BITE3
Battery Impedance Test Equipment

- **Determines health of lead-acid cells**
- **On-line testing with Pass/Warning/Fail calculations**
- **Measures impedance, interconnection resistance and cell voltage**
- **Windows CE operating system with 32 MB of memory**
- **Measures float and ripple currents**
- **Includes PowerDB LITE Management Software**

DESCRIPTION

The Megger BITE3 Battery Impedance Test Equipment determines the health of lead-acid cells by taking measurements of the most important battery parameters. The BITE3 measures cell impedance, an internal ohmic test, cell voltage, intercell connection resistance and ripple current. And, for the first time in a battery instrument, the BITE3 measures float current and the harmonic content of the ripple current. There is even a built-in spectrum analyzer to show the harmonic content of the ripple current. It has firmware that can be upgraded through the Internet and supports multiple languages.

The BITE3 is one of the easiest instruments to use. Its measurements, along with temperature, specific gravity and other battery data, can provide the best basis for evaluating the overall health of batteries from terminal plate to terminal plate and to a lesser extent, the charger (from ripple current and its harmonic content.) Megger recommends that the BITE3 be made part of a comprehensive battery maintenance program with readings taken and recorded semi-annually for flooded, lead-acid cells and quarterly for VRLA.

Unlike load-cycle testing which is expensive, non-predictive and time-consuming (but does provide actual capacity data), the BITE3 is quick, reliable and easy to use. With a rapid test time, one person can easily, quickly and precisely measure cell and string parameters without taking the system off line. Furthermore, in as little as four keystrokes, the instrument is ready to take battery measurements (five, if the power button is included). The processor of the BITE3 uses a Windows® CE Operating System and can store more than 1 million cells' data in any string configuration. It is menu-driven that is easy to navigate. Its unique data analysis screens provide immediate feedback on the status of cell impedance, (see Figure 1, Battery Analysis Report). The first part of the report is the numerical data. The second part is the impedance deviation graph and the third part is the impedance deviation graph but in ascending impedance order. The ascending impedance graph groups the weakest cells together for easier analysis. With the optional printer, this report can be printed by the user and left at the site as a record for future reference.

POWERDB BATTERY MANAGEMENT SOFTWARE

Power DB is a powerful software package that allows you to organize and analyze the recorded battery test data. IDEAL FOR NERC and FERC requirements! Power DB allows you to configure your BITE3 instrument as well as transfer the data from the BITE3 to Power DB. Power DB will then allow you to trend voltages, impedances, strap resistances, cell temperature as well as specific gravity. Power DB will also display the ripple current, float current, ambient temperature as well as having a location for an IR picture or a diagram or graphics. Power DB allows you to use red, yellow and green bands to quickly and easily compare cells versus warning and failure limits. This allows you to quickly and easily identify weak cells or old strings.

Power DB comes in two versions, the freeware version Power DB LITE and the full-blown version Power DB. In addition to the features listed above Power DB LITE also calculates Baseline data, average impedance as well as average strap values. Power DB LITE also allows the user to input their own logo, In addition power DB allows you to view just the charts you wish to view as either line charts or bar charts.

The full-blown Power DB is a purchased copy that supports all the functions of Power DB LITE plus it operates with almost all Megger products and allows the user to merge data from different products onto one report. The full-blown Power DB will also allow users to create custom reports.

Using the BITE3 along with Power DB will allow you to quickly and easily locate individual poor cells within your string. This will help provide longevity for the string. The BITE3 along with Power DB will also allow you to easily locate old strings that are ready to be replaced. In addition the BITE3 along with Power DB will allow you to see how the batteries in your stings are aging. This will allow you to predict their estimated life span for easy budgeting.

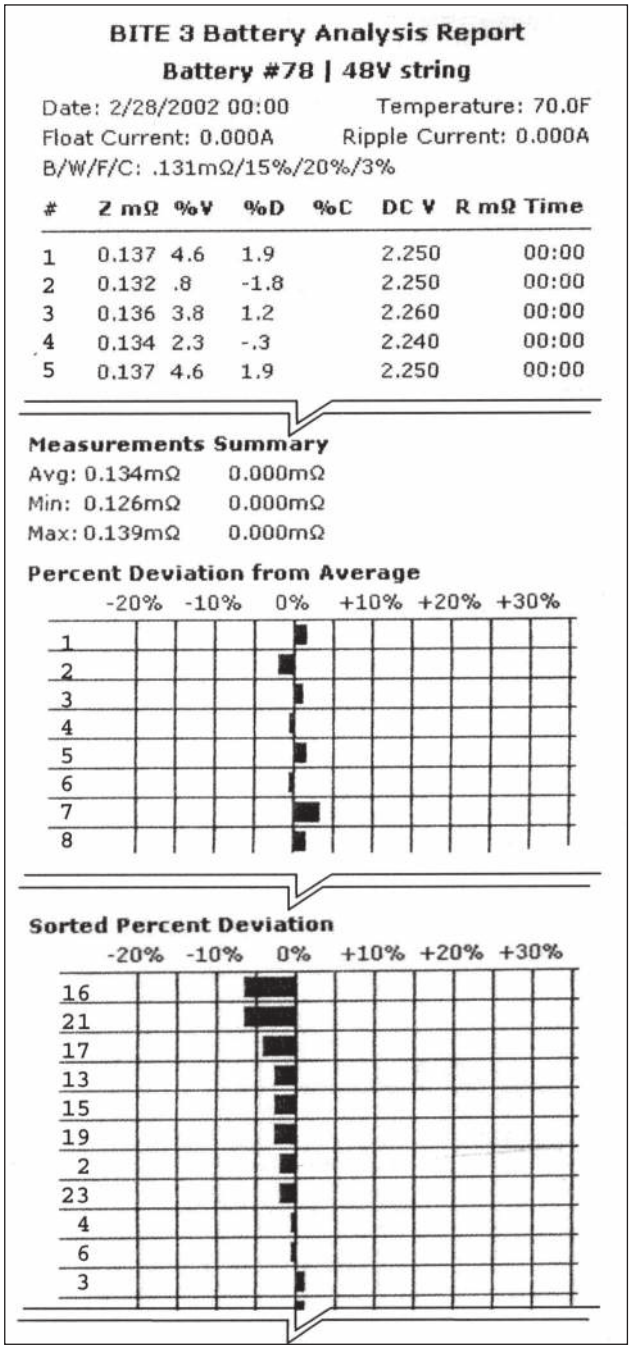

Figure 1: Battery Analysis Report

APPLICATIONS

It is known that impedance is correlated to battery capacity and there has been a long-standing question as to when a user should replace a cell. See Figure 2. Recent studies by EPRI* and other organizations indicate that when the impedance of a sealed battery increases by about 50% from its baseline value, the cell has degraded to less than about 70% capacity. BITE3 and PowerDB allow the user to trend data and to enter baseline values for comparison purposes and to make decisions whether on-site or in the office. Both the BITE3's impedance deviation graph and the trend graph in PowerDB clearly show the status of a cell which helps users to decide what action needs to be taken to ensure battery back up reliability based on users' criteria.

A battery's internal impedance increases as its capacity decreases due to various factors such as age, ambient temperature, discharge history, etc. The BITE3 measures internal impedance and dc voltage for lead-acid cells. It also measures intercell connection resistance, float current and ripple current and the harmonic content of the ripple current to provide a much better evaluation than any other single instrument. Impedance finds electrical path problems due to plate sulphation, post-seal corrosion, dry-out (loss of compression), poor intracell welds and intercell connections and more. These data let the user determine maintenance needs such as:

- Cell replacement criteria based on impedance trends
- Jumper out a cell or two
- Clean and/or retighten intercell connectors
- Shorten the maintenance interval, etc.,
- Evaluate float current and ripple current effects

Typical installations that can be tested using the BITE3 include:

- Electrical power generation plants
- Substations — utility, railroad, industrial
- Telecommunications facilities — OSP, Wireless, POPs, MTSOs, Fiber Regens
- UPS systems — standard and cabinetized batteries
- Railroad — Signals and Communications, CTC
- Aircraft power supplies
- Marine and military

Stationary Battery Monitoring by Internal Ohmic Measurements EPRI, Palo Alto, CA: 2002. 1002925

FEATURES AND BENEFITS

- Calculates impedance automatically and stores results for on-site review to make immediate decisions.
- Serial connector for uploading stored data to a personal computer and to download data from PowerDB.
- Measures a wide range of batteries.
- On-line testing requiring no downtime and introduces less risk to battery testing compared to load testing and other techniques.
- Stores more than 1 million cells' data in any string configuration – no need to stop, download, delete and continue.
- Firmware and software updates are fast and easy for PowerDB and the BITE3 through the Internet.
- No programming skills required. PowerDB is an easy to use, fully functional battery software capable of storing as much information and data as your hard drive (or network) has memory to store.
- PowerDB has the ability to import images such as IR thermographs, diagrams or photographs. This helps to document visual inspections, string configurations, installation techniques, or other aspects of battery systems. Images and data are stored together, providing convenient and easy access.
- The BITE3 and PowerDB accommodate multiple languages.

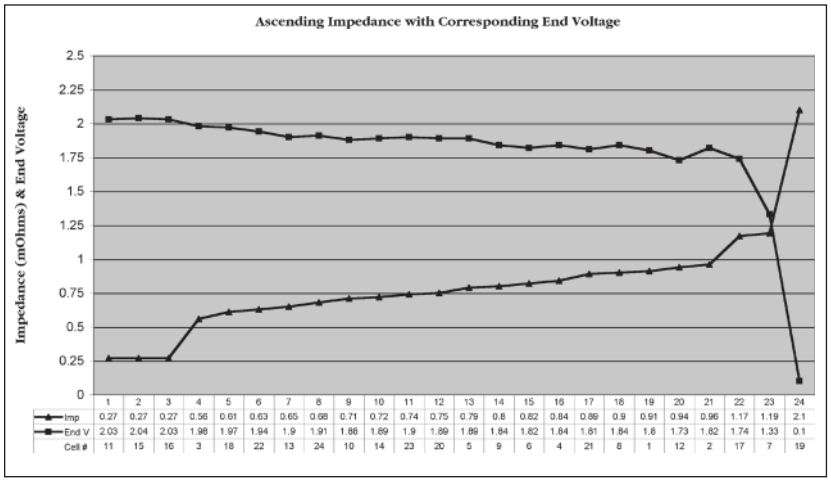

Figure 2: Ascending impedance compared to load test

TEST PROCEDURE

The BITE3 works by placing the lead set at the cell terminals to measure the voltage drop of the ac current signal applied by the instrument to the cell while it is on-line. During each measurement, impedance is calculated following Ohm's Law, displayed on the LCD, and stored. It also measures, displays and records dc voltage, interconnection (strap) resistance, float and ripple currents. Float and ripple current measurements are performed separately at the start of the test. This is because current is the same everywhere in the series connection of the string in accordance with Kirchhoff's law. All of these data together help determine the overall health of the entire battery string's electrical path from terminal plate to terminal plate and to a lesser extent, the charger (by measuring ripple current and its harmonic content).

An innovative, patent-pending measuring technique is being employed so that a clamp-on current sensor is no longer necessary. It is well-recognized that the best way to measure current is with a shunt. Since the battery has many straps, simply by determining a strap's resistance, it can be used as a shunt to determine float and ripple currents. First, while across an intercell connector, the instrument applies a current and measures the voltage drop of the intercell connector to calculate the resistance of the intercell connector. Then, it measures the strap again without the instrument current. A mathematical calculation is performed to determine float and ripple currents and the intercell connection resistance.

The optional CT can be used with short strings in parallel configurations to measure "escape current." Other techniques do not measure the current and can overstate the health of batteries in these types of configurations. By using a CT to measure the actual current in the cell being tested, better results are obtained.

PowerDB can download string header info (with baselines and limits) into the BITE3 along with the most recent data (even if measured by a different BITE). See Figure 3. Then using the menus, simply scroll to the site and string and start taking readings. When finished, close the test and continue to the next string. At the conclusion of the test, simply download to a PC for further data analysis and long-term trending. Its versatility allows comments to be added about the string. These comments will be uploaded with the battery data. Additional comments about the site, string and/or cell such as ambient and pilot cell temperature can be stored by using the keypad to enter them.

DATA ANALYSIS

PowerDB has the ability to download site and string information and data as well as firmware updates to the BITE3. The data downloaded into the BITE3 gives access to the most recent data for the strings being tested during the upcoming week or month.

With previous data loaded, better analysis can be performed simply by comparing the last result to the most recent result. Any cell that changes by more than a few percent suggests that further investigation is warranted.

ON-SITE INTERPRETATION

Impedance readings for individual cells can be used to compare to the string average. Individual cells with deviations of more than ±15% for flooded and ±35% for VRLA typically indicate a problem with that cell. The Battery Analysis Report clearly shows the cells that are weakest when compared to the string average and the other cells in the string. It is typically the one or two weak cells that can take the string off line. By comparing each cell to the string average, it is possible to determine which cell is the weakest in the string and by how much.

If previous data were downloaded through PowerDB, then a comparison of each cell to its previous reading (%C) can provide additional information about each cell. The Battery Analysis Report is designed to provide as much information as possible on which to make decisions while on site; decisions to ensure that the string will properly support the load.

TRENDING ANALYSIS

Impedance readings can be used for trending to determine replacement criteria. Battery cell impedance values should be recorded and compared to previous readings to determine the position of the cell on the curve of impedance versus cell life. Based on experience, a variation of ±20% from baseline of a flooded lead-acid and ±50% for VRLA cells indicate significant change in the electrical path to warrant serious evaluation of the health of the battery system. The BITE3 with baseline values entered can be used as a trending tool while on site. Trending is the best method available to know the most about the health of batteries.

CONFIGURING THE BITE3 USING POWERDB

The PowerDB software allows you to easily and quickly configure the BITE3 remotely. Simply enter the desired settings in the Information and Settings page of PowerDB. Then UPLOAD the settings to the BITE3 connected to the PC. See figure 3.

Data can be easily transferred from the BITE3 and then viewed and analyzed using PowerDB. In PowerDB LITE each test is saved as an XML file. Select the desired string then select the desired test (XML file) performed on that string. See figure 4.

NOTE: The full-blown version of Power DB utilizes a complete database not XML files.

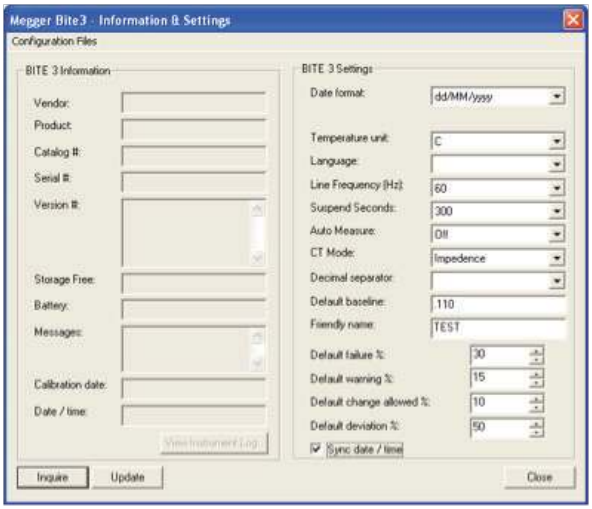

Figure 3: Information & Settings page of PowerDB

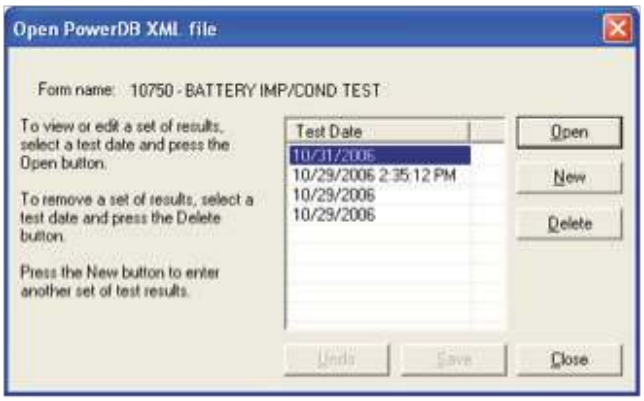

Figure 4: XML file selection

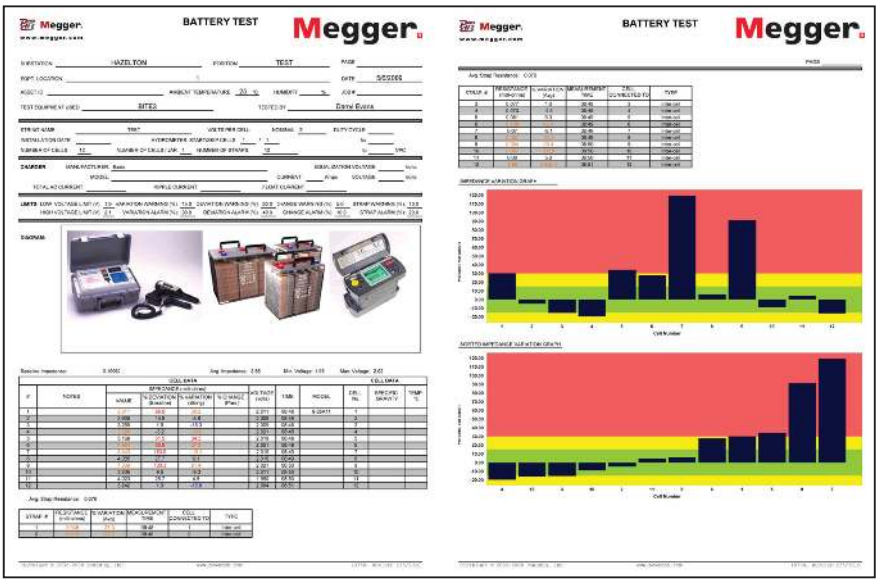

Figure 5: Customizable reporting

You can view all the recorded data in the Battery Impedance Report. This report can be customized to your liking. You can select the data and charts top be viewed. You can also determine the type of chart. This is ideal for meeting NERC and FERC requirements. See figure 5.

In addition the PowerDB software can calculate baseline data, import hydrometer data and import data from the legacy ProActiv software. In addition, the full-blown version of PowerDB will allow you to make custom reports. (Or Megger can make them for you!) The full-blown Power DB software will allow you to mix data from all different types of Megger instruments.

The BITE3 along with PowerDB offers you unprecedented capabilities to ensure your batteries are always ready when you need them.

ACCESSORIES

The BITE3 has many accessories that enhance its versatility. There are several lead sets, a printer, lighted probe extensions and a CT.

The lead set family contains:

- AMP/Burndy lead set for small telco batteries
- Quick Disconnect lead set for ELU systems, security systems, etc.
- Kelvin Clip lead set for other types of batteries

The CT is for measuring escape current in short strings in parallel configurations. The lighted probe extensions are ideal for measuring batteries in (dark) cabinets. The extensions eliminate the need to take the battery off line and can be tested during normal working hours, saving time and money. As with previous BITEs, it is a one person job since the batteries need not be removed from the cabinet.

SPECIFICATIONS

BITE3 Instrument

Impedance Range and Resolution

0.05 to 1.000 mΩ	1 µΩ resolution
1 to 10.00 mΩ	10 µΩ resolution
10 to 100.0 mΩ	0.1 mΩ resolution
10 to 600.0 mΩ	0.1 mΩ resolution

Voltage Range and Resolution

1 to 15 V dc across probes

1 to 8.0 V dc	1 mV resolution
8.0 to 15.00 V dc	10 mV resolution

Current Range and Resolution

0.5 — 9.99 A ac/dc	0.01 A resolution
10.0 — 99.9 A ac/dc	0.1 A resolution

Accuracy

dc voltage: ±(1% rdg +1 lsd)
ac impedance: ±(5% of rdg +1 lsd)
ac/dc current: ±(5% rdg +0.5 A)

Precision

Better than 0.5% one sigma

Source Output Current

1/2 A rms

Display

1/4 VGA LCD
2.83" x 2.95" (72mm x 57mm)

Settling Time per Reading

Approximately 6 to 8 seconds

Battery Pack

2 to 4 hours continuous
4.8 V dc, 7000 mAh, quick charge NiMH battery pack

Note: The batteries are nickel-metal-hydride. If these are changed the disposal of the old cells should be in accordance with local regulations.

Temperature

Operating: 32° to 105° F (0° to +40° C)
Storage: -5° to 130° F (-20° to +55° C)
Humidity: 20 to 90% RH, noncondensing

Safety

Designed to meet IEC 61010-1 specifications

Dimensions

8.6 x 4 x 9.5 in.
220 x 100 x 237 mm

Weight

5.7 lbs (2.6 kg)

Charger

Supply Voltage

90 to 264 Vac, 50/60 Hz
1.6 A max.

Output

12 V dc @ 5 A, 60 W max.

Optional Printer

Thermal, with 4-1/4 in. (110 mm) printing width

PowerDB System Requirements

Processor

300 MHz Pentium II or better

Operating System

Windows 2000 (SP2 recommended)
Windows XP
Windows 7
Windows 8
Note: Windows 95 is not supported

Software

Microsoft® Internet Explorer 5 or later
Microsoft .Net Framework
Will be automatically installed by PowerDB if it is not already installed on your computer. For additional information about Microsoft .Net Framework please visit: www.microsoft.com/net

Hard Drive Space

100 MB

System Memory (RAM)

64 MB (128 MB recommended)

Other Drives

CD-ROM (used only for installation)

Communications Port

COM (used only for importing data from test equipment or to download information to the BITE3)

Monitor/Display

True color, 800 x 600 resolution

Additional Information

For improved usage, an internet connection will make it easy to get automatic PowerDB software updates.
The user should have Microsoft Excel 9.0, or later, to import AVOLink or COMLink files into PowerDB.

ORDERING INFORMATION

Item (Qty)	Cat. No.
BITE3, 110/230 V ac, 50/60 Hz, CE-marked	BITE3
Included Accessories	
PowerDB software	1001-381
Canvas carrying case	35788
RS-232 null modem cable	33533-1
Line charger	6280-333
Battery	6121-492
Dual-point lead set	BI-10002
Tip kit	BI-10017
Operating manual	AVTMBITE3

Item (Qty)	Cat. No.
Optional Accessories	
Lead set, 6 ft (1.8 m) probe to probe	36616
Printer, battery-operated, 110 V ac	35755-3
Printer, battery-operated, 220 V ac	35755-4
Printer paper, 1 roll	26999
AMP/Burndy lead set	BI-10004
Kelvin clip lead set	BI-10005
Quick Disconnect lead set	BI-10006
Cigarette lighter charger	6280-332
Current transformer kit	35873
USB-serial adapter	35871
Probe extensions, lighted	35865
Hard-sided carrying case	35890
Standard transit case	35915
Field test shunt, 0.01 Ω, current rating 10 A	249003
Field test shunt, 0.001 Ω, current rating 100 A	249004
Field test shunt, 0.0001 Ω, current rating 500 A	249005

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