

DATE: November-7-18

FROM: Discover Engineering

Discover Energy Corp.

RE:

- Using conductance meters/testers to determine or validate battery specifications or performance
- Using conductance meters/tester to determine battery state-of-health or end-of-life.

Conductance testers were developed to help field engineers and service technicians measure internal resistance and the changes in resistance *“over time”* to help predict state-of-health and end-of-life characteristics in the stationary battery market.

In this case base line resistance values are always established during the installation and commissioning of the battery (battery bank). Service techs compared readings during regular maintenance against the base line values to measure the growth in internal resistance to establish state-of-health and to help predict end-of-life.

To avoid the necessary service time and costs of properly testing a battery according to industry established standards (charging and load testing), conductance testers were re-purposed and introduced to the mass-merchandise and retail transportation battery market segment as a way to quickly test a battery for end-of-life characteristics and to process warranty claims. This was a mistake when it was introduced and remains a mistake today as retailers seldom if ever are charging the battery before performing the test and batteries are being warranted or changed out that are simply discharged.

The only way conductance testers can be used in the automotive market segment— even with a low level of confidence – is by establishing base line values on the product being used, and that can be used to compare against when performing future maintenance testing. For large fleet operators that means testing the batteries when first installed, recording those values and then being sure to use the same test meter (for calibration) when performing scheduled maintenance. All batteries must still be fully charged before testing.

OVERVIEW

The purpose of this memorandum is to clarify Discover Energy's position on the effectiveness and accuracy of conductance testers to evaluate the battery performance vs specifications of Discover FLOODED, AGM or GEL batteries, or to compare the performance and specifications of Discover's batteries vs similar competitor products.

Discover Energy has tested numerous models of conductance testers that claimed to determine a batteries performance capacities and life status. Testing included tests performed on new batteries just of the production line; batteries newly arrived to distribution facilities; on aged inventory models, and on batteries from the field know to be good and bad. Tests were performed and compared on Discover and competitor brand products with similar specifications.

Corresponding, tests were performed in accordance with BCI, DIN, IEC and JIS industry standards utilizing proper charge procedures and calibrated carbon-pile load testers to develop base line values.

CONCLUSION

Discover Energy has determined that there is no meaningful correlation between the readings given by these conductance testers and the batteries' designed performance ability in amp hours, reserve minutes and particularly its cold cranking ability. Further there is no correlation between the test results produced by the conductance meters and the tests performed using industry recognized test procedures and test equipment.

This comes as no surprise as in fact, conductance meters were not designed to – nor are they capable of – determine performance capabilities in new or aged batteries. While they may seem to work on one type of battery, they give false readings on another. Most conductance meter algorithms are based upon a particular battery design. When the same meter is used to test a battery with a different design with different internal components these same test meters provide different and inaccurate results that often lead to accusatory (and unnecessary) discussions between customers and sellers.

Since conductance meters are based on measuring internal resistance, lower internal resistance battery designs generate higher cold cranking amp readings. In fact, much higher quality batteries that utilize higher quality separators and non-woven fabric scrim on the active material paste of the positive and negative plates to improve structural and cyclic stability test worse than batteries that do not use these advanced components. While these batteries are built with higher cost components that enhance and sustain life many receive "fail" readings on these conductance testers because these same components increase internal resistance.

To highlight further the fact that these meters measure internal resistance, users can perform a simple test in the field. Take a new or slightly used battery. Fully charge it, and then perform a so called CCA test on it using any brand of conductance meter and note the results. Now take that same battery (you do not even need to charge it again) and perform a carbon pile load test on it using industry standard procedures. Follow this test with another conductance meter test without charging the battery first. In virtually every instance the second conductance meter test will be higher than the first because the batteries internal resistance is now lower.

Proper load testers are not simply measuring internal resistance. Load testers are actually drawing current through the battery and in doing so they are causing an electro-chemical reaction that acts against the symptoms of acid stratification inside the battery which affects the batteries internal resistance. (more and in-depth information on acid stratification can be found in the technical resources section of our web site.)

- CONDUCTANCE TESTERS DO NOT AND CAN NOT RELIABLY PASS/FAIL BATTERIES THAT ARE SIMPLY DISCHARGED.
- CONDUCTANCE TESTERS CANNOT RELIABLY MEASURE AMP-HOUR, RESERVE CAPACITY OR COLD CRANKING SPECIFICATIONS.
- CONDUCTANCE TESTERS CANNOT RELIABLY BE USED TO COMPARE AMP-HOUR OR COLD CRANKING PERFORMANCE ACROSS COMPETITORS BRANDS.

FINALLY

When used on batteries already in service - and that have been charged before testing - conductance meters can be a good quick option for determining a batteries state of health.

Conductance testers are not as good at testing a battery as a tester with the ability to put a proper discharge load on the battery in accordance with industry standard practices.

Therefore, as determined by our testing to date, Discover Energy Corp. does not consider readings given by these testers as accurate and will continue (until further notice) to rely solely upon the published industry standard tests to determine new battery ratings and in field battery performance.