

tech tips

TECHNICAL INFORMATION AND PRODUCT SOLUTIONS

The ON Series® Automated Low-Risk Battery Test Feature*

Background

The battery in any UPS product is the single component guaranteed to fail - the only question is "When?". ONEAC® pioneered automated low-risk battery testing in 1988 as an important part of our first Uninterruptible Power Conditioning product and it continues today throughout the ON Series family.

Conventional Approach

The conventional approach to UPS battery testing has been to place all risk and responsibility upon the end-user. Testing batteries in a conventional UPS requires that the user connect a load to the UPS, cut input power to the UPS by disconnecting the input line cord and then use a watch to measure how long the batteries keep the load running.

Problems:

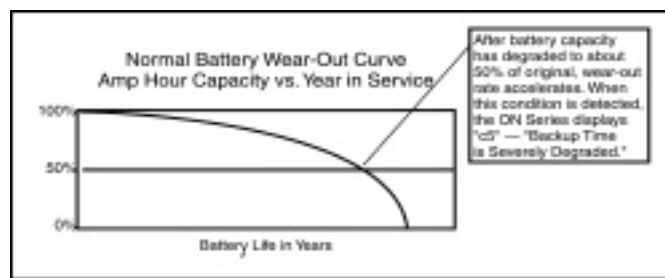
- What test load do you use — a critical system after hours? If not, then what?
- Remembering to do the test, recording the results and analyzing the data over time.

Improved Conventional Approach

An improved conventional approach places a user-activated battery test button on the front panel that allows users to initiate a battery test without disconnecting the input line cord. The results of the test are metered inside the UPS and the PASS/FAIL result is indicated on the front-panel display. In some units, this test can be initiated through the UPS communications port using a control command.

Problems:

- What test load do you use — a critical system after hours? If not, then what?
- Remembering to initiate the test.
- Dependability of the manufacturer's test methodology. It has been reported that some manufacturers' test methodologies allow the load to drop if battery degradation causes the battery to drain too quickly before the test period elapses and the load is returned to AC line power.



ONEAC's approach to battery testing uses a variety of test methodologies which work together to distinguish between severe degradation and normal wear-out while presenting minimal risk to the UPS load.

* Applies to ON Series UPS products with part number suffix "SN"

ONEAC®

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- 1) Battery tests run automatically — no need for users to remember to initiate a battery test.
- 2) Recharge rate is always monitored. If a battery takes too long to achieve float voltage, a c6 alarm condition is raised by the ONEAC UPS — indicating a failed battery that should be replaced now.
- 3) Discharge Tests: There are multiple dimensions which work to minimize the risk of dropping the load during the final phase of a discharge test:
 - Before initiating any discharge test, the unit verifies that the battery is at proper float voltage, and all other UPS system conditions are normal.
 - Discharge rate is checked automatically every 6 days. The test interval can be set to any value over a range of once per day to once every 128 days through the UPS communications port.
 - Before each discharge test, a 5-second pre-test is run before switching the load to inverter. If the pre-test fails, the load test is aborted and the c6 alarm condition is raised on the front panel.
 - The final test phase runs the load from inverter for 10 seconds. The under-load test is immediately aborted whenever battery voltage falls below a conservative threshold. The load is returned to line power and a c6 alarm condition is displayed on the front panel.
 - At the end of the 10 second load test, the battery voltage is compared against a load specific value. A failed test is confirmed by repeating the test. If the second test confirms the reading, a c5 alarm condition is raised indicating the battery has degraded and should be replaced soon.

Summary of Known Battery Failure Modes Detected by ON Series UPS Automated Low-Risk Battery Test

Name	Description	Results	Permanent Failure?	ON Series Test Coverage c5 & c6 Condition Codes
Shorted Cell	A low resistance short between two adjacent plates or contacts within a cell.	Appears as if one cell (2V) is missing from the pack. Not critical failure mode.	Yes	Not detectable until further performance degradation develops.
Ohmic Cell	A high resistance short between two adjacent plates or contacts within a cell.	Appears OK during recharge. When open circuited or loaded the bad cell will quickly discharge through the ohmic short.	Yes	Low voltage detected during pre-test phase of the discharge test. Will trigger c6 front panel display—Replace Battery Alarm.
Open Cell	Oxidation (corrosion) of the positive plate leading to reduced current carrying capability.	Reduced capacity for the entire battery because the cells are in series.	Yes	Will be detected as increased battery impedance resulting in c5—Replace Battery Warning.
Electrolyte Loss	Drying-out of the battery often caused by a malfunction in the battery venting system.	Typically a gradual reduction of capacity. Eventually leads to a complete loss of capacity.	Yes	Will be detected as either increased impedance (c5) or sudden voltage drop in under-load phase of discharge test (c6).
Positive Plate Degradation	Conversion of the active plate material to in-active through repeated discharge cycles.	Gradual reduction of capacity.	Yes	Will be detected as increased battery impedance resulting in c5 — Replace Battery Warning.
Sulfation	Crystalline growth in the battery that increases the impedance of the cell. Can sometimes be removed through prolonged charging and/or discharging.	Higher resistance reduces capacity. In some cases, Sulfate is broken down and full capacity returned after a prolonged recharge time.	No	Will be detected as increased battery impedance resulting in c5 — Replace Battery Warning.