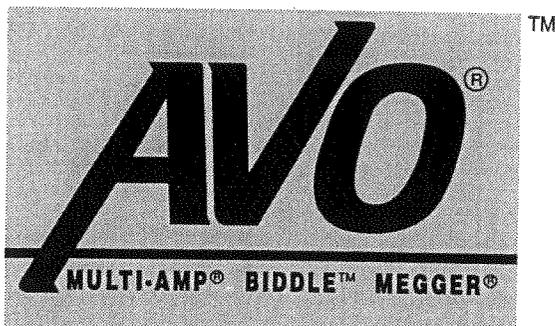

**Instruction Manual
AVTM 246001J**

For

Battery Impedance Test Equipment (BITE™)

Catalog Numbers 246001 and 246001-47



AVO INTERNATIONAL

BLUE BELL, PA 19422 • (215) 646-9200

There are no “missing” pages in the document.

Where it appears to skip over, those were originally blank.

Instruction Manual AVTM246001J

for

Battery Impedance Test Equipment (BITE™)

Catalog Numbers 246001 and 246001-47

Read the entire manual before operating.
Antes de operar este producto lea este manual enteramente.

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Blue Bell, PA 19422

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Section 1

Introduction

Receiving Instructions

Check the equipment received against the packing list to ensure that all materials are present. Notify Biddle Instruments of any shortage. Telephone (215) 646-9200.

Examine the instrument for damage received in transit. If any damage is discovered, file a claim with the carrier at once and notify Biddle Instruments or its nearest authorized sales representative, giving a detailed description of the damage.

This instrument has been thoroughly tested and inspected to meet rigid specifications before being shipped. It is ready for use when set up as indicated in this manual.

General Information

This manual contains instructions for the operation of the Battery Impedance Test Equipment (BITE). The BITE and its accessories are shown in Figure 1. The equipment comprises a transmitter, receiver, source leads, voltage probes, data pad, and instruction manual. These are housed in a rugged molded plastic case with carrying strap and four wheels (two fixed and two swivel). A canvas bag mounted in the lid of the case contains the two 40-ft source leads. Compartments in the transmitter hold the receiver and probes.

History

Internal cell impedance testing has been studied since the turn of the century. Significant studies were performed in 1955 by A. Fleischer and in 1959 by Willihngenz and Rohner. The 1955 study concerned the impedance of nickel-cadmium batteries at audio frequencies and was documented in a Signal Corps contract report No. DA 36-039-SC-42657. The 1959 study was published in an AIEE paper No. 59-823 on battery impedance. Willihngenz said that an equivalent circuit of a battery consists of resistances, inductance, and capacitance as shown in Figure 2.

The series battery resistance consists of the metal resistance (R_m) and the acid resistance (R_a), while the capacitance is shunted by a nonlinear resistance (R_I). During evaluation at Commonwealth Edison of Illinois, it was determined that the resistance of a stationary battery cell increases as the cell is discharged. A cell in poor condition due to sulfating of the plates exhibits a high internal impedance. Other problems such as poor intercell and intertier connections can also be discovered. Cells of different size and manufacturer exhibit different impedance readings, but cells of similar size, age and manufacturer should exhibit similar readings until conditions noted above dictate otherwise.

Test Description

The BITE is used to test for conditions of sulfating, post-seal corrosion, poor intracell connections, and poor intercell connections in a stationary battery while the battery is in full operation. A 60-Hz (50 Hz for Cat. No. 246001-47) ac test current is capacitively coupled through the battery cells in series. Since the impedance of the battery is small when compared to the load or the battery charger, most of the ac current passes through the battery. The impedance test can be made with the charger and load connected.

When the small ac voltage across the cell terminals is divided by the ac current passing through the battery, the result is battery cell impedance. The impedance of a healthy cell may be determined by testing a large number of similar cells under similar conditions and calculating the average value. The condition of a cell may be determined by comparing the impedance measured with the calculated average value. Not only is the ac voltage drop across the cell terminals measured, but also the ac voltage drops of the connections between cells. For accurate measurement of integral bus connections and battery straps, a digital low-resistance ohmmeter, such as the Biddle DLRO[®], is recommended.

Measurement Theory

The purpose of the BITE measurement is to evaluate the relative impedance of the battery cell under test. Since the environment provides a multitude of transient and harmonic signals, the true indicator of impedance will be in rms (root mean squared) form. This provides a direct measure of the power or heating value of the ac waveform with relationship to dc. The rms value of both the current and voltage waveform is digitized with 10 bit resolution and stored for direct computation of impedance. The rms value of the voltage is divided by the rms current value and the resultant impedance displayed on a 3-1/2 digit lcd display with ranges of 0 to 1.999 and 0 to 19.99 m Ω . Any reading greater than 19.99 m Ω results in a flashing display.



Figure 1: BITE and Accessories

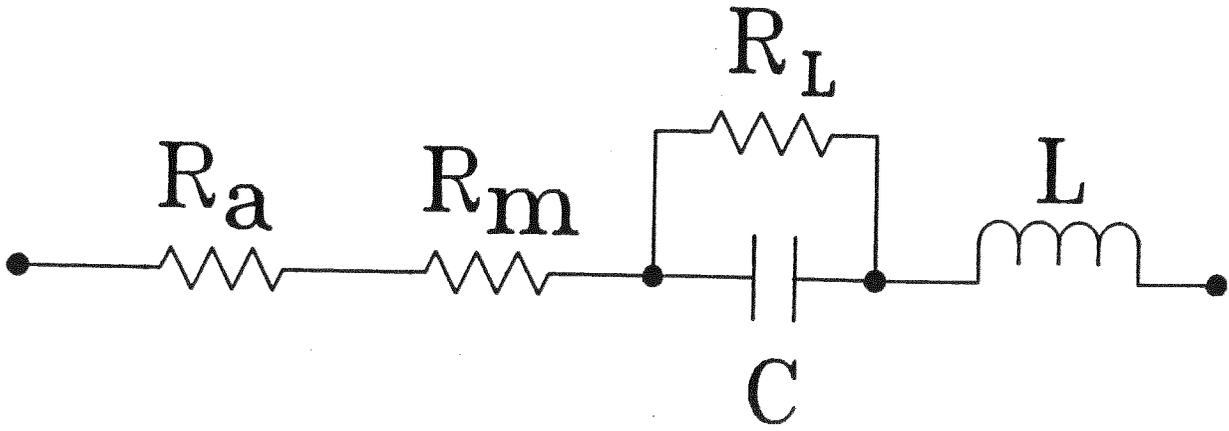


Figure 2: Equivalent Circuit of a Cell

Section 2

Safety

It should be understood that any use of electricity inherently involves some degree of safety hazard. While every effort has been made by Biddle Instruments to reduce the hazard, the user must assume responsibility for his own safety. Any work on large batteries is hazardous and requires constant attention to safety, particularly guard against the possibility of acid spills, explosion, and electrical shock.

- Always connect the source leads to the instrument before connecting to the battery.
- Safety is the responsibility of the user.
- The purpose of this equipment is limited to use as described in this manual. Do not use the equipment or its accessories for any purpose other than specifically described.
- Do not operate in an explosive atmosphere. Explosive gases can be present around batteries. A properly vented battery environment is considered safe but it is the responsibility of the user to verify conditions prior to using the BITE.
- Keep POWER ON/OFF switch set to OFF when making connections or disconnections at the battery. Always wear rubber gloves during these operations.
- Wear protective clothing and eye protection to guard against skin and eye damage from battery acid.
- Ensure that test leads and probes are in good condition, clean and free of broken or cracked insulation.
- Observe all cautions marked on the BITE transmitter panel.
- This instrument is only to be used by suitably trained personnel.

This instrument operates from a single phase power source. It has a three-wire power cord and requires a two-pole, three-terminal, live, neutral, and ground type connector. The voltage to ground from either pole of the power source must not exceed the maximum rated operating voltage (120 V for Catalog No. 246001 and 250 V for Catalog No. 246001-47). Before making connection to the power source, determine that the instrument rating matches the voltage of the power source and has a suitable two-pole, three-terminal grounding type connector.

The power input plug must be inserted only into a mating receptacle with a ground contact. Do not bypass the grounding connection. Any interruption of the grounding connection can create an electric shock hazard. Determine that the receptacle is properly wired before inserting the plug.

Refer fuse replacement to qualified service personnel only. To avoid electric shock and fire hazard, use only the fuse specified in the parts list which is identical in respect to type, voltage rating, and current rating.

The following warning and caution notices are used throughout this manual where applicable:

WARNING

Warning, as used in this manual, is defined as a condition or practice which could result in personal injury or loss of life.

CAUTION

Caution, as used in this manual, is defined as a condition or practice which could result in damage to or destruction of the equipment or apparatus under test.

Section 3

Specifications

Application

All lead-acid and nickel-cadmium cells of less than 2100 Ah capacity.

Tests on some battery systems may be constrained by 2-in. (50.8 cm) maximum opening of clamp-on receiver and physical installation of batteries.

Maximum total voltage at BITE source leads: 250 V dc (larger battery systems can be sectioned to accommodate this specification).

Electrical

Transmitter:

120 V ac, 60 Hz supply voltage (Cat. No. 246001)

220 V ac, 50 Hz supply voltage (Cat. No. 246001-47)

Nominal source output current: 10 A for 60 Hz operation

Maximum battery test voltage: 250 V dc

Receiver:

Three 1.5 V dc alkaline AA cells

Minimum battery life: 40 hours

Maximum dc voltage between voltage probes: 250 V

Time delay after power-on: 30 seconds maximum

Mechanical

Dimensions

Transmitter Enclosure:

12 in. H x 19-9/16 in. W x 11-1/32 in. D

(30.4 x 24.3 x 28.0 cm)

Receiver Enclosure:

8-1/4 in. x 3-1/4 in. x 1-5/8 in. (overall)

(20.9 x 8.2 x 4.1 cm)

Weight: 36 lb (16.3 kg) (total)

Display

Transmitter display: analog meter scaled 0 to 15 A, 5 percent accuracy.

Receiver display: 3-1/2 digit lcd, with ranges of 0 to 1.999 m Ω with 1 $\mu\Omega$ resolution and 0 to 19.99 m Ω with 10 $\mu\Omega$ resolution, ± 5 percent of full scale over operating temperature range, current greater than 5 A through cell under test.

Environmental

Operating temperature range: 32 to 104°F (0 to 40°C)

Storage temperature range: -4 to 131°F (-20 to 55°C)

Humidity: 20 to 95 percent rh noncondensing

Accessories Supplied

Two source leads (transmitter to battery), 40 ft (12 m), 14 AWG stranded copper with acid resistant insulation, rated for 600 V dc, and terminated with latch and lock connector at the transmitter and alligator clips at the battery.

Two potential leads (receiver probes), 8-1/2 ft (2.6 m), rated for 400 V dc, and terminated in banana plugs at the receiver and helical spring point at the battery.

One ac power cord, 6 ft (1.8 m) for standard grounded outlet.

Data pad, 50 sheets

Instruction Manual

Section 4

Controls, Indicators, and Connectors

Transmitter

Figure 3 shows the BITE transmitter control panel. Figure 4 shows a schematic diagram of the BITE transmitter.

J1 - 120 V, 60 Hz (220 V, 50 Hz for Cat. No. 246001-47) receptacle for ac power. Use standard line cord supplied with the instrument. The Catalog No. 246001-47 is not supplied with a power input plug. Depending on whether the test set is supplied with a black, white, and green input supply cord or a brown, blue, and green/yellow supply cord, the black or brown cord lead must be connected to the live pole and the white or blue cord lead must be connected to the neutral pole of an approved power input plug. The green or green/yellow ground lead of the input supply cord must be connected to the protective ground (earth) contact of the input plug.

J2 - Receptacle for BITE source current lead connection to battery under test.

SW1 - POWER ON/OFF control switch (illuminated green) and circuit breaker. The circuit breaker is dual rated for 1.9 A 250 V on the line side of the BITE and 14.2 A 15 V dc on the load side. The circuit breaker protects the user and instrument from current overloads and either sensor will remove ac power to the instrument when tripped.

L1 - READY light (amber) indicates unit is providing test current.

M1 - A.C. SOURCE CURRENT meter monitors transmitter output current. Use for indication only.

Receiver

SW1 - On/off control switch. To turn off power to the receiver, slide SW1 fully toward the ac current jaws. To apply power to the receiver slide SW1 towards the instrument's display. The display will either flash four digits or provide a reading as indication for power on.

DP2 - Liquid crystal display 3-1/2 digit with indicator for

milliohms ($m\Omega$). Error messages are as follows:

lo_b (V)	Low battery supply voltage indication
Err	Invalid data - divide by zero
Lo (A)	ac sensor current too low for proper computation
Hi ($m\Omega$)	Impedance value too large to measure accurately.

The symbols shown in parentheses appear in the right-hand part of the display.

J1, J2 - Receptacles for voltage probe connections.

Current jaw opening control - Press firmly to open the jaws and allow the surrounding of the conductor under test.

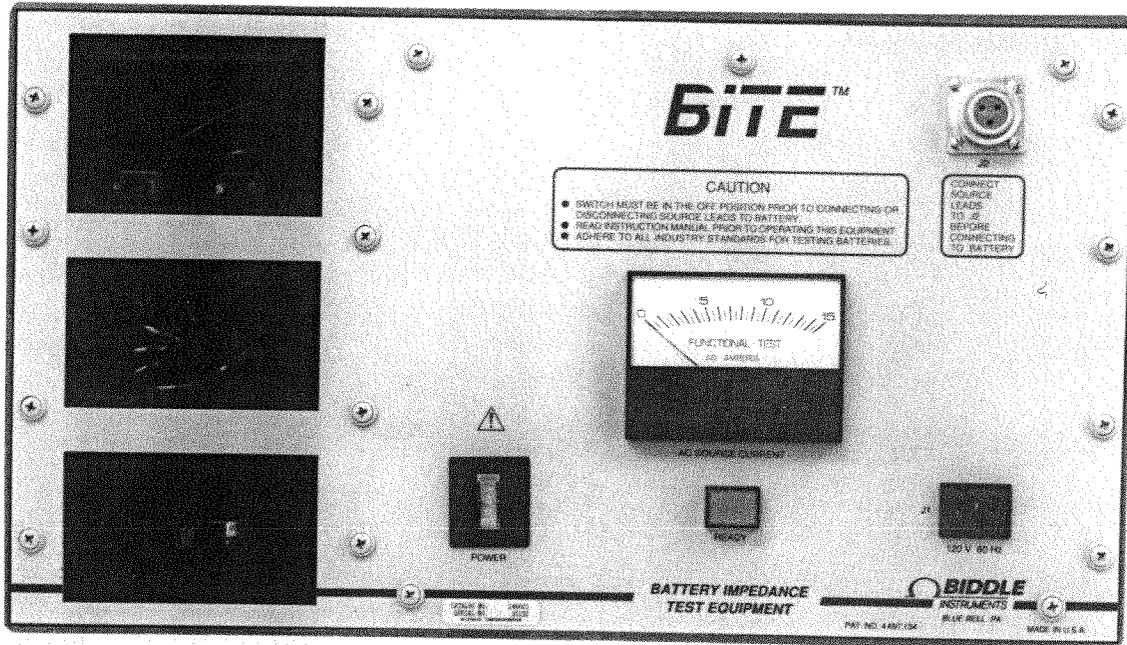


Figure 3: BITE Transmitter Control Panel

Section 5

Operation

Making Measurements

Strictly observe all safety precautions. Refer to Section 2.

1. From the information at the stationary battery site, record the installation date and the type and location of cells being tested on the data sheet provided (Figure 5).
2. Perform a visual check of all cells and connections, using a flashlight and mirror if necessary, for corrosion and other defects. Record and correct all problems encountered before testing.
3. With the BITE transmitter turned off, connect the two source leads to the end positive and negative posts as shown in Figure 6. Confirm that connections are to the battery post and not to intercell connections.

CAUTION

Do not exceed the maximum battery voltage allowed at BITE source terminals, 250 V dc. Section battery at convenient intertier or intercell connections as necessary.

4. Plug the BITE transmitter into a 120-V (or 220-V) outlet, as appropriate. Set the POWER ON/OFF switch to ON. The READY lamp will light, after approximately 30 seconds, indicating that the BITE is producing a current through the cells and connections.
5. Ensure that the charger associated with the battery under test is supplying load current, and that the battery is not in a discharge condition. The best repeatable data will occur when the battery charger is operating at recommended float voltage. Do not perform tests while the battery is under a heavy charge or discharge. If the battery is supplying load current, nonrelative impedance measurements could be calculated. Relative impedance values are affected by charge and discharge.
6. Measure the total ac current using a clamp-on current probe (not provided). The A.C. SOURCE CURRENT meter on the transmitter panel is for indication of transmitter output current only. If an open cell exists in the string under test, the current would not find a path back to the transmitter and the meter would indicate zero.

NOTE

Measure and record a reading within the chain of cells, to give a total current reading greater than 5 A for 60 Hz operation. If there is less than 5 A flowing within the string of cells selected, the BITE receiver will respond with a display of I_o (A). This ensures accurate measurement since the total current includes both current from the BITE and ac ripple current produced by the battery charger.

7. Using a thermometer, measure and record the temperature of a sample cell. Cell impedance can be affected by changing ambient temperatures. For consistent results, always record both ambient and pilot cell temperatures to simplify interpretation.
8. With the BITE unit energized, take individual cell impedance measurements. This is accomplished by attaching the clamp-on end of the BITE receiver in a similar location to that of the clamp-on probe in step 6 and firmly place the probes across the battery cell terminals. The twisting action of the probe tips as the handle is pushed down will clean the point of contact and allow a positive test connection.



BATTERY IMPEDANCE DATA

TEST DATE: _____

LOCATION: _____ SYSTEM: _____ SIZE: _____ (A/H LOAD (Y/N): _____

BATT. TYPE: _____ BATT MFR: _____ INSTALLED DATE: _____

LOAD VOLT: _____ SOURCE CURRENT: _____ (A) RIPPLE CURRENT: _____ (A)

HUMIDITY: _____ AMBIENT TEMP.: _____ (F)

SHEET NO.: _____ of _____

CELL#	AC mOHMS	SPEC. GRAVITY	CELL#	AC mOHMS	SPEC. GRAVITY
1	_____	_____	31	_____	_____
2	_____	_____	32	_____	_____
3	_____	_____	33	_____	_____
4	_____	_____	34	_____	_____
5	_____	_____	35	_____	_____
6	_____	_____	36	_____	_____
7	_____	_____	37	_____	_____
8	_____	_____	38	_____	_____
9	_____	_____	39	_____	_____
10	_____	_____	40	_____	_____
11	_____	_____	41	_____	_____
12	_____	_____	42	_____	_____
13	_____	_____	43	_____	_____
14	_____	_____	44	_____	_____
15	_____	_____	45	_____	_____
16	_____	_____	46	_____	_____
17	_____	_____	47	_____	_____
18	_____	_____	48	_____	_____
19	_____	_____	49	_____	_____
20	_____	_____	50	_____	_____
21	_____	_____	51	_____	_____
22	_____	_____	52	_____	_____
23	_____	_____	53	_____	_____
24	_____	_____	54	_____	_____
25	_____	_____	55	_____	_____
26	_____	_____	56	_____	_____
27	_____	_____	57	_____	_____
28	_____	_____	58	_____	_____
29	_____	_____	59	_____	_____
30	_____	_____	60	_____	_____

Figure 5: Test Data Sheet

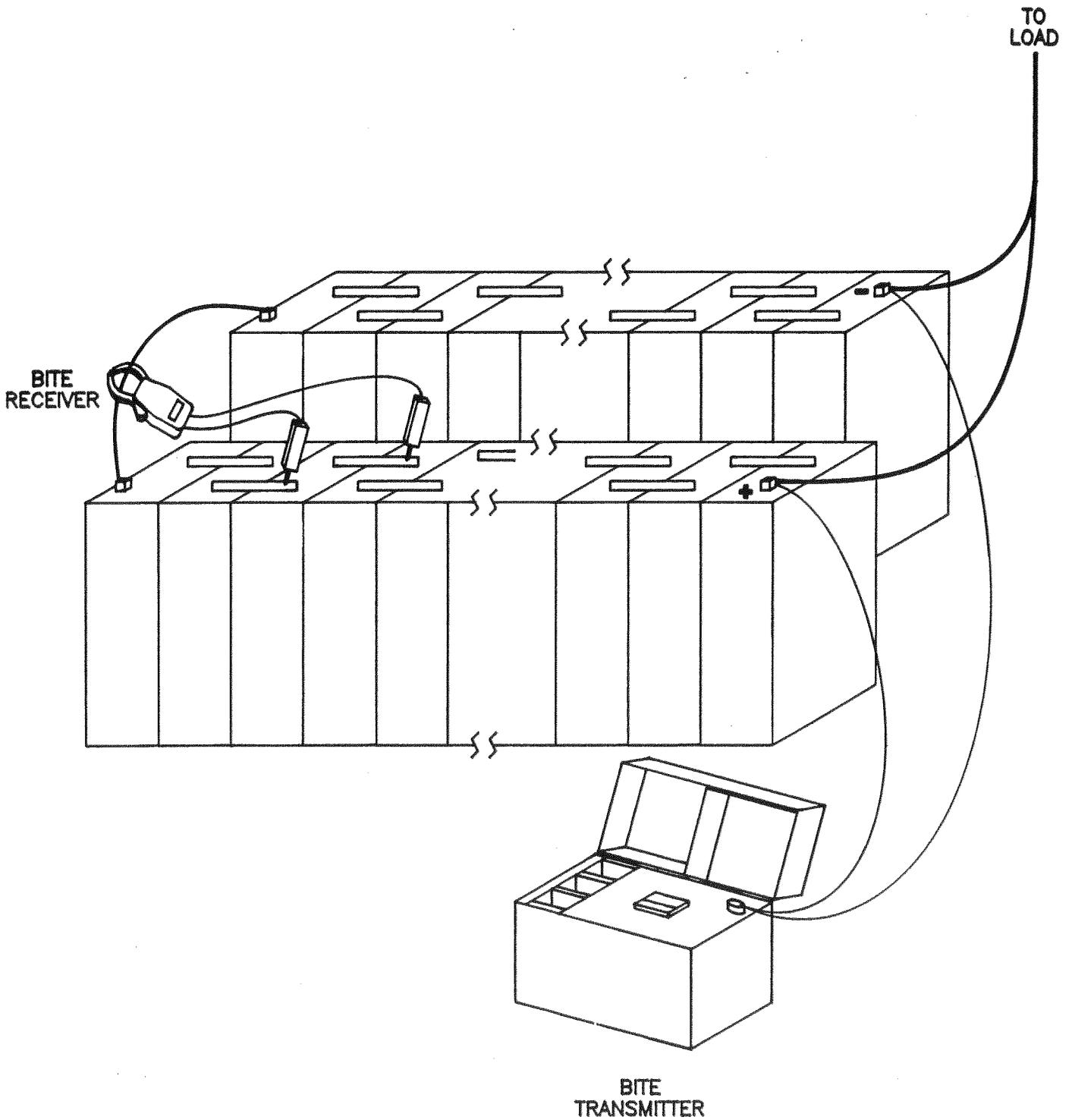


Figure 6: Connection Diagram

CAUTION

Do not exceed 250 V dc, the maximum allowed between voltage probes.

Nominal cell voltage should be less than 2.5 V dc per cell. Multicell modules will have this nominal voltage value per cell value multiplied by the number of cells in the module. Record the impedance across each cell on the data sheets provided. Some valve regulated modules will not provide exposed individual cell terminals and the impedance of the entire module will have to be recorded. Modify the data sheets accordingly to reflect this measurement. The impedance of the cell is determined internal to the receiver by the following formula:

$$Z = \frac{V_b}{I}$$

where: Z = impedance of cell

V_b = rms voltage drop across battery cell

I = total rms current through cell

All cells of a given type should have approximately the same impedance.

9. Measure the impedance between the posts of adjoining cells. From this reading the total resistance of the number of connections and resistance due to the connecting bar or cable is displayed.

WARNING

Do not remove BITE transmitter source leads from the battery until the BITE transmitter is de-energized.

10. After steps 1 through 9 are completed, set the BITE transmitter POWER ON/OFF switch to OFF. Remove the test current source leads from the battery.

Interpreting Measurements

Data produced by the BITE can be interpreted in both short-term and long-term time frames. Biddle Instruments recommends that BITE measurements be made a part of a battery maintenance program, with readings taken and recorded semiannually.

A change in cell impedance is not necessarily due to degradation of the cell. Impedance shifts may be due to temperature, state of charge, or load conditions. All these conditions should be monitored and recorded prior to making measurements. A large difference in the impedance of an individual or group of cells is indicative of a potential problem with a cell and warrants additional investigation.

Short-Term Interpretation

Impedance readings for individual cells can be used in the short term to compare with the average impedance reading for the entire battery. Individual cell values varying by more than ±20 percent of the battery average typically indicate a problem with that cell. Additional investigation of that cell is recommended, including a verification of intercell connections and a load cycle test.

Long-Term Interpretation

Impedance readings for the entire battery can be used in the long term to determine the need for replacement. Battery cell impedance values should be recorded and compared to past readings to determine the cell's position on the curve of impedance versus cell life. A sample curve for a generic lead-acid cell is shown in Figure 7. Curves may differ for other manufacturers and technologies, such as nickel-cadmium. Baseline impedance values and figures indicating percentage of remaining life are not provided by battery manufacturers. However, Biddle Instruments maintains a limited data base of impedance values by manufacturer and some battery sizes and types; this information is available upon request.

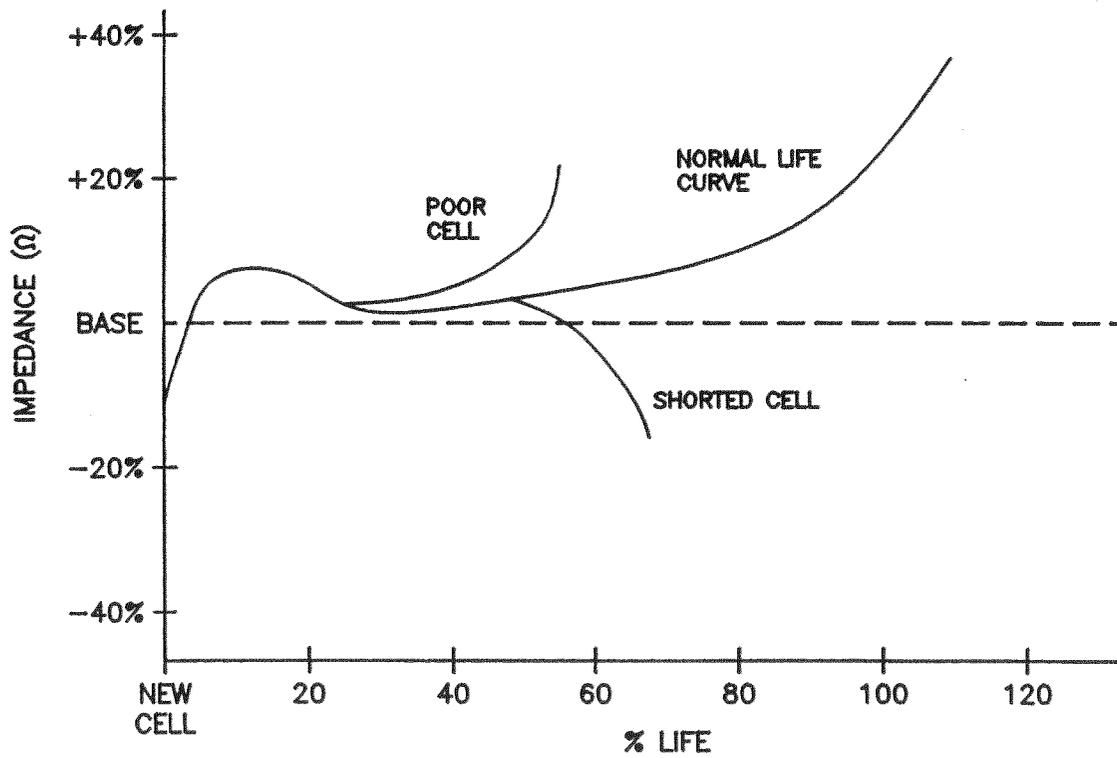


Figure 7: Generic Curve (Independent of Temperature and Cell-type) of Impedance vs. Cell Life and Potential Problems

Application Notes

When performing battery impedance tests using the MBITE, the operator needs to be aware of battery string configurations, the interaction of ripple currents, charger impedances, cell or strap impedances, and noise generated by invertors or switching power supplies.

When testing, keep the potential leads from the receiver twisted to minimize any error that may develop.

Typical Battery Systems

Typical battery systems are shown in Figures 8, 9, and 10. Figure 8 shows a battery system with a single string of cells. After connecting the BITE current source leads, the operator must select an alternative location for source current location if a **HIGH CURRENT** or **LOW CURRENT** message is displayed. The external influences shown in Figure 8 can be measured with a true rms current meter or an oscilloscope to show their magnitude. The **HIGH CURRENT** or **LOW CURRENT** message must be extinguished to ensure that there is sufficient test current in the section of the battery string and to turn on the BITE receiver and enable computation of cell impedance or strap resistance.

Figure 9 shows an impedance analysis of a battery system with parallel strings of cells. The operator must section this system to supply the proper level of test current to stimulate the cell impedance or strap resistance measurements. The impedance analysis shows how to start sectioning. Use the graph shown on Figure 8 as a guide to determine the amount of current that should be flowing in each section. The operator may see other ripple current influences as noted in the single string of cells (Fig. 8) and may have to interchange the position of the source current clips (i.e., reverse the polarity).

WARNING

Do not remove BITE transmitter source leads from the battery until the BITE transmitter is de-energized. Always remove leads at battery connection before removing J2 connection.

Figure 10 shows a 600 V dc UPS system in which the source current leads are connected across a 200 V section of the battery string.

Notes Regarding BITE Operation

The timing circuit controls the current injection to the battery, load, and charger systems. The current is held off by a timer so that the internal coupling capacitor is at the same voltage as the battery system. This prevents transients from occurring when the ac current is injected into the cells of the battery.

The coupling capacitor is designed to operate on battery systems up to 250 V dc. When testing systems over 250 V dc, the operator must test sections of the system at a time, connecting the source current leads across a portion of the string less than 250 V dc.

Ripple Current

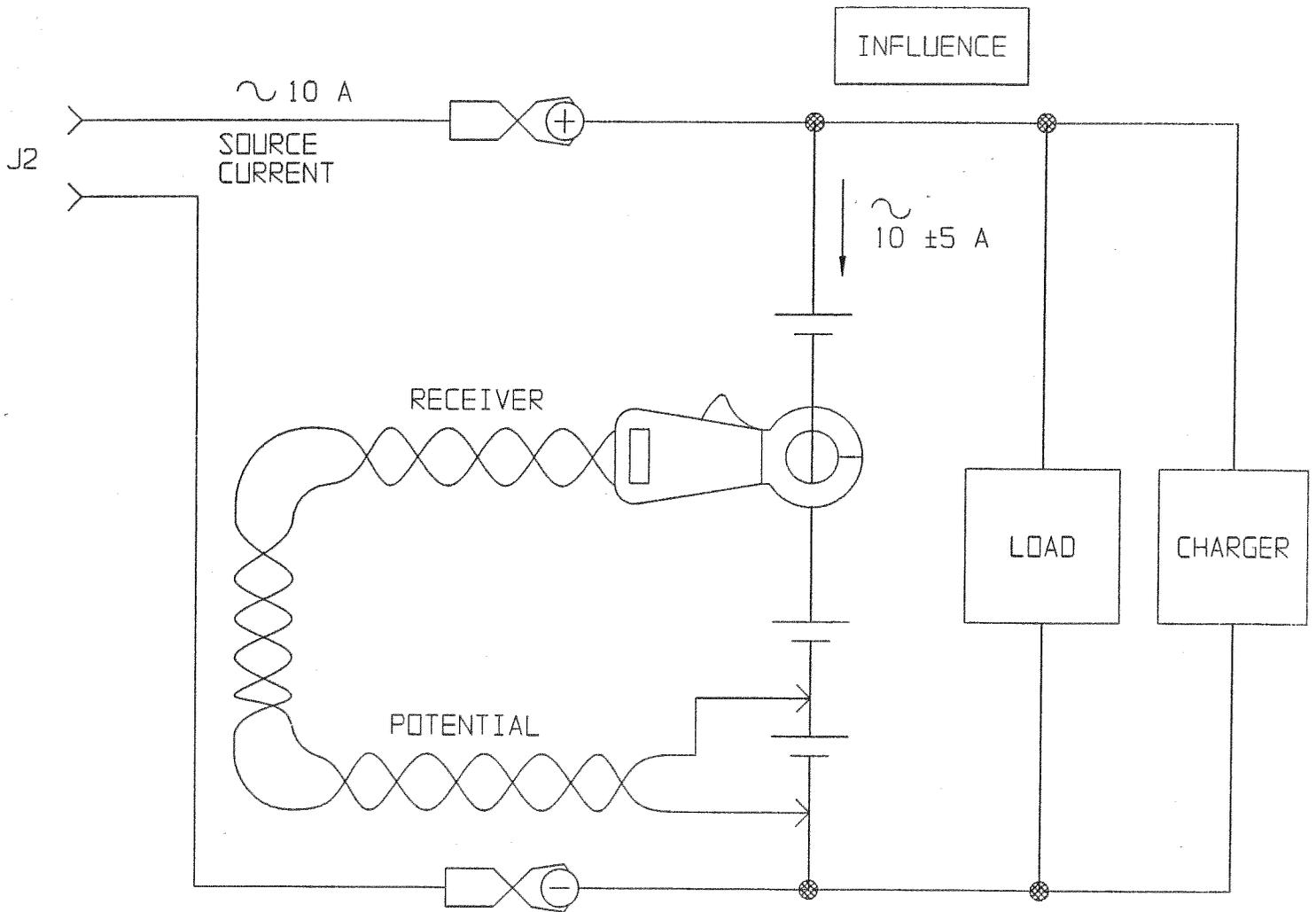
A **LOW CURRENT** or **HIGH CURRENT** message indicates that the summation of rms test current from the BITE and the ripple current from the battery string charger may be outside the limits required for impedance testing. As corrective action, the operator may reverse the positions of the source current lead clips to shift the test current by 180 degrees and offset the effect of the system ripple current in the receiver. It is possible that the ripple current in the cell string is sufficient to enable measurements. The current source leads would be disconnected from the battery string and remain open.

Open Cell/High-Resistance Straps

The **LOW CURRENT** message may also be caused by high resistance in the cell string. This situation limits the source current in the cell string. The operator can verify whether the magnitude of the source current is within the required limits (10 ± 5 A) by connecting the source lead clips together and verify transmitter output current on the ac source current meter. The operator can then section the battery system by connecting the current source leads across various sections of the cell string to isolate high resistance or open cells and straps.

High-Voltage UPS Batteries

The nonpolarized coupling capacitor in the current source is limited to 250 V. This restricts the injection of the source current across battery systems of 250 V dc and higher. The source current is generated from an isolating transformer which allows the



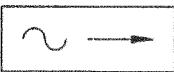
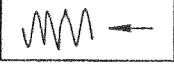
TYPES OF TEST INFLUENCE		CORRECTIVE ACTION
	LOW IMPEDANCE CHARGER	SECTION
	RIPPLE CURRENT FROM CHARGER	REVERSE SOURCE LEADS
	SWITCHING NOISE FROM LOAD	SECTION

Figure 8: Battery System with Single String of Cells

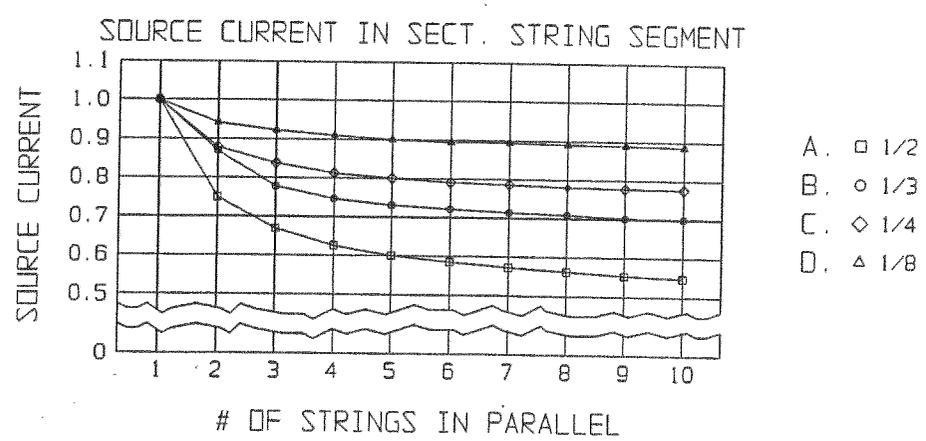
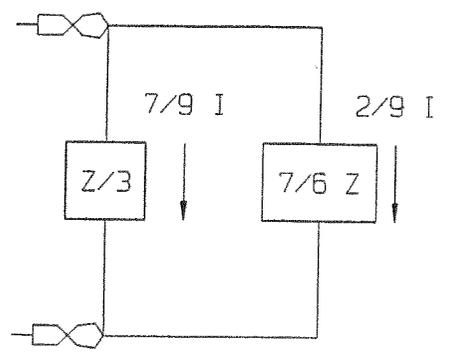
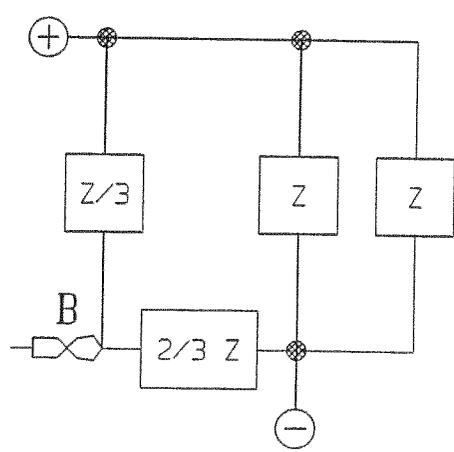
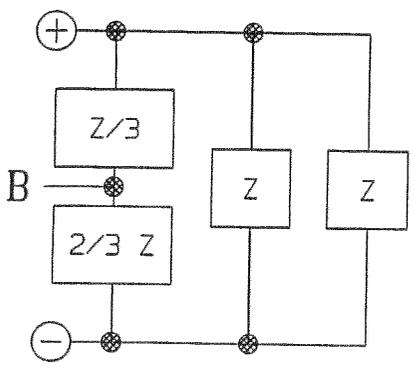
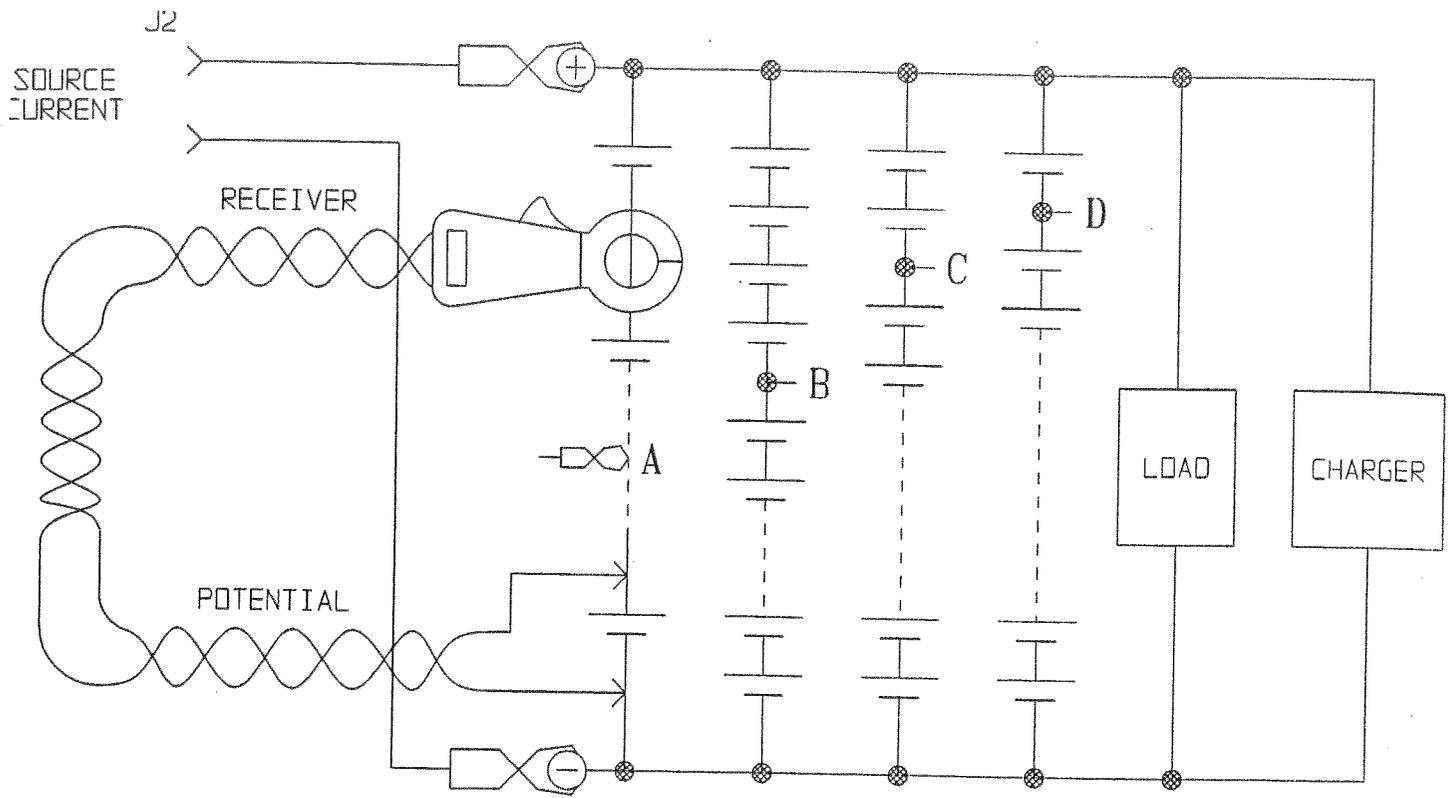


Figure 9: Battery System with Parallel String of Cells

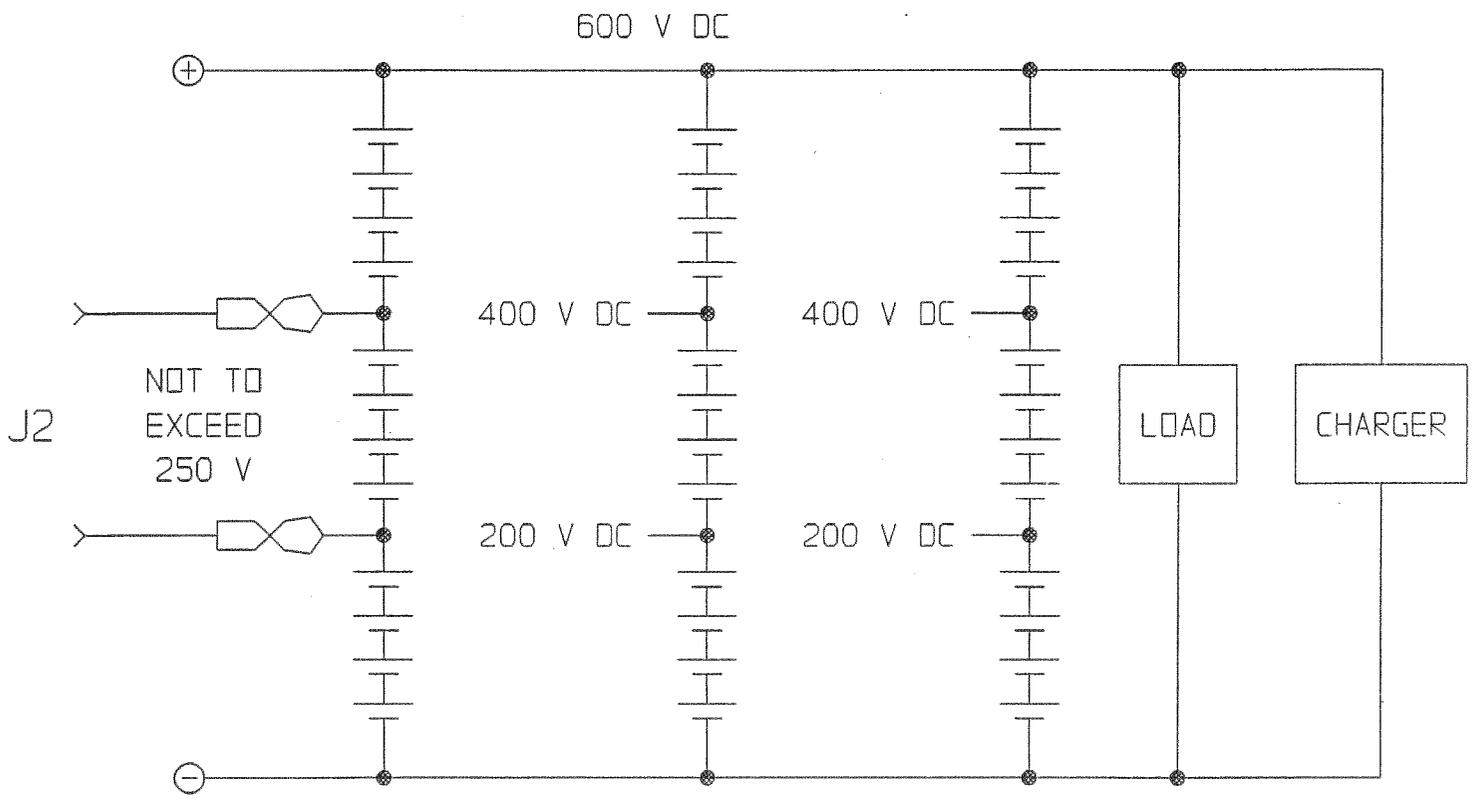


Figure 10: Sectioned 600 V UPS Battery System

operator to connect across a section of the battery system that is within the 250 V range. It is recommended that the operator structure the test procedure so that the same number of sections (group of cells less than 250 V) are stimulated as the test proceeds.

Some UPS systems with voltages up to 600 V dc are designed with parallel strings of cells. The operator should position the current source lead accordingly to satisfy both the test current and the voltage limit of the BITE.

Noisy UPS Systems

The source current may be affected by the noise generated by the switching power supply or the inverter. In this situation, the operator should test a few cells at a time.

Section 6

Maintenance and Repair

Maintenance

Since the instrument and its components are to be used in a corrosive environment, periodically clean all components and test leads with a mild detergent and a soft cloth. Do not immerse either the BITE transmitter or receiver in water or allow moisture to enter the cases. Clean the plastic meter face on the transmitter panel with a static free solution and a soft cloth.

Periodically (every six months) inspect and clean the case, as previously described, all test leads, and connections. Inspect both measuring and source leads for effects of corrosion and wear.

The POWER ON/OFF switch on the transmitter panel contains a dual breaker to protect the instrument from current overloads. The primary side breaker is rated for 1.9 A ac at 250 V ac, while the secondary side breaker is rated at 14.2 A at 125 V ac. Either breaker will immediately remove primary power to the instrument when tripped.

To protect the user from possible shock and to protect the BITE circuitry in the event of catastrophic component failure, a Gould ATM15 fuse is mounted on the rear mounting wall internal to the BITE transmitter. This fuse is coordinated for fast response to a dc inrush from the battery under test.

WARNING

Under no circumstances should this fuse be defeated or replaced with another type fuse. Replace with the type specified in Section 7, Replaceable Parts List.

To verify that the problem is fuse related, move the instrument from the vicinity of the battery under test. With the BITE transmitter leads connected to J2, short the two clip ends together and apply power to the BITE transmitter. Verify that the ac power remains on and that after the time delay, the amber READY lamp lights. Observe the ac panel meter located on the BITE transmitter panel. If there is no indication of current, then the fuse is most likely damaged.

If suitably trained repair personnel are available and fuse replacement is required, follow this procedure for fuse replacement.

Fuse Replacement

1. Remove all ac power to the instrument by setting the BITE transmitter POWER ON/OFF switch to OFF. Disconnect ac line cord.
2. If still connected, remove the source current leads from the battery under test.
3. Remove the source current leads from their J2 connection on the BITE transmitter front panel.
4. Remove 17 Phillips head screws from the transmitter panel and lift the chassis from the instrument case.
5. Find the fuse which is situated on the rear wall of the chassis in a double fuse holder. Only one slot of the fuse holder is wired; the remaining slot houses the spare fuse.
6. Remove the damaged fuse and replace with the spare. Verify with an ohmmeter that the fuse is indeed bad.
7. Visually inspect all components within the BITE transmitter for damage. Since the fuse was installed and sized to protect under component fault situations, this may indeed be the case. If no damage is observed, proceed to the next step. If damage is observed, return the transmitter to the Biddle Instruments Repair Department.
8. Replace chassis in the instrument case, replace 17 screws, and test again as described above. If the instrument still does not respond correctly, return it to Biddle Instruments Repair Department.

Battery Replacement

The BITE receiver is powered by three 1.5-V dc AA cells. Biddle Instruments recommends using alkaline type batteries for replacement. To replace the batteries, remove the four screws and lift the back cover. See Figure 11. Properly dispose of the old batteries and install the replacements with attention to polarity.

Repair

Biddle Instruments offers a complete repair service and recommends that its customers take advantage of this service in the event of equipment malfunction. Please indicate all pertinent information, including problem symptoms and attempted repairs. Equipment returned for repair must be shipped prepaid and insured and marked for the attention of the Repair Department.

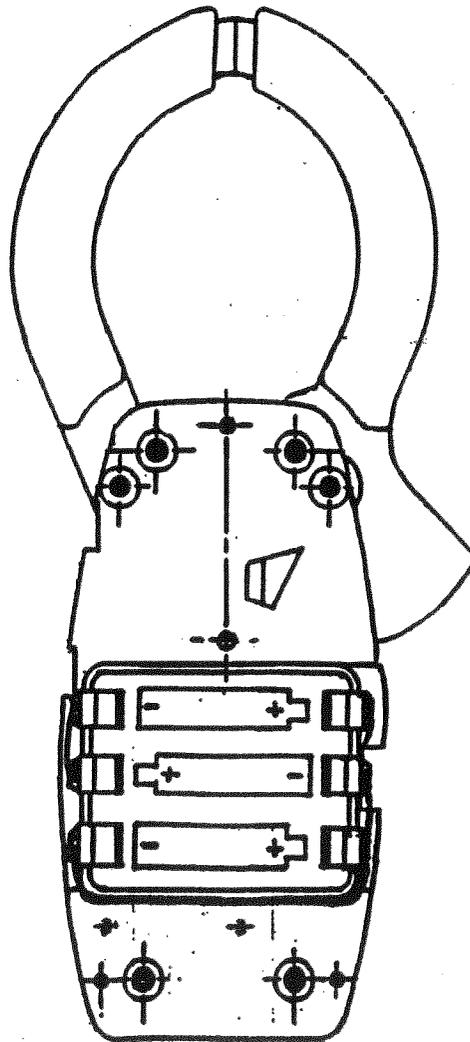


Figure 11: Cell Replacement and Polarity in the BITE Receiver

Section 7
Replaceable Parts List

<u>Description</u>	<u>Part Number</u>
Transmitter Assembly	29380
Probe Assembly	29435-1
Source Lead Assembly	29386-1
ac Line Cord	17032
Receiver Assembly	29430
Transmitter Fuse, ATM15, 15 A, 600 V dc	29330-1
READY lamp bulb	5297-5
Carrying Strap	6580-2
AA 1.5-V dc alkaline cells	23415
Data Pad	246009
Instruction Manual	AVTM246001J

GLOSSARY



use only in accordance with Instruction Manual.

BITE	Battery Impedance Test Equipment, Patent No.4,697,134
cell	a receptacle containing electrodes and an electrolyte either for generating electricity by chemical action or for use in electrolysis.
equivalent circuit	an arrangement of circuit elements that has characteristics, over a range of interest, electrically equivalent to those of a different circuit or device (used for convenience of analysis).
floating	a method of operation for storage batteries in which a constant voltage is applied to the battery terminals sufficient to maintain an approximately constant stage of charge.
lcd	liquid crystal display
ripple current	the alternating component whose instantaneous values are the difference between the average and instantaneous values of a pulsating unidirectional current.
rh	relative humidity
rms	root mean squared
stationary battery	a storage battery designed for service in a permanent location.
sulfating	forming a deposit of a whitish scale of sulfate of lead (on the plates of a storage battery).

WARRANTY

Products supplied by Biddle Instruments are warranted against defects in material and workmanship for a period of one year following shipment. Our liability is specifically limited to replacing or repairing, at our option, defective equipment. Equipment returned to the factory for repair must be shipped prepaid and insured. This warranty does not include batteries, lamps or other expendable items, where the original manufacturer's warranty shall apply. We make no other warranty. The warranty is void in the event of abuse (failure to follow recommended operating procedures) or failure by the customer to perform specific maintenance as indicated in this manual.



AVTM246001J

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