

## BIDDLE® BATTERY IMPEDANCE <u>TEST EQUIPMENT</u>

- Measures impedance and dc voltage values for all lead-acid and nickel-cadmium cells of less than 2500 Ah capacity
- EBITE Transmitter includes built-in printer
- On-line testing
- Stores more than 2000 sets of readings
- RS-232 connector for downloading stored data from the receiver
- Reduces test time

# **Battery Impedance Test Equipment**

#### DESCRIPTION

The Biddle<sup>®</sup> EBITE and BITE<sup>2</sup> are designed for on-line ac impedance and dc terminal voltage measurements of secondary batteries. These measurements, along with other maintenance data such as ambient and pilot cell temperatures and ac ripple currents, assist in determining the overall battery system condition. Unlike load cycle testing that involves substantial downtime and repeated discharges, using the EBITE or BITE<sup>2</sup> requires no battery discharge. With a test time of less than 30 seconds for each cell, the units quickly and precisely measure internal cell impedance and dc terminal voltage without taking the battery system off line. Housed in a rugged case with built-in carrying handle, the EBITE and BITE<sup>2</sup> are easily operated by one person.

## RECEIVER

The receiver incorporates the potential leads, clamp-on current sensor, and data storage capabilities in one unit. It stores more than 2000 sets of data (cell impedance, cell voltage and interconnecting strap resistance).

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. If needed, the operator can retest any of the cells and straps in the current test before the results are downloaded.

Battery Analysis Report FENWICK SUB. 95				
Notes:				
	05/05/95			
Ambient Temp. 74 Pilot Temp. 68				
AC R 0.004	A AC	CI 9.4	0A	
Ν	Aultiplier: C	)		
User ID:				
Cell Notes Zb mg	$\Omega$ Rs m $\Omega$	Volts DC	<u>Time</u>	
001 2.46	0.356 0.359	6.18 6.23	10:56 10:57	
003 2.65	0.341	6.23	10:57	
004 2.47	0.355	6.18	10:58	
005 2.34	0.337	6.23	10:58	
006 2.65	0.347	6.23	10:58	
Cell Impedance Summary				
Minimum	Average	Maximum		
2.34 Dereent De	Z.40	2.0	55	
-10	0 10	n Averag 20	e 30	
001				
002				
003				
005				
006				

Figure 1: Sample battery analysis report printout

Stored data in the receiver can also be downloaded via the RS-232 connector directly to a personal computer or to the EBITE transmitter.

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 current source leads from the transmitter and the battery string.

If the intercell or intertier connection used consists of more cables than the diameter of the clamp-on current sensor can encompass, the receiver has a split-strap function.

With the optional bar-code wand, additional information can be recorded and stored such as location ID, ambient and pilot cell temperature.

The receiver is powered by internal rechargeable batteries and are charged with a separate external charger.

## TRANSMITTER

The transmitter provides the capacitively coupled ac test current to the cells under test via the current source leads. The EBITE transmitter has an LCD and built-in printer, while the  $BITE^2$  transmitter features a large analog current meter.

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Data collected and stored in the receiver can be downloaded to the EBITE transmitter where it can be reviewed and printed but not retested. Figure 1 shows a sample printout of a battery analysis report. Data collected can also be downloaded from the EBITE transmitter directly or exported via a modem to a personal computer.

## **APPLICATIONS**

Independent research indicates that internal battery cell impedance increases with the age and discharge history of a cell. The EBITE and BITE<sup>2</sup> measure impedance values and dc voltage for all lead-acid and nickelcadmium cells of less than 2500 Ah capacity.

The EBITE and BITE<sup>2</sup> test for sulfating, post-seal corrosion, poor intracell and intercell connections. This information lets the operator determine cell replacement criteria based on impedance trends.

Typical installations that can be tested using the EBITE and BITE<sup>2</sup> include electrical power generation plants and substations, telecommunications facilities, UPS systems, aircraft power supplies, and marine and military applications.

## **FEATURES AND BENEFITS**

• On-line testing requiring no down-time.

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

- Requires no battery discharge.
- RS-232 connector for downloading stored data to a personal computer.

• Reduces test time; less than 30 seconds for each cell.

• Measures impedance and dc voltage values for all lead-acid and nickelcadmium cells of less than 2500 Ah capacity. (Specific system environment may permit testing of larger Ah cells.)

• Stores more than 2000 sets of readings.

## **TEST PROCEDURE**

The transmitter provides a capacitively coupled ac current to the battery under test through the current source leads.

The CT is connected to the receiver and then clamped around a convenient battery intercell or intertier connection within the current loop created by the current source leads.

The receiver's potential probes are placed across the cell under test. The receiver shows the calculated im-



Figure 2: Schematic diagram of typical test setup

pedance and the dc float voltage of the cell under test. The information can be verified by the operator and then stored by pulling the trigger on the receiver.

The intercell/strap resistance measurement is made and stored by placing the potential probes across this connection and pulling the trigger. Figure 2 shows a typical test setup.

## Interpretation of Readings

Data produced by the EBITE and BITE<sup>2</sup> can be interpreted in both short and long-term time frames.

AVO International recommends that impedance measurements be made part of a battery maintenance program with readings taken and recorded semiannually. An impedance distribution plot assists in the analysis.

## **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 varying by more than  $\pm 20$  percent of the battery average typically indicate a problem with that cell.

AVO International recommends additional investigation of such cells including a verification of intercell connections and a single cell loadcycle 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.

Baseline impedance values are not provided by most battery manufacturers; however, AVO International maintains a database of impedance values by some manufacturers and battery size/type. For comparison purposes, this information is available upon request.

## **SPECIFICATIONS**

## Application

The EBITE and BITE<sup>2</sup> tests lead-acid and nickel-cadmium cells of less than 2500 Ah capacity. (Specific system environment may permit testing of larger Ah cells.)

#### Maximum Total Voltage at Current Source Leads:

250 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 (-47 model)

## Source Output Current

9.4 A nominal at 60 Hz operation 7.8 A nominal at 50 Hz operation

Maximum Battery Test Voltage 250 V dc at source lead terminals

## **BITE<sup>2</sup> Analog meter**

0 to 15 A

## EBITE Display

Digital LCD meter, 240 x 64 pixel, 5.2 x 1.5 in. (132 x 39 mm) viewing area

#### **EBITE 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

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

## Receiver

#### Accuracy

dc voltage  $\pm(1\% \text{ of } rdg + 1 \text{ LSD})$ ac impedance  $\pm(5\% \text{ of } rdg + 0.7\% \text{ fs})$ 

### Voltage Range

0 to 2.500 V dc 1 mV resolution 2.5 to 25.00 V dc 10 mV resolution

#### Impedance range

0 to 1.000 mΩ (1 μΩ resolution) 1 to 10.00 mΩ (10 μΩ resolution) 10 to 100.0 mΩ (0.1mΩ resolution)

#### **Setting Time per Reading**

3 seconds maximum

#### Supply

4.8 V dc, 800 mAh, quick charge nickel-cadmium battery pack

## **Battery Pack Life, Full Charge**

5 hours continuous

## **Maximum Battery Test Voltage**

25 V dc between receiver potential probes

#### Display

Digital LCD meter, 5 x 7 dot matrix, 2 line 16 character, 2.19 x .43 in. (55.7 x 11 mm) viewing area

## Temperature

**Operating:** 32 to 104° F (0 to 40° C) **Storage:** -4 to 131° F (-20 to 55° C)

Humidity: 20 to 90% RH, noncondensing

## **Clamp Range**

Standard 2.0 in. (50.8 mm) maximum opening Optional 0.5 in. (12.7 mm) maximum opening

#### Safety

Designed to meet IEC 1010 specifications

#### **Dimensions**

## Transmitter

**BITE**<sup>2</sup>

7.5 H x 11.25 W x 9.75 D in. 19.05 H x 28.58 W x 24.76 D cm

#### EBITE

12 H x 19.6 W x 11.1 D in. 30.4 H x 24.3 W x 28 D cm

Receiver (irregular shape)

7.25 H x 11.25 W x 2 D in. 18.4 H x 29.2 W x 5.1 D cm

#### Weight (total) Transmitter

BITE<sup>2</sup>: 15 lb (6.8 kg) EBITE: 32.9 lb (14.9 kg)

**Receiver:** 1.6 lb (0.72 kg)

#### **ORDERING INFORMATION**

Item	Cat. No.
BITE <sup>2</sup> , 120 Vac, 60 Hz	
BITE <sup>2</sup> , 240 Vac, 50 Hz	
EBITE, 120 Vac, 60 Hz	
EBITE, 240 Vac, 50 Hz	

## **Included Accessories**

Transmitter	
for Cat. No. 246002	33660
for Cat. No. 246002-47	33660-1
for Cat. No. 246003	30630-1
for Cat. No. 246003-47	30630-2
Receiver	
for Cat. No. 246002 and 246003	246301
for Cat. No. 246002-47 and 246003-47	246301-47
Current source leads, 20 ft (6 m), fused	29386-2
Current sensor, 2 in. (50 mm) opening	
with 5 ft (1.5 m) lead	33863
CT extension cable, 6 ft (1.8 m)	33864-1
Communication cable, 6 ft (1.8 m)	
with 25-pin to 9-pin adapter	30648
Battery charger	33497-1
Thermal paper (EBITE)	26999
Data extraction tools for Windows®	33734

INFURIMATION
Item Cat. No.
AC line cord, 8 ft (2.4 m)
for Cat. No. 246002 and 246003 17032
for Cat. No. 246002-47 and 246003-47 4127-2
Canvas accessory bag
Instruction manual
for Cat. No. 246002 AVTM246002J
Instruction manual
for Cat. No. 246003 AVTM246003J
Optional Accessories
Current sensor 0.5 in. (12.7 mm) opening
with 2.5 ft (0.8 m) lead 246034
CT extension cable, 20 ft (6 m) 246033
Current source leads, 10 ft (3 m), fused 246147
Current source leads, 30 ft (9.1 m), fused 246347
Current source leads, 40 ft (12.2 m), fused 246447
Bar-code wand with preprinted code sheet
Bar-code labeling software
DOS
Windows <sup>®</sup>
for Cat. No. 246002
101 Cal. 110. 240002
for Cat No. 246003 246010
101 Cut. 110. 240000