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WHITE PAPER

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Revision History

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The IEEE versus NERC

I frequently get asked, "what is the difference between the Institute of Electrical and Electronics Engineers (IEEE) stationary battery maintenance standards and those promulgated by the North American Electric Reliability Corporation (NERC) in PRC-005?" My stock answer is, "lots."

First of all, a little bit of history and a lot of acronyms. In 2003, the Northeast of the Unites States and parts of Canada suffered a massive blackout which demonstrated the vulnerability of the National Bulk Electrical System (BES). As a result, the Federal Electrical Reliability Commission (FERC) established the Electrical Reliability Organization (ERO). The ERO gave responsibility to the National Electric Reliability Corporation (NERC) to come up with standards that were intended to improve the reliability of the BES.

One of these standards was a document titled Protection Systems and Control (PRC) 005 or to use the original full title, the Transmission and Generation Protection System Maintenance and Testing. The first draft was put together in 2005, and after several revisions, arrived at PRC-005-02 in November of 2012. Prior to this, and since PRC-005 contained a large section regarding stationary battery maintenance, in January of 2012, the IEEE Power and Engineering Society Stationary Batter Committee (PES SBC) registered alarm at some of the content of PRC-005-02 (3rd Rev) and created a special task force to review the document. The PES SBC requested an invite to the next NERC System Protection and Control Task Force meeting. As a result, certain language in the document was modified and a Supplemental Guide/FAQ with battery information was added. The battery maintenance requirements of PRC-005 has not changed since PRC-005-02.

As this was going on, I gave a presentation to a turbine user's group annual conference in October of 2013. The title was "Battery Maintenance and Testing for NERC PRC-005-2 Compliance." Unbeknown to me, there was a reporter from the *Combined Cycle Journal* at the meeting, and they published an article in the next issue under the banner heading of "NERC, Industry not in Sync on Battery Testing." The opening paragraph stated that, "The bad news delivered by J. Allen Byrne to owner/operators attending the 7EA User Group's 2013 Conference, at least the way the CCJ editors interpreted it, was that the federal government apparently knows as much about battery maintenance and testing as it does about healthcare. However, in the case of batteries, there seems to be good news: The IEEE Power Engineering Society's Stationary Battery Committee created a special task force to review the government's work and share industry knowledge and experience to help assure that the desired regulatory objectives are achieved."
https://www.ccj-online.com/2q-2014/nerc-industry-not-in-synch-on-battery-testing/

Well, what were the major concerns and differences? The NERC battery maintenance requirements are contained within Tables 1-4(a) through 1-4(f) of PRC-005. These requirements have not changed since issue 02. It was basically a "what is the least we can get away with?" document. Below are only a few of the concerns:

Let's start with Visual Inspection.

A lot of information about a battery can be detected by the trained eye and knowing what to look for, such as:

- Physical damage
- Case leaks
- Post seal leaks
- Pressure relief valve leaks
- Case swelling
- Terminal corrosion
- Dirt accumulation
- The condition of ventilation and monitoring equipment

The IEEE recommends that a visual inspection be carried out monthly. PRC-005 only requires visual inspection every 4 months, and if you have a battery monitor, NEVER.

Next, let's look at Test Measurements.

The IEEE recommends these quarterly measurements in addition to those taken monthly:

- Cell/unit internal ohmic values*
- Temperature of the negative terminal of each cell/unit
- Voltage of each cell/unit
- Electrolyte temperature of 10% of the battery cells where applicable

*PRC-005 only requires this on an 18-month basis. The others, never.

Further, the IEEE recommends these yearly measurements in addition to those taken monthly and quarterly:

- Structural integrity of the battery rack or cabinet*
- Cell-to-cell and terminal connection resistance of the entire battery. Re-torque if any readings are outside manufacturer's specifications*
- AC ripple current and/or voltage imposed on the battery

* PRC-005 only requires these on an 18-month basis, AC ripple, never.

Ohmic Measurements.

IEEE Std. 1491-2012 defines Internal Ohmic Measurement as "a measurement of the electronic and ionic conduction path within a cell or unit, using terms defining conditions commonly known as impedance, conductance, or resistance."

- There are three Basic Types of Battery Internal Ohmic Values:
  - Resistance
  - Conductance
  - Impedance

Can any of these be a substitute to load testing?

Ohmic measurement, although fairly accurate (90% plus) cannot determine with full certainty a battery's state of health. The only really accurate method to establish this is a full load test using either the battery's actual load or a load bank.

- A load test is a battery discharge test that may be required to:
  - Determine if the battery will meet the battery duty cycle
  - Determine if there is problem with a battery
  - Confirm that other indicators are correct in indicating that there is a problem with a battery

The IEEE does make load testing recommendations but the requirement for a full load test is often a judgment call by the battery owner and may depend upon the criticality of the battery.

The IEEE says:

- Ohmic measurements are not a substitute for capacity testing and cannot be used to predict absolute capacity values.
- Ohmic measurements can be used as a trending tool to identify cells that may require further evaluation. When significant changes from the baseline occur, capacity testing should be used to verify whether identified cells are in fact defective.
  - NOTE. The determination of a significant change is open to interpretation. Significance is determined by the application and the battery model. The user should contact the battery manufacturer and test equipment manufacturer to determine what is a significant change for the specific application.

Like all the various battery codes, standards, methods and practices, many are conflicting and are often open to interpretation. That is why Eagle Eye Power Solutions has, on staff, individuals who are knowledgeable on the subject and can help our business partners navigate through what is often a confusing but critical requirement. To quote a former colleague, "the nice thing about battery codes and standards, is that there are so many to choose from."

If you want to fully comply with PRC-005 then your best bet is to install a suitable battery monitor. As stated in PRC-005m Table 1-4(f) titled "Exclusions for Protection System Station DC Supply Monitoring Devices and Systems," one basically will comply with the NERC requirements, and you don't have to do anything else. You will also need an electrolyte level device.

If you want to have a battery that you can rely on, stick with IEEE Std. 450 for VLA, IEEE Std. 1188 for VRLA, and IEEE Std. 1106 for NiCd.

Disclaimer.

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