New Battery Monitoring Standard

"Guide for Selection and Use of Battery Monitoring Equipment in Stationary Applications" - IEEE 1491

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Agenda

- New Standard – IEEE 1491
  - Approved by Standards Committee
  - In IEEE Editing and release process
  - Release target – 1/1/06
- Battery Measurement Parameters
  - Definitions
  - Why Monitor?
  - Analysis
- Technical Review
- Q&A

IEEE 1491 MEASUREMENT PARAMETERS

- Float Voltage
- Equalizing Voltage
- Recharge Voltage
- Open Circuit Voltage
- Discharge Voltage
- Midpoint or Partial String Voltage
- Cell/Battery DC Current
- Ripple Voltage
- Ripple Current
- Cell/Unit Temperatures
- Ambient Temperature
- Cycles
- Cell/Battery Ohmic Values
- Specific Gravity
- Electrolyte Level
- Connection Resistance
- Ground Fault Detection

1. FLOAT VOLTAGE

- Description

  The voltage applied to a cell/battery to maintain it in a fully charged condition during normal operation.

- Why Monitor?

  To identify and report out-of-range values.

- Analysis

  Loss of capacity, sulfation, grid corrosion end of life issues,

  gassing, water loss, (dry-out in VRLA), and thermal runaway.

2 - Equalizing Voltage

- Description

  Equalizing voltage is a temporary voltage, above the normal float level. It's purpose is intended to correct inequalities that may develop in normal service.

- Why Monitor?

  To verify that its level and duration are correct, and that the cell/battery has responded favorably to equalize charging.

- Analysis

  Use equipment and battery manufacturers' guidelines.

  May not achieve the desired results.

3 – Recharge Voltage

- **Description**

Recharge voltage is normally higher than float voltage, and is applied to a cell/battery to restore the energy removed during a discharge.

- **Why Monitor?**

To identify and report when the recharging voltage level and duration are outside specified limits.

- **Analysis**

Can result in detrimental effects regarding temperature, gassing, water consumption, and state of charge.

It can also affect connected equipment.

4 – Open Circuit Voltage

- Description

Open circuit voltage is measured at the terminals of a cell or string after all charging sources and loads have been removed.

- Why Monitor?

To identify and report that the open circuit voltage is within manufacturers' parameters. The open circuit voltage can be used for diagnostic purposes and/or to control the charging system.

- Analysis

Indication of a shorted or reversed cell, low state of charge or specific gravity issues.

5 – Discharge Voltage

- Description

  Discharge voltage is the voltage measured across battery and cell terminals at any point in time during discharge.

- Why Monitor?

  Collection of information concerning battery terminal and individual cell voltages during discharge, is fundamental in determining the capacity of the battery, analysis of individual cell performance, and inter-cell connection integrity.

- Analysis

  Indication of low battery/cell capacity, battery deterioration, low state of charge, and/or high connection resistance.

6 – Midpoint or Partial String Voltage

- **Description**

  Midpoint or partial string voltage is a monitoring technique consisting of measuring the float voltage of similar string segments and comparing these relative values. The accuracy of this method is inversely proportional to the size of the measured segments.

- **Why Monitor?**

  Comparing segment voltages can be a simple method of evaluating groups of cells.

- **Analysis**

  A wide spread in segment measurements indicates the need for further evaluation.

7 – Cell/Battery DC Current

- **Description**

  Current within a battery can be classified in three categories: discharge current, charge current, and float current. Cell current is the same as string current, unless a ground fault is present.

- **Why Monitor?**

  Current measurements can provide users with useful information related to the state of health of the battery. Current measurements can also be used to indicate the operation of the charger and/or the integrity of the cell connections.

- **Analysis**

  Float current of a fully charged battery will depend on the temperature, voltage, and condition of the battery. A significant change in float current indicates a need for further investigation.

NOTE: A method of the future!

8 – Ripple Voltage

- ## Description

  Ripple voltage is the AC voltage component of the DC bus. Applications such as telecommunications, switchgear, and engine starting, will typically have lower ripple components than UPS

- ## Why Monitor?

  To identify and report out of range values that could impact the performance of the battery and/or charging system.

- ## Analysis

  The normal level of ripple voltage for each system must be individually determined by initial and ongoing measured values.

  Monitoring the exact value of this parameter is not as important as trending the value as the system ages.

NOTE: Another method of the future!

9 – Ripple Current

- **Description**

  Ripple current is the AC current component of the charger output. Some UPS systems have a higher, measurable ripple component but other applications such as telecommunications, switchgear, and engine starting typically will not.

- **Why Monitor?**

  To identify and report out of range values that could impact the performance of the battery and/or charging system.

- **Analysis**

  The normal level of ripple current for each system must be individually determined by initial and ongoing measured values.

  Monitoring the exact value of this parameter is not as important as trending the value as the system ages, and comparing values between parallel strings on the same charging system.

NOTE: Another method of the future!

10 - Cell/Unit Temperatures

- Description

  Cell/ Unit temperature is the actual temperature of the cell as measured by a contact or non-contact temperature-measuring device.

- Why Monitor?

  Temperature measurements are used to identify potential battery problems and can be used to control rectifier/charger output.

- Analysis

  Abnormal temperatures affect the operation of the battery.

  Changing temperature trends indicate other changing conditions.

11 - Ambient Temperature

- ## Description

  Ambient temperature refers to the temperature of the atmosphere where the batteries are installed, such as the battery compartment, room, building, hut, or cabinet.

- ## Why Monitor?

  Inside ambient temperature is relevant in determining the influence of temperature on the battery. However, it is not as good as direct cell/unit temperatures.

- ## Analysis

  Battery temperature measurements are typically implemented in conjunction with ambient temperature measurements. Differences between ambient temperature and battery temperature can be critical.

12 - Cycles

- Description

  A cycle is defined as any battery discharge event followed by a recharge. The number of cycles available from a given system is a function of the depth of discharge per cycle, The battery design life and warranty requirements determine the importance of monitoring these cycle events.

- Why Monitor?

  To aid in determining the remaining battery cycles. This provides information for warranty claims and replacement decisions.

- Analysis

  Battery manufacturers specify the total number of discharges available to a given depth of discharge under normal operating conditions. The monitor should be capable of storing and retaining this history over the life of the battery.

13 – Cell/Battery Ohmic Values

- Description

  The internal ohmic value of a cell/unit consists of any value of resistance, conductance, or impedance derived from the relationships between changes in voltages and currents in a stationary battery under various conditions and used as an indicator of a battery's state of health.

- Why Monitor?

  These measurements provide information about battery internal state of health.

- Analysis

  Changes and differences are subject to careful interpretation, and can be considered significant.

14 – Specific Gravity

- Description

  Specific gravity (SG) is a measurement of the density of the electrolyte. Specific gravity is dependent upon the state of charge and temperature.

- Why Monitor?

  Specific gravity can be monitored to verify that it is within the design parameters of the battery.

- Analysis

  A deviation in excess of the manufacturer recommendation can indicate the need for further investigation. Specific gravity measurements may not be accurate when the battery is on charge following a discharge or following the addition of water.

15 – Electrolyte Level

- **Description**

  Electrolyte level is associated with the electrolyte fluid level in a battery cell. This measurement is only applicable to flooded battery cells.

- **Why Monitor?**

  The purpose of this measurement is to ensure that the plates of the battery cell are fully submerged in electrolyte fluid at all times in order to prevent plate drying.

- **Analysis**

  The accuracy of the measurement of electrolyte level is meaningful only when the cell is at a full state of charge.

16 – Connection Resistance

- Description

  Connection resistance is the resistance of the inter-cell connections measured between the connected posts so as to include both the resistance of the connector and the bolted connection.

- Why Monitor?

  The purpose of this measurement is to identify high resistance connections. It is very important to minimize the connection resistance to reduce power losses and to prevent catastrophic failure due to overheating.

- Analysis

  Baseline resistance values for each type of connection should be established. Any subsequent resistance reading exceeding 20% of the baseline value specified by the manufacturer, should be identified and investigated further.

17 – Ground Fault Detection

- Description

  Ground fault detection is defined as identification of unintentional current paths to ground from within the battery system. Examples of ground fault paths are electrolyte leaks, damaged cable insulation, dirt, moisture, etc.

- Why Monitor?

  The purpose of this measurement is to ensure system integrity, performance and safety. Failure to detect ground faults can cause degradation of system reserve capacity, cause safety hazards and if left unchecked, catastrophic failures.

- Analysis

  Insulation resistance should be in the range of meg-ohms and maximum ground current leakage current should be in low range of milliamps.