Case Study *Managing extreme temperatures in substation battery applications*

Situation

- Over the course of one year, SBS assessed multiple 125-volt DC substation battery systems in Wisconsin and Florida which were housed in enclosures that were not temperature regulated
- The battery systems in Florida were regularly exposed to extreme heat and the battery systems in Wisconsin saw nearly 100^{F} change in ambient temperature over the time of the assessment
- These environments resulted in over/under charging

Observations

- **Extreme heat and overcharging battery systems led to:**
  - *Excessive gassing/hydrogen production*
  - *Additional watering requirements and plate exposure*
- **Extreme cold and undercharging of battery systems led to:**
  - *Reduced capacity*
  - *Sulfation formation*
- None of the locations had chargers which were equipped with automatic temperature compensation
- The sites required excessive maintenance and replacement costs of up to 4 times the original purchase price
- Systems degraded as much as 50% more rapidly than expected from the original installation

Approach

Assessment of these sites relative to other locations, where temperatures were regulated, revealed that proper battery float voltage would need to be maintained to resolve the issues.

Possible solutions were evaluated including:

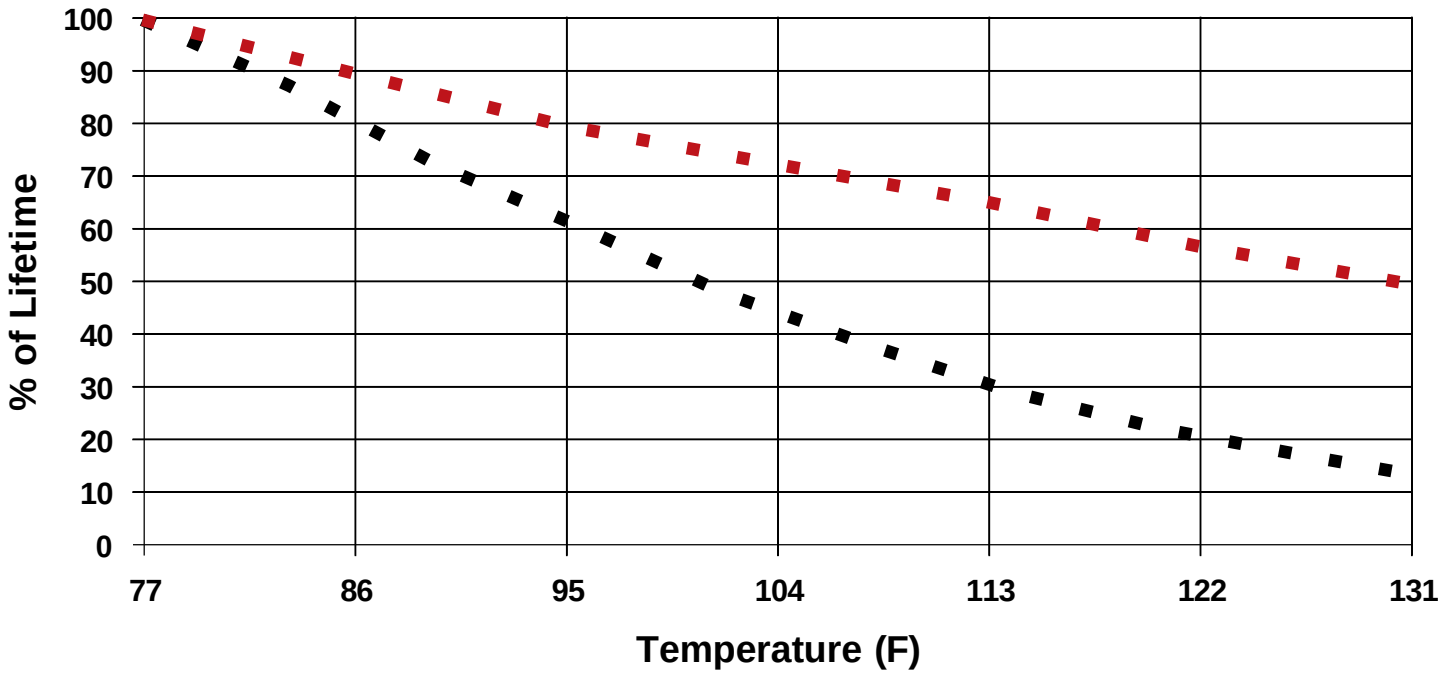
1. Manually adjust battery float voltage on a regular basis
2. Add temperature compensation capabilities to existing chargers if possible
3. If retrofit not possible, replace the chargers with ones that had temperature compensation capabilities

Solution

In each case, existing ***SBS-AT10*** chargers were able to be retrofitted with available temperature compensation probes.

Temp vs. life: Lead Acid vs. Ni-Cad batteries

Note: *Black dots represent a Lead Acid battery's life, while the red dots are Ni-Cad.*



Suppose you have a Lead Acid battery whose temperature is 100°^{F} / 37.8°^{C}. As shown on the graph, the output voltage should be approximately 97% of the 77°^{F} voltage. If the float voltage is set on the front panel to 132-volt DC, the actual output voltage will be: 132 x 0.97 = 128-volt DC

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Results

- **Implementation of retrofitted chargers with automated temperature compensation capabilities resulted in:**
  - *Greater battery system life expectancy*
  - *Elimination of overcharging/undercharging and reduced risk of system failures*
  - *Need for less system maintenance (watering)*
- **The economic impact of this included:**
  - *Reduced maintenance time and associated costs*
  - *Delayed expense of replacing systems (estimated at $50,000)*
  - *Higher reliability*

About temperature compensation

The temperature compensation options available with the ***SBS-ATEVO*** chargers adjust the float voltage up or down in response to battery temperature fluctuations. The temperature is measured by a probe mounted on or near the battery and connected by a cable to the chargers main control board. It is compatible with both Lead Acid and Ni-Cad batteries. It is recommended for both Lead Acid and Ni-Cad batteries installed that are not temperature regulated and strongly recommended for all *VRLA* applications.

Click **HERE** to visit the website or contact your ***Exponential Power*** rep regarding the ***SBS-AT10*** *Single Phase Charger* or the ***SBS-AT30****-Three Phase Charger* with temperature compensation for the best long-term solution.

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Using temperature compensation

Whenever an electric storage battery is being charged, the terminal voltage of the battery changes a small amount whenever the battery temperature changes. As the battery temperature increases, its terminal voltage decreases. When the battery is being charged with a float type charger, with a constant output voltage, the float current increases when the temperature increases. This results in overcharging the battery, which can result in damage to the materials, or at least the need for more frequent maintenance.

When the charging system is equipped with a temperature compensation probe, it can adjust the output voltage applied to the battery to keep the float current constant, thereby avoiding overcharging. The probe senses the ambient temperature at the battery and adjusts the output float/equalize voltages to compensate for variations in temperature. If the ambient temperature increases, the charging system output voltage decreases.

Daily temperature deviation in AZ control house