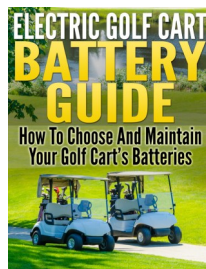


# The Electric GOLF CART BATTERY GUIDE



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# Chapter 1 - How your electric golf cart batteries work

An electric golf cart battery holds electricity for later use.

The golf cart battery develops voltage from the chemical reaction produced when two unlike materials, like the positive and negative plates, are immersed in the electrolyte, a solution of sulfuric acid and water.

In a typical lead acid battery, the voltage is approximately 2 volts per cell, for a total of 12 volts. As soon as there is a circuit between the positive and negative terminals, electricity flows from the battery. This happens when any load that needs electricity, such as your golf cart, is connected to the battery.

Most people don't realize that a lead acid battery operates in a constant process of charge and discharge. When golf cart batteries are connected to a load that needs electricity, such as an electric golf cart, current flows from the batteries. The golf cart batteries begin to be discharged.

In the reverse process, golf cart batteries become charged when current flows back into them, restoring the chemical difference between the plates.

When a golf cart battery discharges, the lead plates get more chemically alike, the acid becomes weaker, and the voltage drops. Eventually the battery is so discharged that it can no longer deliver electricity at a useful voltage.

By feeding electrical current back into it you can recharge a discharged battery. A full charge restores the chemical difference between the plates and leaves the golf cart lead acid battery ready to deliver its full power.

This unique process of discharge and charge in the lead acid battery means that energy can be discharged and restored over and over again. This is what's known as the cycling ability in a battery.

If the battery won't start your golf cart, you usually refer to it as "dead," even though that's not technically correct. A battery that's merely discharged can be recharged to its full capacity by [using an electric golf cart battery charger](#). But a lead acid battery that's at the end of its service life can't be recharged enough to restore it to a useful power level. Then it truly is dead, and must be replaced.

### **A golf cart lead acid battery is deep cycle:**

Lead acid batteries are designed to be discharged down as much as 80% time after time, and have much thicker plates. The major difference between a true deep cycle battery and others is that the plates are solid lead plates - not sponge. Often, it is impossible to tell what you are really buying in some discount stores or places that specialize in batteries. The popular golf cart battery is generally a "semi" deep cycle - better than any starting battery, better than most marine, but not as good as a true deep cycle solid lead plate.

The purpose of a lead acid battery:

The purpose is to supply electricity for a given period of time before it needs to be recharged. This is different than one designed for engine starting. The deep cycle cannot supply high current demands but can supply lesser current for a longer period of time without damage.

The very nature of deep cycle batteries seems to invite misuse and damage. Operating for extended lengths of time at less than full charge with deeper discharges causes increased build up on the plates. This build up prevents electricity from flowing. The battery consists of lead plates in a solution of sulfuric acid. The sulfuric acid and the lead plates act together to create and store electricity.

However this process creates a gradual build-up of a residue called lead sulfate (sulfate for short) on the plates. The sulfate build up reduces the flow of electricity because it prevents the acid from contacting the lead plates.

Therefore, deep cycle batteries require maintenance and you should recharge your electric golf cart batteries as soon as possible after each use and maintain the State of Charge at 100% to prevent permanent build-up.



### **As a general rule of thumb**

**If you use your golf cart for 15 minutes or more, then charge the batteries when you're done. This is based on the system having an automatic charge control in the charger. In today's market it's hard to overcharge your batteries. However, if a defect occurs in the charger or battery itself, it's possible. To ensure that this doesn't happen it's recommended that you monitor your golf cart's charge time as well as regular maintenance on the system.**

## Chapter 2 – Tips on choosing the right golf cart batteries

As an electric golf cart user you want your cart to be reliable as any unexpected downtime may cost you both money and your enjoyment. What could be worse than having your golf cart's batteries go dead on the 8th hole?

Electric golf carts use a bank of standard lead-acid batteries to run an electric motor. They are designed to be used all day then recharged all night.

Choosing the right battery and knowing how to properly maintain your golf cart are two of the easiest, yet overlooked, ways of ensuring the operation of your electric golf cart.

The freshness of a new golf cart battery is very important. The longer a golf cart battery sits and is not recharged the more damaging sulfation build up there may be on the plates.



**Check the date code on the battery to make sure it hasn't' been sitting on the shelf for ages. This can seriously affect performance. Most golf cart batteries have a date of manufacture code on them.**

Upfront costs are what most people usually look at. However, golf cart batteries are the component that are most often skimped on, but can make or break your enjoyment of the game. Price is a fair indicator of the overall expected life of your batteries and is most likely the most important aspect of the purchase, as you will depend on the strength of the golf cart batteries power to keep going for long durations. As a general rule, the more expensive the golf cart battery, the longer it will last. Generic golf cart batteries can be expected to last 3 to 5 years

**To obtain the best return on your battery investment, follow the guidelines outlined in this ebook to obtain the maximum performance and life from your deep cycle batteries.**

When you buy your golf cart batteries, make sure that they come with a warranty, so that you can be confident it will be replaced if it fails sooner than could be reasonably expected. Golf cart batteries are expensive, and the assurance of a warranty will give you peace of mind that you are getting a good, quality product for your money.

### **The right battery:**

The first thing you have to do is to determine the appropriate voltage and connections. The golf cart manufacturer has designed the cart to fit specific battery sizes in series, so usually there is no choice in battery voltage and connection.

**36V System:** This will typically need six 6V batteries in series to make up the 36V.

**48V System:** In a 48V system you will need six 8V or four 12V batteries in series. However, there are some carts that have been made to fit eight 6V batteries.

### **The Capacity is important:**

The next thing for you to consider is the capacity, which is rated in minutes or ampere hours (AH).

It works this way. The more you drive your cart the more capacity you'll need.

For example, you could use the capacity the golf cart manufacturer uses as a baseline, knowing the capacity required is for two rounds of golf a day. However, if you want to use your cart more than that you may need a higher capacity battery. Then again, if you need less, you may be able to get away with a lower capacity battery.

Please note that although two rounds a day may seem like more than you use, it can actually be less as you may only have the pedal down for 30 minutes per round; the cart being idle during a lot of the time spent on a round of golf.





However, as many golf cart owners drive around the community – for example to the golf course and back, you may need more energy than it takes for a round of golf.

Therefore, when choosing the right battery for golf, you should lean towards the safe side and oversize a battery for capacity. Undersizing a battery may leave you stranded, while oversizing will simply give you longer life

### **What voltage is my golf cart?**

Determining how many volts your golf cart uses is as easy as counting the water fill caps on the batteries. Lifting up your golf cart's seat reveals the golf cart battery compartment. The water fill caps are located on each battery. Each battery cell covered by a cap is 2-volts. Simply count all of the battery fill caps on your batteries, multiply this total by two, and you will have determined your golf cart's voltage.

A 6V battery has three water filler caps.

An 8V battery has four water filler caps.

A 12V battery has six water filler caps.

Even the sealed batteries have cells and each cell is 2 volts but these are usually harder to identify in this manner. The advantage here is the sealed battery is usually cleaner so the label stays in tact.

Golf cart batteries are connected in long series string. It is very important to have balance so all of your batteries should have the same voltage to ensure you don't damage your batteries.

There are other battery types that are also used by golf carts, which include 12 volt, 24 volt, 36 volt and 48 volt but remember that you need to run your batteries in sequence.

It's always best to have a professional install your batteries correctly. A technician knows and understands how your batteries need to be hooked up.

While reading this ebook, please keep in mind that all battery systems are unique. Battery type, charger technology, equipment loads, cable size, climate, and other factors can all vary. Slight or significant, these differences will require battery maintenance to be adjusted. Therefore, use this ebook only as a guideline for proper battery care. Each particular system will always require a degree of customized attention.

## Chapter 3: -Charging batteries with battery chargers

Remember, you must put back the energy you use as soon as possible after use. If you don't the battery sulfates and that affects performance and longevity. Using correct golf cart battery chargers and methods extend battery life and range between charges.

### Golf cart battery chargers have three functions:

- (1) Getting the charge into the battery (Charging)
- (2) Optimising the charging rate (Stabilizing) and
- (3) Knowing when to stop (Terminating).



**You should charge new batteries completely before they are used the first time.**

Charging time, using a golf cart battery charger, will probably be at least 12 hours as new batteries need up to four hours more charging time than "mature" batteries. If possible, schedule enough charging time so that your golf cart battery charger shuts off automatically.

The age of the batteries, condition of the batteries, state-of-discharge, temperature of electrolyte, AC line voltage level, and other variables affect charging time.

Limit the use of new batteries between charging for the first 5-20 cycles. New batteries have less capacity than batteries, which have been broken in. New golf car batteries should be limited to 18 holes between charges.

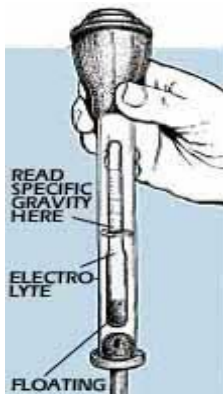
## Golf cart battery chargers:



**There are some important things that you should remember when it comes to charging your golf cart batteries. First of all, always become familiar with, and follow the instructions from manufacturers of golf cart battery chargers. When used correctly, golf cart battery chargers can double or triple the useful life of your batteries.**

Batteries should be charged after each period of use. Lead-acid batteries do not develop a memory and need not be fully discharged before recharging. You should charge your golf cart's batteries only in well ventilated areas and always keep sparks or flames away from a charging battery. Don't forget to verify that the charger voltage settings are correct. Check the electrolyte level (see the maintenance information) and tighten all vent caps before charging. Do not overcharge or undercharge the batteries; do not interrupt a charge cycle and never charge a frozen battery. In addition, avoid charging at temperatures above 120 degrees F.

Whenever possible, for longest battery life, recharge batteries as soon as they become 20% discharged. Never allow batteries to fall below 80% discharged. Deep discharging significantly reduces battery life.



Batteries in storage self-discharge and should be recharged whenever the specific gravity falls below 1.240. The rate of self-discharge varies directly with temperature.

Battery state-of-charge can be determined by using a hydrometer (a tool used to measure the specific gravity of the electrolyte solution) or by connecting the charger and observing the charging rate. If the ammeter needle jumps smartly to 20-25 amps and then tapers below 14 amps within 15 minutes, the battery is fully charged. When you test a battery with a hydrometer you are measuring the amount of sulfuric acid in the electrolyte.

If your reading is low, that means the chemistry that makes electrons is lacking. So where did the sulfur go? It is resting to the battery plates and when you recharge the battery the sulfur returns to the electrolyte.

### **What about leaving golf cart battery chargers plugged in ?**

You can leave golf cart battery chargers plugged in until they kick off.

**However**, there are some things you need to consider. First of all, do not tempt fate by leaving golf cart chargers plugged in during a lightening storm. You should think about purchasing a very good surge suppressor.

Remember, the key to achieving optimum performance and long life is a solid golf cart battery maintenance program.

### **What voltage is my golf cart ?**

Determining how many volts your golf cart uses is as easy as counting the water fill caps on the batteries. Lifting up your golf cart's seat reveals the golf cart battery compartment. The water fill caps are located on each battery. Each battery cell covered by a cap is 2-volts. Simply count all of the battery fill caps on your batteries, multiply this total by two, and you will have determined your golf cart's voltage.

### **Types of golf cart battery chargers:**

Battery chargers for electric golf carts fall into two basic types; automatic (these are newer) and non-automatic (older). Both of these basic golf cart battery charger types have an ammeter on the front to show the number of amps being drawn by the battery pack, but otherwise they're very different.

The new generation of golf cart battery chargers are engineered for precision recharging to promote battery life and prevent overcharging mistakes.

You connect the battery pack to the charger and let it run. It sets the current flow, charge time and shut-off time automatically.

Any battery charger should initially start by providing at least 15+ amps to the batteries. The amps may drop down very quickly if the batteries are fully charged, but it should show at least 15 amps to start. If you know that the batteries need charging and the ammeter will not go above 15 amps, then you have a faulty charger and it must be repaired. The older non-automatic battery chargers usually have an On/Of Timer knob that switches the charger on or off and allows you to set the number of hours the charger will stay on, usually a maximum of 12 hours.

These older ones are typically for 36 volt systems although there are some 24 volt and 48 volt systems as well. The newer automatic chargers employ solid state circuit boards that must sense some amount of voltage out of the battery pack to even come on at all. If the battery pack voltage is very low the charger will not come on, perhaps leading you to think that the charger is bad, but this may not necessarily be the case. There are a number of things that can go wrong with a charger. Examples include: a burned out transformer or circuit board with timer units, diodes and bad DC charger plates being the most common failures.

A battery charger converts AC power from the generator or from the power company into low voltage DC to charge a battery. An automatic golf cart battery charger offers the greatest convenience. Just plug the battery into the battery charger and the charger does the rest. Manual chargers, although equally effective at charging batteries, require a greater level of attention. Generally speaking, automatic battery chargers are priced higher than manual chargers.

Correctly charging batteries requires that you administer the right amount of current at the right voltage. Most charging equipment automatically regulates these values. However, some chargers allow the user to set these values.



**For proper charging, you should always refer to the instructions that came with your charging equipment.**

## Chapter 4: - Maintaining your golf cart batteries



**Improperly maintained electric golf cart batteries, can pose serious, even dangerous threats.**

**Some users assume that the batteries that operate their golf carts are maintenance-free.**



**A lack of knowledge about basic battery maintenance can lead to all kinds of problems. The key to achieving optimum performance and long life is a solid golf cart battery maintenance program.**

**It is recommended that you obtain following equipment for use in battery care and maintenance:**

Wrench - Distilled water - Voltmeter (an instrument used for measuring the voltage between two points in an electric circuit) - Hydrometer (a tool used to measure the specific gravity of the electrolyte solution) –Please see the Chapter on How to use a Hydrometer, post cleaner - Baking soda - Petroleum jelly - Goggles and Gloves.



**Tools, wires and metal objects can cause sparks when shorted across a battery or batteries. You should use insulated tools.**

## **Important golf cart battery maintenance notes:**

Battery acid is poisonous and can cause severe burns so always wear protective clothing, acid proof gloves and goggles when handling batteries and remove all jewellery. Always have baking soda and lots of water nearby because this will neutralise any acid spills from battery refilling. They also prevent further corrosive damage. Remember, the electrolyte is a solution of acid and water, so skin contact should be avoided. You should definitely avoid spilling acid on the chassis and body of your cart as it will corrode the metal trays and eventually destroy your chassis if left unwatched. Also, do not smoke near golf cart batteries and never add acid to a golf cart battery.

Golf carts are typically powered by six lead acid batteries mounted on a metal plate beneath the front seat.

## **Inspection steps for a longer lasting electric golf cart and its batteries**

Batteries in your golf cart are connected in a series, one to another, by cables. In order to get the best performance from your cart (that is, for example all 36 - or -48 volts) you need to have good connections across all batteries.

First of all, examine the outside appearance of the batteries. You should look for cracks in the container and the top of the battery. Posts and connections should be free of dirt, fluids and corrosion. You should replace any damaged batteries. Any fluids on or around the battery may indicate that electrolyte is spilling, leaching or leaking out and leaking batteries must be replaced. You should also check all battery cables and connections and look closely for loose or damaged parts. Any cable that is broken or frayed should be replaced. Batteries are connected by 6 gauge wire with 5/16 terminals that hook onto the battery posts. Each negative connects to a positive. Cables should be kept intact and tightly connected to the battery posts at all times. Tighten all wiring connections to the proper specifications and be sure there is good contact with the terminals.



If you have any room for vibration on the battery terminal at all, you can melt the post and render the battery useless. Do not over-tighten terminals as over-tightening can result in post breakage, post meltdown or fire. Make sure there is good contact with the terminals.

### **Cleaning your electric golf cart batteries:**

Check that all vent caps are tight. Then clean the battery top with a cloth or brush and a solution of baking soda and water ensuring that any cleaning solution or any other foreign matter does not get inside the battery. Then rinse with clean water and dry with a clean cloth. Solvents or spray cleaners should not be used. Then clean the battery terminals and the inside of the cable clamps with a post and clamp cleaner. Reconnect the clamps to the terminals and thinly coat them with petroleum jelly or anti-corrosion spray. Always keep the area around the batteries clean and dry.

### **Watering:**

Water should only be added after fully charging the battery. Prior to charging, there should be enough water to cover the plates. If the battery has been discharged



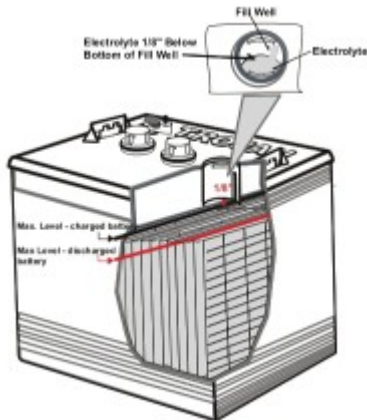
(partially or fully), the water level should be above the plates. Some important things to remember are: Do not allow plates to be exposed to air and do not fill the water all the way up to the cap. Never allow the electrolyte level to fall below the plates. Do not use water with a high mineral content.

**You should use only distilled or deionised water and you should follow this procedure:**

Remove the vent caps and check the electrolyte level ensuring the minimum level is to the top of the plates. If there is no electrolyte visible, add just enough water to cover the plates and then replace and tighten all water vent caps. Put batteries on a complete charge before adding any more water. (See Charging Chapter). Once charging is completed, remove the vent caps and check the electrolyte level. Add water until the electrolyte level is 1/8 inch below the bottom of the fill well. Clean, replace and tighten all vent caps.

## Lifespan of your golf cart batteries

Some electric golf cart batteries offer quick-release 3-gang vents, which allow you to check water for all three cells at the same time. The batteries have very thick plates and are designed for hours of heavy discharge each day, followed by a fast recharge in only a few hours each night.



Check water levels in each cell of each battery weekly to ensure that the leaded plates in the battery are submerged in liquid. Use only distilled water to refill, and don't fill the cell all the way up -- add just enough water to cover the plates. Don't forget to use safety glasses and heavy rubber gloves to check and refill the batteries.

The lifespan of a battery will vary considerably with how it is used, how it is maintained and charged, temperature, and other factors. Golf cart batteries can be destroyed, even without ever being used, in less than a year, because they're left sitting in a hot garage without being charged. A golf cart battery can last between 2 and 6 years depending on how it's maintained.

As batteries age, their maintenance requirements change. This means longer charging time and/or higher finish rate (higher amperage at the end of the charge). Usually older batteries need to be watered more often and, their capacity decreases.



**Inactivity can be extremely harmful to a battery. It is a VERY poor idea to buy new batteries and "save" them for later. Either buy them when you need them, or keep them on a continual trickle charge.**

## **Storing your golf cart's batteries:**

Avoid locations where freezing temperatures are expected. Also by keeping your batteries at a high state of charge as this also prevents freezing.

Avoid direct exposure to heat sources as temperatures above 80 degrees F accelerate the battery's self-discharge characteristics. If you are storing your golf cart and its batteries completely charge the batteries before storing and keep in a cool, dry location, protected from the elements. Stored batteries should be given a boost charge when they show a 70% state of charge or less. In addition, completely charge the batteries before reactivating.

At some stage you will have to remove your golf cart's batteries and with the seat-bottom removed, the golf cart's battery compartment can be accessed and the golf cart's batteries and battery cables can be removed.

**Please follow the manufacturer's instructions for maintaining batteries.**

## Chapter 5:-Using a Battery Hydrometer

**A battery hydrometer is a float-type device used that measures the concentration of sulfuric acid (specific gravity) of battery electrolyte ("battery acid") in lead acid batteries.**



From this reading you can easily and accurately determine a non-sealed lead acid battery's State-of-Charge. A battery hydrometer is a glass barrel or plastic container with a rubber nozzle or hose on one end and a soft rubber bulb on the other. Inside the barrel or container, there is a float and calibrated graduations used for the Specific Gravity measurement.

**The following is a list of instructions on how to correctly use a battery hydrometer.**

If the battery's electrolyte is above 120° F (48.9° C), allow it to cool.

Wear some glasses (preferably safety glasses) and gloves, in the unlikely event that a battery explosion or electrolyte spill might occur.

### **Lead acid batteries:**

Hold a clean battery hydrometer vertically and then squeeze the rubber bulb. Then insert the nozzle into the electrolyte in the cell, and release the bulb. The electrolyte will be sucked up into the barrel or container allowing the float to ride freely. Start with the cell that is closest to the POSITIVE (+) terminal.

To dislodge any air bubbles on the float, tap the hydrometer.

Squeeze the rubber bulb to release the electrolyte back into the battery's cell.

To increase the accuracy of the measurement, in the same cell, repeat this process several times so the float will reach the same temperature as the electrolyte. If you are measuring a large battery, stratification can occur when the more concentrated electrolyte settles to the bottom. If you notice a difference in the readings from electrolyte taken at the top and bottom of the cell, average the two readings.

At eye level and with the float steady, read the Specific Gravity at the point the surface of the electrolyte crosses the float markings. The Specific Gravity reading of golf cart batteries should be between 1.25 and 1.28 at 80 degrees Fahrenheit (this is the specific gravity of the electrolyte solution within the battery at 80 degrees compared with 1.000 being the specific gravity of water at the same temperature). As the charge drops, the specific gravity reading will drop and approach that of water.

Release the electrolyte back into the cell from which it was taken and record the reading. Be sure to avoid spillage.

The acid solution should be 1.250 times heavier than water at this temperature. To correct for the air temperature at which the reading was taken, add or subtract .02 for every 5 degrees difference from 80 degrees.

Repeat the process for each individual cell. The Specific Gravity reading should not have a difference of more than 30 "points" (.030) between the lowest and highest reading or 10 "points" (.010) below the battery manufacturer's recommended temperature value with the battery fully charged. If so, try and equalize the battery by following the battery manufacturer's procedures. If equalizing does not help, replace the battery.

Determine the battery's State-of-Charge (SoC) by taking the average of the cell readings, but the battery's performance will be based on the weakest cell.

To test the golf cart batteries for distance, apply a battery load tester to see how they hold up with a 300-amp pull from the batteries.

Thoroughly rinse the hydrometer with water after using it.

**Note: Do not equalize Gel or AGM batteries.**

## Chapter 6:- Removing and Changing Golf Cart Batteries

With the seat-bottom removed, the golf cart's battery compartment can be accessed and the golf cart's batteries and battery cables can be removed.

### Important battery disposal information:



**Before you begin disconnecting battery cables, make sure the key is turned to OFF**

### Safety Note when removing your golf cart's batteries:

When undertaking battery disposal, always wear eye protection and ear protection, and follow proper safety precautions, when working with power tools. Also wear eye protection any time that you are working beneath a vehicle.

You should inspect all new batteries for any damage and to ensure that they are the proper battery for your cart. It's not the first time that someone has replaced old batteries with incorrect ones and then wondered why the cart would not perform. Ensure the battery cables are still in good condition i.e. no fraying or melting, good crimps on the terminals and not corroded. If not, replace them. Check all battery hold downs, (also called J bolts) and the battery rack. Be sure there are no rocks or other foreign matter in the battery rack.

Standard golf carts use a fairly complex power set-up usually with six 6-volt batteries hooked in series. To disconnect the batteries from the cart, there are three connections that must be taken loose: two positive cables and the ground cables. To keep track of the wires and connections, mark each cable being disconnected using tape and a marking pen, then mark the batteries with the corresponding letters. In this way you can keep track of which cable will need to be reconnected to which battery.

Once the cables and batteries have been marked, unbolt the battery cables starting with the positive cable, then the second positive cable and then the ground. It's not necessary, in this procedure, to unhook the cables between each of the batteries.

Install the batteries and install battery cables in the right sequence. Make sure all connections are tightened. Spray the terminals with battery protector spray. Then fully charge the cart before operation.



**When you disconnect battery cables be careful to keep them from touching each other, battery posts and other wires.**

## Chapter 7: -Disposing of golf cart batteries

All lead acid batteries are now classified as "hazardous waste"



**Lead acid batteries have been determined to be unsuitable for disposal as municipal solid waste because they contain toxic heavy metals and have corrosive properties.**

Golf cart deep cycle batteries are not to be placed in wastebaskets or dumpsters where they will end up as municipal trash.

So, what can you do? For starters, don't toss your golf cart's old deep cycle battery into a bin with your household recyclables and leave it on the curb. The deep cycle battery, also referred to as a lead-acid battery, contains about 21 pounds of lead, three pounds of plastic and one gallon of sulfuric acid. These items can be toxic if handled improperly.

If you are the do-it-yourself type, take your spent deep cycle batteries to a quality auto parts retailer that is committed to battery recycling.

Nearly 90 percent of all lead-acid batteries are recycled. Almost any retailer that sells lead-acid batteries collects used batteries for recycling, as required by most state laws. Reclaimers crush batteries into nickel-sized pieces and separate the plastic components. They send the plastic to a reprocessor for manufacture into new plastic products and deliver purified lead to battery manufacturers and other industries.

Many states have regulations in place requiring battery recycling. (Thirty-seven states in the U.S. require lead-acid battery recycling; making retailers collect used lead-acid batteries from customers who buy new batteries.)

As neither sulphuric acid nor lead are exactly good for the environment you have to be careful when you dispose of old lead-acid batteries. Leave it for recycling. You can also leave your old battery where you buy your new one.



If that should not be the case, contact your local municipality to check where you can safely dispose of old batteries. In the old days, when we changed a battery, we threw out the old one and never gave it a second thought. Today, we know better. We know that:

- Individuals who become poisoned by lead can experience symptoms including irritability, stomach aches, poor appetite, diarrhoea, colic, distractibility, and lethargy;
- Lead acid typically consists of 40% sulfuric acid, a corrosive that can burn skin; and
- The improper disposal of lead-acid batteries can contaminate soil and water. The toxic metal is not able to dissolve in water or biodegrade, dissipate, decay, or burn, making it an extremely harmful hazard.

On a positive note it seems as if most people take this seriously. About 93% of all battery lead is recycled, making it the most highly recycled consumer product. Help in making sure we go towards 100%!

## Chapter 8: -Troubleshooting golf cart batteries

### Why do my golf car batteries fail ?

Batteries fail prematurely because of a variety of reasons, including poor battery maintenance.

### Why do my golf car batteries not hold or take a charge ?

Batteries may not accept a charge for several reasons. Many home chargers have minimum voltages that must be present in the battery before the charger will switch on. These low voltages are normally well below those exhibited by batteries that appear to be 'dead'. However, it's often the case that the batteries are not given the adequate amount of time to accept the charge.

One of the best tips regarding battery charging is to observe the charger's ammeter swing needle (available on some chargers) during the charging procedure. After the charger is connected to the battery and is on, the needle should deflect to a high amperage level if the battery is partially discharged. If the battery is severely discharged, the needle only deflects slightly away from zero. Continue to observe the needle in either situation. On a normally discharged battery only, the needle will start to taper in amperage back toward zero, usually in less than five minutes. This reduction in amperage typically indicates the battery is accepting a charge.

On a severely discharged battery, the needle will start off very low then rise. This rise of the needle is a preliminary indication the battery is accepting a charge.

Remember, chargers vary in capability and **always observe safety procedures recommended by the charger manufacturer**. Always determine the battery's state of charge before and after recharging. The most accurate method for a battery with removable vent caps is the specific gravity test with a hydrometer.

My golf cart batteries start my golf cart sometimes but not at other times

This is probably not a battery problem. Make sure that all the connections are good.

If the problem occurs only after the vehicle sits overnight or for a day or more before starting, the problem is often a low state of charge, so test your battery to determine its state of charge.

### **My batteries get corrosion build-up on the terminals:**

Although all batteries contain highly corrosive sulfuric acid, corrosion should not occur under normal conditions without spillage or one of the following:

**Overfilling:** Add distilled water to the electrolyte of a fully charged battery if it is lower than 1/8" to 1/4" below the vent well at a full charge. If the battery requires charging, only add water if the electrolyte is at or below the plates.

**Overcharging/overheating:** Overcharging by the alternator or normal charging at an extreme battery temperature can result in excessive gassing of the battery, which may produce increased corrosion.

**Inadequate metal contact:** When current passes through poor or loose electrical connections, a form of corrosion may form.

**Metallic exposure:** When an electrical wire is exposed to salt particles in the air, corrosion will eventually occur. Remember to keep connections clean, tight and sealed by protectorates. Do not overfill the battery or allow it to become overcharged or overheated.

### **My batteries keep failing though I seldom drive my golf car:**

Just like people, batteries need exercise to remain healthy. Exercise to a battery is getting recharged so it can remain healthy. Batteries will self discharge while sitting unused.

## **Chapter 9: Golf cart battery questions answered**

### **Why can't I use a car battery on my golf cart or trolley?**

A golf cart and trolley requires a 'deep cycle golf battery'. The term 'deep cycle,' put simply, means a battery that is designed to store a lot of energy, which can be drained and then recharged over and over again. In contrast, a starting battery, which is used in a car, is designed to deliver a quick burst of energy, but never become very drained, as it is continually charged up by the car's alternator. It is very important to only use a deep cycle battery on your trolley with the correct type of charger as a car charger will shorten your golf trolley battery's life very considerably.

### **Is it okay to leave my golf cart charging for extended periods of time?**

Leaving it to charge overnight is fine, but leaving it plugged in while on vacation is a bad idea. If there's an electrical storm while you're away, one lightning strike can destroy your electronic speed controller, or any number of other electrical parts.

### **Should I always keep my golf car charged?**

Yes, you should never allow the batteries to become discharged for long periods of time. As a battery becomes discharged, lead sulfate begins to form, clogging the sponge-like pores in plates. If left uncharged long enough, it will ruin the battery. Also, if you live in a colder climate, keeping the batteries charged will prevent freezing. A fully charged battery will not freeze until 50 or 60 degrees F below zero.

### **I have a new golf cart. Do I let my batteries get completely dead before charging them ?**

No. New batteries should be fully charged before you use them. They will need to be charged fully a number of times before reaching full capacity.

## **The battery pack - does it perform differently over time ?**

Yes. As your batteries age, they will require water more often and longer charging times.

## **There was only one bad battery, so I replaced it. My golf cart ran OK for a while, but now it won't hold a charge again.**

When batteries are connected in a series, as they are in golf carts, you will need to replace an entire set rather than single batteries. Each battery in the pack needs to be approximately the same age, size and usage level. Do not put a battery in a pack that has more than 50 cycles on it. Instead, replace with all new.

How much water should I put in my batteries?

The water should completely cover the plates inside the battery, but should be about a quarter inch below the bottom of the fill tube. A battery filler bottle will automatically stop at the proper level, eliminating the guesswork. Always try to use distilled water if possible.

## **How do I test my batteries? What is specific gravity?**

You will first need to purchase a hydrometer to perform this test. The specific gravity of golf car batteries should be between 1.250 and 1.280 at 80 degrees Fahrenheit. This is the specific gravity of the electrolyte solution within the battery at 80 degrees compared with 1.000 being the specific gravity of water at the same temperature. The acid solution should be 1.250 times heavier than water at this temperature. To correct for the air temperature at which the reading is taken, add or subtract .02 for every 5 degrees difference from 80 degrees. It is never recommended to add acid to your batteries unless the battery was spilled. Most of the acid is contained within the porous lead plates and does not readily evaporate. Usually, just add distilled water up to a quarter inch from the bottom of the battery fill tube.

The specific gravity does not indicate your pulling power or the distance the golf cart can go under a load. It only indicates the state of charge as measured by the amount of sulphuric acid in the electrolyte. As the charge drops, the specific gravity reading will drop and approach that of water. To test the batteries for capacity, you will need to apply a battery load test or a discharge test to see how they hold up with a 300-amp draw on the batteries.

### **How old are my batteries?**

The battery codes will differ with the manufacturer, but only slightly. Below is the most commonly used date code system. The code will either be stamped into the battery posts or applied to the top of the battery with a sticker.

Battery Code Examples:

A=Jan 8=1998

B=Feb 9=1999

C=Mar 0=2000

D=Apr 1=2001

So a code of F9 would mean the battery was manufactured in June of 1999.

### **Can I replace just one of my batteries?**

Yes, you can. **However**, there are some other considerations. If you have a single bad battery, and the batteries are not too old, replacement may not be a bad idea. However, if you have more than one bad battery, or they are 6 or 8 years old, it is recommended to change the whole set. If you place a new battery into a cart with old batteries, you will not get the full life or capacity out of the new battery. For lack of a better term, batteries tend to seek "the lowest common denominator".

The new battery's performance and capacity will be quickly brought down to the level of the used batteries. Replacing just one battery will result in a reduction in the overall performance of the new battery, but is more cost effective than replacing the whole set.

Beware, old batteries and cheap batteries will nickel & dime you to death. Once you start replacing more than one battery, the loss in performance can start to outweigh the cost of just biting the bullet and buying a new set of batteries.

### **Acid is bubbling out of my batteries! Is this normal?**

Venting, or gassing, is a normal occurrence when your batteries are charging but this should not leave puddles of acid on the battery tops. If the batteries have been overfilled with water before charging then the cells may spill acid out. This is not good for the batteries, the battery racks & hold down brackets or battery cables & cable ends. If the acid is coming from anywhere other than the caps on top of the battery, you may have a leak. Spilled acid will ruin the smooth finish of a concrete garage floor, if left untreated.

### **How do I neutralize excess battery acid that has leaked out or bubbled over from my batteries?**

Any acid can be neutralized by a simple base. You can use a professional acid neutralizing solution or a simple baking soda wash will work. Be sure that the caps are securely on your batteries and that you don't get any neutralizer inside the battery.

## Golf cart myths:

### 1. Storing batteries on a concrete floor will discharge them: **False**

All lead-acid batteries will naturally self-discharge.

### 2. Driving a cart will fully recharge a battery: **False**

### 3. A battery will explode: **True**

Charging a wet lead-acid battery naturally produces hydrogen and oxygen gasses as electrolysis of the water occurs and needs to occur in well ventilated areas. While spark-retarding vent caps help prevent external battery explosions, sparks occur connecting or disconnecting charger or battery cables and ignite the gas causing an explosion.



**Should a battery explosion occur and battery electrolyte (battery acid) gets in someone's eyes, flush them out with any drinkable liquid immediately because **SECONDS** count, continue flushing with water for at least 15 minutes, and seek immediate medical attention.**

### 4. A battery will lose its charge sitting in storage: **True**

Depending on the type of battery and temperature, batteries have a natural self-discharge or internal electrochemical "leakage" at a 1% to 60% rate per month.

### 5. Do not use tap water to refill batteries: **True**

Use only distilled, deionized or demineralized water to replace the lost water in batteries because using tap or reverse osmosis water from residential systems can produce calcium or magnesium sulfate crystals that can fill the pores and coat the plates. In an emergency, use rainwater because rainwater does not contain calcium or magnesium.



## **Chapter 10: Golf Cart Winter Storage Tips:**

**Follow the tips below for proper storage of your electric golf cart during winter**

### **Cleaning the Batteries:**

Ensure all the cell caps are snugly attached and unplug the charger and wash the battery compartment. Start on one side of the golf car and spray Battery Neutralizer all over the tops of the batteries. Be sure to spray it between the batteries, down on the battery racks, and the inside walls of the body panels, if they are metal. Use an old paintbrush to scour all the battery tops and sides. Water from a garden hose using plain water, or use a solution of Baking Soda (about 2 tablespoons to 1 gallon of water) to neutralize the acid.

### **Maintaining the battery terminals on your golf cart batteries:**

Check, clean, tighten & treat all of the battery terminal connections. Be sure the cables are tight to the post. Carefully wriggle each cable end side-to-side and then gently up & down. There should be no looseness or sideways movement. If your battery terminals are badly corroded, you will need to do some serious cleaning. Check the water levels in each cell. Use distilled water to fill. Be sure the electrolyte (water) in each battery cell is above the plates. In cold climates, when the car will be left uncharged for several months, leave the water level a little low. This raises the specific gravity of the acid, which will help prevent freezing. A lead acid battery keeps much better in the cold than in the heat, as long as the charge stays up. A fully charged battery will not freeze until 60 to 70 below zero whereas a discharged battery can freeze at 20 degrees above zero. As a battery discharges, the acid turns into water by the basic chemical nature of the lead acid battery. The more discharge, the more water and the more likely it is to freeze. Also a dirty, acid covered battery will self-discharge at a faster rate than a clean treated battery, even in cooler temperatures.

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Don't leave your electric golf car plugged into the charger for extended periods of time. After the charge is done, unplug the charger from the cart and from the wall. Leave the cart in Neutral and turn the key off. Either way, scotch the wheels so you can leave the hill brake released. This prevents strain on the cables and the brake shoes can't lock to the drums.

If you are not going away for the winter, you can plug your Charger in for a few hours once a month to insure a full charge is maintained. The charger should be unplugged from the car and the wall after charging.

**Finalizing for winter storage:** Check the tire pressures and inflate to 20-25 psi. Roll down the rain curtains and zip them part way down. If you have to leave the car out in the open, or under an open shed, neatly fold the rain curtain and bring it in the house till spring. Very cold weather will cause the see through vinyl to become very brittle and a puff of wind will blow it out.

## Chapter 11: Battery Do's and Don'ts



### **Battery Do's:**

- Think Safety First.
- Do read this entire guide
- Do regular inspection and maintenance especially in hot weather.
- Do recharge batteries immediately after discharge.
- Do buy the highest RC reserve capacity or AH amp hour battery that will fit your configuration.
- Freshness - Check the date code on the battery to make sure it hasn't been sitting on the shelf for ages. This can seriously affect performance.



### **Battery Don'ts:**

- Don't forget safety first.
- Don't add new electrolyte (acid).
- Don't use unregulated high output battery chargers to charge batteries.
- Don't place your golf cart into storage without some type of device to keep the battery charged.
- Don't disconnect battery cables while the engine is running (your battery acts as a filter).
- Don't put off recharging batteries.
- Don't add tap water as it may contain minerals that will contaminate the electrolyte.
- Don't discharge a battery any deeper than you possibly have to.
- Don't let a battery get hot to the touch and boil violently when charging.
- Don't mix size and types of batteries

## **Conclusion:**

The bottom line is that having this basic maintenance done regularly – on the schedule recommended by the manufacturer – can drastically extend your vehicle’s lifespan and improve its performance.

**Appendices A to D follow.....**

## Appendix A - Golf Cart Manufacturers

Here's a list of some of the main golf cart manufacturers:

Additional information may be obtained by visiting their web sites:



### **COLUMBIA GOLF CARTS:** [Columbia Golf Carts](#)

Columbia Parcar Corp  
1115 Commercial Ave  
Reedsburg, WI 53959  
USA|Toll Free 800-222-4653



### **CLUB CAR:** [Club Golf Carts](#)

Club Car, Inc.  
P.O. Box 204658  
Augusta, GA 30917  
800-258-2257



### **E-Z-GO:** [E-Z-GO Golf Carts](#)

E-Z-GO  
1451 Marvin Griffin Rd.  
Augusta, GA 30906  
800-241-5855

## **YAMAHA**

### **YAMAHA GOLF CAR CO:** [Yamaha Golf Car Co.](#)

Yamaha Golf-Car Company  
1000 Highway 34 East  
Newnan, Georgia 30265  
Phone: 1-866-747-4027

## **APPENDIX B: - The location of golf cart serial numbers**

### **Club Car:**

Underneath the passenger side dash compartment where it meets the floorboard.

### **Columbia Par Car:**

Located on the driver's side rear upper spring mounting plate. May vary.

### **E-Z-Go:**

Inside or just below the passenger's dash compartment.

### **Harley Davidson and older Columbia Par Car:**

Inside the engine compartment, usually just above the rear driver side tire of the car, stamped into a metal plate riveted to the frame.

### **Yamaha:**

It could be in one of two places. If your entire body tilts backward to access the engine or battery compartment, look for it stamped into the metal just below where the rear bumper mounts bolts to the frame. If only your seat tilts forward for battery or engine access, look inside the engine or battery compartment, on the portion of the seat, which tilts forward right behind where the floor mat ends.

### **Melex:**

Inside or just below the passenger's dash compartment.

## APPENDIX C: - Resources:

Need golf cart help ?



**If you aren't sure about what you're doing or don't totally understand the concept/requirements, then please ask for more information or DON'T DO IT! If done improperly you can possibly damage major components of your cart or get hurt.**

Here's a list of other resources of golf cart information

### Golf Cart Forums:

"Buggies Unlimited":

<http://server1.buggiesunlimited.com/phpBB2/>

"Buggies Gone Wild"

<http://www.buggiesgonewild.com>

### Golf Cart Batteries:

**Trojan Battery Company**

12380 Clark St.

Santa Fe Springs, CA 90670

800-423-6569

<http://www.trojanbattery.com>

### Golf Cart Accessories

**Buggies Unlimited**

701 S. Keeneland Dr.

Richmond, KY 40475

888-444-9994

<http://www.buggiesunlimited.com/>

## **APPENDIX D: - Equipment and other helpful resources to improve your game**

### **(A) Lengthen your drive and cut your handicap !**

Would you like to lengthen your drive and cut your handicap by 7 to 12 strokes in just two weeks ?

[Then please click here](#)

### **(B) Improve your game ! - Excellent fitness program !**

If you want to easily get in shape for golf in less than 30 days then this program is a recommended must. Your golf swing will have effortless power !

[Check out the program here](#)

### **(C) GigaGolf.com – for the hottest technology in golf clubs !**

[GigaGolf's Best Sellers](#)

### **(D) Golf Balls and Accessories – Cool Golf Stuff !**

[Golf Accessories](#)