

After the Inspection - What Are You Doing With the Data?

Rick Tressler

Senior Training Engineer



Recharging your
Knowledge



Introduction

Introduction

- Why take readings in the first place?
 - Track and trend condition of a battery over its service life
 - Identify problem areas, take corrective action to maintain reliability
 - There is much more to battery maintenance than just taking the readings
 - You must *do something with the readings* after you take them

Assumptions

- Readings are being taken on a regular basis
 - Pen and paper
 - Portable test equipment
 - Hard wired monitoring system
- Not taking readings?
 - You should be very concerned about reliability

What Are You Doing With The Readings ?

- Hopefully you are looking at the numbers, and trending them over time
- Referencing manufacturer specifications or industry guidelines
- Taking corrective action when readings indicate problems
- Taking readings but not performing analysis?
 - Don't bother taking readings!

Supporting Documentation

- There is help!
- Battery manufacturer operation and maintenance manuals
- Applicable IEEE standards
 - VRLA-IEEE 1188-2005
 - VLA-IEEE 450-2002 (soon to be 450-2010)
 - Nickel-Cadmium-IEEE 1106-1995
- White papers

Measured Parameters

Measured Parameters for Discussion

- Voltage
- Specific gravity
- Temperature
- Float current
- Internal ohmic readings
- Connection resistance

Battery Voltage

- Taken while battery is on float charge
 - What are you doing with the reading?
 - Divide reading by total cells in battery to obtain the charge potential at the volts per cell level (VPC)
 - Reference manufacturer recommendations
 - Battery voltage within specification? Great!
 - If not, why and what to do?
 - Verify charger set point and adjust if needed

Cell/Unit Voltage

- Individual cell or unit voltages
 - If you can read down to cell level, do so!
 - What are you doing with these readings?
 - Review, compare, trend, reference to mfr. documentation
 - VLA, calcium – 1.215 S.G. = 2.13 critical
 - Does not mean cell is in danger of imminent failure
- Indicates the need for single cell charge or replacement

Specific Gravity

- What are you doing with the readings?
 - Review, compare, trend, reference to mfr. documentation
 - VLA, calcium – nominal 1.215 S.G. range typically +/- 10 pts or 1.205 – 1.225
 - Low gravity? When was water last added?
 - Check charging voltage if no water added
 - What was charge voltage last month?
 - What is the trend if any?
 - Low gravity may require equalize charging

Temperature

- Ambient & Cell – Ideal = 25°C
- What are you doing with the readings?
 - Review, compare, trend, reference to manufacturer documentation
- Cell and ambient temperature should be the same or very close to each other
- Maximum allowable deviation 3°C and assumes uniform battery room temperature

Temperature (continued)

- If battery temperature is increasing is the ambient doing the same?
 - If used, check float current trend – higher float current can contribute to increased battery temperature especially in VRLA

Float Current

- Considered by the nuclear user community to be the best indicator of state of charge
- If you are using it, what are you doing with this reading?
 - Review, compare, trend, reference to mfr. documentation
 - Float current is normally a very low value – frequently less than 1 ampere

Float Current (continued)

- Calcium and Selenium cells require less float current than Antimony types of equal ampere hour rating
- Float current generally stable over battery service life
 - Float current in antimony increases with age under similar conditions
- Increased float current with no change in float voltage is cause for further investigation – also check temperature

Internal Ohmic Readings

- Available instrumentation in the marketplace measures resistance, impedance or conductance
- Once again we ask, what are you doing with the readings?
 - Review, compare, trend, reference to manufacturer documentation
 - Reference data may not exist
 - Resistance and impedance *increases* with age
 - Conductance *decreases* with age
 - Both changes result in reduction of capacity
 - Measure at the cell level whenever possible

Internal Ohmic Readings (continued)

- Red flags
 - Vary with manufacturers
 - Can be 10% - 25% or more above/below baseline
 - Do not ignore significant deviations in ohmic readings!
 - Further investigation is frequently abandoned and the battery fails
 - Establish an internal ohmic baseline 6-12 months after commissioning a battery

Connection Resistance

- All bolted interconnections throughout a battery have a finite DC resistance
- Micro-ohmmeters or other instruments are capable of making this measurement
 - Includes some internal ohmic test equipment
- What are you doing with the readings?
- Note that all batteries do not provide for measurement due to design

Connection Resistance (continued)

- Have you established baseline values?
 - Segregate differing connection geometries and document these baseline values
 - Compare and trend the collected readings against the baseline values
 - Increases of more than 20% from baseline are cause for further investigation
 - Application of re-torque values on connections may correct this

Periodic Performance Testing

A Nemesis for Battery Owners?



Periodic Performance Testing

- The “other half” of battery maintenance
 - You need to do **both halves to make it a complete program**
 - **First Half** - Routine inspections for condition monitoring
 - **Second Half** - Performance testing for dynamic capability
 - IEEE standards detail requirements and procedures
 - Trend the test results, reference battery manufacturer and industry recommendations for replacement schedules

But Testing Hurts My Battery!

- **Not true!**
- Typical schedule for VLA batteries
 - Acceptance
 - Performance within 2 years
 - Then, every 5 years thereafter until degradation
 - At point of degradation, test every 12 months
 - When battery reaches 80% capacity, replace within 1 year
 - VRLA schedule is similar, but test at 2 year intervals

Summary

Summary

- Obtain copies of industry recommended practices and adopt them for use in your maintenance program
- Conduct maintenance on a regular schedule
- Use appropriate test equipment and companion software to analyze the readings
- Backup your maintenance data files!
- Use battery manufacturer manuals as a guide to specific battery specifications and limitations
- Take corrective action when it is indicated

Thank you for your time today!

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