# SLA Battery Cold Performance Tests: Gel vs. AGM

386 Beth Bartel February 25, 2016 Batteries, Polar Programs, Power Test Reports 10184

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UNAVCO performed cold chamber tests to evaluate possible differences in cold performance between Gel and AGM, the two major types of Sealed Lead-Acid (SLA) batteries. Two tests were performed with one new Deka Gel Battery (P/N 8G31) and one new Deka AGM Battery (P/N 8A31). These tests also provide a benchmark against which to evaluate other battery types.

## Test #1: Charge/discharge capacity at cold temperatures.

The batteries underwent identical charge/discharge tests at varying temperatures; no temperature compensation was applied to the charge routine. Each battery was allowed to equilibrate at the test temperature before two-stage charging. The "fast charge" stage brought the battery to 14.40 volts (2.40 volts/cell, 6 cells per 12 volt battery) with current limited to 1.5 amps. The "float charge" stage then held the battery at 13.80 volts for a maximum of 12 hours, with current limited to 1.0 amps.

Discharge capacity (in amp-hours) was then measured by applying a 1.0 amp load until 10.8 volts was reached. Note that the 1.0 amp discharge current is a significantly higher load than each battery would see in a field installation, where for example a 10-battery bank would power a 5 watt load. Time constraints did not permit testing with such extremely small discharge currents.

Results from the test series are presented in the table below. Since each battery had a different nominal capacity (8G31: 98 amp-hour, 8A31: 105 amp-hour), discharge capacities are provided in percent of their values at 25C.

| Temperature (C) | Pre-Test Soak Time (hours) | GEL Capacity | AGM Capacity |
|---|---|---|---|
| 25 | n/a | 100% | 100% |
| -20 | 24 | 24% | 23% |
| -30 | 12 | 10% | 13% |
| -35 | 12 | 3% | 4% |
| -40 | 12 | 1% | 2% |
| -45 | 12 | 0% | 1% |
| -50 | 12 | 0% | 0% |
| 25 | 48 | 108% | 96% |

These results do not show a significant difference in the cold performance between Gel and AGM batteries in cold temperatures. Also, both batteries recovered fully after the test series.

The results also demonstrate the dramatic roll-off in capacity that lead-acid batteries typically experience in the cold. However it should be noted that because no temperature compensation was applied during

the charge routine, the discharge capacities at low temperature are lower than results from manufacturer tests (where charging voltage is increased as temperature decreases).

## Test #2: Recovery After Cold Exposure

To identify possible permanent damage as a result of extreme cold exposure, each battery was tested at room temperature after exposure to -70C. This temperature was chosen since a system on the Antarctic Plateau which turns off during the winter will quickly assume ambient temperature, but must still be chargeable when summer returns. The test was repeated with each battery in both the fully-charged and fully-discharged states.

| Test Description | GEL Capacity | AGM Capacity |
|---|---|---|
| Soak fully-charged battery at -70C for 48 hours; test after 48 hour soak at 25C | 101% | 92% |
| Soak dicharged battery at -70C for 48 hours; test after 48 hour soak at 25C | 97% | 88% |

This result indicates that the Gel cell may be more resistant to extreme cold than the AGM, however a much larger sample size would be necessary for validation. Overall, neither battery experienced a large, permanent drop in capacity from exposure to -70C, whether fully charged or discharged.

Online URL: https://kb.unavco.org/article/sla-battery-cold-performance-tests-gel-vs-agm-386.html