

Fllooded Lead-Acid Battery Capacity Testing Procedure

Based on IEEE-450-2010*

This document is intended to simplify and condense the above IEEE document into a helpful guide to testing battery capacity.

Capacity/Discharge Testing

Capacity tests should be carried out in accordance with IEEE-450-2010. Discharge tests should be performed between 65°F and 90°F.

Pretest Requirements

- An equalize charge should be completed. 72 hours at 2.40Vpc is recommended by SBS.
- A float charge of no less than 72 hours should follow the equalize charge up to the start of the test. All battery voltages should be within tolerances noted in charging section 3.0. If any batteries have a voltage outside of the allowable float charge range SBS should be contacted prior to the test starting.

Test Length

SBS recommends discharge times of 1 to 8 hours to an end cell voltage of 1.75Vpc.

Discharge Rate

Performance data is available at www.sbsbattery.com/STT or can be supplied by contacting SBS.

Information to Record Before and During Test

- Record the overall float voltage and current of the string just before the start of the test (with charger on).
- Record the float voltage at the battery terminals just before the start of the test (with charger on).
- Record the float voltage of each cell/block just before the start of the test (with charger on).
- Record the electrolyte temperature of 10% or more cells to establish an average temperature (every 6th cell).
- At regular time intervals during the test, measure Total Vdc, Amps DC and Individual cell voltages of all batteries / cells.
- As the test nears its end, it may be necessary to take readings more frequently to monitor cells that are approaching low voltage limits.

What to Do if a Cell's Voltage Drops Below the Specified End Cell Voltage Prematurely – Per IEEE450

- Do not interrupt test until an individual cell voltage is less than 1 volt.
- If one or more cells are less than 1 volt, however the test time is 90%+ completed, continue the test until the specified end system voltage is reached.
- If earlier in the test, an individual cell is less than 1 volt but the total end system voltage has not yet been reached, the test should be stopped and the weak cell should be disconnected from the battery string and bypassed with a jumper of adequate conductor ampacity. The new minimum terminal voltage should be determined based on the remaining cells. The test should then be continued in order to determine the capacity of the remaining cells. The time required to disconnect the cell, install the jumper, and restart the test shall not exceed 6 minutes. This "downtime" shall not be included in the test discharge period (i.e., the capacity determination shall be based on the actual test time). No more than one "downtime" period should be allowed when a battery is being tested.

Temperature Effect on a Capacity/Discharge Test

If the operating temperature of the system is above or below 77°F, a correction factor will need to be applied to either the test results** or to the current applied to determine the true capacity of the system. (Reference IEEE-450-2010)

**Time Adjusted Method for Calculating System Capacity – Recommended by SBS

When using this method, no correction of any type is required prior to the performance of the test. The system's capacity is calculated after the completion of the test using the published performance data at 77°F. This method is recommended for test over 1 hour.

To calculate the % capacity of your system
$$C = \frac{T_a}{T_s \times K_t} \times 100$$

- C = % capacity at 77°F
- Ta = the actual time (in minutes) of the test to specified end cell voltage
- Ts = the rated time (in minutes) of the test to specified end cell voltage
- Kt = the time correction factor in Table 5

Table 5 Temperature-Correction Factors

°F	65	67	69	70	71	73	75	77	79	80	81	83	85	87	89	90
Kt	0.920	0.935	0.948	0.955	0.960	0.975	0.985	1.000	1.007	1.011	1.017	1.030	1.040	1.050	1.060	1.065

Example: A STT2V200 battery is rated to deliver 38Amps for 5 hours (300 minutes) to 1.75Vdc at 77°. The system was 65°F, was discharged at 38Amps and the systems end cell voltage was reached at 4 hours and 25 minutes (265 minutes).

$$C = \frac{265}{300 \times .92} \times 100 = \text{System has 96\% Capacity}$$

Suggested References

IEEE-1187-2002

Recommended Practice for Installation Design and Installation of Valve-Regulated Lead Acid Batteries for Stationary Applications.

IEEE-450-2010

Recommended Practice for Maintenance, Testing and Replacement of Vented Lead Acid Batteries for Stationary Applications.

IEEE-485-2010

Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications.

IEEE-1657-2009

Recommended Practice for Personnel Qualifications for Installation and Maintenance of Stationary Batteries.

*The above is based on SBS’s interpretations of IEEE-450-2010. This information should be used for guidance purposes only and SBS can’t be held responsible if the information is incorrect or if other parties interpret the information differently.