# BITE2 and BITE2P
# Battery Impedance Test Equipment



BITE2P

BITE2

- **Determines condition of lead-acid and NiCd cells up to 7000 Ah**

- **On-board Pass/Warning/Fail indications**

- **Robust, repeatable instruments**

- **On-line testing**

- **Checks charger condition by measuring ac ripple current**

- **Includes PowerDB LITE Software**

## DESCRIPTION

The BITE2 and BITE2P Battery Impedance Test Equipment determine the condition of lead-acid and nickel-cadmium cells up to 7000 Ah. An advanced feature set has been developed that includes Pass/Warning/Fail calculations based on a user-entered baseline value, advanced printing functions and more. The case of the BITE2P consists of both the transmitter and a carrying case for all of the standard accessories and some of the optional accessories, in an all-in-one unit. The BITE2 and its accessories fit into a sturdy canvas case with a shoulder strap.

The instruments work by applying a test signal across the battery string while on-line, then calculates impedance based on simultaneous measurements of current and resulting voltage drop of each cell/jar. They also measure dc voltage and interconnection (strap) resistance to help determine the overall condition of the entire battery string's electrical path from terminal plate to terminal plate.

In addition, the BITE2 and BITE2P measure ac ripple current which, if too high and over an extended period of time, can damage the battery by heating it. (An increase of battery temperature by 18°F/10°C will halve the life of lead-acid batteries.) Battery manufacturers generally recommend a limit of 5A of ac ripple current for every 100 Ah of battery capacity. The first measurement that the instruments take is ac ripple current which should be trended.

The BITE2 and BITE2P receiver stores the readings in its internal memory. These measurements, along with other maintenance data such as ambient and pilot cell temperatures and ac ripple current, assist in determining the overall condition of battery systems. Megger recommends that impedance measurements with the BITE2 or BITE2P be made part of a battery maintenance program with readings taken and recorded semiannually for flooded batteries and quarterly for VRLA.

Unlike load cycle testing that involves substantial downtime and repeated discharges, using the instruments require no battery discharge, nor do they stress the battery in any way compared to other techniques. With a test time of less than 15 seconds for

each cell and intercell connector, one person can easily, quickly, and precisely measure internal cell impedance, dc terminal voltage and intercell connection resistance without taking the battery system off line and evaluate charger condition also.

Naturally, everything you need to perform these tests is included with the basic instruments. There is a full line of optional accessories to enhance the capabilities of the BITE2 and BITE2P. Both have the ability to download to a PC for data interpretation and to PowerDB, Megger's battery database management software. Additionally, the BITE2P has a built-in printer to review the active test and also to leave a hard copy record at the site.

### Receiver

The battery-operated receiver incorporates the potential leads, clamp-on current sensor, and data storage capabilities. It stores more than 2000 sets of data (cell impedance, cell voltage and interconnecting strap resistance, date and time stamps) in up to 300 tests. It also allows for printing the active test for easy review and retest. Selective printing of any test and deleting oldest tests are now included features to maintain in memory the most critical tests.

At any time while performing a test, the operator can review the current test results by using arrow keys and scrolling back through the active test screen. The operator can also print the active test using the BITE2P transmitter printer. If needed, the operator can retest any of the cells and straps in the current test. Stored data can also be downloaded via the RS-232 connector directly to a personal computer or the BITE2P transmitter printer.

One additional feature of the receiver is that if you are called away while in the middle of the test, simply shut down the instrument and it will remember where you left off in the test.

The clamp-on current sensor is connected to the receiver during testing and clamped around a convenient intertier or intercell connection within the loop created by the transmitter's current source leads and the battery string. If the intercell or intertier connection consists of more cables than the diameter of the

clamp-on current sensor can encompass, the receiver has a split-strap function.

There are optional RopeCTs™ available for large buss work. With the optional bar-code wand, additional information such as location ID, user ID, ambient and pilot cell temperatures can be recorded and stored. There is space on the printout to enter specific gravity readings.
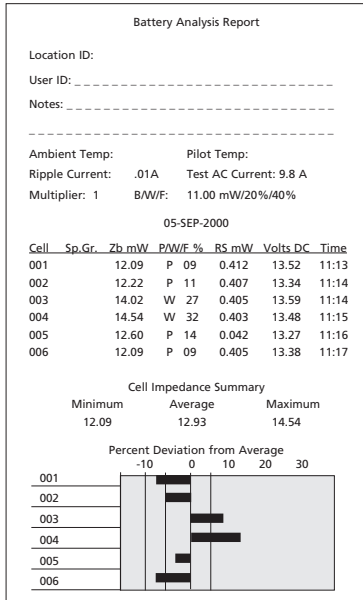
### Battery Analysis Report

Location ID:

User ID: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Notes: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

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Ambient Temp:  Pilot Temp:
Ripple Current:  .01A  Test AC Current: 9.8 A
Multiplier: 1  B/W/F:  11.00 mW/20%/40%

05-SEP-2000

| Cell | Sp.Gr. | Zb mW | P/W/F | % | RS mW | Volts DC | Time |
|------|--------|-------|-------|-----|-------|----------|------|
| 001 | | 12.09 | P | 09 | 0.412 | 13.52 | 11:13 |
| 002 | | 12.22 | P | 11 | 0.407 | 13.34 | 11:14 |
| 003 | | 14.02 | W | 27 | 0.405 | 13.59 | 11:14 |
| 004 | | 14.54 | W | 32 | 0.403 | 13.48 | 11:15 |
| 005 | | 12.60 | P | 14 | 0.042 | 13.27 | 11:16 |
| 006 | | 12.09 | P | 09 | 0.405 | 13.38 | 11:17 |

Cell Impedance Summary

| Minimum | Average | Maximum |
|---------|---------|---------|
| 12.09 | 12.93 | 14.54 |

Percent Deviation from Average

**Figure 1. Sample battery analysis report**

### Transmitter

The transmitter provides the capacitively coupled ac test signal to avoid transients on the dc buss and applies it to the cells under test via the source leads. Both the BITE2 and BITE2P transmitters have an LCD and built-in receiver charger, while the BITE2P transmitter features a built-in printer.

Data, measured and stored in the receiver can be exported to a PC. It can also be printed to the BITE2P transmitter printer where it can be reviewed. Figure 1 shows a sample printout of a full battery analysis report.

### APPLICATIONS

A battery's internal impedance increases with decreasing capacity due to various conditions such as age, ambient temperature, discharge history, etc. See Figure 2. Both the BITE2 and BITE2P measure impedance values and dc voltage for lead-acid and nickel-cadmium cells up to 7000 Ah capacity.

Impedance finds electrical path problems due to plate sulphation, post-seal corrosion, dry-out, and poor intracell and intercell connections. This information lets the operator determine maintenance needs such as:

- Cell replacement criteria based on impedance trends.

- Jumpering out a cell or two.

- Clean and/or retorque intercell connectors.

- Shorten the maintenance interval, etc.

Typical installations that can be tested using the BITE2 and BITE2P include:

- Electrical power generation plants.

- Substations: utility, railroad, industrial

- Telecommunications facilities: CO, Wireline, Wireless, MTSO

- UPS systems

- Railroad: Signals and Communications, substation

- Aircraft power supplies

- Marine, military

### FEATURES AND BENEFITS

- On-line testing requiring no downtime.

- Enhanced printing and memory functions.

- Calculates impedance automatically and stores results for on-site review.

- Requires no battery discharge.

- Receiver can download stored data to PowerDB software for quick, easy analysis.

- Reduced test time: less than 3 seconds for each cell.

- Measures impedance and dc voltage values for all lead-acid and nickel-cadmium cells up to 7000 Ah.

- Stores more than 2000 sets of readings in up to 300 tests.

- Checks charger condition by measuring ac ripple current.

- PowerDB LITE allows data to be stored and allows custom reporting. **(ideal for NERC & FERC requirements)**

### Test Procedure

The BITE2 and BITE2P work by applying a capacitively coupled ac test signal across the battery string while on-line. The receiver and potential probe are placed at the cell terminals to measure the signal and resulting voltage drop for each cell/jar. During each measurement, impedance is calculated following Ohm's Law, displayed on the LCD and stored. The instruments also measure, display and record dc voltage and interconnection (strap) resistance to help determine the overall condition of the entire battery string's electrical path from terminal plate to terminal plate. The also measure ac ripple current, a charger parameter.

The BITE2 and BITE2P receiver stores the readings in its internal memory. These measurements, along with other maintenance data such as ambient and pilot cell temperatures and ac ripple current, assist in determining the overall condition of battery systems. Figure 2 shows a typical test setup.

### Interpretation of Readings

Data produced by the BITE2 and BITE2P can be interpreted in several modes:  instantaneous, short-term and long-term time frames. PowerDB makes data analysis fast & easy. See figure 3.
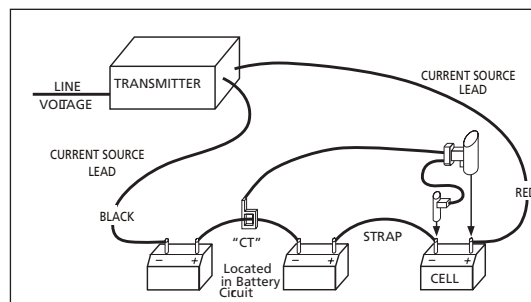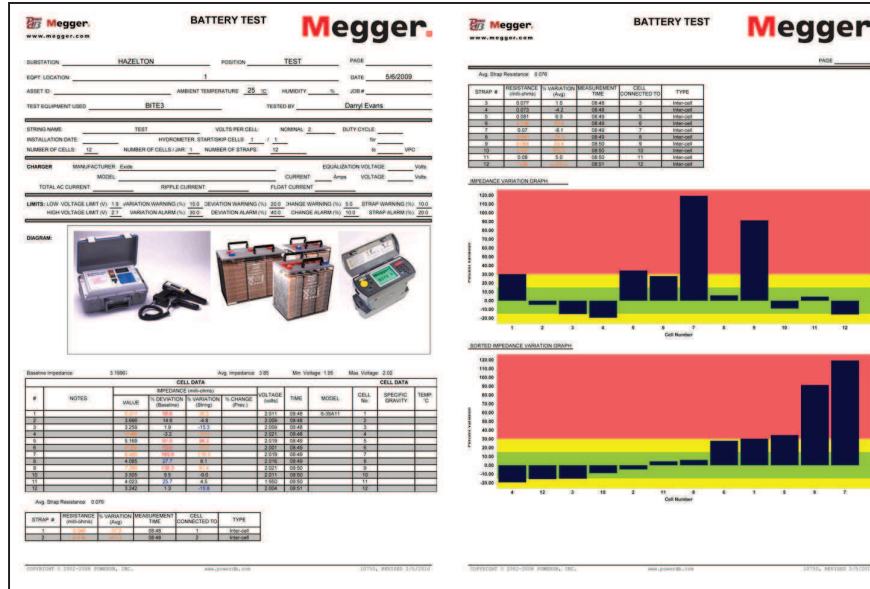
**Figure 2. A typical test setup**

**Figure 3. Power DB reporting**

## Instantaneous Interpretation

The operator can enter a baseline value from either the impedance measurements obtained at commissioning. The percent changes from baseline for warning and fail levels are entered, but 20 percent and 40 percent are the default settings. The LCD on the receiver will display the status of the cell for a few seconds before proceeding to the next cell. The status of each cell/jar will be printed on the Battery Analysis Report.

## Short-Term Interpretation

Impedance readings for individual cells can be used in the short term to compare with the average impedance readings for the entire battery string. Individual cell values with deviations of more than ±15% for flooded lead-acid, ±35% for VRLA, and 50% for NiCd cells from the battery string average typically indicate a problem with that cell. Megger recommends additional investigation of such cells including a verification of intercell connections and a single cell load-cycle test.

## Long-Term Interpretation

Impedance readings for the entire battery can be used in the long term 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 as shown in Figure 4. Based on experience, a variation of ±20% from baseline for flooded lead-acid, ±40% for VRLA and 50% for NiCd cells indicate significant change in the electrical path to warrant serious evaluation of the condition of the battery system. Megger maintains a database of impedance values by some manufacturers and battery size/type. For comparison purposes, this information is available upon request.
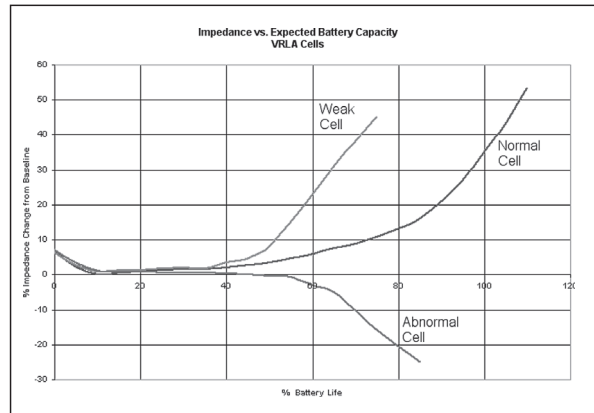


**Figure 4. Impedance increases with battery age (and weakness)**

## SPECIFICATIONS

### Application
The BITE2 and BITE2P test lead-acid and nickel-cadmium cells up to 7000 Ah.

### Maximum Total Voltage at Current Source Leads
275 V dc (larger battery systems can be sectioned to accommodate this specification)

### Transmitter
**Supply Voltage**
100 to 130 V, 50/60 Hz, 200 VA max
210 to 250 V, 50/60 Hz, 200 VA max

**Source Output Current**
10 A nominal, 50/60 Hz operation

### Maximum Battery String Test Voltage
275 V dc at source lead terminals (section the battery if >275 Vdc)

**Display**
Digital LCD meter, 0 to 15 A

**BITE2P Printer**
Built-in thermal, with 4.25 in. (110 mm) printing width

**Charger**
**Supply Voltage**
100 to 130 V, 50/60 Hz, 14 VA
210 to 250 V, 50/60 Hz, 14 VA

**Output**
6.50 V dc @ 1.10 A dc charging (max)
9.60 V dc open circuit

**Receiver**
**Accuracy**
ac impedance 5% +1 LSD
dc voltage ±(1.5% of rdg +1 LSD)

**Precision**
Better than 0.5% one sigma

**Voltage Range and Resolution**
1 to 2.500 V dc, 1 mV resolution
2.5 to 25.00 V dc, 10 mV resolution

**Impedance Range and Resolution**
0 to 1.000 mΩ, 1µΩ resolution
1 to 10.00 mΩ, 10µΩ resolution
10 to 100.0 mΩ, 0.1mΩ resolution

**Settling Time per Reading**
3 seconds maximum

**Display**
LCD, 2 x 16 characters

**Supply**
4.8 V dc, 800 mAh, quick charge NiMH battery pack

**Battery Pack Life, Full Charge**
5 hours continuous

**Maximum Cell/Jar Test Voltage**
25 V dc between receiver and potential probe

**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

**Clamp Range**
**Standard CT**
2.0 in. (50 mm) maximum opening

**Optional Miniature CT**
0.5 in. (12 mm) maximum opening

**Optional RopeCT™**
6 in. (150 mm) opening, approx.

**Standards**
Conforms to the EMC Directive 2004/108/EC and the LVD Directive 2006/95/EC

**Dimensions**
**Transmitter**
**BITE2:** 6.5 H x 14 W x 10.6 D in. (16.5 H x 35.6 W x 27 D cm)
**BITE2P:** 7.5 H x 18.5 W x 14.6 D in. (19 H x 47 W x 37 D cm)

**Receiver (irregular shape)**
7.25 H x 11.25 W x 2 D in. (18 H x 29 W x 5 D cm)

**Weight**
**Transmitter**
**BITE2:** 17 lb (7.7 kg)
**BITE2P:** 18 lb (8.2 kg) alone, 32 lb (14.5 kg) packed

**Receiver**
1.6 lb (0.7 kg)

## ORDERING INFORMATION

| Item (Qty) | Cat. No. | Item (Qty) | Cat. No. |
|---|---|---|---|
| BITE2, 110/230 V ac, 50/60 Hz | 246002B | Manual for BITE2 and BITE2P | AVTM246004 |
| BITE2P, 110/230 V ac, 50/60 Hz | 246004 | Accessory bag for BITE2 | 29996 |
| **Included Accessories** | | **Optional Accessories** | |
| Transmitter for BITE2 | P30044-300 | Current sensor 0.5 in. (12 mm) opening with 2.5 ft (0.8 m) lead | 246034 |
| Transmitter for BITE2P | P30044-100 | CT extension cable, 20 ft (6 m) | 33864-2 |
| Receiver | P30620-3 | Current source leads, 10 ft (3 m), fused | 246147 |
| Fused Source Leads, 20 ft (6 m) | 29386-4 | Current source leads, 30 ft (9.1 m), fused | 246347 |
| Current sensor, 2 in. (50 mm) opening with 5 ft (1.5 m) lead | 2002-786 | Current source leads, 40 ft (12.2 m), fused | 246447 |
| CT extension cable, 20 ft (6 m) | 33864-2 | Bar code scanner kit with preprinted code sheet | 246201 |
| Communication cable, 6 ft (1.8 m) | 35340 | Flex Current Clamp (6" ID) | MCCA-100B2 |
| Charger cable | 35341 | | |
| Thermal paper | 26999 | | |
| ac line cord, 8 ft (2.5 m) | 17032-7 | | |

**Megger**

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