WHITE PAPER

POWER SONIC
TRUSTED BATTERY SOLUTIONS

LITHIUM CRANKING AMPS

Lithium Iron Phosphate, often referred to as LiFePO4, – the chemistry for Power Sonic's Lithium Power Sport batteries – has only been around since 1996. Although it is the newest lithium chemistry, it is still the most common choice for lithium starter batteries.

When selecting your lithium starter battery, you will notice there is oftentimes not a Cold Cranking Amps (CCA) rating listed for the battery like you would expect with an SLA battery. In the What is CCA on a motorcycle battery part 2 of our trilogy on CCA blog, we covered the reasons why CCAs aren't exactly applicable to power sport applications. Going one step further as we talk about lithium batteries within power sport applications, we can see that the automotive standards for CCA testing cannot be conducted on a lithium battery.

You might be thinking, "does this mean my lithium battery won't work in cold weather?!" The simple answer is, "No." The long answer is that automotive testing of CCAs do not apply to lithium and there is currently no standard related to lithium.

CONTINUOUS POWER FROM LITHIUM

Don't be worried about the lack of standards for lithium, because there are other factors that we can use to evaluate the two chemistries. For example, lithium delivers a continuous amount of voltage across its cycle, unlike SLA batteries whose voltage is dependent on its state of charge (SOC). This means the lithium battery can deliver the same amount of power at 5% discharge as it can at 95% discharge, which shows how the voltage aspect of testing isn't relevant to lithium batteries since the voltage isn't dictated by the SOC. You can learn more about constant power in lithium batteries in The Complete Guide to Lithium vs Lead Acid Batteries blog.

CONTINUOUS CRANKING AMPS

What is oftentimes tested in lithium batteries is continuous cranking amps. In our Hyper Sport Pro line, this testing is conducted after the battery has been kept at -20°C for 20 hours, and then tested with continuous current for 15 seconds. As you may remember, the JIS standard checks for voltage after 5 seconds and is only conducted at -10°C and is specifically intended for SLA batteries, not lithium.

This means that continuous cranking amps, especially when conducted at cold temperatures, are still a good indication of the cold cranking amps the battery is capable of providing. Is it also important to note that when checking out "CCA" ratings on batteries, that you clarify if they mean "continuous cranking amps" or "cold cranking amps", and to even check how they are being tested. As indicated above, there is no true standard for cold cranking amp or continuous cranking amp testing for lithium batteries. This leaves it up to the battery manufacturers to decide how they want to test their batteries.

LITHIUM BATTERIES IN COLD WEATHER

There is a downside to lithium - it is limited by cold weather. Its capacity and life are affected in the same way as SLA – as the temperature goes down, capacity goes down, and cycle life is extended. But, while lithium can discharge in cold temperatures (-20°C or -4°F), the lowest it can charge is at freezing point (0°C or 32°F). That being said, it is highly unlikely you will be charging your lithium starter battery outside in the winter. You'll likely be charging it inside your garage, where the temperature will be above freezing.

GLOBAL HEADQUARTERS
(USA AND INTERNATIONAL EXCLUDING EMEA)
Power-Sonic Corporation
365 Cabela Dr Suite 300,
Reno, Nevada 89523
USA
T: +1 619 661 2020
E: customer-service@power-sonic.com

POWER-SONIC EMEA
(EMEA – EUROPE, MIDDLE EAST AND AFRICA)
Smitspol 4, 3861 RS Nijkerk,
The Netherlands
T NL: + 31 33 7410 700
T UK: + 44 1268 560 686
T FR: + 33 344 32 18 17
E: salesEMEA@power-sonic.com

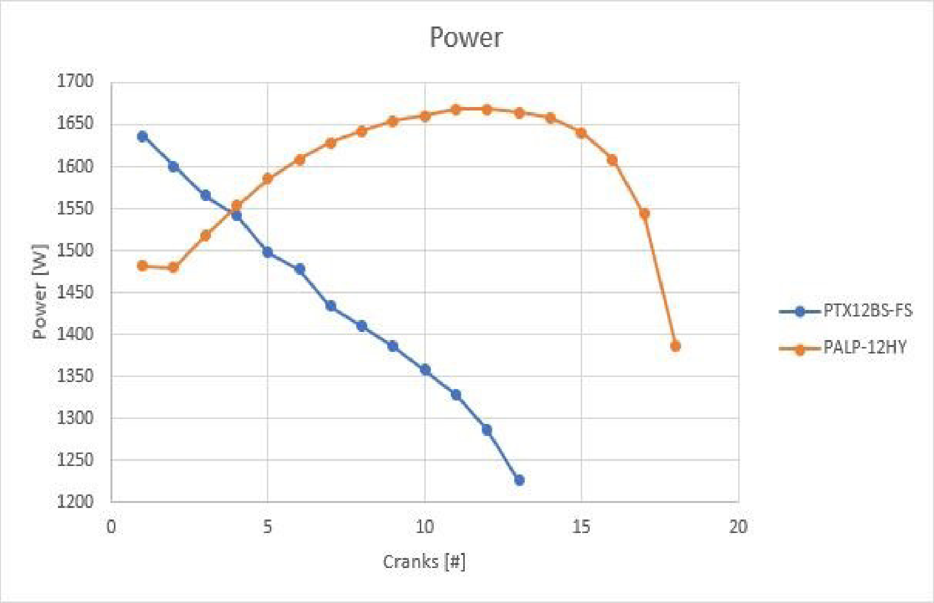
LITHIUM CRANKING AMPS

LITHIUM BATTERY CRANKING

In part 2 of our CCA trilogy blog, we discussed continuous current with SLA starter batteries. The test for 5-second continuous current is to allow for enough time for the motorcycle's engine to start, and provides the cranking power to turn the engine over. See the graph below to examine lithium's constant power delivery versus SLA, over the number of cranks each had before needing to be charged again. What you see below in the graph is power (measured in Watts) as it is delivered over several cranks. The power equation is P=VI where P is Power, V is Voltage, and I is Current. One crank cycle is 5 seconds of power delivered to turn over an engine.

The testing method for the data shown in the graph below was a 5 second crank, waiting a short time, performing another crank, waiting a short time, etc. The test was conducted with an ambient temperature around 60° Fahrenheit.

With the lead battery (the blue line), each crank is removing energy from the battery, and the voltage is dropping as the energy is being removed. This causes a reduction in the available power in the next crank and eventually the lead acid battery cannot crank anymore. With the lithium battery (the orange line), the energy is also being removed but the voltage doesn't drop. So, in the lithium battery, each crank will deliver approximately the same amount of power. In the first few cranks on the lithium, what you are seeing is the lithium battery actually self-heating itself, which is beneficial in colder temperatures as heat increases the capacity and performance of the battery. It is important to note that SLA doesn't perform this way. Often times, when it is cold with a lithium battery you'll see it recommended to turn on the headlight on your bike before cranking – this is to help the battery warm up as opposed to the crank-warming you're seeing below.



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As the SLA battery drops in voltage during discharge, it is losing power. As you can see going from crank to crank, the SLA battery will deliver less power with each crank. In fact, it loses 25% of it's power an may not be able to turn over the engine after 12 cranks. In lithium, the battery provides constant voltage across the discharge which means it provides the same amount of power from the first crank through to the last crank before needing to be charged again.

CHARGING & SELF-DISCHARGE

In addition to the constant power delivery of the lithium battery, the lithium battery will also be able to provide more cranking cycles between charging than the SLA battery. Referring back to the earlier chart, you can see how the SLA battery performed 30% less cranks than the lithium battery, with the SLA battery losing power along the way. This means the lithium battery will need to be charged less often than an SLA battery.

SLA will self-discharge ten times more each month than the equivalent lithium battery. So, if you take your dirt bike out a few times in April, and don't ride it again until mid-July, the SLA battery will have discharged with use and will have additional self-discharge from sitting while not in use. The lithium battery doesn't suffer from this same fate, and doesn't require trickle or float charging between long periods of storage to stay at a higher level of SOC.

In light of not having a standard for cold cranking amp testing in a lithium setting, the apples-to-apples comparison between SLA and Lithium performance is a good real-world test of which battery ultimately performs better.

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USA
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T FR: + 33 344 32 18 17
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