LEAD-ACID BATTERY SELF-DISCHARGE

I have read about several solutions to the problem of self discharge of a lead-acid battery when it is stored on a cold concrete surface in this column ("Q&A," *Electronics Now*, April 1995). All of them are wrong! The solution to the problem is a simple method for circulating the electrolyte.

My knowledge of battery self

discharge under the conditions discussed in the article is based on several years of work with submarine storage batteries.

Self discharge of batteries is caused by temperature gradients in the battery electrolyte and is called *electrolyte stratification*. When a battery is stored on a cold surface, the lower parts of the cells are cooled to a temperature that is lower than the upper parts. That temperature differential causes a drop of the specific gravity of the cooler part of the cells at the rate of 0.004 points of gravity per 100° F of temperature change above or below 80° F.

The voltage produced by a cell is proportional to the specific gravity of the electrolyte. This difference of specific gravity between the top and bottom of a cell results in a potential difference that is proportional to the specific gravities of the two parts of the cell.

An electrical current will flow between any differences in electrical potentials, so a current will circulate through the cell plates from the top to the bottom of the cell. Those currents will persist as long as a temperature differential exists, and they can be enough to discharge the battery over time, as if it were connected to a constant load.

Devices called percolator tubes inside the cells controlled that condition in submarine storage batteries (where the steel hull immersed in ocean water provides a massive heatsink). A stream of air bubbles passed through the percolator tubes circulated electrolyte from the bottom to the top of the cells, maintaining constant specific gravity of the electrolyte.

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