Ni-Cad Battery Capacity Testing Procedure

Based on IEEE-1106-2005*

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

Pretest Requirements

- For accurate test results the battery should be on float charge for at least 12 weeks since its last discharge.
- All battery voltages should be within tolerances noted in charging section of this manual. No cell should be less than 1.36 Volts prior to the discharge test. Take any required corrective actions to correct voltages that are out of tolerance.
- Verify the battery has had a high-rate charge completed more than 1 day and not more than 30 days prior to the test.
- Record the float voltage of each cell just prior to the test (with charger on).
- Record the float voltage at the battery terminals (with charger on) just before the start of the test.
- Record the electrolyte temperature of 10% or more cells to establish an average temperature.
- Determine proper discharge current and time. Contact SBS if assistance is needed.

Information to Record during Test

- 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, take readings more frequently to monitor cells that are approaching low voltage limits.

Test Procedures

A. Set up the load and the necessary instrumentation to maintain and record the determined discharge rate.
B. Disconnect the charging source, turn on load, start the timing and continue to maintain the selected discharge rate.
C. Read and record the individual cell voltages and the system voltage. The readings should be taken while the load is applied at the beginning and at the completion of the test and at specified intervals. As the test nears its end it will be necessary to take readings more frequently to monitor cells that are approaching low voltage limits.
D. Maintain the discharge rate, and record the elapsed time at the point when the system voltage decreases to a value equal to the minimum average voltage per cell (e.g., 1.10 Volts) times the number of cells per string.
If the battery does not pass, additional data will be beneficial for evaluation or for determining corrective action. If possible, the testing should be continued to the original test time or a lower final voltage to acquire this information. Nickel-cadmium cells are not damaged as a result of cell reversal, so no provisions are required for bypassing weak cells. Reversing the polarity of NiCad cells should not be a basis for terminating a discharge test before the over all terminal voltage is reached.
E. If one or more cells are approaching reversal of their polarity (0.5 Volts or less), and the test is at 90–95% of the expected completion time, continue the test until the specified terminal voltage is reached.
F. If earlier in the test one or more cells are approaching reversal of their polarity, the test may be continued so as to determine the capacity of the remainder of the battery. Bypassing of cells is not recommended. Because the reversed cell(s) will be making a negative contribution to the overall battery voltage, adjust the minimum terminal voltage to compensate. The new minimum terminal voltage will be the minimum cell voltage multiplied by the number of non-reversed cells, plus the negative voltage of the reversed cell(s). ***For example,*** *a 95 cell battery is being tested to a minimum terminal voltage of 105 Vdc (1.10 Vpc). During the discharge, two weak cells go into reversal and stabilize at –0.30 Volts. The new minimum terminal voltage is 93 cells × 1.10 Vpc – (2 × 0.3) = 101.7 Vdc.*
G. At the conclusion of the test, determine the battery capacity according to the Time Adjusted Method for Calculating System capacity procedure outlined below.

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

When using this method, a discharge rate correction is not required prior to the performance of the test. The systems capacity is calculated after the completion of the test using the published performance data at 77°F.

To calculate the % capacity of your system $$C = \frac{Ta \times Kc}{Ts} \times 100$$

C = % capacity at 77°F
Ta = the actual time (in minutes) of the test to specified end cell voltage
Kc = the time correction factor in the below table
Ts = the rated time (in minutes) of the test to specified end cell voltage

*The above is based on SBS's interpretations of IEEE-1106-2005. 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.

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Recommended Temperature-Correction Factor (Kc)

^{0}F	65	67	69	70	71	73	75	77	79	80	81	83	85	87	89	90
Kc	1.087	1.069	1.055	1.047	1.041	1.026	1.015	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Example: *KPM50 battery rated to deliver 10 Amps for 5 hours (300 minutes) to 1.00 Vpc at 77F. If the battery was 65°F, discharged at 10 Amps and the end cell voltage was reached at 4 hours and 25 minutes (265 minutes) the capacity would be calculated as follows:*

$$C = \frac{265 \times 1.087}{300} \times 100 \quad = \text{System has 96\% Capacity}$$

Suggested Reference

IEEE-1188-2005

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

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