12 or more.

We will do one other test first though to check the overall voltage of the battery (but this time with a load placed on it).

Test 2) Load Testing

You can do a load test by using a battery load tester. To perform one of these tests, connect the load tester with the battery (in the same way a multimeter would be connected); however, the load tester has clips which are attached to the terminals. You have to ensure that the red clip is attached to the positive terminal first and then the black clip to the other terminal - as depicted in the following diagram:

Description: Testing the voltage of the battery with a load placed on it (using a battery load tester).

After hooking the clips up, you will get a reading showing no load voltage on the load tester. After you see that, there will be a button that you have to press and hold for about 10 seconds on the load tester. When you press that button, the load tester will apply a load to the battery and measures the voltage of the battery under that load.

Next, depending on what kind of load tester you have, the load meter will either give you the actual voltage of the battery or just a description like: “bad”, “weak” or “good”.

The voltage ranges for bad, weak, and good are shown in the following chart:

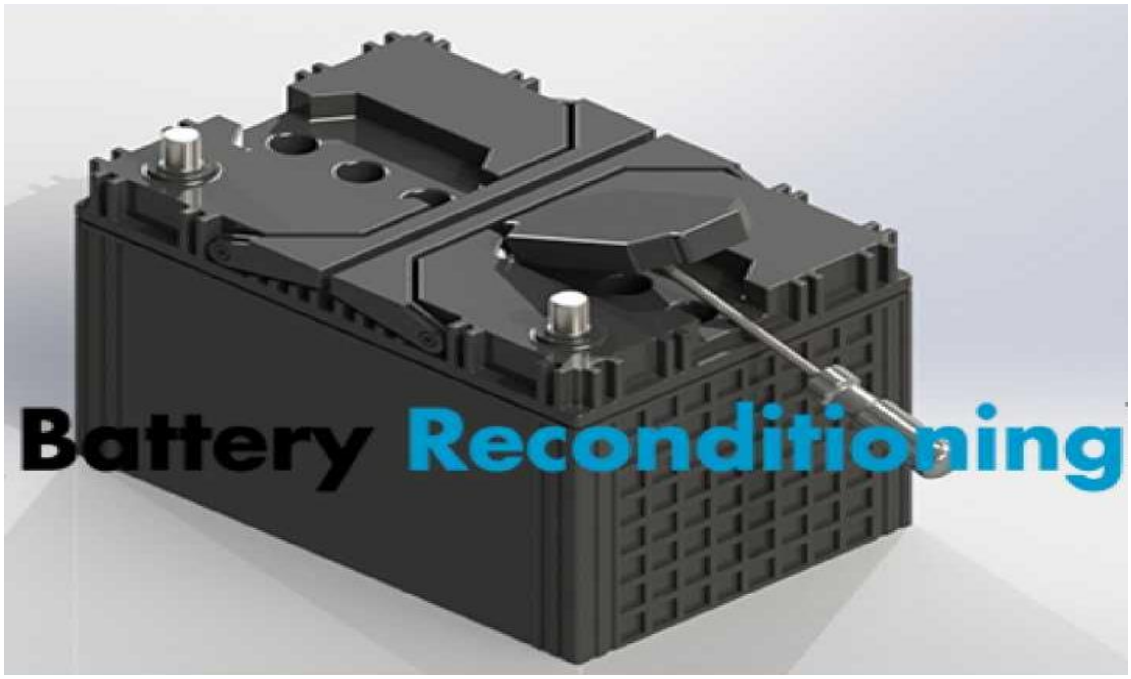
Battery Voltage under Load	**Battery State**
Less than 6.1 volts	► bad
6.1 to 10 volts	►weak
10 to 12 volts	► good

If the load test indicates a “bad” or “weak” signal, then you should repeat this test. If the batteries are in the upper portion of the “weak” state, there is a good chance that the battery will get new life after we recondition it. But if the signal comes back as “bad” (or in the bad voltage range) repeatedly, then it will most likely not be restorable. At this point you can either dispose of the bad battery or take it a step further and do one of the next two tests to check on each individual cell in the battery. These next two tests will allow you to definitely identify whether the battery has a bad cell or not (but these tests require you to open the battery up - that’s why we left them last). Remember, if there is a bad cell - the battery can’t be restored.

Test 3) Hydrometer Testing –Testing Each Cell

To do this test you need a battery hydrometer. A battery hydrometer is a glass tube with a suction bulb at the end, which is used to draw up the electrolyte from inside each battery cell. Once the electrolyte is in the hydrometer tube it will give you a reading of the cell's health.

This type of test is used to find out if there are any dead cells in the battery. To conduct this Battery Hydrometer test you first have to remove the battery cell caps (*simply put a screw driver under the caps and pop them off like the model below shows).*



If you have a sealed lead acid battery, there will be no cell caps and you will be required to drill a hole to reach each cell (remember there are typically 6). To do this, use an electric drill. There will be marks on the battery where the cells are located so finding the exact location for the cells is not difficult *(*note:* if you drill into your battery, you will have to plug these wholes up again with plastic plugs after you are done testing/restoring it).

After you can access each cell (by either removing the cell caps or drilling), follow these steps to conduct the hydrometer test *(*note: there is a 3-D model 2 pages from now showing how to use a hydrometer if you want a visual):*

1. Take the hydrometer in your hand and squeeze the bulb prior to inserting it in the first cell.

2. Next, place the tip of the hydrometer into one of the cells and release the bulb which will and draw up some of the electrolyte liquid into the hydrometer. * *caution:* During this step, you must be careful to not spill the electrolyte liquid, which can be quite dangerous as we already discussed.

3. After you draw up some of the liquid into the hydrometer's tube, you will see a part inside the hydrometer begin to float.

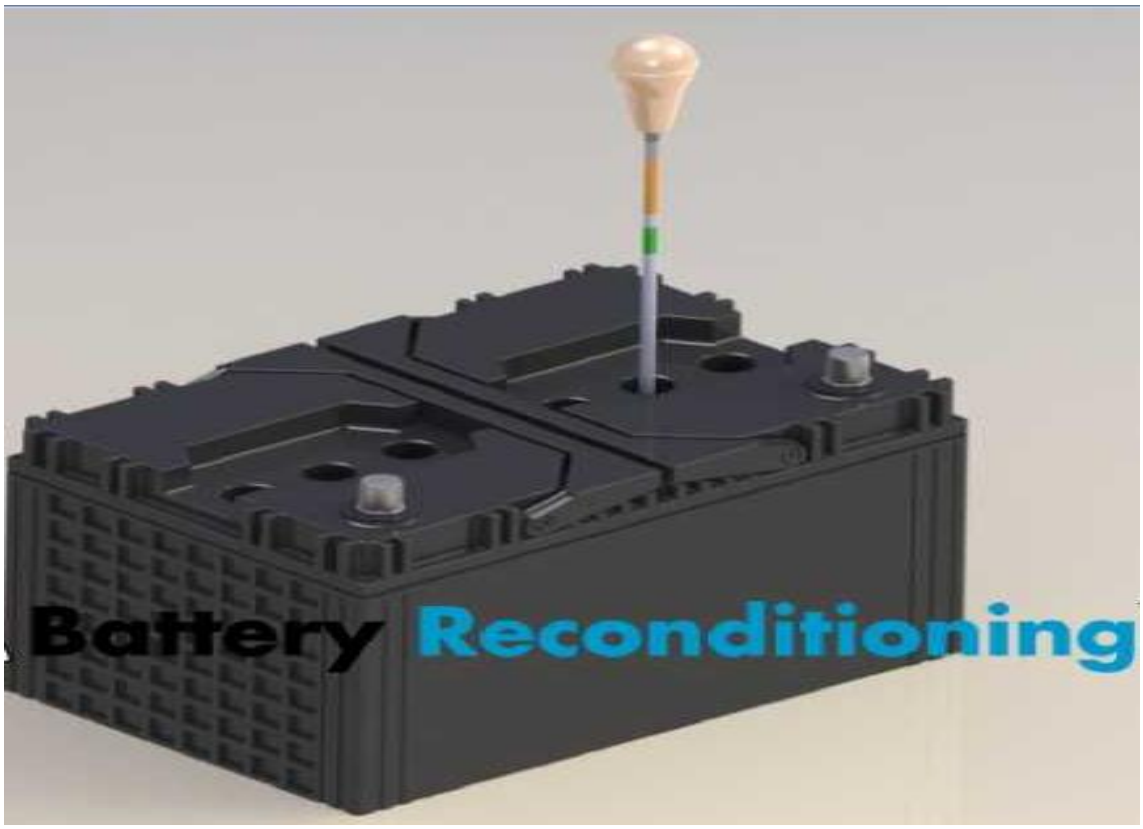
4. Hold the hydrometer steady and in a vertical position to get an accurate reading from this float. - The float will have a few levels marked on it which indicate the condition of each cell based on the condition of the electrolyte in the tube. You check how high the "liquid line" goes up the marks on the float

to get the reading/figures.

5. After you get this reading, squeeze the bulb on the hydrometer so the liquid goes back into the cell

6. Repeat this to test for each of the 6 cells (or however many cells your battery has).

If you find out that a majority of the cells give you gravity readings of over 1.2 on the hydrometer and only a single cell shows a 1.12 or below, it will signify that the battery most likely has a bad cell - so discard the battery. **see the 3-D below to see how to use a hydrometer:*



Description: Testing each of the battery cells with a hydrometer.

You can also check the condition of each cell by just looking at the level that the float sits in electrolyte fluid. Check the color according to the list below.

Floats towards the green ---------- ► the cell is in good shape

Floats towards the white ---------- ► the cell is in fair shape

Floats towards the red ---------- ► the cell needs a charge

If you notice that the float sits much lower in the electrolyte fluid for 1 cell compared to all the other cells (in the "red" area) - this almost certainly means that this 1 cell is bad - so discard of the battery.

*tip - the level of the electrolyte liquid should be at least an 1/8 of an inch above the top of the lead plates - so since you already have the battery open at this step, add some distilled water if you notice the level is too low inside.

Test 4) Check Each Battery Cell's Voltage

This is the 4th and final test for the battery. By now you should probably already be able to determine if the battery has a bad cell or not; however, we wanted to give you one other test in case you want another way to check.

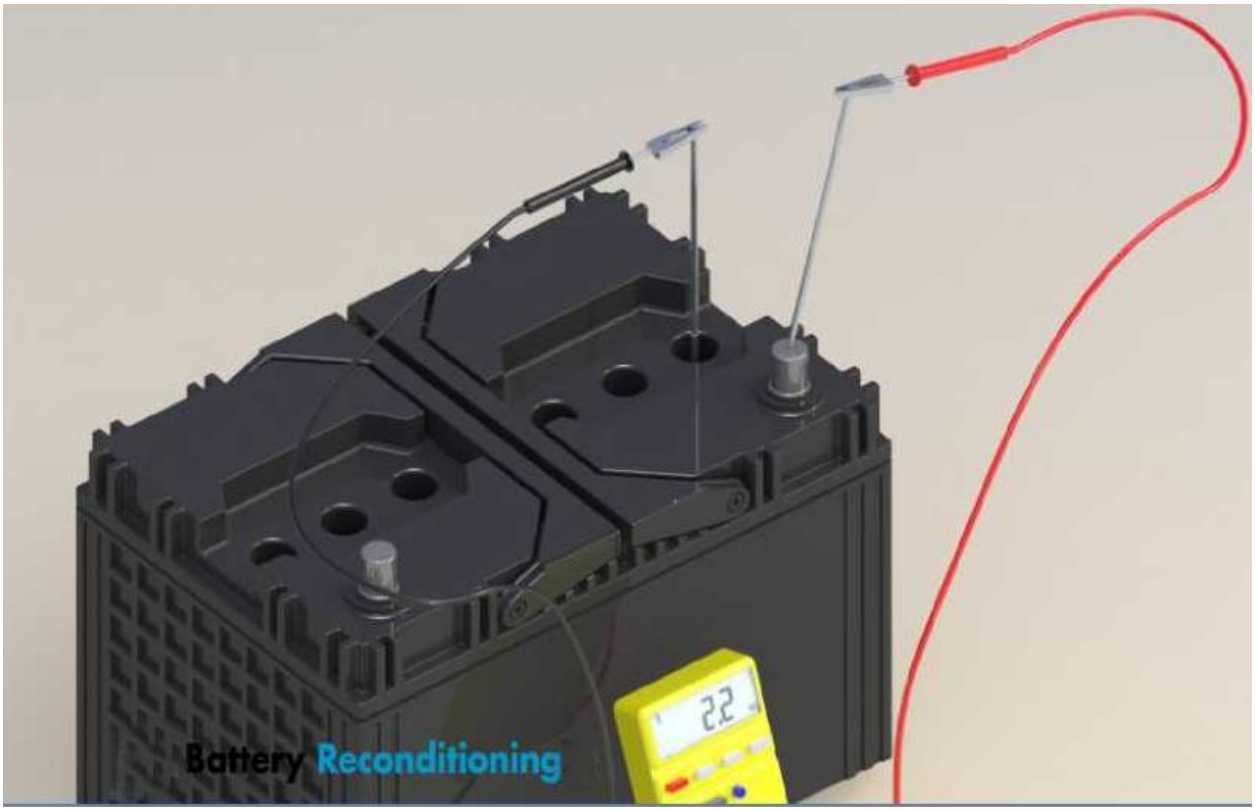
In this test, we will test the voltage of each cell with a multimeter. We previously tested the battery voltage - but now we will take it a step further and actually test each cell in the battery.

To do this, the battery caps must be off again (or if you are working with a sealed battery, you need to drill according to how we told you in the last step).

Testing the 1st Cell: Now, to check the first cell, place the red probe on the positive battery post and clip the black probe to a wire and place that wire on the first cell's negative terminal (in the electrolyte liquid). It should read at least 2 volts.

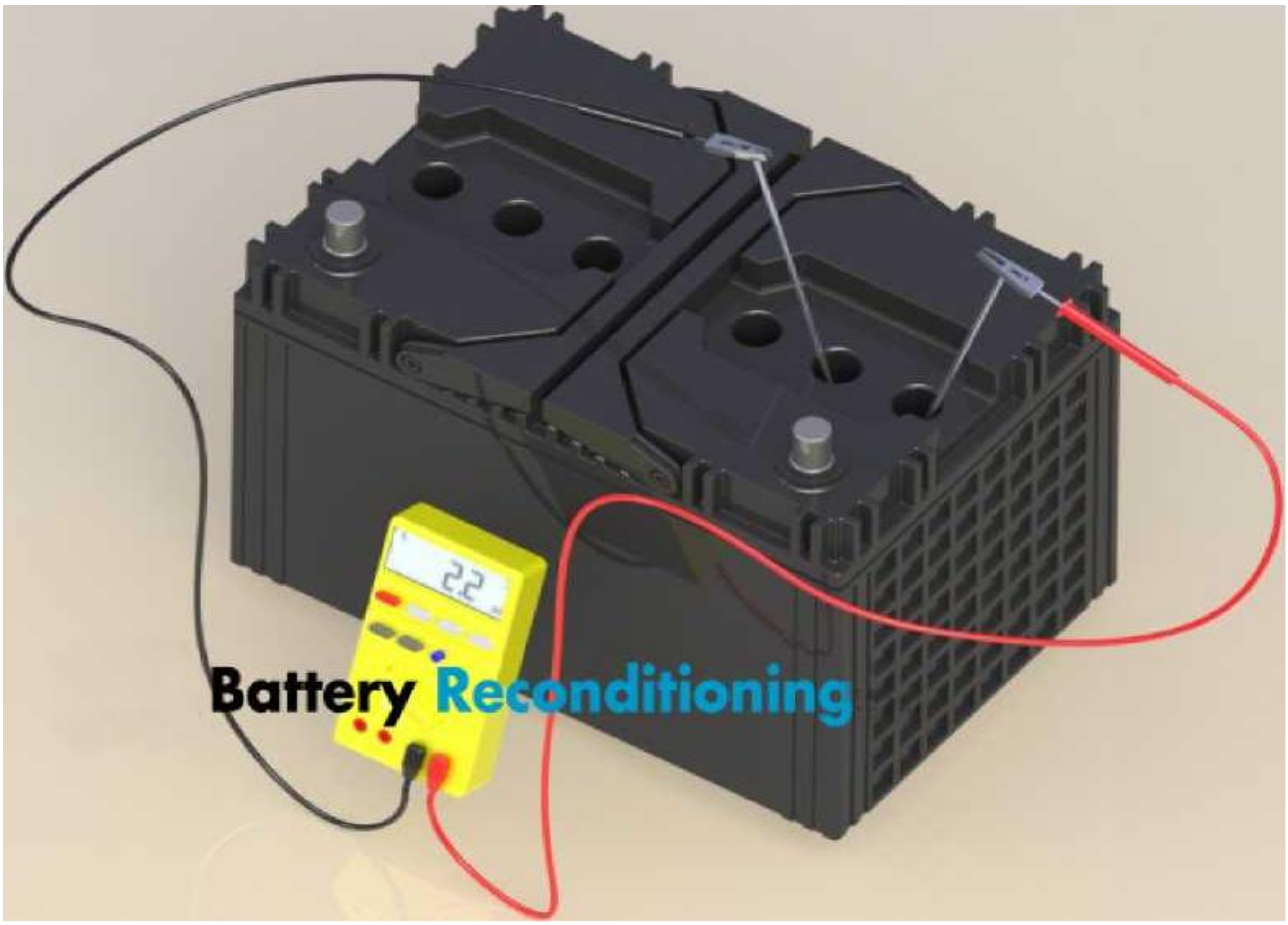
*tip: we typically cut a metal clothes hanger and use that as the wire that we clip to the probe of the multimeter. The acid in the cells will eventually ruin the metal but because we are just using cheap clothes hanger wires, this test is very inexpensive.

**see the 3-D model on the next page for a visual of this test:*



Testing the 2nd Cell (and on): Next, to check the second cell, connect the red probe to a wire and place it in the first cell and connect the black probe to a wire and place the wire in the second cell. You should again get 2 volts.

**see the 3-D model on the next page for a visual of this test:*



This process must be repeated by moving down the row of cells until the voltage of all the cells has been checked. You must get a reading of at least 2 volts for

each cell. If you have one cell that gives you less than 2 volts and all of the other cells give you 2 volts (or more) - you know you have a bad cell. And if the battery contains a bad cell like this, then it cannot be reconditioned and you can discard the battery.

**note*: if you drilled holes in your battery during this testing step because you were testing a sealed battery, you can plug/re-seal those holes with plastic plugs if you discard the battery.

Reconditioning and Restoring Batteries of Lead Acid/12 Volt Type

If your battery passed the 4 tests from the past chapter and it does not contain a bad cell; it should be restorable. There are a variety of ways to recondition and restore 12 volt/lead acid batteries. In this chapter, we will discuss in detail the three techniques we commonly use. The 3 methods we will discuss are:

i) How to apply an equalizing charge to the battery,

ii) How to add chemical additives to a battery to restore it,

iii) How to use readily available desulfating tools.

We will discuss each of these 3 methods in the order listed above.

Use the restoration method that you find easiest. And if one of the 3 restoration methods doesn't work for a particular battery - try another one of the methods. As long as your battery passed the tests we already discussed and you determined that it can be restored (based on the criteria we gave you in the last chapter) - these methods should definitely work to restore the battery.

So let's get started with the first method; Application of an Equalizing Charge...

Application of an Equalizing Charge

This first method to restore a battery is quite simple. This method may not work 100% of the time but we generally like to try it first before we jump to the other 2 methods.

To apply an equalizing charge, the battery must be charged for a small amount of time at a relatively high voltage. The overall steps are as follows:

- First of all, you have to ensure that all plates in the cells are properly covered in the electrolyte fluid. If they are not, you should pour distilled water in the battery until the cells are covered with the electrolyte.

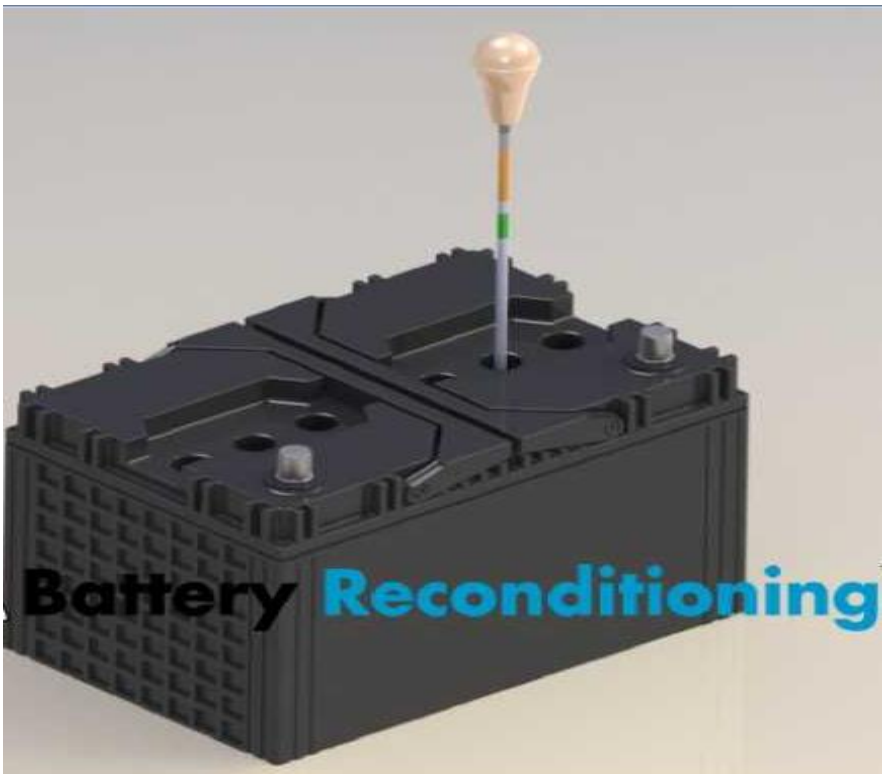
- Next, you have to recharge the battery in full using standard charging methods.

- Next, boost the charging voltage above the batteries typical charging voltage by 5%-10%. Normally the equalizing voltage is between 14.4 volts and 15 volts (for a normal 12 Volt battery) (During this charging stage, if you have a sealed battery make, sure the battery does not go above 100°F and if you have a battery with caps on it; make sure it does not go above125°F. If the battery does exceed these temperatures then you have to stop the equalizing process and allow the battery to cool down before you can continue).

- Due to the equalizing voltage, gas bubbles should come out from the liquid in each cell - this is just from gas that is created during the equalizing stage *(*remember - don't smoke or have anything that can cause a spark around this).*

Now, record the specific gravity from each of the six cells every hour. When the specific gravity values are no longer increasing every hour and when all the cells are gassing equally, you need to stop equalizing.

**note:* as we previously discussed in this guide, you can take each cells gravity readings with a battery hydrometer by drawing up the liquid into the tube of the hydrometer and looking at the readings on the floating part inside the hydrometer.



***Description*: using a hydrometer.**

- Now you discharge the battery to 50% and recharge it twice in a normal way. Then test whether the equalizing charge has worked or not.

Utilization of Chemical

The 2nd method to restore a 12v/lead acid battery is with the utilization of chemical additives. There are two types of chemical additives that people commonly add to the inside of their batteries to restore them:

(1) Magnesium Sulfate/Epsom Salt,

(2) "Battery treatment chemicals" found online or at local battery stores.

Epson Salt and the different "battery treatment chemicals" you can find online (or at a battery store) all basically work the same way to restore your batteries. All you have to do is add them properly to the battery and they will do all the hard reconditioning for you. We will caution you that not all battery treatment chemicals/mixtures found online are created equal - so before you purchase any, look up reviews.

The good news is that whether you use Epsom salt from a local convenience store or a battery treatment chemical you find online; they are both added to the battery the same way basically - and this section will show you how to do that.

It will be up to you to decide if you want to use Epsom salt or a battery treatment chemical you find at a store or online. We typically use Epsom salt because it's so inexpensive and easy to use and buy - but the choice is yours because there are some good chemical mixtures online too.

For this step, you will need the following tools and equipment:

- Safety glasses
- A plastic funnel
- A common screw driver
- The restoration chemical or mixture you decide to use (whether that is Epsom salt or another battery treatment chemical you find).

Epsom Salt Directions

We will first go over how to recondition a 12 Volt battery using specifically Epsom salt *there is a model at the end of this section showing how we pour Epsom salt or other battery treatment chemicals into our battery cells).*

***note**:* Epsom salt is also known as: magnesium sulfate.

a. Heat nearly ^ quart of distilled water to almost 150°F. It must be hot enough to dissolve the Epsom salt.

b. Take 250 grams or 8 to 9 ounces of Epsom salt and add it to this hot water. Now stir this solution until the Epsom salt is completely dissolved.

c. If you are restoring a battery with caps - remove them now. If you are restoring a sealed battery - drill 6 holes in the batteries case where the batteries cells are located.

d. If the battery plates are fully covered with liquid and the battery has the appropriate level of electrolyte, then take away about a ^ quart of liquid from the batteries cells *(*tip:* you can draw up this liquid with your battery hydrometer). Also, you have to make sure that you are taking the same amount of liquid from each cell.

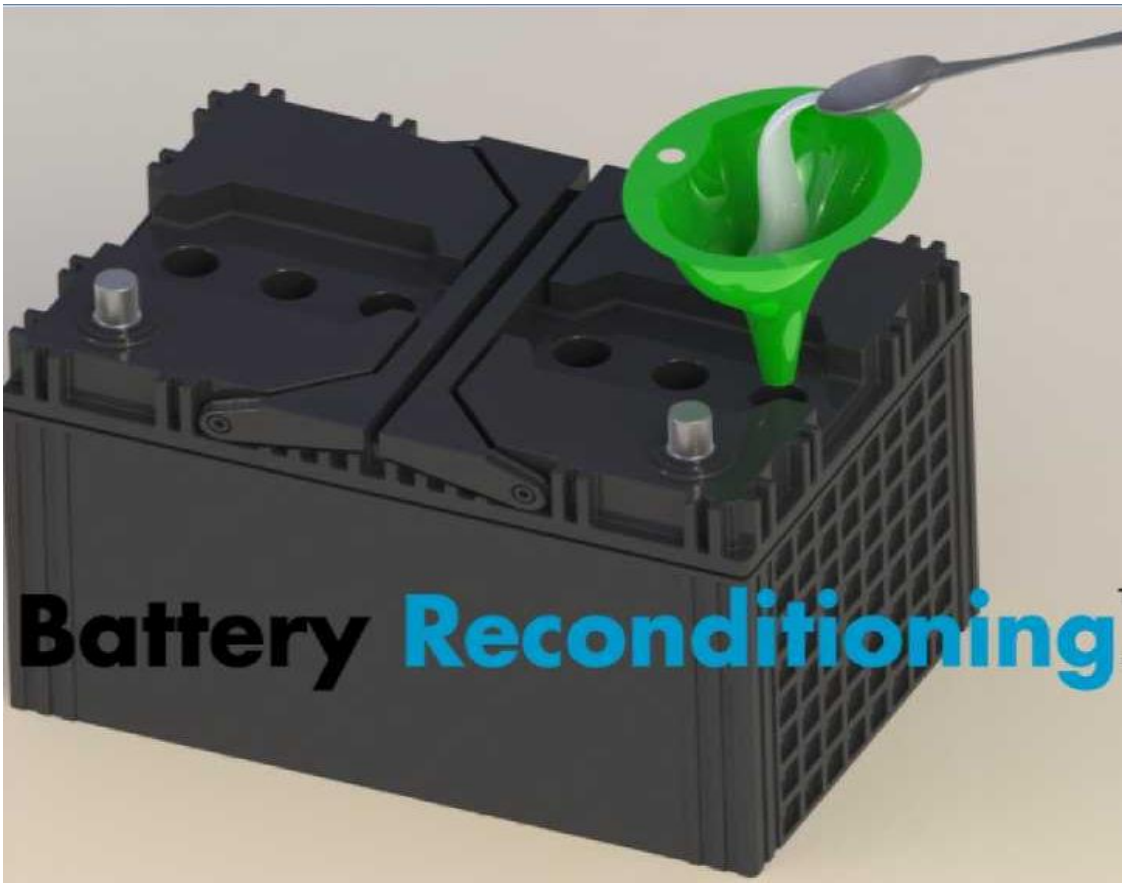
e. Next, add that quart of Epsom salt solution to the inside of the battery using a small funnel made of plastic. You need to place the funnel in each of the 6 cells and make sure you put the same amount of Epsom salt solution into each cell. To do this, divide the quart of Epsom salt solution into 6 parts and add 1 part to each cell so each cell gets an equal amount. Make sure each battery plate is covered completely.

f. Now put the battery caps back on the battery or plug the holes you drilled (if you were restoring a sealed battery).

g. Next, shake the battery well so that the Epsom salt solution mixes in with the batteries fluid and is evenly dispersed.

h. Lastly, the battery should be charged in full, and then discharged down to 50%, and then recharged again a couple of times. After that, you can test the battery to see if it has new life (*See the model on the next page for a visual reference of how to put Epsom Salt or other Battery Treatment Chemicals into the battery*).

Pouring Epsom Salt or other Battery Treatment Chemicals into the battery:



Description: Using a funnel and spoon to pour the right amount of Epsom Salt OR Battery Treatment Chemical into each cell.

***note*:** If you end up buying a different battery treatment chemical than Epsom salt, you will pretty much follow the same steps above. From our experience with different battery treatment chemicals, you pretty much add about a table spoon of these mixtures to each cell and allow it to sit for about 24 hours.

After you follow these steps, you should get a perfectly reconditioned battery after about 24 hours! **Great job.**

Use of Desulfating Element of Special Type

The last way you can restore a 12v/lead acid battery is by using special desulfating equipment that is specifically designed to restore these types of batteries that have sulfate build up.

The methods we taught you in the last section (using chemicals) generally works better than using these tools - but you can still try this method if you want. If you are interested in getting equipment for this specific purpose, look for lead acid battery chargers that have a "desulfating" mode. We have tested a few of these chargers over the years and some of them work very well when we flip this setting on.

There are also other tools that use alternating pulses of current to break loose the lead sulfate build up. You will have to do your own research on these though because we have not yet found one that we think works really well (maybe you will though!).

We generally only use these tools as a last resort (or if we want a really quick/lazy way) to do a restoration. Feel free to give it a shot though. You may really like this method or find a great tool for this job.

Generally though, we will typically do our restorations by first trying the equalizing charge method, then we will move onto the chemical additives if the charge didn't restore it, and lastly, we will use these desulfating tools as a last resort. By now though, as long as your battery passed the tests in the last chapter - 1 of these 3 methods should definitely work to restore your battery!

Great job - you just saved a lot of money.

Proper Ways to Maintain 12 Volt/Lead Acid Batteries

Once you restore some batteries and start to use them; you will probably want to make them last as long as possible - and that's what this chapter is all about!

So, if you want to keep your batteries healthy and increase their lifespan, then follow the following steps:

1. **Maintain the Correct Level of Electrolyte**

If you have a vented battery, you need to make sure the battery plates are covered with electrolyte. To do this, make sure you add distilled water in the battery cells if the water level goes down. Typically you want the liquid level about 1/8" above the plates in the battery.

2. **Keep the Terminals on the Battery Clean and Free of Corrosion**

You can use a terminal cleaner to clean existing corrosion off of the battery posts. Simply put a terminal cleaner on the post and rotate it to get the corrosion off. - Repeat this for both posts.

You can also make a solution that will get rid of corrosion. You prepare it by mixing two tablespoons of baking soda with a pint of water and applying it to the posts.

Furthermore, you can make another solution to stop corrosion from happening in the first place. To do this, put a little bit of silicone sealant at each post's base. Now put a felt washer over the post. Next, coat the washer with Vaseline or grease that is meant for high temperatures. After you do this, put the cable connector back onto the post and make sure it is tightened and secured.

3. **Don't Leave the Battery In High Temperatures**

If the temperature of your battery goes above 100^0F then it will increase the internal discharge and thus the sulfation of the battery. So try to keep your battery out of really hot areas.

4. **Disallowing Long Time Intervals Between Charges**

The battery cannot cope with long time intervals between charges. It self - discharges in a gradual way.

5. **Don't Drain Automotive Batteries Too Much**

SLI or automobile batteries cannot cope with deep discharges. So don't use these types of batteries in a way that will allow them to discharge deeply (especially below 50%).

6. **Charge Your Batteries Regularly**

Don't wait too long between charging your batteries. It is not good for a battery to have an extended period between charges.

7. **Use a Smart Charger if you have a Deep Cycle Battery**

If you are using a deep cycle battery, you must make sure that these get recharged after their discharge cycle. If you wait too long to charge these types of batteries after they disscharge then it is not good for the battery.

A smart charger for lead acid batteries typically has three (maybe four) steps:

- Bulk charging - At this step, the battery is charged to 80% of its capacity at the highest voltage level and current rating of the charger.
- Absorption charge - When the voltage of the battery reaches 14.4 volts, this step starts. Here, the voltage remains constant at 14.4 volts. The current decreases until the battery is charged to 98%.
- Float charging. In this step, the voltage is kept at 13.4 volts. The current is held below one amp. This method will raise the charge level of the battery to 100%.
- Equalization charging - If your smart charger has a fourth step, it will be called equalization charging. This process involves applying a higher level of voltage to a fully charged battery for a particular period of time.

Conclusion

Well you've done it! You made it to the end of our guide and now have every bit of knowledge you could ever need to restore 12 volt/lead acid batteries! You know all the different types/features of these batteries, you know how they work and why they develop problems - you also know how to test them to make sure they are restorable. And most importantly, you know how to actually restore them and then maintain them to protect your investment for a long time!

Restoring batteries like we teach you is an excellent way to save A LOT of money over the years. Now that you have this knowledge, you probably won't ever have to buy another 12v/lead acid battery again for your car, boat, or alternative energy application - because you can go out and get batteries for free (or for really cheap) that others have thrown out; and then just restore them like we showed you. And if you are someone who uses alternative energy like wind or solar, you can now build a large battery bank to store their energy for hardly any money.

Restoring batteries like this can also become an excellent business. You simply go out and collect old batteries (or buy them extremely cheap in bulk), restore them, and sell them to consumers. Piece of cake!

...Well, we're going to wrap this up now but we hope you enjoyed this guide. Thank you very much for choosing us as your battery restoration expert. We wish you the best of luck.

CHAPTER 2. Cell Phone Batteries

Revive a "Dead" Cell Phone Battery

With smartphone flagship models being released every year, mobile technology is developing at a faster and faster rate.

However, the batteries that power our mobile devices have yet to catch up. In a perfectly good phone, the battery is often the first thing that needs to be replaced.

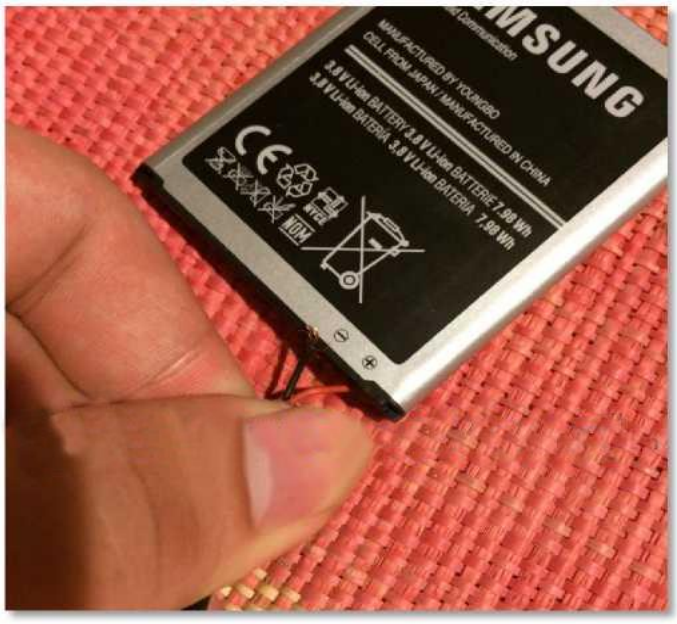
But before you shell out the dollars needed to buy a new one, you ought to try this simple method of reviving a dead cell phone battery.

Step 1: Slice of the small end of a standard USB cable exposing the positive and negative wires.

Step 2: Remove the battery from your phone.

Step 3: Locate the polarity markings on your phone battery.

Step 4: Plug the USB cable into your computer and touch the negative and positive wires to the corresponding terminals to jump-start your battery.



Step 5: Put the battery back in the phone and check the results.

CHAPTER 3. Forklift Battery

Introduction

Forklift batteries are similar in many ways to lead acid car batteries. Servicing and reconditioning forklift batteries is nearly identical to servicing and reconditioning 12 volt automotive batteries - but forklift batteries are larger, heavier, and require a couple extra reconditioning steps.

We go into depth about how to recondition car batteries in our lead-acid reconditioning guide, so we will not repeat the details of those steps in this guide. Instead, we will tell you what steps to follow in this guide, but you will have to use the lead-acid reconditioning guide to see the diagrams and step-bystep instructions for those steps.

When there's a step not covered in the lead acid reconditioning guide that you need to recondition a forklift battery, we will go into depth about that step in this guide. But this will only happen if it's something specific to forklift battery restoration.

So with that being said, this guide should be looked at as a supplementary guide to the main lead-acid battery reconditioning guide - and both guides will be needed to recondition a forklift battery. Reconditioning forklift batteries comes down to proper cleaning, replacing fluids, and removing sulfation *(*again, all of these topics are addressed in the lead-acid reconditioning guide).* And we've broken down the forklift battery reconditioning process into 12 easy to follow steps and then give you care and maintenance information at the end of this guide.

The equipment you'll need for this job is also detailed in the lead-acid battery reconditioning guide, but most simple tools and parts needed may already be in your garage or home.

Everything else can be found at electronics or hardware stores, as well as online marketplaces such as eBay and Amazon. When we reference a specific part in this guide, we also try and link to where you can find that part online, for your convenience.

So if you're ready to recondition forklift batteries using our 12 easy to follow steps, let's get started!...

Step 1 - Prepare The Battery For Reconditioning

First, the battery must be removed from the forklift. Check the forklift user's manual for specific battery removal and maintenance instructions. But keep in mind that a forklift battery can weigh up to several thousand pounds and may require heavy equipment to move. Often times industrial companies will already have the proper equipment to move the forklift batteries that you can use.

Step 2 - Figure Out the Operating Voltage

Once removed from the forklift, place the battery in a well-ventilated concrete area. Then record the operating voltage (i.e. *rated voltage)* of the battery.

If it's not labeled, you can count the cell water filler caps and then multiply that number of filler caps by 2 volts each. So that means:

- 12 caps would equal 24 volts

- 18 caps equals 36 volts
- And 24 caps equals 48 volts

Step 3 - Clean The Battery Terminals

To clean the battery terminals, first sprinkle the terminals and battery top with baking soda. Then wet the baking soda with clean water and scrub with a soft-to medium-bristled brush *(or use a* battery terminal cleaner*).* This neutralizes any acid on the battery and helps remove grime. If any residue remains, use dish detergent as an additional cleaning agent.

While the baking soda should neutralize any acid on the battery, it is still important to wear protective clothing - clothing such as an apron, gloves, and goggles - to protect against the highly corrosive battery acid and reduce risk of injury.

Step 4 - Check if the Overall Battery Voltage Equals The Operating/Rated Voltage

Next, take your DC volt meter (i.e. *multimeter)* and set it for the proper voltage to match the battery voltage. Then measure from the positive terminal to the negative terminal and record the voltage (see *image below).*

This reading should be about equal to the operating/rated voltage of the battery. It's even possible for it to be a little higher if the battery was just charged. But if the overall voltage is lower than the rated voltage, then the battery has some cells that are weak.

Each cell should be 2.1 to 2.5 volts. We'll test the individual cells in another step, but if you get a cell that reads below 2 volts when we test them, it will affect the battery's performance *(*more about this later though).*

Step 5 - Remove All Cell Water Filler Caps

Next, you'll have to remove all the cell water filler caps.

Some forklift batteries have automatic watering systems connected to them. If this is the case, try to remove the hose and cap together to save yourself some time and labor later.

Step 6 - Check The Individual Battery Cells

For this step, you'll need a DC volt meter (i.e. *multimeter)* and tester probes *(like we show you in our lead-acid reconditioning guide).*

When you're testing the cells make sure you use the proper polarity with the testing probes. Also, clean off the top positive terminal at the top corner of the battery by the filler cap *(if it's not already clean from step* 3).

Then use the probes clipped to the volt meter cables *(like we show you how to do in our lead-acid reconditioning guide)* and put the positive probe on the cleaned positive terminal and place the negative probe into the first cell's electrolyte water.

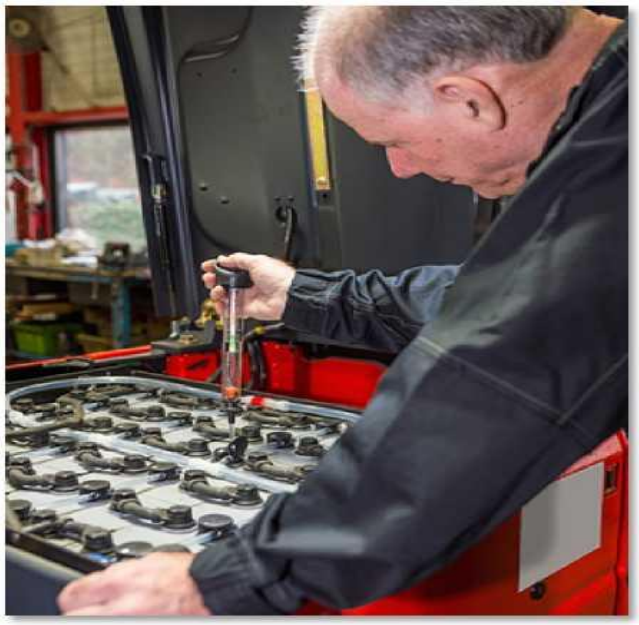
Next, take the reading from the volt meter. It should be at least 2 volts.

Then put the probes into each additional cell and get the voltage of these cells as well. Again, each cell should be at least 2 volts (possibly up to 2.5 volts).

Step 7 - Use A Hydrometer & Read The Gravity Of Each Cell

Next we'll take the gravity reading of each cell using a hydrometer.

This step is also covered in the main lead-acid reconditioning guide so please reference the instructions and diagrams in that guide to learn how to get the gravity of each cell *(with a* hydrometer*)*.



Step 8 - Decide If The Forklift Battery Can Be Reconditioned Or Not

Now that you have the voltage and hydrometer readings you can decide if the battery can be reconditioned or not.

If the hydrometer readings are very low *(in the white or red of the float),* it is a good indicator that the battery has sulfated from poor care over the years – but this can be reversed often times with our reconditioning methods. On the other hand, if the cell tests read under two volts each, fully reconditioning the battery may not be possible.

But even if your tests indicate that the battery may not be fully restorable, it's still worth trying the restoration techniques we teach because there have been many instances where we were able to get forklift batteries back to "like-new" condition even though we initially thought reconditioning wasn't going to be possible.

And because forklift batteries are very expensive, it's definitely worth a shot!

Step 9 - Discharge The Battery

Next, discharge the battery to 80% of its labeled voltage. But this is important, do NOT discharge that battery more than 80% of its labeled voltage.

Step 10 - Refresh The Battery

Next, remove the cell caps to access the battery water. Traditionally, battery water contains a ratio of 30% sulfuric acid to 70% water.

Use your hydrometer to measure and record the acidity for each cell *(if you haven't yet)* - this will indicate how much water or acid should be added to restore the proper ratio.

When adding to the cells, use battery acid or distilled water as required - but NEVER add tap water. Tap water contains additional minerals and contaminants that could further damage the battery while in use.

During this reconditioning process, and even during the normal life of the battery, continue checking the acid concentration and be sure to add the correct amount of either distilled water or acid.

Step 11 - Recharge The Battery

Once each cell has the proper acid/water ratio *(30%/70%),* replace the cell caps and charge the battery fully. This will roughly take eight hours.

If after charging, the battery is not reading the expected voltage on the voltmeter, recheck the acidity ratio within the cells and make any necessary adjustments, recharging after each adjustment.

Attaining the proper acid/water ratio may take a number of tries.

Also, to avoid overcharging and permanently damaging the battery, be sure to discharge to 80% before each new charge cycle.

When rechecking, if you have the correct acidity ratio, and the battery is still not reading the expected voltage, a damaged cell may be to blame. If this is the case, measure the voltage of each individual cell again to identify which one is damaged. If a cell is damaged, it will need to be replaced or repaired *(but this is not typically the reason a forklift battery needs reconditioning).*

Step 12 - Remove sulfation

Sulfation is the most common cause of lead acid battery failure - and our reconditioning methods focuses on reversing and fixing this.

Over the years sulfation is caused by improper charging that results in sulfate crystal build up on the negative plates within the battery. And this affects the battery's ability to properly accept a charge.

Our lead acid battery reconditioning guide shows you several methods to fix sulfation. So for this step, please reference that guide and use those exact same techniques.

The lead acid battery reconditioning guide has diagrams that are easy to follow and you'll be able to bring forklift batteries back to life with those techniques, after you follow steps 1 through 11 in this guide.

In addition to the reconditioning methods we teach in the lead-acid battery reconditioning guide, you can also try using a desulfation device that sends pulses to the battery terminals. While this device may not be able to fully reverse sulfation in heavily damaged batteries, it does lower crystal formation in healthy batteries, which makes using our reconditioning methods even more effective.

Additionally, using a device like this can also improve charge holding capabilities and charging speeds.

For preventative battery care, a desulfation device can reduce sulfation likelihood in new or healthy batteries. So if you are planning on regularly reconditioning forklift batteries, it make be worthwhile to invest in a simple desulfation device to use in conjunction with our other reconditioning methods.

Conclusion

How To Keep Your Reconditioned Forklift Battery Alive and Productive For Many Years *(With Proper Maintenance & Care)*

Now that you've reconditioned the forklift battery and it's refurbished, it's important to properly care for it to avoid damage and to also maintain the battery for as long as possible.

Simple upkeep and care is easy and not time consuming at all - and if you're reconditioning forklift batteries as a business, you can set-up monthly servicing agreements *(which can be very profitable and a nice source of regular income).*

First and foremost, it is important to know how and when to charge your battery. Unlike other batteries, forklift batteries last longer if they are charged as needed instead of daily. Wait to charge your battery until you reach close to the critical 80% level, and then fully charge it.

An automatic charger with microprocessor control can help immensely. These help prevent improper charging and they detect when a charge is required and apply it accordingly.

Every five charges, check the water levels of your battery - the water level should be just high enough to cover the plates within the battery. A dry battery will become damaged quickly, so it is important to make sure that the water level is accurate. If you find that the water level is low, add distilled water to get it back up to the correct level, but do **not** fill the cells completely to the top, as the space at the top is needed for gas expansion during use.

Clean batteries last longer, and any overflow from the battery should be cleaned up immediately. It is also a good idea to rinse the battery every six months or so, to help prevent residue build-up on the terminals.

With the battery reconditioning steps we covered in this guide, your old forklift battery should be back up and running again! And after you recondition the battery, use the maintenance and care instructions we covered in the conclusion of this guide and your forklift battery will have a very long and productive to life!

CHAPTER 4. Recondition Alkaline Batteries

Introduction

The worldwide market for disposable batteries was a few billion dollars in 2015 - and Alkaline batteries accounted for the bulk of disposable battery sales.

So like most people, you probably regularly use alkaline batteries to power your electronics. Then once those batteries die, you just throw them out and buy new ones. But as I'm sure you know, these batteries cost a lot of money to keep replacing!

But here's some exciting news... You can actually recondition and bring alkaline batteries back to life again multiple times. And no, I'm not talking about Rechargeable Alkaline Manganese (RAM) batteries, I'm actually talking about, regular alkaline batteries.

I bet you didn't even know that was possible! Most people don't. But let me assure you: it is!

Just imagine if you could recondition and reuse your old alkaline batteries. Think about all of the money you'd save by reusing those batteries instead of buying new ones!

Well, you won't have to image it, because by the end of this guide you'll know exactly how to give your alkaline batteries a 2nd, 3rd, and 4th life.

But before we teach you our two methods that will bring your alkaline batteries back to life again, we first want to give you a little background about alkaline batteries.

Background On Alkaline Batteries

Alkaline batteries owe their popularity to a few great benefits they provide:

1. **They're easy to use** - You can just pop them into your device *(that takes alkaline batteries)* and you're ready to go!

2. **They're widely available**

3. **They're relatively affordable**

4. **High energy density**: Alkaline batteries have high energy densities that are close to the energy density of Lithium-ion (Li-ion) batteries *(and much higher than Nickel-metal hydride (NiMH) and Nickel-Cadmium (NiCd) batteries).* This makes the alkaline cells ideal for portable applications such as remote controllers and digital cameras.

5. **No memory effect**: Alkaline batteries do not suffer the memory problems that NiCd batteries do *(and also NiMH batteries- but to a lesser extent).* In NiCd batteries, cadmium hydroxide crystals form on the cadmium anode (negative terminal). These crystals prevent the contact of the electrolyte to the anode resulting in a poor performance (**note:* This memory effect can be resolved with the methods we teach you in our NiCd reconditioning guide).

6. **Reduced self-leakage**: Self leakage is a phenomenon where the charge in a battery is lost over time even if no external circuits are connected. This happens due to the chemical reactions that happen within the cell. The discharge from self-leakage increases at higher temperatures. However, Alkaline batteries have a much reduced self-leakage issue when compared to NiCd batteries.

7. **Improved deep discharge performance**: Some electronic devices draw a huge current for a short time. For instance, digital cameras use a higher current when processing a picture. Under this condition, called a deep discharge, the voltage across the battery can drop significantly in some batteries. And certain batteries, like Rechargeable Alkaline Manganese (RAM) battery suffer from this problem. But normal alkaline batteries do not show this same effect and can be used for deep discharge applications.

Why not use Rechargeable Alkaline Manganese (RAM) batteries instead?

RAM batteries are usually priced steeply compared to alkaline batteries. And even though RAM batteries are meant to be recharged, they can only withstand a limited number of re-charge cycles (usually around 25 - 30 times).

So when you factor in the high price of Ram batteries, plus the fact that RAM batteries also have poor deep discharging performance, regular alkaline batteries become the more attractive option in many applications.

And now that you know regular alkaline batteries can be reconditioned and recharged as well .. .they seem like the obvious choice for most alkaline battery applications *(instead of RAM batteries).*

Can normal alkaline cells *REALLY* be re-charged?

Normal alkaline batteries are primary batteries. This means that they are meant to disposed of after the charge in the batteries completely drains. However, even though these batteries are not built to be recharged, they can in fact be re-charged about 10 times.

We will note though that recharging primary alkaline batteries is not without its fair share of issues. Since the alkaline cells are not built to be re-charged, they typically have a poor recharge capacity (*when compared to RAM batteries).* They also support fewer recharge cycles than batteries that are built to be re-charged, such as NiCd or NiMH batteries.

But with that being said, it IS possible to recharge/recondition primary alkaline batteries and give them a second life. And you'll have particularly good luck doing this if you recondition the batteries before they're completely dead. The more drained they are, the harder reconditioning becomes (even *though it's still possible).*

When we recondition and recharge primary alkaline batteries, we always use one of two methods. So we'll teach you both!

Method 1 - Use a battery charger

The simplest way to recondition and recharge an alkaline cell is to use one of the new alkaline battery chargers that is capable of recharging primary alkaline cells. Most people don't know these devices exist but a few new models just hit the market that work pretty well.

Because of this, we first recommend you try out this method (i.e. *method* 1) before trying out method 2. You will quickly make back your small investment into an alkaline battery charger after you recondition a few sets of alkaline batteries. So it's a great little investment and it's something you can use the rest of your life.

But the directions *(and precautions)* that come with many of these new battery chargers are pretty bad from what we've seen, so read our reconditioning steps below and our precautions at the end of this guide if you decide to get an alkaline battery charger:

Items Needed: Discharged alkaline batteries, battery charger.

Optional Items: Battery tester, Multimeter.

Steps:

Step 1. Identify discharged cells:

The first step is to identify which alkaline batteries (i.e. *cells)* have drained out.

When a device that needs more than one battery stops working, it is very likely that only one battery has discharged while the others are still good. And this is when a battery tester comes in handy because you can use it to check which battery is actually drained *(and which batteries are still good).*

A multimeter is also useful for this because it measures the voltage output of the battery to identify if the battery is good or not. The proper voltage for AA/AAA alkaline batteries is 1.5 V.

To test the batteries voltage with a multimeter, follow these steps:

First, turn on your multimeter/voltmeter and put the voltmeter on DCV and make sure that it is far above the battery voltage. On most voltmeters there is a setting "20" in the DCV area. So switch your voltmeter to that setting.

Next, with the battery in front of you, put the red probe to battery's nipple (+) and the black probe to the battery's flat side (-).

Now notice the voltage reading on the voltmeter. If the reading is more than 1.3 V for alkaline battery (non-rechargeable) then the battery still has some juice left in it and can be reconditioned quite easily. Otherwise, if the voltage reading is lower, it's still possible to recharge the battery but it may not recharge quite as well.

Step 2. Connect the 'dead' battery to the battery charger: Connect the cells that are discharged to the battery charger unit. Ensure that the battery is connected to the charger unit with the correct polarity.

Step 3. Charge the battery: Wait for the battery to charge. The battery charger may show that charging is complete after a few hours. However, it is better to leave the battery in the charger for 10 - 12 hours at a stretch. Doing so allows the alkaline cell to charge to its full potential, rather than some intermediate value between 70% to 90%. Once the charging is complete, the battery charger supplies a reduced trickle current to maintain the battery charge at an optimal value.

Please see our precautions at the end of this guide as well - but following these simple steps will recharge the bulk of your alkaline batteries, giving them a whole new life!

But if for some reason, this doesn't work well for some of your alkaline batteries, you can move on to method 2...

Method 2 - Use a cell phone adapter

If you try method 1 but a few of your alkaline batteries are still having a hard time recharging, then you should move on to method 2! You can also try method 2 if you are a real battery reconditioning enthusiast like we are!

Items Needed: Discharged batteries, low voltage cell phone charger, alligator clips, wires *Optional Items:* Multimeter

Steps

Step 1) Identify the discharged battery: Follow the same procedure we discussed in Method 1 to identify the dead batteries that need to be reconditioned.

Step 2) Choose the right charger: In order to charge your alkaline batteries, you will need a cell phone charger. If you have a few cell phone chargers choose one without a really high amperage. Since high current charging leads to leaking batteries, a lower current will help with this.

A charger with about 50-70 mA or so is good. You can go all the way up to 300 mA but with that high of current you'll have to cycle the power to the battery a little more frequently (meaning you'll have to periodically disconnect and re-connect the charger - *see step 4).*

Step 3) Connect the charger to battery: When charging you always go positive to positive & negative to negative.

Most transformers are "Plus-tip" meaning the inner circle or hole in the middle of the plug is positive and the outer ring is negative. Some may be the opposite of this though so you may have to test it first.

You can then use a little bit of wire and put it into the center of the middle hole and use that to connect the positive of the charger to the positive terminal of the battery with an alligator clip (to hold it in place).

Next, you can connect the negative terminal of the battery to the negative of the adaptor.

Step 4) Charge the battery: The best charging performance happens when the source is pulsed. This can be accomplished manually by disconnecting the circuit every couple minutes, checking the voltage, and then reconnecting it.

*<u>note</u>: Don't just connect the charger and leave. This needs to be monitored for safety and effective charging.

If the voltage is high (1.65 or greater) you need to let it cool off so the voltage drops back to 1.50 - 1.60v. Once it does, repeat the process ... then repeat it again ... then again, etc.

<u>How To Test The Voltage</u>: To test the voltage, simply turn on your multimeter/voltmeter and put the voltmeter on DCV and make sure that it is far above the battery voltage. On most voltmeters there is a setting "20" in the DCV area. So switch your voltmeter to that setting.

Next, with the battery in front of you, put the red probe to battery's nipple (+) and the black probe to the battery's flat side (-).

Step 5) Try it out! After you repeat step 4 many many times (pulsing the current) try the batteries out! Place them in a device that takes alkaline batteries and see how they work! I think you'll be shocked at how well they begin working again!

Precautions

Precaution 1) During the regular operation of alkaline batteries and during the charging process, minute amounts of hydrogen gas are generated. If there is a pressure build-up within the battery, it can cause the container to burst resulting in leakage of the contents inside. If this happens before or during the charging process, stop the charging and discard the battery immediately.

Precaution 2) When connecting the charger to the battery, ensure that the terminals are connected correctly as indicated in the section above. If a commercial battery charger is used, ensure that you plug the battery in the correct slot with the correct orientation as indicated in the manual.

Precaution 3) The voltage of the battery charger should be higher than that of the battery at full charge. If this is not the case, power will flow from the battery to the charger. This can damage the charger.

Precaution 4) If you notice corrosion on the battery container, discard the battery and do not attempt re-charging.

Conclusion

Using either method 1 or method 2, you should bring most of your old alkaline batteries back to life again.

Alkaline batteries are very useful with many benefits, and they're some of the most widely used batteries. So the ability to recondition and re-use these will save you money and also give you better performing alkaline batteries.

Using the simple methods in this guide will save you hundreds of dollars over your lifetime on the cost of alkaline batteries.

We hope you've enjoyed this guide and found it very helpful.

CHAPTER 5. Charging a "Dead" Golf Cart Battery

Though many people argue that electric golf carts are much easier to maintain than gas-powered ones, electric golf cart owners still have to perform regular maintenance on their carts to keep them in top condition.

If you leave your electric golf cart unused for a long period of time, such as when on vacation, you may come back to find that your golf cart will no longer charge. This can be distressing considering replacement batteries cost a couple of hundred dollars each.

Don't worry because your batteries aren't dead. They have simply lost too much juice to be properly charged. Because most chargers are "automatic", they need to sense a voltage from the battery before they begin to charge It.

The steps that we will be detailing below will show you how to manually charge your battery so that you can continue using and charging your golf cart normally. It's advised that you wear proper eye protection before attempting any of this.

Step 1: Remove the seat of the golf cart to reveal the batteries which are usually placed there.

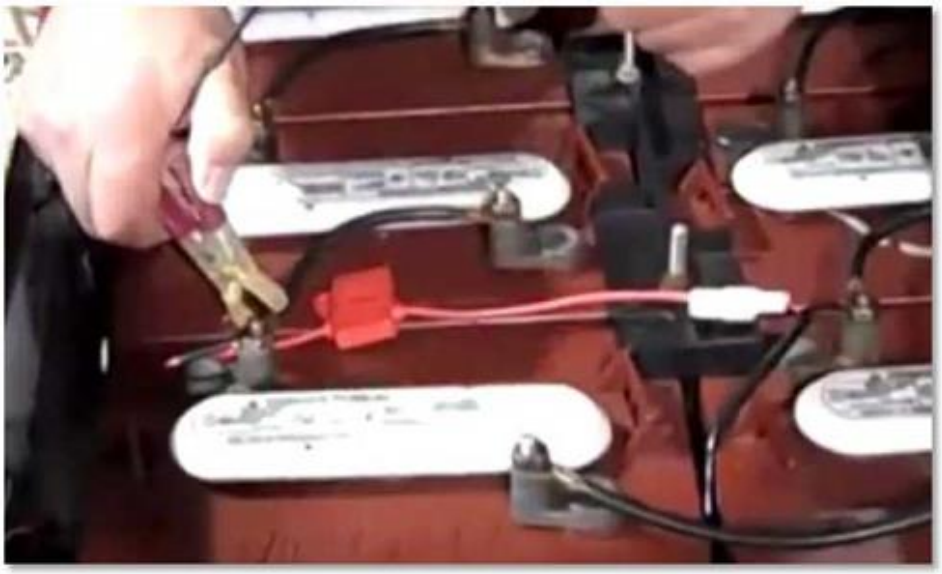
Step 2: Open up the battery and check if there is enough water covering all of the plates in each cell. If not, add distilled water as needed.

Step 3: Take a regular, 12 Volt, wall-plugged car battery charger, hook up the positive clamp to the positive terminal on the first battery in the series, and take the negative clamp and hook it up to the negative terminal of the second battery.

Finishing Up:

After charging for 30 minutes to an hour, repeat process for the 3rd and 4th batteries, and the 5th and 6th batteries.

Because batteries produce explosive hydrogen gas when charging, you want to avoid making a spark when connecting and disconnecting the clamps.



Make sure that you unplug the car battery charger every time you connect and disconnect the clamps to the corresponding battery terminals to avoid this.

After you have finished charging all of the batteries, they will hopefully have enough of a surface charge to charge normally.