Improving Power System Dependability Through Battery Surveillance and Management

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The installation of uninterruptible power supplies (UPS) or other back-up power systems are typically a forgotten piece of insurance for Maintenance, Facility, or Operations Managers to ensure operational integrity despite fluctuations in commercial AC power. Often, these systems are activated without much thought or consideration given to one key element in most systems: the batteries. Most system options include battery systems as the primary device for storage of the critical electrical energy that is supplied upon loss of the mains feed. Because of the growth of communications systems, electronic commerce opportunities, and an "information on demand" culture, more and more UPS systems, and therefore stationary batteries have been deployed in ever increasing numbers by a wide variety of organizations.

Due to these installations, battery testing and/or monitoring has become a key element of a proper power maintenance regime. In the past, this routine has included regular battery discharge (also known as load, capacity or rundown) testing. This testing, while quite conclusive in terms of evaluating the battery systems' ability to deliver its designed power *at a given moment*, can be somewhat impractical for modern operations given the logistics, time and resources required (not to mention the expertise and safety precautions). To address these weaknesses, electronic testing and monitoring technology (with roots and a proven history back to the 1970s) has been enhanced with cutting edge electronics to offer an effective alternative to the burdensome qualities of battery discharge testing. A leader among this electronic technology has been the measurement of electrical conductance to determine the battery's ability to deliver power.

Battery conductance is a measurement of a battery's ability to produce current/power. It is calculated and measured through the injection of an AC signal of a pre-determined level, and capturing and assessing the conducted yield. The resultant output is then analyzed and produces a numeric value in the form of either Siemens or Mhos (the reverse of Ohms, the measure of resistance rather than conductance). Conductance can be also described as the equivalent measurement/approximation of the battery plate and reaction sites/surface area available within the battery for chemical reaction and exchange, an established predictor of the potential for supplied power from the battery. Through the standard aging/degradation and use process, the battery's plate surface will form sulfate, shed active material, and can be altered chemically; conversions that adversely affect the battery's ability to perform. This expected aging/degradation process forces battery conductance to decrease gradually as the battery service life is consumed, and therefore a predictive trending pattern can be established.

Using a conductance based system for effective battery management can take many forms. The most common is manual testing through the use of a conductance based battery analyzer, like the Midtronics Celltron® Ultra. This approach is best suited for applications where field engineers are available to survey the battery site and make the simple measurements with the analyzer on a scheduled basis.

For other applications where staff is unavailable or systems are too plentiful to be managed practically by personnel, an automated remote monitoring application is justified. A monitoring system should of course have at its foundation an conductance measurement capability to capture battery state of health trends, but since the system is physically installed and can measure on a more frequent basis, it should capture additional variables, most importantly block/jar level temperature. Measuring temperature is key for the advanced notification of severe battery malfunction, in the form of a thermal runaway event, especially in the context of a discharge. Beyond temperature, measurement of inter-cell connection integrity, jar voltage and system discharge current are all possible through the use of an installed monitoring system. A system such as the CellGuard™ system can provide these benefits to the user with simplified installation.

Beyond these equipment options, management software to capture and analyze the data produced is also essential to an effective program. A software system that is flexible enough to manage data from multiple systems in different locations as well as from either a testing program or a monitoring installation is preferable as this allows scalability should different methods be employed in the future. Additionally, software that is server-based (an enterprise architecture) is more effective from a data collection, retention and availability standpoint.

Applying one or all of these tools in an effective program will ensure not only reliability of the battery and power system, but can provide cost-savings as well. These benefits will drive peace of mind throughout the organization!