

BETTER
TRUCKING

The Complete
Automotive
Battery Guide

Kevin Gauthier

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Letter From the Author:

Please note that much of this publication is based on personal experience and anecdotal evidence.

Although the author and publisher have made every reasonable attempt to achieve complete accuracy of the content in this guide, they assume no responsibility for errors or omissions. Also, you should use this information as you see fit, and at your own risk. Your particular situation may not be exactly suited to the examples illustrated here; in fact, it's likely that they won't be the same, and you should adjust your use of the information and recommendations accordingly.

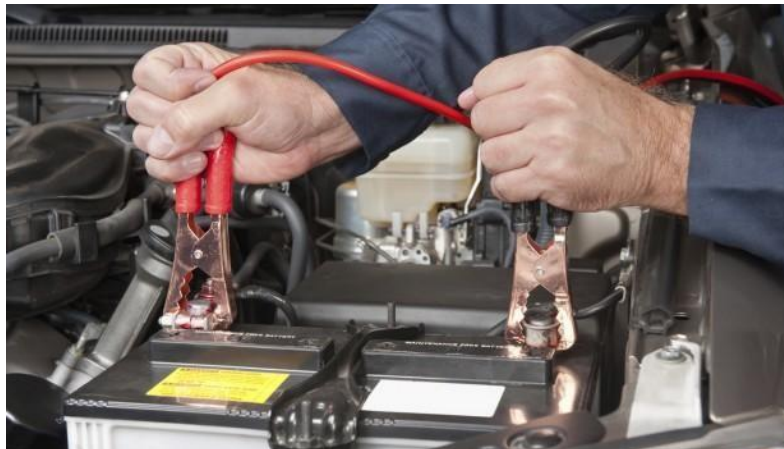
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Introduction

We all know the importance of having quality batteries. It's not just a question of whether the truck will start. When batteries go bad there is still the question of time lost, late or missed deliveries, and additional costs of getting a boost. What is new, however, is the added requirements of onboard diagnostics. One may wonder what OBD has to do with batteries and the answer is, a lot. Significant voltage drops upon start-up can create check engine codes and can lead to significant problems down the road, literally. Also, a vehicle is programmed to "adapt" as much as possible to the way that you drive and the way components wear. Weak or defective batteries will wipe out this memory, leaving you with the lesser default settings.

Luckily, the series 31 type batteries that we use in transport are in such demand that companies have gone to great lengths to improve them. Dependability and durability are but a few of the many characteristics by which we can now measure batteries. Maintenance free batteries drastically reduce problems, and all the problems inherent to battery maintenance.



What lies ahead on the following pages is the complete guide for any truck owner or operator and all the information you could need along with actionable steps you can start taking today to get the most out of your truck's batteries.

Choosing Batteries

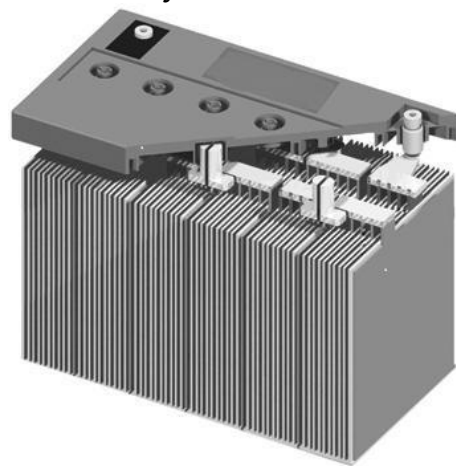
Considering the fact that if your batteries fail, you can't work, very little time, effort or consideration is put into choosing batteries when you buy a truck. While, on the one hand, you probably don't want to have to choose every single nut and bolt put on your truck, the choice of batteries will have a major impact on the functionality and dependability of your vehicle. If you're buying a new truck then you may have a few options on batteries. At the same time, a lot of trucks have as many, if not more, options for the battery box, than the battery type. If you are buying a used truck, then the choice you get is likely between the batteries currently installed, or batteries in better condition, if necessary.

Consider this. With today's fully electronic vehicles, low or inconsistent batteries can cause problems ranging from invisible minor issues, to check engines, to complete failure of components. Almost any recent vehicle, that has been on the road for a reasonable amount of time, likely has at least one low voltage related code. Also, keep in mind that all of those electronics are essentially meant to do three things. Provide safety. Run environmentally responsibly. And, run efficiently. If you need to know why that matters, simply put, a safe, environmentally friendly and efficient truck is a truck that is less expensive to operate.

Battery Options

For all this talk of paying attention to battery selection, there are, for practical purposes, three areas of importance that we need to look at. There are the two different types of battery construction, two design purposes, and then countless characteristics including quality of material and workmanship. Below we will unpack each one of these important elements to help you quickly and simply identify the battery that will suit your needs.

Battery construction



Flooded Batteries

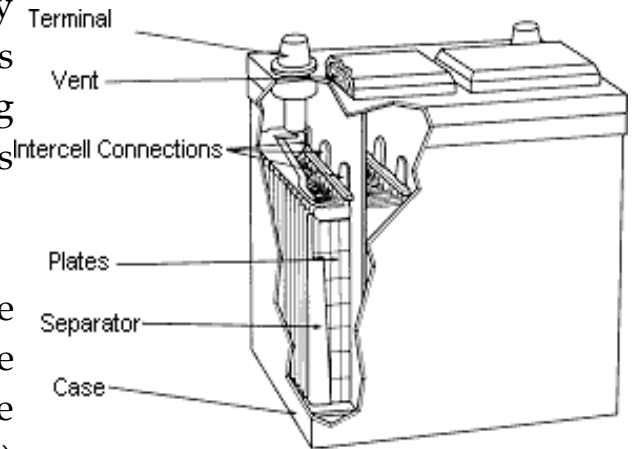
The most commonly used and the most cost-effective battery construction type is the flooded lead acid battery. As the name suggests it is a battery made up of lead plates, flooded with an acidic formula. This formula is made up of battery acid and distilled water. The reason for the distilled water as opposed to tap water is that ions and other difficult to see particles regularly found in tap water is known to seriously reduce the lifespan of a battery's properties.

It is worth noting that this water and acid mix is bad for your health. Especially when hot, it's bad for your clothes (sometimes taking days to wreak its havoc, often inside a laundry basket with other clothes), and it can damage automotive paint.

Sealed AGM

This title is a little less obvious. The battery is, as implied, sealed. However, AGM stands for Absorbed Glass Mat. Instead of having freely flowing battery acid, the battery acid is soaked into a fiberglass matt.

These batteries are more expensive because manufacturing them is much more intentional. The advantages, however, can be well worth the price for many (but not all) applications.



For one, the absence of free water leads to the ability to completely seal the battery, preventing them from drying out. This makes them truly maintenance free. This is also what makes them more attractive to aquatic environments. There is also much less internal resistance which means you can get more amperage out of the same lead plates, faster.

Due to the fact that there is faster, cleaner power output, AGM batteries are typically only used as a starting battery for on-road vehicles.

Design Purpose

Starting

This may seem obvious. And it is. All batteries are used for starting. Otherwise, all a vehicle would need is an external crank and a generator. The goal of a starting battery is to provide a starter motor with a short but high output of energy. We measure this in amperes. The battery is, of course, used after the start to supply a steady, dependable voltage to vehicle components like injectors, ECM's, lights and the alternator.

Deep-Cycle

This is a term that seems to be misunderstood, or forgotten, by many. A deep-cycle battery is designed to deal with more of a discharge than a starting battery. What this means is that it is more resistant to low voltage than a starting battery. The reasons that someone may care about this is that if a vehicle is not driven on a regular basis, or when accessories are used for a significant amount of time between when the engine is running, then the battery needs to be resistant to these demands. Where a starting battery will eventually "burn out" a deep-cycle battery is able to keep coming back for more. To a certain extent, of course. A deep-cycle battery is not limitless in its ability to take abuse.

Other Characteristics

On the tag

Typically, on a battery label we will find a lot of acronyms. The usual ones and the ones that matter are VLTS, CA, CCA, and RC. While VLTs must be 12, the others usually want to be as high as possible. This depends, however, on the application. Your owner's manual should tell you the recommended amperage output of your batteries. That being said, you rarely will have too much.

CA

Cranking amps. Often ignored for the sake of CCA, but very important. Cranking amps is the optimal amperage you can expect out of this battery, when healthy, in average climates and conditions. Best case scenario. Many people would read that as "it's only true on a test bench". I struggle to say they are wrong.

CCA

Cold cranking amps. The standard by which we hold our batteries to. Even when we don't live where there is any real cold. The CCA is to say how many amps can be delivered by the battery at 0 deg. f or -17 deg. c for 30 seconds. In other

words, on the most miserable of days, a healthy battery should be able to supply you with this many amperes. This is, of course, much more valuable if you live in a cold climate. But always good.

100%	30° Cel
90%	5° Cel
80%	-7° Cel
70%	-14° Cel
60%	-23° Cel
50%	-30° Cel
40%	-35° Cel

Approximate loss of capacity by temperature

RC

Reserve capacity. The forgotten one, yet very important. This is actually not an expression of amperes or volts but of minutes. As in, how many minutes the battery can stay above the minimum of 1.75 volts needed to run a vehicle. Many people tend to ignore this number but it can be extremely practical when the accessories strap breaks or an alternator fails far from a shop. If your charging system were to fail, and your RC is 60, you should have 60 minutes of power to get to a better or at least safer place.

Other General Notes

After what has been discussed comes the many nuances of any given battery. Many of which are hard to see. Some of these characteristics may mean a tougher build, for heavy vibrations. Extreme temperatures such as northern (very cold) or southern (very hot) climates.

Unfortunately, many characteristics can be broken down to cost-cutting measures for which one rarely saves any money at all in the long-term. Without a doubt, the best way to discern all the particular characteristics of a given battery is to find a representative of a given brand who is well trained and has experience in helping you find the best battery for your needs.

Not to despair, the most expensive battery is not always the best choice, nor should you automatically be convinced of this. A 15-liter engine spending its day

in an icy field needs much more amperage, ruggedness, and durability than a 13-liter highway truck that makes 2 quick stops per day on two shifts and is otherwise always running.

There is also a noticeable difference in warranties given for different batteries. 12 months seems to be the minimum worthy of being trusted. This is not always enough. If you plan on selling the vehicle receiving the new batteries it may not matter to you at all, but otherwise, a warranty can be a good indicator of the quality of the battery. Don't trust the stamp on the battery or what is written in the brochure, ask about the process to claim a legitimate warranty and examples of someone else who has successfully claimed one. On the other hand, too many off the cuff examples of warranties may mean a high percentage of failure.

BATTERY GROUP SIZE Maximum LENGTH x WIDTH x HEIGHT

Group 24: 10.75" x 6.82" x 9.4"

Group 27: 12.1" x 6.82" x 9.25"

Group 29: 13.2" x 6.75" x 9.2"

Group 30: 13.5" x 6.82" x 9.25"

Group 31: 13" x 6.82" x 9.44"

Group 34: 10.25" x 6.82" x 7.88"

Storage

The most important consideration when storing any battery is to make sure the voltage never drops below 12.4 volts. Following these simple tips can help extend the life of your battery.

Using a charger. There are two types of maintenance chargers and both will do a great job of maintaining the health of your batteries. The better of the two is a fully automatic multistage or multistep charger, which monitors the battery and charges as necessary. Multistage will charge at varying voltages and varying amperages, depending on what is required. Some of these multistep chargers are also able to work well as a battery charger.

The other is a trickle charger. This is a less expensive and less useful option. As the name suggests, this type of charger simply provides a very light charge, equal to or greater than the charge typically lost while a battery is not in use. Unfortunately, the charge is often more than necessary and can, in fact, result in damaging a battery in the long term. That makes the less expensive option a bit counterproductive if not properly monitored.

If it is not possible to use a maintenance charger, disconnect the battery from the vehicle during storage and leave it clean to prevent the vehicle from discharging the battery. Even the smallest voltage draw, such as a radio and ECM for settings, can kill a battery in the long term.

Always provide a battery with a full charge prior to storage. Then, check the battery voltage every three to six months and charge if it falls below 12.4 volts.

Also, as much as possible, store your battery in a cool, dry location.

The way batteries fade over time is referred to "self-discharge." Due to normal reactions within the battery plates, all lead-acid batteries will lose part of their charge or efficiency over time. The warmer the battery compartment and the older the battery, the higher the rate of self-discharge.

A battery's rate of discharge is only affected by its age, the temperature outside, and the way the inside of the battery is made and its use.

It is common knowledge, in many garages, that a battery cannot be left on a concrete floor and that if this is done, then the battery will be drained by the floor. This is no longer true, for the most part. It was true because battery casings were not built well as well as they are today. Today they are sealed and tightly packaged cells. This is still true, however, if a battery is dirty and the dirt on the battery, which is actually leaking battery acid. Also, if acid is making contact between both posts, and/or the concrete floor the same effect will occur. A new, clean battery will not have this problem. An old or dirty battery will.

Maintenance

Most people look at a battery and figure next to nothing can be done to “maintain” a battery. This couldn't be further from the truth. The reality is that there are many little things that can dramatically alter the lifespan and efficiency of your battery.

Unfortunately, it is hard to see the ill effects of poor battery maintenance until the system simply fails. Those who do little more in the way of maintenance than washer fluid, are typically the same who fail to see the positive impacts of proper battery maintenance.



While much of what would be called good battery maintenance revolves around maintaining a healthy charge, there are several other important areas of significance.

Having healthy batteries begins with being properly installed. Every battery box should be clean and have a rubber under pad. A battery can very well sit on an aluminum or steel plate but having a sheet of rubber or even an old, flat mudflap will help dampen vibrations inherent to heavy vehicles.

It's surprising just how much debris can build up in a battery box over the years. Consider the conditions in which the batteries live.

At the same time that we are watching for vibration dampening, batteries need to be properly secured. Partly because, again, vibrations and partly because batteries can be lost and can touch conductive components and cause a short circuit. While using hold down brackets is a must, there is a limit.

An owner's manual should tell you just what that torque should be. If a torque rating can't be found, the guiding principle is to tighten enough that the batteries cannot move, but not too tight as to squeeze the battery casing, thus damaging it. Make sure to keep the batteries secure at all times.

Check all power and ground cables. Note well, all power and ground cables, not just the positive and negative posts of the battery. A loose or corroded terminal on a ground, starter or alternator can be detrimental to batteries.

Verdigris is when a terminal, usually but not always the positive, creates a sort of green powder. Many think that if the connection is tight, verdigris can't hinder the connection. And they are wrong. It is generally recommended to take apart all these electrical connections but especially on the battery and alternator, twice a year and thoroughly inspect clean and repair as needed.

While many excellent products are available to clean battery terminals, water and baking soda worked with a brush will do the job just fine.

A silicone grease will work wonders, when properly applied to a clean surface, to protect these terminals from corrosion, but it is not a perfect nor a permanent solution. Proper maintenance and inspections are still necessary.

State of resting battery	
12.66v	100%
12.45v	80%
12.24v	60%
12.06v	50%

Battery inspections can't be left out of the equation. There isn't a whole lot to look out for but any one of the signs below can be a warning of problems.

Cracks and other deformities. Any cracks or bulge in a case are obvious signs of damage that signal a defective battery. If left, a short and or spill is very likely, both with dire effects.

Leakage

Leakage can be a sign of a few things, such as overheating, a loose or damaged cap or body, or having been shaken or leaned to its side. In some cases, the battery could be checked for electrolytes and water level. Often, however, the battery should be replaced and the charging and starting system inspected.

Electrolyte level

This can be checked both visually by opening the cap or caps to the battery and seeing if the plates are covered by approximately 1/8th of an inch of liquid. The quality can be verified with a gravity tester or refractometer.

Load test and voltage check

These two go hand in hand. Voltage should be checked as per the chart at the top of this page and a load test should be performed as is described in the chapter on testing and in the literature provided with your tester. Always read and use the information that came with the tool you intend to use. Always use appropriate personal protection in a safe work environment.

Testing

To test a battery is well and good, but what causes a battery to require testing? There are several causes that we can find to be the reason for a weak battery. Time and abuse are two of the most common.

Extreme temperatures

Excessive heat or cold are both damaging and taxing on a battery. In the heat, Batteries tend to dry up, evaporating the water inside of the battery. In the case of extreme cold, the entire engine becomes more difficult to start as oil thickens increasing the load that a starter motor requires to do its job.



Charging too fast and draining too low

The slower the charge, the healthier the charge, the less a battery is subjected to a low voltage the better a battery can maintain its charge.

Vibrations and other physical abuse

Transport vehicles vibrate. There is little one can do about it. That doesn't mean nothing can be done. Even a cut up mud flap to rest on is less taxing than a metal base. Also, manufacturers don't specify torque ratings for the bolts that secure batteries for nothing. There is a fine line between loose batteries and excessive clamping that squeezes the batteries. That fine line is commonly referred to as the torque specification.

Now, to the point of testing. Most testers are what is called a 'carbon tester' or 'load tester'. Fairly simple machines, and not very expensive. There are, for much more money, high tech testers that don't require any knowledge at all, even if they are plugged the wrong way it will tell you so, and you get a printout of the analysis of the health of the battery. They also will have a line indicating 'good battery', 'bad battery' or 'recharge and retest'. For those exact reasons, we'll focus on load testers, the less obvious ones.

The two names we give these traditional testers are both true. They use 'carbon' stacks to simulate the 'load' of starting an engine.

Battery Council International is a non-profit that counsels for the battery industry internationally. They recommend testing a battery with one-half of the CCA rating found on the label. A battery must be fully charged to perform an accurate test. If you don't know the CCA rating, then you should not be testing it with this method. There is no method to really know for sure if it is healthy if you don't know the CCA rating. Follow the instructions for your particular tester. You will typically be told to test for 15 seconds. You do not want to test longer because this is very tough on the batteries and will often cause the batteries and the tester to overheat. An overheated battery is an incredibly dangerous thing. It can and has caused property damage, seriously injured and even caused the death of people. Always allow time between tests for everything to cool down.

Acceptable voltage drop after
15 second carbon pile test

Battery Temp (F) Voltage

70°+	9.6
60°	9.5
50°	9.4
40°	9.3
30°	9.1
20°	8.9
10°	8.7
0°	8.5

Some things you can do to minimize risk are testing in a well-ventilated area where dangerous gasses can escape. Also, inspect the battery before you begin a test. A crack or deformation in the battery assures you the battery is to be replaced and should not be tested for health, safety and practical reasons.

If ever there is any doubt in the battery, the tester or the person testing the battery, then a professional who is more accustomed and or trained in the task should be sought out to do the work instead.

Some additional safety precautions:

- Red test lead to red positive terminal followed by the black test lead to the black negative terminal.
- Perform the test on a flat surface, with proper ventilation.
- Don't smoke or have anything that can cause a fire nearby.
- Always refer to the instruction manual. When in doubt, do not perform the test.
- Leave any and all labels on your tester and battery. Too much information looks better than a dangerous mistake.
- Reconsider performing these tests with the advice of a doctor if you have a pacemaker.
- Don't touch the cooling vents. Hot acid or gas is the only thing that can come out of them.
- If there is limited space in the battery box, remove the batteries to perform the test as to avoid slip-ups and mistakes.
- Avoid dropping or damaging the tester. It can damage important internal components.
- There are countless other scenarios that can play out when working on or with batteries. If ever unsure or untrained, refer to a professional who has been properly trained.

Note: If ever a set of batteries are to be replaced and no physical damage or abuse has been identified then the charging system should be suspected and verified with a new set of batteries.

Disposal

Disposing of an old battery may not seem like a big deal. And doesn't have to be. That being said, a dead battery presents you with an opportunity to do something environmentally ethical, and give you a bit of money. Here's why and how.

Truck and car batteries commonly contain heavy metals such as lead. This is an opportunity to make a few dollars. Don't try to get the metal out of the battery yourself. They contain acid and plastic as well. That is the opportunity to do something environmentally ethical. In over 90 percent of cases, batteries can be recycled. And they should be. But you need to get them to the correct location for recycling. There is value in this. Any given location could offer money ranging from 5-20\$ or more per battery depending on the battery type and condition. Some may actually charge you for your old batteries, but you should never accept this. At a minimum, ask that it be used for a 'core charge' for a new battery.

When in doubt, call a local garage, parts shop or municipality for help. If your city does not have a program, you can contact the business that regularly disposes of your household or business trash.

One last word of warning when you're getting rid of defective batteries. Just because a battery has been deemed unusable does not mean it cannot cause damage. Let a piece of metal fall across both poles and you're in for a big surprise. It can still short circuit. It has led to entire buildings burning down.

Also, many batteries have a vent so be careful not to spill battery acid on yourself or your property or vehicle. It will take a while but the acid will finish by eating a hole in most fabrics, and ruining any paint it's allowed to settle on. Neither takes very long.

Conclusion

That sums up everything you should know about batteries in transport vehicles. Of course, a lot of this knowledge transfers directly to passenger vehicles or any other battery bearing machine. I hope you got a lot out of this e-book and don't shy away from sharing not only your newfound knowledge but this e-book itself with others.

Drive safe,
Kevin