Guidance Note



Fire Industry Association

Leading Excellence in Fire Since 1916

A Study of Handheld Testers used in the Fire Industry: Methods and Recommendations for Accurate Battery Testing

TABLE OF CONTENTS

1. INTRODUCTION AND BACKGROUND 3
2. PREFERRED BATTERY TESTING METHODS 4
2.1. Open Circuit Voltage (OCV) Testing 4
2.2. Ohmic Measurements 4
2.3. Pulse Load Testing 5
2.4. Full Discharge Testing 5
3. INDUSTRY OUTLOOK 5
4. DEFINITIONS 6
4.1. Cell/Unit internal ohmic measurements 6
5. CONCLUSION 7

1. INTRODUCTION AND BACKGROUND

The Fire and Security industry increasingly reports inconsistencies in battery test results, specifically when using handheld meters for battery performance verification. Multiple brands are affected, with results often showing inaccurate or misleading data on battery health, leading to unnecessary replacements, or missed failures.

Some handheld devices claim to measure a battery's Ah capacity. However, our research indicates these results can be misleading. Handheld testers vary in design and methodology, leading to inconsistencies, particularly when comparing batteries from different manufacturers with different internal designs. Results from such devices should not be used as a definitive measure of battery health or true capacity.

Global battery manufacturers supplying the UK Fire and security market do not endorse any meter that claims to provide an Ah capacity measurement based on ohmic readings or similar characteristics.

This document examines current battery testing techniques and the challenges in accurately measuring the capacity of Sealed Lead Acid (SLA) batteries used in backup systems for Fire and Security applications. The objective is to outline best practices and identify reliable testing methods, highlighting both the limitations of handheld testers and the importance of choosing appropriate techniques to ensure accurate results.

In brief, this report concludes that:

- **Accurate testing is essential** to prevent system failures or premature replacements. Handheld testers frequently provide inconsistent results that can lead to incorrect conclusions about battery health. There are handheld testers which claim to measure Ah capacity across different brands of batteries. Our findings indicate that the readings may create more problems than they resolve. Inaccurate readings can be misleading and may indicate a battery is at the end of its service life when in fact the battery is healthy.

- **All test methods have some form of limitation**, and handheld devices will be more effective as trending tools for long-term monitoring rather than for absolute capacity measurement. Baseline data taken on fresh batteries will be necessary for trending studies.

- **A full discharge test remains the gold standard** for precise capacity verification, though it is time-consuming and impractical for regular field use. The only 100% reliable way to verify battery capacity is to carry out a full discharge test and then compare the results against the manufacturers' data.

- **Momentary or pulse load testing** offers a viable compromise for field testing, balancing reliability, and efficiency with a practical approach to testing.

Fire alarm and security systems use various types of industrial Sealed Lead Acid batteries as secondary power source for situations where the local power supply is interrupted or fails. Design calculations and the standby periods required for safe operation are used to size the battery capacity to support the alarm or security system. Design calculations are based on the expected performance criteria and typical operating environments.

There is a need to test and verify the effective battery state of health at periodic maintenance visits. The testing method used must not materially affect the charge state of the battery and it is also important to recognise that a testing regime is only a part of the assessment of the operational life of the battery. (Other factors such as age, storage, handling, and operational temperature will affect performance).

The time taken to carry out the testing must also be considered; during a test procedure an alarm system will not have its battery connected and any prolonged time test should be avoided.

2. PREFERRED BATTERY TESTING METHODS

Accurate testing of Sealed Lead Acid batteries is crucial in ensuring the reliability of backup systems. Various methods can be used, each with its own strengths and limitations:

2.1. Open Circuit Voltage (OCV) Testing

OCV testing is a straightforward method using high-quality calibrated multi-meters to measure a battery's voltage. Typically, the voltage of the battery is measured and compared to the optimal value expected, benchmarked against the manufacturers published data (OCV Vs SOC); a small variation to this test is to allow a current to be drawn from the battery for a period of time to eliminate the surface charge. Although this test method does provide a quick and cost-effective form of measurement, it is insufficient on its own for assessing true battery capacity (Ahr).

The OCV of a fully charged battery is higher than that of a discharged battery. Typically, the OCV of a battery decreases as it ages. Therefore, measuring the OCV over time, can not only help to determine state of charge, but also the rate of degradation. This information can be used to estimate the remaining useful life of the battery and plan for replacements.

2.2. Ohmic Measurements

Ohmic testing, which includes impedance, conductance, and resistance measurements, offers insights into the battery's internal resistance and continuity. These readings are influenced by factors such as temperature, connection quality, battery construction, and state of charge, making them useful for trending purposes, but less dependable for one-time capacity assessments.

2.3. Pulse Load Testing

Momentary or pulse load testing applies a brief, controlled load to the battery, allowing an assessment of voltage response under stress. While not as accurate as full discharge testing, it is a practical compromise for field applications where time is a constraint.

These readings are influenced by factors such as temperature, connection quality, battery construction, and state of charge, making them useful for trending purposes, however, should not be used to try to predict absolute capacity values, which can only be achieved via full discharge testing.

2.4. Full Discharge Testing

The most accurate method, full discharge testing, involves drawing a constant current from the battery over the manufacturers specified time (typically 10-20 hours) and comparing performance to manufacturer data. This approach is accepted as the most accurate method for testing the capacity of a battery. However, such testing requires investment in specialist test equipment and controlled test conditions. Therefore, despite its reliability, this method is not feasible in field environments due to the time required and the potential disruption to connected systems.

3. INDUSTRY OUTLOOK

Reporting a failing battery as satisfactory:

As batteries are critical to safety systems, it is essential to choose the right testing approach and equipment. Misinterpretation of handheld test results can lead to two primary risks:

- This could compromise fire and security systems, potentially leading to serious safety failures.
- Fire Alarm System backup power will not support the system as intended, leading to the potential failure of detection and / or evacuation strategies.
- The root cause of premature battery failure is unlikely to be investigated. This leads to unnecessary replacement costs, environmental impact, and wasted resources.

Reporting a good battery as failing: (Most likely scenario).

- Inappropriate costs to end users of new batteries.
- Environmental impact associated with unnecessary disposal and costs.
- With a focus on sustainability, a high % of batteries being replaced which are in fact healthy.

The use of Ohmic measurements on industrial Sealed Lead Acid batteries has been gaining popularity throughout the UK Fire and Security Market.

The use and application of Ohmic measurement is well documented throughout the industry.

While Ohmic testing and pulse load methods have become more common, these should primarily serve as trending tools rather than definitive indicators of capacity. The IEEE and battery manufacturers recommend that Ohmic measurements be trended over time, with baseline data collected early in the battery's life cycle to track gradual changes.

As the internal design of batteries may vary from one manufacturer to another, this variation only increases the inaccuracies already inherent with some methods of testing. Unfortunately, the test engineer is unaware of these technical issues and has no means of verifying the accuracy of such products and invariably accepts the results. In some cases, the percentage errors being reported across different brands of batteries is significant, with claims to be greater than 100%.

Some handheld portable battery testers claim to use specific battery characteristics and algorithms to determine accurate capacity of a lead acid battery, within a short (few second) test period. These testers also claim to measure Ah capacity across different brands of batteries. Our findings indicate that the readings and results are often inconsistent. There are many variables which may affect the reading including temperature, SoC, differences in the internal design of batteries which may vary from one manufacturer to another, even connecting the handheld meter may lead to variation in the measurements which can lead to incorrect conclusions.

Ahr Meter measurements are not a substitute for battery capacity testing and should not be used to predict absolute capacity values.

Leading battery manufacturers claim it is not possible to reliably predict the Ah capacity of a battery just by using the methods utilized by an Ah meter, and do not endorse any type of Ah meter, or support warranties based on Ah meter readings**.**

4. DEFINITIONS

This section summarizes key terminology related to Ohmic measurements as outlined in IEEE Standard 1188™-2005:

4.1. Cell/Unit internal ohmic measurements

These measurements provide information about circuit continuity and can be used for comparison between cells and for future reference. The internal ohmic properties of a cell consist of several factors, including the physical connection resistances, the ionic conductivity of the electrolyte, and the activity of the electrochemical processes occurring at the plate surfaces. With multicell units, there are additional contributions due to intercell connections. The techniques for measuring internal ohmic properties are not standardized, and in many cases, the techniques are proprietary.

However, the basic goal of these measurements is to provide some form of consistent method to

quantify the ohmic value. The fundamental principal behind the measurement is to apply a forcing function into the cell and measure the resultant response. Different manufacturers use various frequencies and amplitudes and interpret the resultant signal differently. The IEEE endorses no particular technique or manufacturer. Individual users should select equipment based on their particular needs and proven results.

When internal ohmic measurements are taken, the type of test equipment used, the test points selected, cell/unit voltages, and cell/unit temperatures (measured at the negative terminal posts) should be recorded. Significant changes in the values typically indicate a significant change in the cell that may be reflected in its performance. However, limited changes in the specific values obtained do not necessarily indicate that the cell is free of defect or deterioration.

Cell/unit ohmic values measured will vary with the specific measurement techniques and the conditions under which the measurements are taken. **Internal ohmic values are useful as a trending tool**. To use these readings effectively, accurate baseline readings should be taken after about six months of battery operation. Internal ohmic readings taken without the benefit of baseline data may be difficult to interpret and of limited value. These readings should be trended over time, and the user should note any significant changes from the baseline. Depending on the degree of the change a performance test, cell replacement or other corrective action may be necessary.

In summary:

- **Cell/Unit Internal Ohmic Measurements:** These measurements help identify circuit continuity issues and establish baseline data for future trending. Consistency in test points, cell voltages, and temperatures is crucial to achieve reliable results.

- **Trending with Ohmic Values:** Trending ohmic values over time can reveal deterioration trends, but these readings should be contextualized with other performance data, as minor changes do not always indicate failure.

5. CONCLUSION

Accurate battery testing is essential for the safety and efficiency of backup systems in the fire and security industry. While full discharge testing remains the benchmark, it is impractical for regular use. Ohmic measurements and pulse load testing offer reasonable alternatives for field applications but should be used with an understanding of their limitations.

The use of conductance testing techniques for determining battery state-of-health and for identification of premature capacity failures is widely considered to be a reliable method of testing sealed lead acid batteries. The conductance method is recognized by the IEEE standard for testing batteries with proven correlation to battery capacity.

Our test results provide evidence that the conductance method of testing provides reliable outcomes and test results, with a tight spread of results with little variability between each battery tested, using different handheld meters. These measurements are similar and tightly grouped, providing a strong indicator of reliability and consistency in the process and product being tested.

This is crucial in maintaining quality standards and for field use by engineers.

The most accurate method of testing battery capacity is a full discharge test in accordance with the battery manufacturers' recommendations.

Our testing has shown that sealed lead acid batteries which were shown as faulty using an Ah battery tester were in fact proven healthy batteries. Extensive discharge testing in accordance with the manufacturers guidelines shows a measured capacity (Ah) meeting or exceeding the manufacturers' data sheet for ALL the units under tests, which had previously been reported as faulty. (Test equipment: Neware CT3008 discharge equipment).

Our testing showed that measurements recorded using an Ah meter from the same brand, on the same sample battery, show consistently different results, when testing both amp hour and voltage.

For trending purposes, handheld testers can be useful tools, provided baseline readings are established and maintained over time.

Ultimately, the fire and security industry must approach handheld test results with caution and ensure that test methods align with manufacturer recommendations and IEEE standards to maintain the highest safety and reliability standards.

Source and reference:

1. IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead- Acid (VRLA) Batteries for Stationary Applications IEEE Std 1188™-2005
2. Enersys – White Paper - Ohmic Measurements as a Maintenance Tool for Lead Acid Stationary Cells
3. Power Sonic – testing Power Sonic batteries - MSC042 Rev 4 (11/2017)
4. GS Yuasa Battery Sales UK Ltd Technical Bulletin - Ah meters - 27 May 2022

Copyright

FIA retain the copyright of this document but would permit the content to be copied and used by third parties.

Published October 2026. Guidance Note: A Study of Handheld Testers used in the Fire Industry: Methods and Recommendations for Accurate Battery Testing

DISCLAIMER

The information set out in this document is believed to be correct in light of information currently available but is not guaranteed and neither the Fire Industry Association nor its officers can accept responsibility in respect of the content or any events rising from use of the information contained with this document