BATTERY MONITORING AS A TOOL

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OVERVIEW

We consider battery-monitoring systems as a tool that is used to help us maintain a reliable battery back up to serve our client - information systems and processing. A tool much as a voltmeter, ammeter, hydrometer and a flashlight. None alone can tell you how your system is doing, but all together can give you an indication of how well it will perform.

Our major use of these systems in the Corporate Data Center environment is to save man-hours and more efficient use of personnel. With over 4,000 cells to be maintained and an in house staff that has been reduced from five to two, our monitoring tool has become a real time saver.

Critical loads are served by three UPS systems. Two systems of 3600 KVA each and a third system of 3000 KVA with 6 modules each for a total of 10,200 KVA system capacity. These systems include 18 strings of flooded UPS cells for total 3,840 cells. There are ten standby generators, six diesel sets at 1500 kW each and four gas turbine sets at 900 kW each for a system capacity of 12,500 kW. This means we have 30 locomotive start batteries to maintain to ensure a start in case of power failure. Two 15 kV express feeders feed the electrical service to the complex. Each feeder is rated at 9.5 mVA and 11 mVA short time. There are three medium voltage vaults, 11 transformers, and six sets of NiCd station batteries. When added up, there are over 4,100 cells to be maintained.

Battery monitoring began for us in 1991 with two Albér SBM-1000 systems monitoring 1200 UPS cells. As we grew and expanded, our needs grew, and we added an Albér SBM-320. Further expansion caused us to buy two Albér BDS-256 systems, and now we monitor over 3900 cells and more are being added to the monitor system.

MONITORING AS A TOOL

Our use of the monitoring systems as a tool to save on man-hours can be summed up fairly easily - it works. The systems are remote alarmed and monitored by a 24 hour control center. In case of an alarm, on-site personnel can make conditions safe or call for assistance. Typical morning rounds include a look at the overview screen on all systems to see if any alarms exist and anything that might need attention. If an out of hour's event (discharge) occurred, we will access the discharge data reports and analyze them. Typical logging of float history, temperatures, pilot cell voltages and alarms.

CASE HISTORY #1

Nickel cadmium (NiCd) station battery for the 13.2kV incoming switchgear has been in service for six years. Monitored by an Albér SBM-320. Cell #24 started to slip behind rest of 37 cells on float voltage average. No alarm thresholds were crossed, but it was evident a problem was starting. Verified readings with VOM. The string was placed on equalization for 72 hours at 1.50 VPC. After equalization, Cell #24 held an average of 1.40 VPC. Over time, cell #24 again began to fall behind the string average. Tracking of the voltage continued until it crossed maintenance threshold. The string was placed in an equalize mode for 72 hours at 1.50 VPC. After equalization, the cell held float for a short time but soon began to fall behind.

Using the installed analysis software, a trend graph was created and data sets. See figure 1 for the trend graph that was created. The manufacturer's representative was contacted and all data provided to them. After their review of the data, a warranty cell was ordered, delivered and installed.

CASE HISTORY #2

UPS flooded 33 plate, positive wrapped, in a string with 200 cells floating at 2.25 VPC and a string voltage of 450 VDC. This is a dedicated string to an UPS module and was in service for two years. Monitored by an Albér SBM-1000. The cell (#64) indicated that it was lower float voltage than the rest of the string. Verified by VOM that readings were correct. When cell crossed threshold of maintenance alert, a close inspection was performed - VOM readings, specific gravity taken temperature and visual inspection of the plate conditions as well as any sediment in bottom of the jar. Nothing outstanding came after the inspection other than low float voltage. A single cell charger was placed on cell and charged at 2.33 VPC for 72 hours. After charging, the cell held up to float average but, after time, it began to fall off again. A disturbance occurred and UPS went into a brief discharge - less than 3 minutes. The discharge data that was collected indicated a weak cell. The cell was again single cell charged for 72 hours at 2.33 VPC. The cell came off charge but failed to hold float average. Over the weekend, the cell had went into critical alarm. On Monday the monitor system showed the cell at 0.00 volts DC. Believing the monitor had a problem, I went and checked cell voltage with a VOM and discovered it to be 0.00 VPC. An electronic hydrometer confirmed a specific gravity of 1.000. Immediate action required removing the string as well as the UPS module from service. An attempt to strap around the cell was not successful due to a cross member on the rack, so we had to move the inner aisle cable back three jars, past the defective cell, and readjust the UPS module rectifier charger for 197 cells. We contacted battery manufacturer representative and new warranty cell is on order.

We believe the monitor did a SAVE for the data center. Without a monitor system, this condition would have been extremely difficult if not impossible to detect in time to prevent a possibly dangerous condition from occurring. This is one of many saves we have gotten from our monitoring.

SUMMARY

Our "Tool" - the battery monitoring systems give us a quick look at our batteries, especially our 3840 UPS cells. The start batteries and station batteries are not forgotten by being able to look at their systems. The discharge reports that are created after events give us details of how cells performed under load. Twice a year we perform a Disaster Recovery testing of the complex. We open the 13.2 kV incoming feeders and let the complex go dark. The UPS goes into discharge, the emergency engines start and come on line and take load. All components of the emergency systems are tested. True, the discharge only lasts for five minutes, but that data that is generated has real value. Soon, the ability to fully test a UPS system on our 3-megawatt load bank will be complete.

The paper trails that are created for warranty propose all have worth and leave little to doubt regarding the performance of the battery with the manufacturer representatives. Man-hour savings are substantial. Our ability to focus on routine maintenance and respond to troubles is increased. Sorting out problems is greatly increased, rather that stumbling upon them by chance. At one time, we had five mechanics in-house but, due to transfers, retirements, etc., our force is down to two. The "Saves" provided through active monitoring have assisted us in maintaining the highest degree of reliability to maintain our goal of ZERO outages.

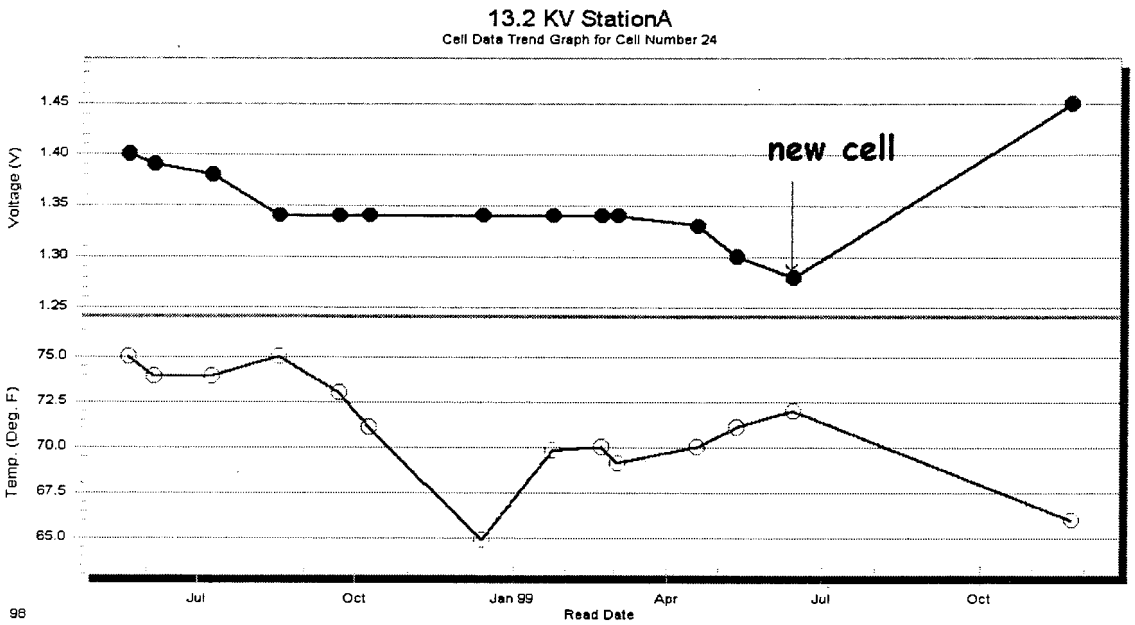
13.2 KV StationA
Cell Data Trend Graph for Cell Number 24
new cell
Voltage (V)
1.45
1.40
1.35
1.30
1.25
Temp. (Deg. F)
75.0
72.5
70.0
67.5
65.0
Jul
Oct
Jan 99
Apr
Jul
Oct
98
Read Date

FIGURE 1