

Frequently asked Questions about EarthX Lithium Batteries

Captured 17 March 2014 at

<http://tinyurl.com/nxzf7r2>

The following is a list of the most frequently asked questions. However, if you have a question that does not appear on this list, please contact us at (970) 301-6064.

What is the difference between PCA and CCA

Unlike Cold Cranking Ampere (CCA), the Pulse Cranking Ampere (PCA) rating does not have an “official” definition by the automotive industry. CCA tests are done at 0 deg F with a 30 second discharge time which is unrealistic for most motorsport vehicles. PCA is a measure of battery discharge amps for <10 seconds at 77 deg F (25 deg C). Our manual shows the CCA and PCA rating of each battery. The CCA rating is most important for snowmobiles due to the colder temperatures.

Bob Nuckolls- In other words, the 'ratings' for comparative performance are meaningless. Lord Kelvin reminded us of the necessity of having measurements to advance thinking to the level of science. Professor Lewin of MIT reminds us that any number cited without knowing its degree of uncertainty is also meaningless when discussing the science of things.

The paragraph above is perfectly suited to the selling of laundry soap but completely inadequate for assessing the value of these batteries aboard an airplane . . . ESPECIALLY one that's electrically dependent.

Will the battery work in my snowmobile when is it in extreme cold? (less than 0 deg F?)

All batteries lose cranking amps in colder temperatures. Every make, model, and year of vehicles has different amounts of cranking amps needed to turn the engine over. You also have to factor in the health and maintenance of the vehicle as well. So the answer is..... it depends. Some vehicles have no issues starting at -25F while some could have issues at -5F. What is unique about a lithium battery is you can warm the internal components by simply trying to start your vehicle. Do not try starting your vehicle for more than 10 seconds per minute as that is not good for your vehicle or battery, but after attempting to start the vehicle, wait one minute, try again. Depending on the amount of warming up needed to get the desired cranking amps, the amount of times needed to do this varies.

How does the “EqAh” capacity rating compare to lead-acid Ah ratings

Our ratings are shown as the lead-acid equivalent (EqAh). In performance and real life usability for lead acids that are vehicle starter batteries, lead acid batteries can only use 30% of the stated amp hours or stated as “30% depth of discharge”. So only 30% of its amp hours are usable, whereas lithium batteries have a 100% depth of discharge. For example, our ETX24 is a replacement for an YTX20 Yuasa series, which has 18ah of capacity. The amount of actual useable amp hour is $(18\text{ah} \times .3 = 5.4\text{ah})$. We use a 7.4ah cell in our ETX24 which is actually 2 amp hours MORE than the lead acid battery we are replacing. Another example is our ETX18 which is a replacement for the YTX14AH-BS. This has an actual amp hour of 12ah. So the amount of useable amp hour is $(12\text{ah} \times .3 = 3.6\text{ah})$. We use a 5ah cell which is 1.4ah MORE than the lead acid battery we are replacing.

BN- This paragraph is full of inaccuracies and technobabble. Lead-Acid equivalency? Marketing hype pulled from where the sun doesn't shine. The term 'ampere-hour' is exceedingly vague. If you go look up Watt-second, Kg, meter, Volt, or Joule in the scientific literature, you will find internationally recognized, inarguable definitions for said terms. No such definition exists for Ampere-hour.

Even those who would purport to explain the term on the 'net don't understand it. For example:

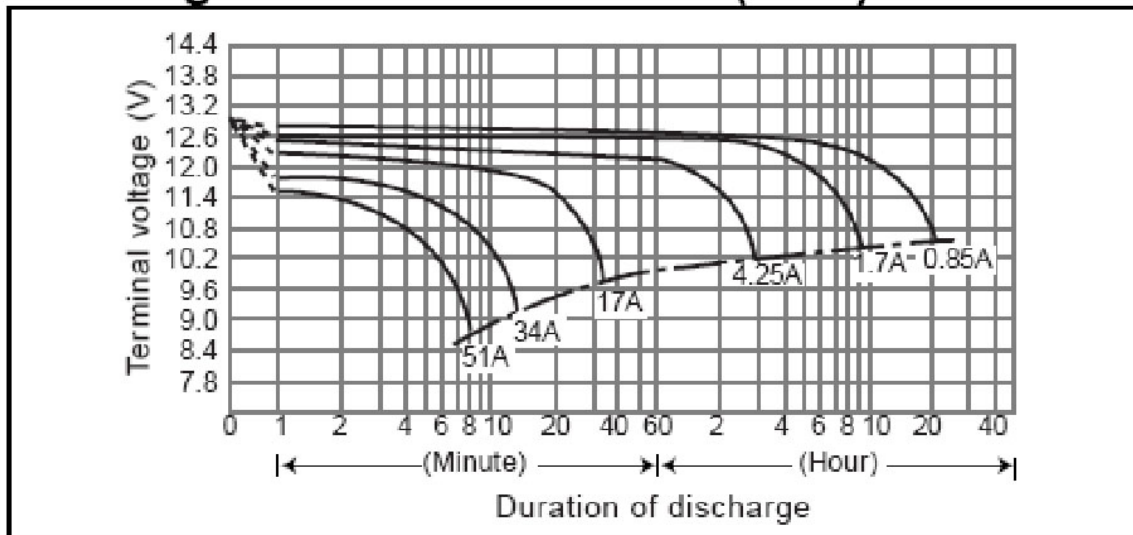
<http://tinyurl.com/97dtr8s>

An ampere hour (abbreviated Ah, or sometimes amp hour) is the amount of energy charge in a [battery](#) that will allow one [ampere](#) of [current](#) to flow for one hour.

A milliampere hour (mAh) is 1,000th of an Ah, and is commonly used as a measure of charge in portable computer batteries. The mAh provides an indication of how long the PC will operate on its battery without having to recharge it.

BN- The aH rating of a cell is all over the place depending on how the cell is loaded. I've published graphical data that looks like this countless times over the years . . .

Discharge characteristics 77°F (25°C) (Note)



*In the chart above we see that a particular sample of 12V battery discharged at a .85A rate produces output at or above 10.8v for a period of 20 hours . . .hence a "20 Ah" rating. But discharge at any other rate and you get different numbers. The Ampere-hour number is a **PERFORMANCE** benchmark for a particular product under a particular set of circumstances and is only loosely related to **ENERGY** available from the battery.*

So, to speak of Ampere-hour ratings of two different chemistries of two different functional qualities is meaningless.

The paragraph does state a 5 Ah performance rating for 'their cells' . . . which is interesting. Now, if they would only publish a graph not unlike that shown above, perhaps that 5 Ah number could be given some real meaning.

What is the warranty period?

Our Lithium batteries include a two year warranty that is not pro-rated for manufacturer defects.

Can I "jump" a lithium battery from an automobile?

NO. It is not a good idea to "jump" a motorsport battery from a car or truck. It is much better to re-charge it if at all possible. On the top of each battery is a label that will specify the maximum amount of charging amps to use and a "jump" start is about 150X more amperage than maximum amperage recommended, if not more. ***This can cause the***

cells to rupture and even catch on fire. Again, do not jump start a motorsport battery from an automobile!

BN- Rupture? Catch on fire? Say what? Okay, so I've just had a hard start in my airplane. With the engine running, I flip on the alternator switch . . . exactly how does it happen that my 60A alternator knows not to exceed the rated charging amps for the lithium battery?

Can I “jump” start a lithium battery from one power sport vehicle to another? Yes, like sized batteries are no issue.

What maintenance is required?

Lithium batteries require no maintenance such as adding liquid, worrying about freezing in subzero temperature, or the heat of summer damaging them. Just be sure the terminal connections are tight and free of corrosion. If you have a vehicle that has a drain even if the key is off, (Harley's definitely do) then you will need to charge them every 2 months of inactivity by putting a charger on for 2 hours or less, however long it takes for the green light.

What is the cause of a sudden battery failure?

If your battery suddenly stops working, it may just need to be charged. A Lithium battery's voltage remains relatively constant while discharging, but when the battery runs out of power it does so abruptly. Our BMS is designed to disconnect the flow of current in the event of over discharge or over charge situations. If the voltage is reading 0 volts, the loop has been disconnected and needs to be reconnected by being put on a charger. The moment current flows through the battery, the loop will be reconnected again. Try charging the battery for up to 3 hours at 2 Amps. If the battery still does not work, or the measured voltage is less than 8V, the battery is permanently damaged and needs to be replaced.

BN- A BMS . . . This line of products includes a battery management system? Exactly how does it perform? Is it in series with the cell structure and effects some kind of disconnect from the external terminals based on some assessment of external forces? How do I incorporate the existence of this feature into my Failure Modes Effects Analysis?

How do I know when the battery is fully charged?

You must use a modern smart charger. These types of chargers will turn off automatically when the battery is fully charged. While the charger is in operation, it will output approximately 13.8 -14.7 volts. A fully charged lithium battery will measure 13.2 to 14.5 volts.

The battery does not seem to charge or hold a charge, why?

If a battery does not seem to charge or perform as well as it once did, it may be for one or more of the following issues:

- There may be a problem with the charging system. While the charging system is in operation, it will begin putting out approximately 13.8 -14.7 volts.
- The vehicle electrical system may have a short circuit or current drain
- The terminals on the battery are not properly tightened

Why does cold weather cause starting problems?

Lithium batteries and lead acid batteries internal resistance increases as the temperature decreases, so the battery will put out fewer amps in cold weather.

What is the normal charge rate?

Anything less than 10 amp hours. Most power sport chargers are 2 amp hours or less.

BN- This is embarrassing . . . an "Ampere-hour" rating on a charger? First they use the term in an apples-oranges comparison of two different chemistries then they repeat the error in a totally different context.

Can the battery be installed in any position?

Yes, Lithium battery can be installed in any position for they are a dry cell technology.

How do I know if my battery charger is working ok

These newer fully automatic chargers need to be hooked up to a battery before they will output any voltage. This is primarily a safety feature that prevents spark when hooked up, and protects the charger against reverse polarity hookup. Some chargers need to see as much as 5.5 volts before they recognize that they are attached to a battery. Once the charger is hooked up, it should output 14.2-14.7 volts. If your charger does not do this, you may want to contact the manufacturer for further troubleshooting tips.

Is it safe to hook up the battery to a charger and walk away? No. As with any battery being charged it is best not to do this in the event of a faulty charger. Follow these safety tip for charging ANY type of battery.

- Never leave the battery or the toy unattended when recharging it.
- When charging a battery, place it on a non-flammable, and remove any flammable items nearby.
- Unplug chargers from the toy always after the battery reaches full charge.
- Disconnect chargers from electrical outlets when these are not in use.

BN- Wait a minute . . . place in a fire-safe environment, sit around and watch for unwelcome behaviors while the battery is being charged? I can't imagine even the snowmobile and motorcycle folks signing up to these admonitions.

How do I know if my vehicle charging system is working ok

Connect a voltmeter to the battery. Measure the voltage before the vehicle is started and shortly after. The voltage should increase after the vehicle is started, to approximately 13.8 – 14.7 volts. If your charging system does not output a voltage higher than the battery, there may be a problem with the charging system.

How often should I charge the battery?

Only when needed. Due to lithium batteries extremely low self-discharge rate, less than 50% of its charge is lost over a 6 month period, so you may not have to charge your battery before the season starts! If the vehicle cranks over, then all is good.

My battery won't charge after being deeply discharged?

If you fully discharge the battery (voltage reading is less than 8 volts), you need to re-charge it ASAP. If your charger, when connected, does not want to “turn on” it may be because the charger has a protection feature that does not allow it to charge a “dead” battery. Other chargers may not charge as “normal” but may trickle charge the battery until the battery voltage increases to a normal level (>8 volts). In cases like these the charger may have to be connected for 24 hours or so just to charge the battery to a level where the charger is allowed to charge at normal charging current levels.

BN- So if I go off and leave the master switch ON, odds are that by the time I get back to fly again, my battery is trash? I take it that their BMS does not manage auto-disconnect to protect cells from over-discharge?

How should I dispose a Lithium Battery?

A lithium battery should be fully discharged before disposal. Lithium batteries are classified by the federal government as non-hazardous waste and are safe for disposal in the normal municipal waste stream. These batteries, however, do contain recyclable materials and are accepted for recycling by the Rechargeable Battery Recycling Corporation's (RBRC) Battery Recycling Program. Go to the RBRC website at www.rbrc.org for additional information.

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