

IEEE Stationary Battery Committee
NERC Task Force Report
Part of IEEE Power & Energy Society

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At the most recent meeting of the IEEE Battery Standards Committee Meeting in January of this year concerns were registered over statements contained in the proposed NERC Document PRC-005-2 Protection System Maintenance.

As a result of these concerns, a special task force (herein referred to as ***the task force***) was formed to study the details of PRC-005-2 as it relates to stationary batteries. This task force is composed of a number of members who are recognized representatives of battery manufacturers, battery charger manufacturers, ohmic measurement and battery monitoring equipment manufacturers, battery testing companies and functional entities (nuclear, power generation and substation).

We recognize that the document is intended to address reliability issues for protection and control circuits for the Bulk Electric System [BES], but because of the integral role played by the stationary batteries, they have been included under the expanded scope of the DC power supply section.

If we understand the objective of the PRC document, it is to lay out a baseline standard that ensures that all components identified within the scope of the standard are capable of performing as expected in a worst case condition and verified by periodic maintenance that includes testing and/or measurements as defined for batteries in Tables 1-4(a) through 1-4(f).

A common thread is that the functional entity employing this Protection System Maintenance Program (PSMP) “verifies” that the functional components (in this case, the battery) “can perform as designed.” This is confirmed by the wording at the end of the section describing maintenance activities for the VLA wet cell in Table 1-4(a), the VRLA “sealed” cell in Table 1-4(b) and the Nickel Cadmium cell in Table 1-4(c).

If we read the document correctly, there seems to be an implication that ohmic measurements can act as an alternative to capacity testing to determine that the battery will “perform as designed.” It appears that support for this position is confirmed in the *Supplementary Reference and FAQ* where on pages 80 and 81 discussion is made with respect to “two acceptable methods for proving that a station lead acid battery can perform as designed.”

Reference is made to EPRI technical reports and application guides and certain IEEE battery standards. The IEEE Battery Standard Committee Guidelines of 450 (VLA), 1188 (VRLA) and 1106 (Ni-Cd) are referenced specifically. The specific EPRI technical reports are not referenced in Section 15.4; however, one of the most widely referenced EPRI documents is 1002925 for “Stationary Battery Monitoring by Internal Ohmic Measurements.” It is the foundational basis for a paper given by Eddie Davis and Dan Funk of the Edan Engineering Corporation and Wayne Johnson of EPRI at the Battcon 2002 conference.

In the EPRI document under Section 13.4 on page 13-6 the conclusion is given: *“Internal ohmic measurements have the ability to identify degradation in individual cells. Although the internal ohmic measurements can identify low capacity cells (which is certainly valuable), the technology does not precisely predict overall battery capacity. Important backup power applications should still be confirmed by periodic battery capacity tests.”*

In the concluding remarks of the 2002 Battcon paper, the statement is fortified: *“This does not really imply a shortcoming of internal ohmic measurement technology, but it does mean that we will likely be limited to identifying good or bad cells rather than making claims that a certain internal resistance indicates a particular cell capacity.”*

In addition to the EPRI report and the Battcon paper there are several other papers that have been written on ohmic measurement testing. All draw the same conclusion. Several leading US and European battery manufacturers have weighed in on the subject through white papers and/or operating instructions. Four examples are given below:

“Ohmic measurements are not a substitute for capacity testing and should not be used to predict absolute capacity values” – EnerSys white paper entitled “Ohmic Measurements as a Maintenance Tool for Lead Acid Stationary Cells.”

“In summary, internal ohmic testing can be a valuable tool to assist in diagnosing batteries, but it is important to understand what the measurement value represents and know the limitations. . . . The only surefire way to tell the battery’s true health and whether or not the batteries will provide sufficient capacity to fully support the system load is through a measured capacity discharge test.” – C&D Technologies white paper entitled “Impedance (Conductance) Readings,” 2009.

“Responsible ohmic device manufacturers acknowledge that there is no direct relationship between percent ohmic change from baseline and battery capacity” – GNB Installation and Operating Instructions for ABSOLYTE GP Batteries, 2010.

Right now the current state of technology of ohmic testing has significant value in monitoring the trend of changes within individual cells or continuity in a battery string. But if performance or capacity has to be verified, the only true methodology at this point in time is a capacity or performance test.” – Hoppecke in a paper entitled “Ohmic Measurements as a Tool for Determining Capacity of a Stationary Lead-Acid Battery,” 2012.

In conclusion, **the task force** wishes to make the following points and recommendations:

1. **The task force** in no way wants to instruct the NERC PRC 005 Standard Drafting Team (SDT) on how it should write its standard. It would welcome the opportunity of assigning a representative from our membership to participate with the SDT going forward as it relates to appropriate battery testing and maintenance.
2. **The task force** recognizes that many functional entities are looking for a way to reduce costs through reduced manual maintenance and testing equipment related expenses. However, economic or risk-management decisions should be based upon just that, i.e. the economic or risk factors; and not justified by the use of unproven or misleading interpretation of data.
3. **The task force** believes strongly, and is supported by the vast majority of battery manufacturers and ohmic measurement testers, as well as from papers and the study of the closest correlation testing published to date, that ohmic measurement testing cannot serve as a substitute for capacity testing if the true reliability of the battery is to be measured against the statement that the battery “can perform as designed.” Capacity testing is the only way to confirm that the battery will perform as designed.
4. Therefore, to ensure the highest reliability of a stationary battery system, load testing per IEEE guidelines is recommended. We appreciate that there are installations where the economics are such that load testing may not be a viable option. However, the functional entity must recognize that some level of reliability will be sacrificed if other analytical techniques such as ohmic testing are used in lieu of load testing.
5. It is the opinion of **the task force** that ohmic testing alone is not sufficient to achieve the required reliability of the BES.
6. We recommend that language to that effect be clearly established in the revised draft of PRC-005-2.

Respectfully,

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