

MUST KNOW TESTING FACTS

Testing Lead Acid Batteries

Digital testers that compute the cranking amps CA and cold cranking amps CCA of a battery are not accurate tests, because digital testers do not measure amps. Digital testers measure only internal resistance across the tops of a batteries plates. The digital tester then preforms a math equation with the resistance measurement to guess the amperage. If a battery is built with a higher quality separator it have higher resistance, which results in a lower amperage computation on a digital tester. A digital tester will rate a higher quality battery lower. In the following pages, we have attached technical sheets from digital tester manufacturers, that say the Cold Cranking Amp CCA test does not produce an actual value.

How to Interpret a Digital Tester

Cold Cranking Amps CCA can only be truly determined if a Society of Automotive Engineers SAE J537 test is conducted. The SAE J537 requires a battery to be cooled to (0°F) for 24 hours, then discharged at the batteries rated CCA for 30 seconds. To pass the test the voltage must remain above 7.2 volts for the full 30 seconds. Since true CCA can not be tested by a digital tester the below charts will help you interpret a digital tester. The messages displayed by a digital tester such as: Good, Bad, Pass, Fail, Recharge or Bad Cell are preprogrammed. Digital testers can not tell if a battery is truly good or bad, **you have to interpret the data! Load testing is recommended as a verification test against a digital test.**

Battery Voltage and Corresponding Charge Percentage										
10.5	11.3	11.5	11.7	11.9	12.0	12.2	12.3	12.4	12.5	12.6+
0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

Very Important - digital testers are only designed to measure resistance thru lead, not other metals. Tests performed on non-lead metals will produce crazy results, like 100% charged batteries with 0 amps. A warm or hot battery will cause measured amps to be lower than actual, only test a room temperature battery.

DIGITAL TESTER MEASURED CCA											
YOUR BATTERIES RATED CCA	CCA	100	200	300	400	500	600	700	800	900	1000
	100	100%									
	200	50%	100%								
	300	33%	67%	100%							
	400	25%	50%	75%	100%						
	500	20%	40%	60%	80%	100%					
	600	17%	33%	50%	67%	83%	100%				
	700	14%	29%	43%	57%	71%	86%	100%			
	800	13%	25%	38%	50%	63%	75%	88%	100%		
	900	11%	22%	33%	44%	56%	67%	78%	89%	100%	
	1000	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

If your batteries measured CCA % is equal too or greater than the charge %, then your battery is most likely good regardless of the message displayed by the tester.

If your batteries CCA % is less than the charge %, then your battery is either sulfated or bad.

WARRANTY

Who is Covered

This warranty is limited to the original retail purchaser within the 50 States of the United States or the District of Columbia.

What is Covered

This warranty covers defects in materials and/or workmanship beginning at the date of sale. If a battery should fail due to a defect in materials and/or workmanship within the free replacement period, it will be replaced with the same battery model if available and if the same battery model is not available it will be replaced with the nearest equivalent. A free replacement warranty continues from the original battery's date of purchase.

What is Not Covered

This warranty does not cover batteries that are "merely discharged" that can be recharged and returned to service. This warranty does not cover batteries that are damaged due to sulfation, abuse, neglect, fire, flooding, collision, explosion, freezing, opening, overcharging, undercharging, cracked or damaged cases, melted terminals, low acid levels, the use of special additives, or failure to keep the battery properly maintained. This warranty does not cover batteries that fail as a result of hardware used in the electrical system, batteries used in the wrong application, or batteries that are not sized properly for the electrical system load. This warranty does not cover punitive, consequential, or incidental damages, such as the cost of labor, towing, loss of time, loss of use of a vehicle, lost wages, lost profits, or damage to property other than the battery. Some states do not allow the exclusion or limitation of these incidental or consequential damages, so the above limitations or exclusions may not apply to you.

Sulfation On Plates



Over Charging Under Charging

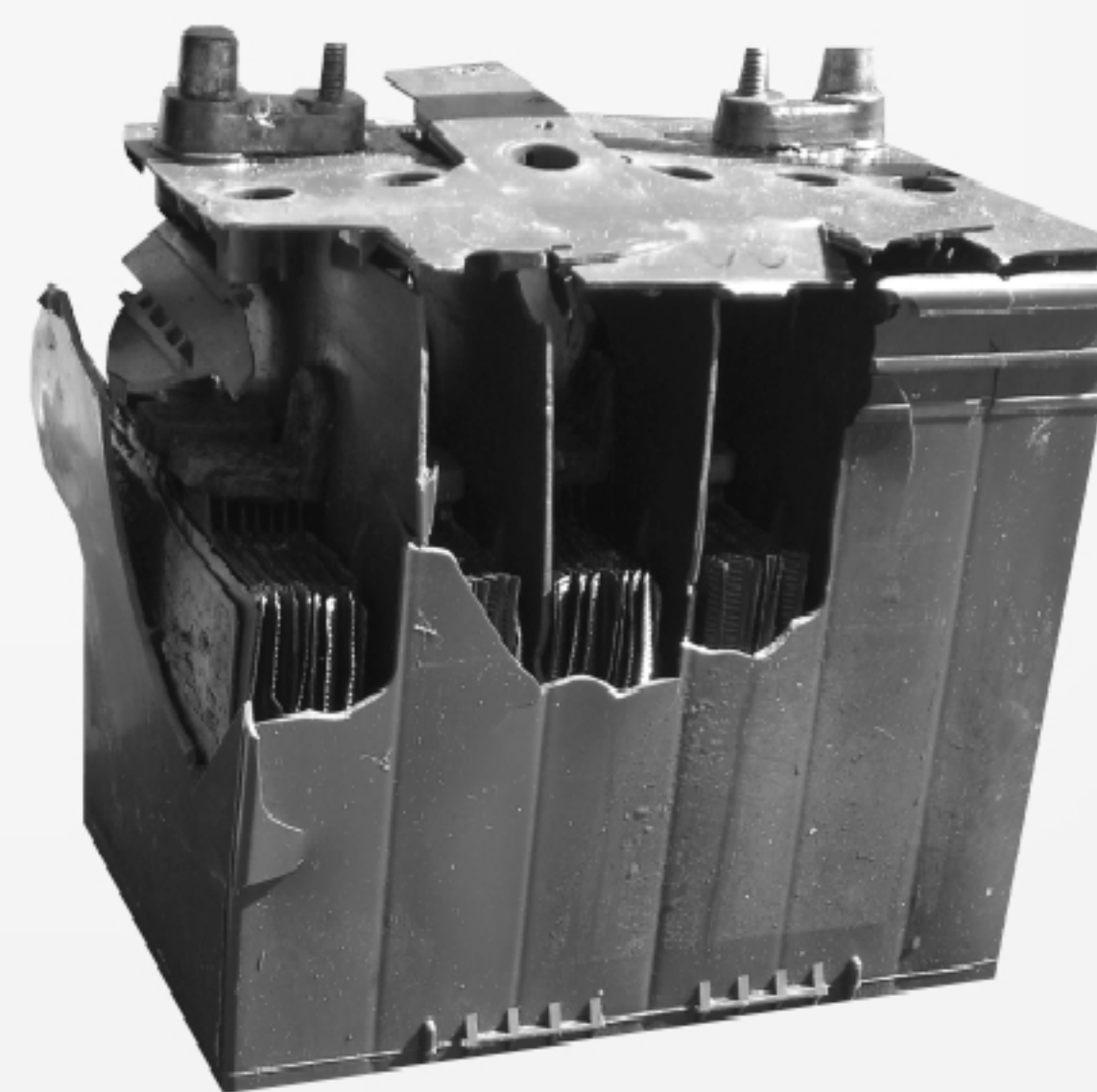


Over-Charged



Under-Charged

Cracked, Damaged, Exploded Cases



Melted Terminals



MUST KNOW CHARGING FACTS

Charging Modern Lead Acid Batteries

Lead Acid Batteries produce Hydrogen gas when charging that **WILL CATCH FIRE** if ignited. Charge batteries in well ventilated areas and keep anything that can ignite the battery gas away. We have seen batteries catch on fire due to cigarettes, welders, over heating or sparking battery charger clamps, and sparks from hooking up battery charger clamps while the charger is on, just to name a few!

Modern batteries are made with different alloys and chemistries compared to batteries made 20 years ago; therefore, the recharging process is more complicated. At **our store**, we charge several hundred batteries a week. Due to our extensive knowledge of how batteries accept charging, we use the below methods of charging. The below methods are for charging a single 12 volt battery.

Make Sure Your Battery Actually Needs To be Charged Before Charging It

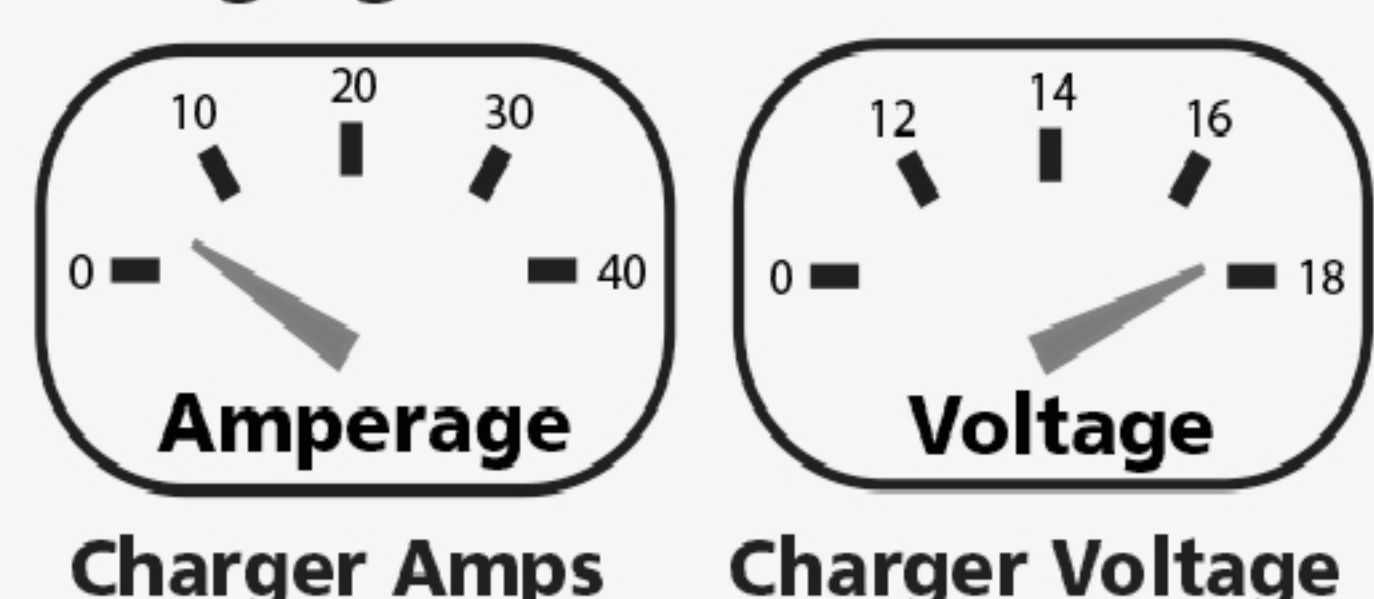
Use a NOCO Smart Charger: These chargers do all the thinking for you by providing a multi-stage charging process. In addition, if your battery is deeply discharged the NOCO Smart Charger has a repair mode function. Noco Smart Chargers are available in many amperages, we recommend the 15 amp or 26 amp for faster charging. When trying to recharge an extremely sulfated battery manual charging is sometimes required.

Use a Manual Charger: We recommend a 30 amp 12 volt charger. Most manual chargers only have an amp meter and do not have a volt meter. If your battery charger does not have a volt meter, you will need to use a handheld volt meter. In most cases, **when you start charging your battery it will act one of two ways.**

1. You will see very little amperage flowing into the battery and the voltage will rise up to 16 volts. This is a result of sulfation on the battery plates. To get a sulfated battery to take a charge the sulfation must be reversed. When attempting to reverse sulfation, charge the battery 3 times in 15 minute intervals at 30 amps limited to 16 volts (hint: to reduce voltage hook another slightly discharged battery up in parallel with the sulfated battery). **At anytime when charging any battery, if a battery becomes warm or starts gassing, stop charging it and let it cool before continuing.**

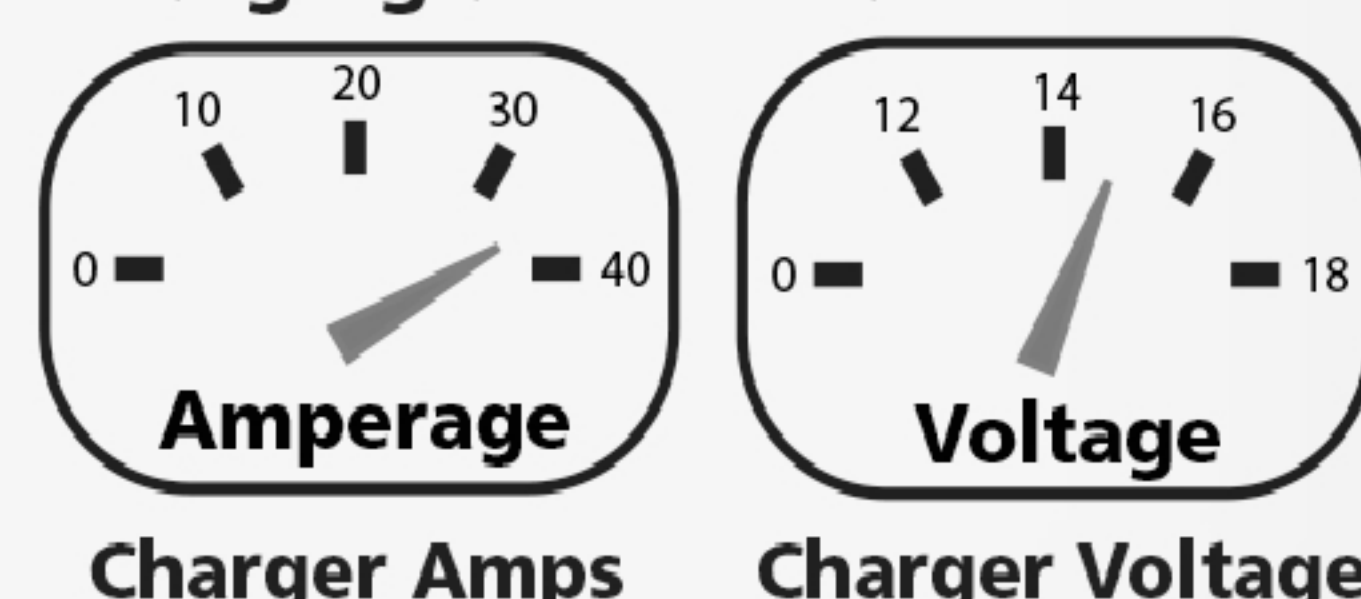
Typically, within the first or second charging interval the sulfation will melt and the amp meter will climb up to a 30 amp flow into the battery. As amperage climbs, voltage will reduce. Once the battery is able to accept 30 amps, proceed to #2.

Charging before Sulfation Melts



Sulfated Plate

Charging after Sulfation Melts



Desulfating Plate

2. You will see an immediate 30 amp flow into the battery. Continue to charge the battery in 30 minute intervals until the amperage drops back to the 10 amp range, at this point the battery will be approximately 80% charged. The last 20% of charging takes twice as long as the initial 80%. To top off charge the battery above 80% reduce the amperage to 10 amps and let the battery charge in 30 minute intervals until the amperage gauge drops below 5 amps. At any time, if the battery becomes warm, stop charging and let it cool before continuing. We recommend a Noco smart charger for top off!

MUST KNOW BATTERY FACTS

Proper Battery Care

The majority of battery failures are due to improper care by their owners or other hardware malfunctions within the electrical system. You must know how to properly maintain your batteries to get the most life out of them. Batteries are like tires, if you do not keep your tire pressure full, your tires will wear out quickly. The same applies to your battery, if you do not keep your battery charge full, your battery will wear out quickly. Batteries need to be exercised and kept fully charged. The best exercise for a battery is to use it. Batteries need to keep their acid mix balanced. If you do not use your battery, the electrolyte will separate into water and acid, this is called stratification. Batteries like to be used and they must be **Fed** or they will **Die**, they **Eat Recharging**.

Dave Brown's Battery Facts, Care, & Maintenance

1. A batteries life span is not measured in time. A batteries life is determined by how many cycles it goes through.
2. Commercial vehicles will use up a batteries life cycles 2 or 3 times faster than a personal vehicle, this is why battery warranty is less in commercial applications. Batteries will be replaced in commercial applications more often.
3. It is normal for the acid level in a battery to decrease as the battery is discharged, the acid will rise back up as a battery is recharged.
4. Never charge or use a battery if the acid level is below the plates.
5. Findout if your battrey requires electrolyte levels maintained or if your battery is maintenance free.
6. When adding electrolyte to a battery only use deionized water. Any other water has impurities in it that create electrolyte imbalance inside the battery.
7. Never add water to a battery more than 1/2 way between the top of the plates and the top of the battery
8. Never leave a battery discharged longer than a week, discharged batteries need to be immediately recharged.
9. Batteries below 1.4 volts per cell, will be sulfated and require recovery recharging. Recovery recharging has to be done by a battery specialist using formation charging techniques.
10. To prevent premature failure, disconnect the negative cable when the battery is not in use and do not let it go dead. another option is to use a battery maintainer.
11. Leaving battery maintainers connected to batteries for months at a time without using the battery, will cause battery damage. We have seen maintainers evaporate the electrolyte.
12. Older battery chargers may not be properly charging your battery, proper charging requires multiple steps.
13. Modern day batteries are made with calcium alloy to reduce gassing, however calcium makes batteries harder to recharge.
14. Maintenance free batteries will never need water added to them if used properly.
15. Never use starting batteries in deep cycle applications
16. You will never have more than 1 battery fail in a bank of multiple batteries unless something has gone wrong, such as hardware failure, operator error, or lack of maintenance.
17. If a battery goes dead, the battery owner is the only person that can answer why it went dead, because batteries can not discharge themselves unless they are left unmaintained for 6 to 12 months.
18. 90% of all batteries replaced within 2 years are simply in need of recharging.
19. Batteries are not designed to be discharged below 50%. Discharging below 50% drastically shortens life.



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SALES BULLETIN

SUBJECT: Available Power: Conductance in terms of CCAs

Midtronics testers and digital battery analyzers output the battery's relative power in CCAs at the end of the test. While this value is not the same as a CCA test, it is the best available measure for showing a battery's current condition versus its rating. The CCA measurement is intended to compare a battery's current capability to its rated capability. The CCA measurement is provided to answer the question, "how good is it?"

For reference, a CCA test does not produce an actual value, but is a pass/fail test. For example, a fully charged battery rated at 500 CCA must be able to produce 500 amps for 30 seconds at 0° F without falling below 1.2 volts per cell. If the battery voltage holds at 7.2 volts or above, the battery passes. Since the listed battery rating is a minimum performance criterion, batteries often have the capability to outperform their rating. This difference can be even greater when comparing batteries produced with different technologies. This is one reason the CCA measurement on a Midtronics tester can be significantly higher than the listed rating.

The CCA value shown at the end of a Midtronics test represents the battery's condition today in comparison to its rating, or original condition. On average, a new, fully charged battery would read 10-25% higher than its labeled rating when using a Midtronics tester. As the battery ages, the conductance CCA measurement will fall to near its rating and continue to decline until the battery fails.

In other words, a battery rated for 700 CCAs but measuring only 500 CCAs available power on a Midtronics tester is probably not stronger than a 500 CCA battery measuring at 475 CCAs in available power. In fact, the 700 CCA battery is failing to perform, while the 500 CCA battery has degraded, but is most likely still working.

It is Midtronics intention that the CCA reading be used to judge the remaining performance capability of the battery under test. **However, many battery resellers have chosen to use the measure to compare their battery to the competition and prove they deliver more power. This type of comparison is not technically accurate and is a misuse of a powerful measurement tool.**

There is a direct relationship between conductance and battery cranking capability, which means that in general, the higher the conductance CCA measurement, the better the cranking performance, when comparing batteries of similar chemistry and construction. If I measure a new 500 CCA battery and a new 700 CCA battery, the 700 CCA battery should always read higher. **However, when measuring two batteries to compare performance, there are several characteristics that could affect the CCA reading, including chemistry, box size, and construction. Different technologies can also be a significant factor. A difference in CCA readings caused by one or all of these reasons does not necessarily indicate a difference in cranking performance and should not be used to conclude that one battery is better than the other.**

For example, the electrolyte of a given battery can be adjusted to a higher specific gravity to produce additional cranking performance in a given size and plate count battery. However, this can also result in a shorter service life and is usually associated with poor reserve performance.

Because the CCA rating is a minimum performance criterion, you will find batteries rated at lower numbers that read exceedingly high. This is sometimes caused by a battery being underrated to make up for a stock shortage or production capacity deficiency in a particular group size and performance requirement. Since the manufacturer's obligation is to provide the minimum performance, this is an acceptable industry practice. However, it also makes it more difficult for any battery tester to provide an accurate analysis of the battery's condition and is not the most important factor for the battery reseller or consumer.

While the test algorithms for making a pass/fail decision take all of these variables into consideration, an unsuspecting consumer can be easily misled by the comparison. In general, a major difference in the CCA measurement when comparing one like battery (i.e. same technology, same construction) to another does reflect a difference in performance potential. In general, when purchasing batteries, the most important elements are:

Purchase your battery(s) from a supplier or salesperson with a proven history and reputation. As with most products, the person you are buying from is often more important than the product itself.

Choose the battery that provides the required cranking performance and maximum reserve capacity. In general, despite the allure of high cranking performance, the battery that can handle the rigors of everyday use usually has the most lead.

Will Sampson
ATC Business Unit Director

IS CONDUCTANCE TESTING USEFUL?

January 4, 2010 by kevin

Conductance testing is useful for determining the remaining life (or state of health, SOH) in a battery. Many battery distributors and service centers use conductance testing on a regular basis for this very purpose and warranty processing. However can conductance testing be used to establish a rating for a new battery?

According to Midtronics, a leader in conductance testing, no! To quote their website,

"The Midtronics CCA value derived from conductance does not, however, determine the actual Cold Cranking Amps of the battery because that test includes a lengthy discharge of 30 seconds at a very high current rate."

"The Midtronics CCA values are designed simply to mimic the initial starting characteristics of new batteries with a given CCA rating under the same operating conditions."

For example, if a battery that is rated at 600 CCA is measured at 500 CCA, it can be thought of as having similar starting characteristics of a new battery having a rating of 500 CCA if that battery is substituted with the test battery. It does not mean that the battery will pass a Cold Cranking Test at 500 CCA. It should also be remembered that the cranking power of all batteries increases with temperature and decreases with discharge and degradation."

In talking with one of their engineers at the recent AAPEX show in Las Vegas and going through a demonstration of their product, it was clear that the Midtronics unit is not designed to set the CCA number, only to estimate it given a standard. You enter the factory rated CCA data into the Midtronics machine and the machine returns a CCA that represents the battery's state of health.

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Again to quote the Midtronics website:

- Since the qualitative conductance test requires a standard, how can that standard be established?

"The most effective method for the establishment of a standard requires the performance of a timed discharge test to locate a cell or battery that performs to 100% of the rated discharge capacity. A conductance test can then be performed and a reference established. A sample of 30 or more new batteries can also be used to establish a standard. Without a set reference value, conductance testing can still be utilized to trend state of health, as batteries can be monitored through periodic conductance readings and the observation of deterioration over time."

What is said above corresponds to what is said here by the BCI:

"Ohmic measurements are not a substitute for capacity testing and cannot be used to predict absolute capacity values." For full text, see bci_ohmicreadings.pdf

For these reasons XS Power does not use conductance testing to rate our batteries. Instead we use the BCI method of timed high rate discharge and have equipment in house to verify it.

XS Power sells the highest performance AGM batteries on the market. They are built with lead-tin technology which is the highest energy density among the AGM chemistries. When it comes to buying a real racing battery go with the same battery other winners are using right now, go with XS Power!