BTRM White Paper

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Lead acid batteries are the most frequently used batteries in UPS systems. They are economical components that have proven to be effective over the many years of their use. Lead acid batteries do age and their capacity slowly deteriorates until they need replacement.

Why do they deteriorate?

The most common problem is Sulfation of the battery plates. Sulfates are created and consumed as part of the normal charging and discharge battery process. However, a residual amount of sulfate can be left on the battery plates each cycle. This sulfate coating builds up over time and reduces the useful area of the plates. This loss of plate area reduces the battery capacity. Additionally, the Sulfation process is accelerated if the batteries are left in a discharged state.

What else impacts the life of a battery?

A variety of other factors will cause a decline in battery capacity

High Temperatures: Battery temperature can rise significantly during high rates of discharge or high charge rates, and overcharging. In Sealed Lead Acid batteries this can cause the battery to swell subsequently warping the thin battery plates and can cause venting of hydrogen from the cells.

Long periods of inactivity:

If the battery left is unused for extended period, the electrolyte can experience Stratification. In this situation, the acid and water components in the battery electrolyte will separate with the acid settling to the bottom of the cell leaving the water at the top. The higher acid concentration at the bottom of the cell will corrode away plate material, reducing battery capacity, eventually leading to battery failure. This situation can be avoided when the battery is in routine use, because in the discharge and charge processes small gas bubbles form that promotes mixing of the electrolyte.

Most of these conditions are not observable by monitoring the battery terminal voltage while in standby mode. With the result that, in an AC Line Down situation, where batteries are expected to back-up critical applications, these conditions will result in shorter runtimes, or in worst case, an immediate system shutdown.

How do people typically test batteries in the field now?

The two most popular tests are Run Tests and Ohmic testing. In a Run Test the battery is either partially discharged or fully discharged. From the runtime data collected, capacity can be determined directly. An Ohmic test is used to determine the batteries internal impedance. In most cases there is a relationship between loss of capacity and increase battery impedance. This measured value can be compared to the impedance value as specified by the manufacturer to arrive at an estimate of the batteries health.

Are there more expensive battery testing devices (e.g. Midtronics) that can be used?

Ohmic testers need to be capable of measuring the sub milliohm variations in battery impedance with high precision. This requirement tends to make them quite expensive. Additionally, not all capacity issues can be resolved by this method. For example ohmic test on fully charged batteries may not be able to differentiate between a battery that is 100% good and one that is reduced to 80%. In particular this applies to batteries that may have relatively few cycles with plates still in good condition, but have been partially vented due over temperature or overcharging.

What is the best way to truly test a batteries health?

The most accurate evaluation of a batteries health is to allow the batteries to power its respective load, and time the test to low voltage cut-off. This measurement is then compared to the original design specification. However, this full discharge Run Test not only adds cycles to the battery which can decrease its capacity, running the battery down to a low state of charge also carries a considerable risk of the system being unable to perform if a back up situation occurs.

How does the BTRM evaluate battery health? How does it know when to test the battery and when not too? Why is this method the most effective?

The BTRM200 utilizes the Run Test method, but limits the Run Test to a partial discharge window, on the order of 20% or less, and from the collected data estimates the full Runtime capability. This minimal discharge limits any impact on battery health due to cycling and also minimizes the risk of the batteries not being ready for a backup situation. Additionally the Run Test’s discharge and charge cycle helps offset the Stratification issue caused by long period of inactivity.

The BTRM proactively sends email and text alerts to a user specified account.

When an alert is sent, does that mean my battery bank will fail?

Or will it not meet the defined battery backup time? Do I need to replace the batteries immediately? How much time do I have to replace the batteries?

One of the primary advantages of having the BTRM200 monitor the capacity on a scheduled basis is that BTRM200 can better assess the batteries health over time. For example the BTRM200 allows you to differential between a battery that continues to consistently perform, even at some reduced capacity, but still beyond the standby requirement, or a battery is showing a continual or rapid decline.

The battery industry recommends replacing batteries that have reached 85% of their capacity. However, having the information the BTRM200 provides allows you to potentially extend the lifetime of batteries that have declined tin capactiy but remain stable performers.