

# VRLA Battery Capacity Testing Procedure

Based on IEEE-1188-2005\*

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

## Capacity/Discharge Testing

Capacity tests should be carried out in accordance with IEEE-1188. 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](http://www.sbsbattery.com) or can be supplied by contacting SBS.

## Information to Record Before and During Test

- Read and record the float voltages of the system AND each battery 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 ambient temperature as well as the batteries temperature at the negative terminal.
- Record the voltage of each cell once the charger is off prior to placing the load on the system.
- 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 IEEE1188

- If the specified end system voltage has not been reached **do not** interrupt the test unless an individual cell is approaching reversal of its polarity (0.0 volts).
- If one or more cells are approaching reverse polarity (0.0 volts) the test should be continued with the cell/unit bypassed where feasible. The time required to disconnect the cell, install the jumper, and restart the test shall not exceed 6 minutes. Complete the bypass away from the cell/unit to avoid arcing. The new minimum voltage should be determined based on the remaining cells.
- 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. It is very important that the user work with the manufacturer or other experienced personnel to plan the course of action. The possibility of a weak cell(s) should be anticipated, and preparations should be made for bypassing the weak cell(s) with minimum hazard to personnel.

## 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 A) the test results or to B) the current applied to determine the true capacity of the system. **(Reference IEEE-1188-2005)**

## A) Time Capacity Determination 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.

\*The above is based on SBS's interpretations of IEEE-1188-2005. 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.

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

- C = % capacity at 77°F
- T<sub>a</sub> = the actual time (in minutes) of the test to specified end cell voltage
- T<sub>s</sub> = the rated time (in minutes) of the test to specified end cell voltage
- K<sub>t</sub> = the time correction factor in Table 3

**Table 3–Temperature-Correction Factors**

°F	65	67	69	70	71	73	75	77	79	80	81	83	85	87	89	90
K <sub>t</sub>	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:** An AGM-300 battery is rated to deliver 104Amps for 5 hours (300 minutes) to 1.75Vdc at 77. The system was 65°F, was discharged at 104Amps and the systems end cell voltage was reached at 4 hours and 25 minutes (265 minutes).

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

**B) Rate Adjustment Capacity Determination**

When using this method the published rating (current) for the selected test length is de-rated below 77°F and increased above 77°F to take into account the effects temperature has on a batteries performance.

To calculate the adjusted discharge current for test  $A = \frac{X_t}{K_c}$

- A = adjusted discharge current for test
- X<sub>t</sub> = the published rating (current) for time to specified end cell voltage at 77°F
- K<sub>c</sub> = the temperature correction factor in Table 4

**Table 4 - Current Correction Factors**

°F	65	67	69	70	71	73	75	77	79	80	81	83	85	87	89	90
K <sub>c</sub>	1.080	1.064	1.048	1.040	1.034	1.023	1.011	1.000	0.987	0.980	0.976	0.968	0.960	0.952	0.944	0.940

**Example:** An AGM-300 battery is rated to deliver 104 Amps for 5 hours to 1.75 Vdc at 77°F. The site temperature is 65°F prior to starting the test.

$$A = \frac{104}{1.080} = 96.3 \text{ Amps}$$

The system should be discharged at 96.3 Amps for 5 hours to 1.75 Vpc.

**Suggested References**

**IEEE-1187-2002**

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

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**IEEE-1188-2005**

Recommended Practice for Maintenance, Testing and Replacement of Valve-Regulated Lead Acid Batteries for Stationary Applications.

**IEEE-1189-2007**

Guide Selection of Valve-Regulated Lead Acid Batteries for Stationary Applications.

**IEEE-1657-2009**

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

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