This copy is a reprint which includes current pages from Changes 1 through 2

TM 11-6140-203-23

TECHNICAL MANUAL

AVIATION UNIT AND INTERMEDIATE

MAINTENANCE MANUAL

for

AIRCRAFT NICKEL-CADMIUM BATTERIES

BB-432A/A (NSN 6140-01-072-3125) (EIC: N/A)

BB-432B/A (NSN 6140-01-134-2277) (EIC: N/A)

BB-433A/A (NSN 6140-01-046-1116) (EIC: N/A)

BB-434/A (NSN 6140-00-753-2252) (EIC: N/A)

BB-476/A (NSN 6140-01-061-2818) (EIC: N/A)

BB-558/A (NSN 6140-01-186-6802) (EIC: N/A)

BB-564/A (NSN 6140-01-185-4217) (EIC: N/A)

BB-649A/A (NSN 6140-01-068-8572) (EIC: N/A)

BB-664/A (NSN 6140-01-307-1326) (EIC: N/A)

BB-678A/A (NSN 6140-01-150-5381) (EIC: N/A)

BB-708/U (NSN 6140-01-032-4285) (EIC: N/A)

BB-716/A (NSN 6140-01-089-8234) (EIC: N/A)

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HEADQUARTERS, DEPARTMENT OF THE ARMY

15 JULY 1994

Change
No. 2

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DEPARTMENT OF THE ARMY
Washington, DC, 1 February 1996

Aviation Unit And Intermediate Maintenance Manual

AIRCRAFT NICKEL-CADMIUM BATTERIES

BB-432A/A (NSN 6140-01-072-3125) (EIC: N/A)
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BB-708/U (NSN 6140-01-032-4285) (EIC: N/A)
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Remove Pages	Insert Pages
1-21 through 1-24	1-21 through 1-24
3-43 and 3-44	3-43 and 3-44
3-111 through 3-120	3-11 through 3-120

2. File this change sheet in front of the publication for reference purposes.

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Remove pages	Insert pages
iii and 1-0	iii and 1-0
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1-19 and 1-20	1-19 and 1-20
2-3 through 2-11/(2-12 blank)	2-3 through 2-11/(2-12 blank)
3-3 and 3-4	3-3 and 3-4
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B-11 and B-12	B-11 and B-12
None	D-5/(D-6 blank)
Index-1 through Index-3/(Index-4 blank)	Index-1 through Index-4

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DISTRIBUTION:

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WARNING

Nickel-Cadmium (NICAD) batteries contain potassium hydroxide (KOH), which is a caustic agent. Serious and deep burns of body tissue will result if the electrolyte comes in contact with the eyes or any part of the body.

EYEGLASSES ONLY SHALL BE WORN BY MAINTENANCE PERSONNEL. Potassium hydroxide will fuse contact lenses to the surface of the eye on contact. Water will not aid in removal of contact lens. This will result in damage to the eye or loss of eyesight.

WARNING

If batteries show signs of leaking use of rubber gloves, rubber apron, and protective goggles. Follow FIRST AID instructions if you believe any electrolyte has gotten on you.

WARNING

Excessive fast-charging of NICAD batteries may produce explosive gases. Be sure that batteries are charged in ventilated areas. Do not smoke in proximity of battery charging areas. To avoid the possibility of electrical sparks igniting gases, be sure that battery charge power is off before connecting and disconnecting the battery.

Battery gases are explosive! Do not allow the presence of an open flame near the battery during charge.

WARNING

Do not short circuit batteries. Severe electrical burns can cause injury or death to personnel.

Remove all metallic objects from wrists and fingers before servicing a charged or partially charged battery.

WARNING

The electrolyte used in NICAD batteries reacts violently to the sulfuric acid used in the more common lead-acid type batteries. DO NOT add sulfuric acid electrolyte to the battery; the mixing of the acid and potassium hydroxide (KOH) electrolytes will cause a violent reaction which could result in the splattering of the mixture into the eyes and onto the skin. Every effort must be made to keep NICAD batteries as far away as possible from lead-acid batteries. Do not use the same tools and materials such as screwdrivers, wrenches, syringes, hydrometers, and gloves for both types of batteries. Any trace of acid or acid fumes will permanently damage NICAD batteries on contact.

WARNING

Be extremely carefully when tightening terminal screws and studs. Bodily injury and equipment damage could result if the tools used to tighten hardware accidentally cause a short circuit.

First Aid Instructions

1. In the event of contact with eyes, immediately flush eyes with water and continue to flush for at least 15 minutes. The first few seconds after contact are critical and immediate flushing of the eyes may prevent damage. An eyewash fountain is preferred, however, an eyewash hose or other source of clean water should be used in an emergency.

2. In the event of contact on other parts of the body, being flushing the area with large quantities of clean water immediately.

3. After flushing, seek medical attention without delay. Inform medical personnel that you have been contaminated with potassium hydroxide (KOH).

4. The precautionary warnings on the product label should be consulted for full first-aid information. Provide the label information to the attending physician.

5. Neutralizers and solvents (alcohol, etc.) should not be used by the first aider. The spread of skin absorbing corrosive poison, like phenol, can result in death. Don't depend upon spilled chemical to evaporate from your clothes. Exposure of skin can kill you.

BATTERY SHOP SAFETY PRACTICES

Nickel-cadmium battery maintenance personnel should be thoroughly trained in the use of charging, discharging, and test procedures. The employment of properly trained personnel in the maintenance of nickel-cadmium batteries cannot be overemphasized. The nickel-cadmium battery shop must be used ONLY to maintain nickel-cadmium batteries. Anything associated with lead-acid batteries should never come in contact with nickel-cadmium batteries, including acid fumes. In addition to the equipment required to maintain nickel-cadmium batteries; the nickel-cadmium battery shop should have adequate ventilation; deluge shower, eyewash fountain, and fire extinguisher.

TECHNICAL MANUAL

NO. 11-6140-203-23

HEADQUARTERS
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Aviation Unit and Intermediate Maintenance Manual for AIRCRAFT NICKEL-CADMIUM BATTERIES

BB-432A/A (NSN 6140-01-072-3125) (EIC: N/A)
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BB-708/U (NSN 6140-01-032-4285) (EIC: N/A)
BB-716/A (NSN 6140-01-089-8234) (EIC: N/A)

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), located in back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-LC-LM-LT, Fort Monmouth, New Jersey 07703-5007. A reply will be furnished direct to you.

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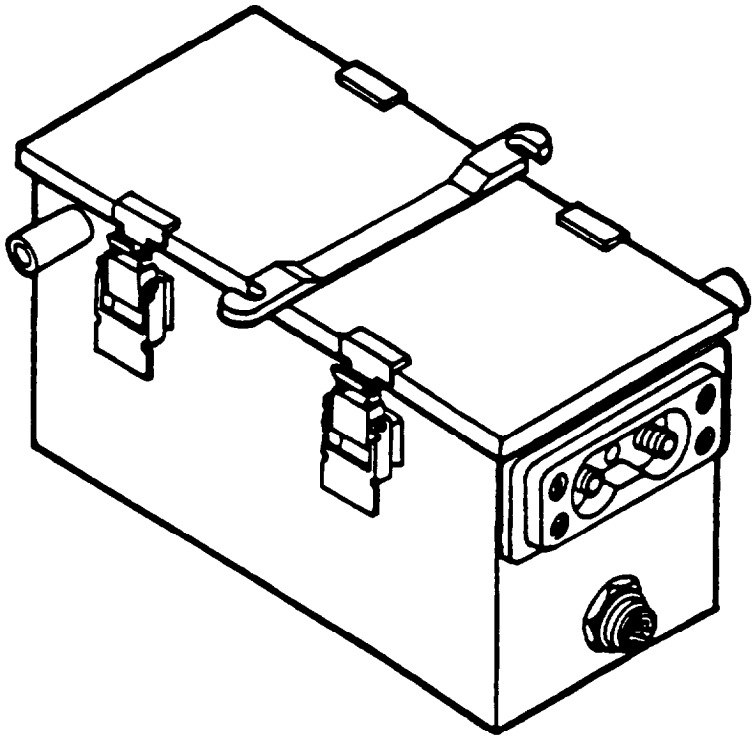

Figure 1-1. Aircraft Nickel-Cadmium Battery, Typical.

CHAPTER 1

INTRODUCTION

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OVERVIEW

This chapter contains general information pertaining to aircraft nickel-cadmium (NICAD) batteries, and specific information covering equipment description, data, and technical principles of operation.

Section I. GENERAL INFORMATION

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1-1. Scope

This technical manual provides a description, technical principles of operation, preventive maintenance, troubleshooting, and corrective maintenance for aircraft NICAD batteries.

1-2. Maintenance Forms, Records, and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed in DA PAM 738-750 as contained in The Army Maintenance Management System (TAMMS).

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/SECNAVINST 4355.18/AFR 400-54/MCO 4430.3J.

c. Transportation Discrepancy Report (TDR) (SF 361). Fill out and forward Transportation Discrepancy Report (TDR) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19/DLAR 4500.15.

1-3. Consolidated Index of Army Publications and Blank Forms

Refer to the latest issue of DA Pam 25-30 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

1-4. Administrative Storage

Administrative storage of the equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS tables before storing. All procedures required to be performed, are provided in the maintenance chapters. Refer to paragraphs 3-33 and 3-34, for instructions to place the batteries into storage or to prepare them for shipment.

1-5. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 756-244-2.

1-6. Reporting Equipment Improvement Recommendations (EIRs)

If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to Commander, U.S. Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-LC-ED-CFO, Fort Monmouth, New Jersey 07703-5023. We will send you a reply.

1-7. List of Abbreviations

ABS	Acrylonitrile-Butadiene-Styrene
Ah	Ampere Hour
cc	Cubic Centimeter
KOH	Potassium Hydroxide
ma	Milliampere
mm	Millimeters
NICAD	Nickel-Cadmium
V	volt

Section II. EQUIPMENT DESCRIPTION AND DATA

Paragraph		Page
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1-9	Description and Equipment Data for NICAD Aircraft Batteries	1-3
1-10	Safety, Care, and Handling	1-26
1-11	Differences Between Models	1-26

1-8. Equipment Characteristics, Features and Capabilities

The vented NICAD batteries described in this manual are used to provide very high currents to start aircraft and/or emergency power to aircraft equipment over a wide range of temperatures. Each battery supplies 24 volts dc from 19 series-connected nickel-cadmium cells. An exception is Battery BB-716/A which includes a 206th low-capacity cell. The differences between batteries are mainly in capacity (5 to 30 ampere-hours) and size and weight. In addition, batteries such as the BB-432B/A, BB-558/A, BB-564/A, BB-664/A, and BB-716/A include control, sensor, and/or heating elements to interact with on-board aircraft charging and fault indication systems.

Vented NICAD cells used in all batteries have molded nylon cell cases with a low pressure plastic vent. The cell plate materials are nickel-oxide for the charged positive and cadmium for the charged negative. The plates are separated by a plastic laminate layer. The electrolyte is potassium hydroxide (KOH), 31% (by weight) in distilled water.

1-9. Description and Equipment Data for NICAD Aircraft Batteries.

In the pages which follow, paragraphs a. through k. give the leading particulars for the batteries covered in this manual. For each battery, this includes a multi-view illustration and a table of equipment data.

The multi-view illustrations show the major components of the batteries and reveal the cell arrangements. Brief descriptive material included with the illustrations Is keyed to numbered call-outs in the figure. The tables of equipment data are presented on facing pages and cover the pertinent electrical and mechanical characteristics of the batteries.

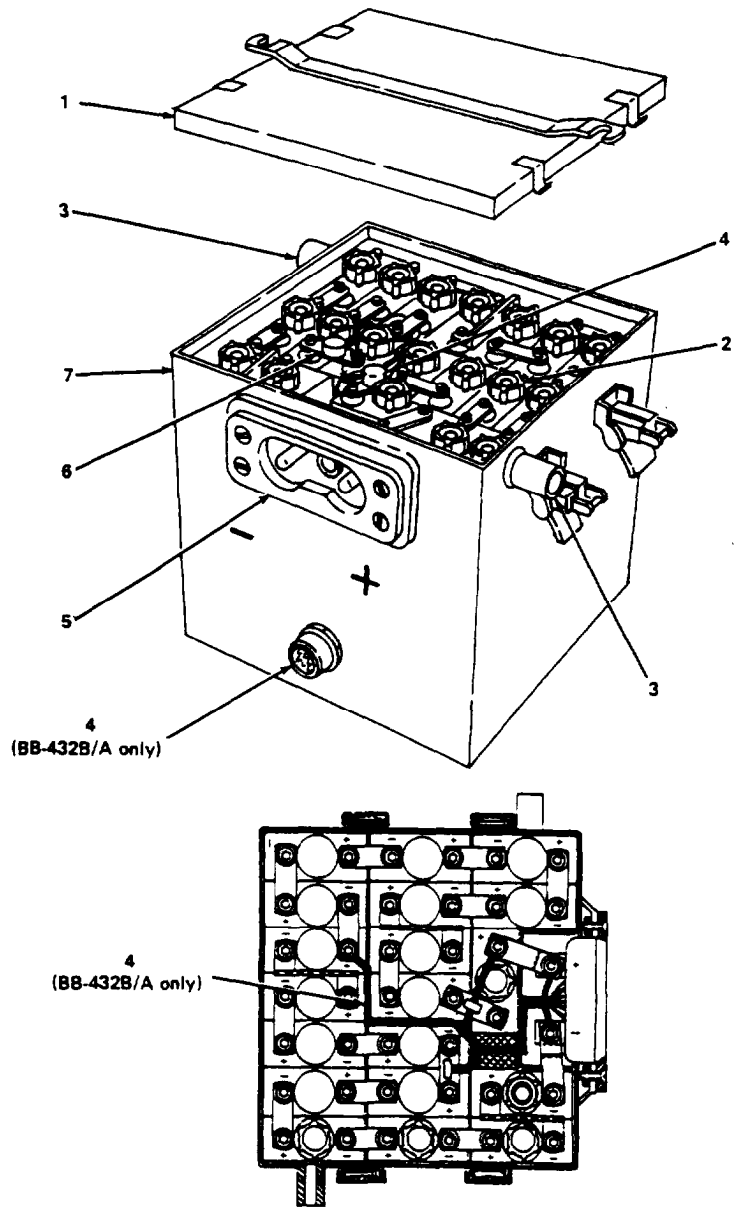
The paragraph and figure number assignments for the various battery types are outlined below:

Battery Type	Para	Fig. No.
Battery BB-432A/A & BB-432B/A	a.	1-2
Battery BB-433A/A	b.	1-3
Battery BB-434A/A	c.	1-4
Battery BB-476A/A	d.	1-5
Battery BB-558/A	e.	1-6
Battery BB-649A/A	f.	1-7
Batteries BB-564A/A & BB-654A/A	g.	1-6
Battery BB-678A/A	h.	1-9
Battery BB-708/U	i.	1-10
Battery BB-716/A (Marathon - see note)	j.	1-11
Battery BB-716/A (Saft - see note)	k.	1-12

NOTE

There are two versions of Battery BB-716/A. The one described in paragraph j. and shown in figure 1-11 is manufactured by Marathon. The one described in paragraph k. and shown in figure 1-12 is manufactured by Saft. Functionally, the two batteries are identical: physically, they differ only in minor details associated with the cells, receptacles, shims, and wiring harness routing.

a. Batteries BB-432A/A and BB-432B/A. These light-to-medium-duty batteries provide 24 Vdc at 10 ampere-hours. The BB-432B/A includes monitoring circuits; the BB-432A/A does not.



1 Cover and Gasket. Keep out dirt/debris.

2 Cells. 19 cells, type BB-599A/A.

3 Case Vents. Prevent buildup of explosive gas during charging.

4 Wiring Harness. Used in BB-432-B/A only. Includes monitoring circuits, external connector.

5 Elec. Receptacle. MS3509 Quick Disconnect.

6 Terminal Links. 20 nickel-plated links connect cells In series.

7 Case. Epoxy-coated steel. Polyamide plastic sheets insulate; prevent cell movement.

Figure 1-2. Batteries BB-4324/A and BB-432B/A, Major Components.

EQUIPMENT DATA

BATTERIES BB-432A/A and BB-432B/A

Electrical data:

Rating	10 ampere-hours for 1 hour at 80°F above 18 volts
Voltage (open circuit)	25 volts (fully charged, 24 hour rest)
Voltage (under loads of:)	
5.5 A at 80°F (26°C)	24V decreasing to 19.2V In 2 hours
10 A at 80°F (26°C)	24V decreasing to 18.0V in 1 hour
75 A at 80°F (26°C)	23V decreasing to 14.4V in 5 minutes
75 A at -22°F (-30°C)	22V decreasing to 14.4V In 3 minutes
Operating Range:	
Temperature	-40° to 165°F (+40° to 74°C)
Atmospheric Pressure	sea level to 100,000 feet
Storage Range:	
Duration	Unlimited, regardless of state of charge
Temperature	-65° to 130°F (-54° to 54°C)

Physical Data:

Weight	34 lb. (15.4 kg)
Height	7.75 in. (197 mm)
Depth	8.375 in. (212.7 mm)
Width	9.78 in. (248 mm)
Connector	MS3509, Quick Disconnect type

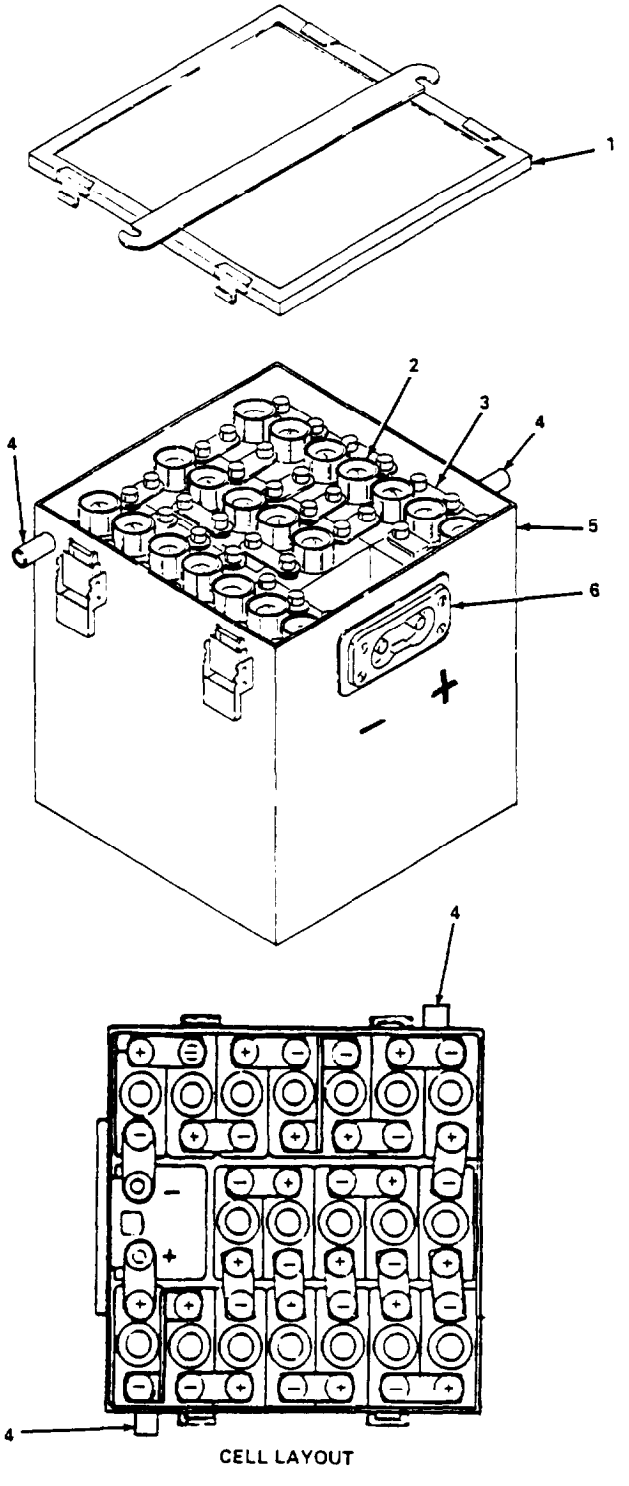
Cell Data:

Type and Number	BB-599A/A, 19 each
Weight	1.25 lbs (0.57 kg)
Dimensions	6.95 In. (177 mm) Height, 2.42 in (61.5 mm) Width, and 1.06 in (27.4 mm) Depth

Special Features:

BB-432B/A only	Monitoring circuits sense temperature and voltage. Thermal switch opens on temperature rise at 140 ± 5°F (60 ± 2.8ºC) as overtemperature warning. Sensed voltage output permits adjustment of aircraft charge termination voltage.

b. Battery BB-433A/A. This heavyduty battery provides 24 Vdc at 30 ampere-hours.



1 Cover and Gasket. Keep out dirt/debris.

2 Cells. 19 cells, type BB-600A/A.

3 Terminal Links. 20 nickel-plated links connect cells in series.

4 Case Vents. Prevent buildup of explosive gas during charging.

5 Case. Epoxy-coated steel. Polyamide plastic sheets insulate; prevent cell movement.

6 Elec. Receptacle. MS3509 Quick Disconnect.

Figure 1-3. Battery BB-433A/A, Major Components.

EQUIPMENT DATA

BATTERY BB-433A/A

Electrical data:

Rating	30 ampere-hours for 1 hour at 80° F above 18 volts
Voltage (open circuit)	25 volts (fully charged, 24 hour rest)
Voltage (under loads of:)	
17 A at 80°F (26°C)	24V decreasing to 19.2V in 2 hours
30 A at 80°F (26°C)	24V decreasing to 18.0V in 1 hour
240 A at 80°F (26°C)	23V decreasing to 14.4V in 5 minutes
240 A at -22°F (-30°C).	22V decreasing to 14.4V in 3 minutes
Operating Range:	
Temperature	-40° to 165°F (40° to 74° C)
Atmospheric Pressure	Sea level to 100,000 feet
Storage Range:	
Duration	Unlimited, regardless of state of charge
Temperature	-65° to 130°F (-54° to 54°C)

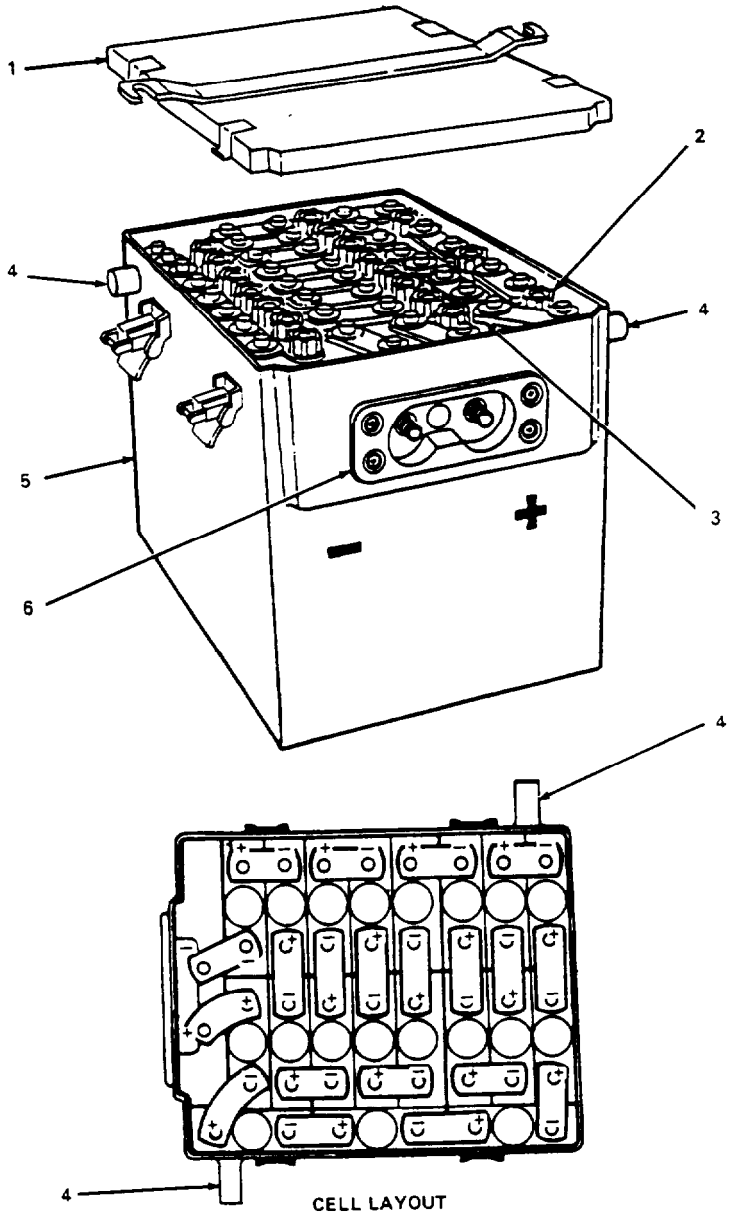
Physical Data:

Weight..	76 lb. (34.5 kg)
Height..	10.25 in. (266.4 mm)
Depth..	10.5 in. (266.7 mm)
Width	11.82 in. (300 mm)
Connector..	MS3509, Quick Disconnect type

Cell Data:

Type and Number	BB-600A/A, 19 each
Weight	3.4 lbs (1.55 kg)
Dimensions	9.4 in. (238.5 mm) Height, 3.14 in (79.8 mm) Width, and 1.38 in (34.9 mm) Depth

c **Battery BB-434/A.** This mediumduty battery provides 24 Vdc at 20 ampere-hours.



1 Cover and Gasket. Keep out dirt/debris.

2 Cells. 19 ceils, type BB-601A/A

3 Terminal Links. 20 nickel-plated links connect cells in series.

4 Case Vents. Prevent buildup of explosive gas during charging.

5 Case. Epoxy-coated steel. Polyamide plastic sheets insulate; prevent cell movement.

6 Elec. Receptacle. MS3509 Quick Disconnect.

Figure 1-4. Battery BB-434/A, Major Components.

EQUIPMENT DATA

BATTERY BB-434/A

Electrical data:

Rating	20 ampere-hours for 1 hour at 80°F above 18 volts
Voltage (open circuit)	25 volts (fully charged, 24 hour rest)
Voltage (under loads of:)	
11 A at 80°F (26°C)	24V decreasing to 19.2V in 2 hours
20 A at 80°F (26°C)	24V decreasing to 18.0V in 1 hour
150 A at 80°F (26°C)	23V decreasing to 14.4V in 5 minutes
150 A at -22°F (-30°C).	22V decreasing to 14.4V in 3 minutes
Operating Range:	
Temperature	-40° to 165°F (-40° to 74°C)
Atmospheric Pressure..	Sea level to 100,000 feet
Storage Range:	
Duration	Unlimited, regardless of state of charge
Temperature	-65° to 130°F (-54° to 54°C)

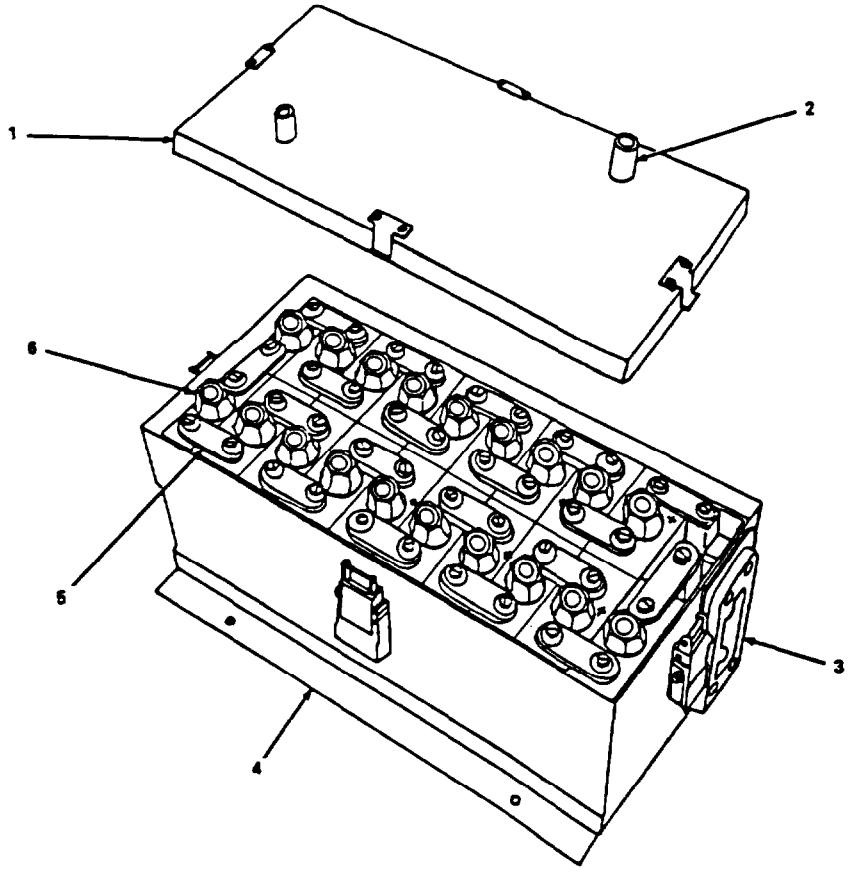
Physical Data:

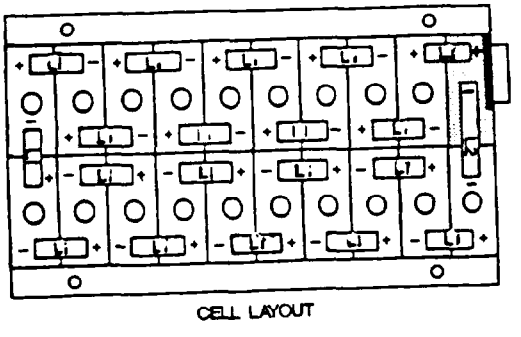
Weight	55 lb. (25 kg)
Height	8.81 in. (223.8 mm)
Depth	10.66 in. (270.8 mm)
Width	9.82 in. (249.4 mm)
Connector	MS3509, Quick Disconnect type

Ceil Data:

Type and Number..	BB-601A/A, 19 each
Weight	2.3 lbs (1.05 kg)
Dimensions	8.28 in. (207.6 mm) Height, 3.19 in (34.9 mm) Width, and 1.08 in (27.4 mm) Depth

d. **Battery BB-476/A.** This light to mediumduty battery provides 24 Vdc at 13 ampere-hours.





1 Cover and Gasket. Keep out dirt/debris.

2 Case Vents. Prevent buildup of explosive gas during charging.

3 Elec. Receptacle. MS3509 Quick Disconnect.

4 Case. Plastic fiberglass. Polyamide plastic sheets insulate; prevent ceil movement.

5 Terminal Links. 21 nickel-plated links connect ceils in series.

6 Cells. 19 cells, type BB-475/A.

Figure 1-5. Battery BB-476/A, Major Components.

EQUIPMENT DATA

BATTERY BB-476/A

Electrical data:

Rating	13 ampere-hours for 1 hour at 80° F above 18 volts
Voltage (open circuit)	25 volts (fully charged, 24 hour rest)
Voltage (under loads of:)	
6.5 A at 80° F (26° C)	24V decreasing to 19.2V in 2 hours
13.0 A at 80° F (26° C)	24V decreasing to 18.0V in 1 hour
120 A at 80°F (26°C)	23V decreasing to 14.4V in 5 minutes
75 A at -40° F (-40° C)	22V decreasing to 14.4V in 5 minutes
Operating Range:	
Temperature	-40° to 165° F (-40° to 74°C)
Atmospheric Pressure	Sea level to 100.000 feet
Storage Range:	
Duration	Unlimited, regardless of state of charge
Temperature	-65° to 130° F (-54° to 54° C)

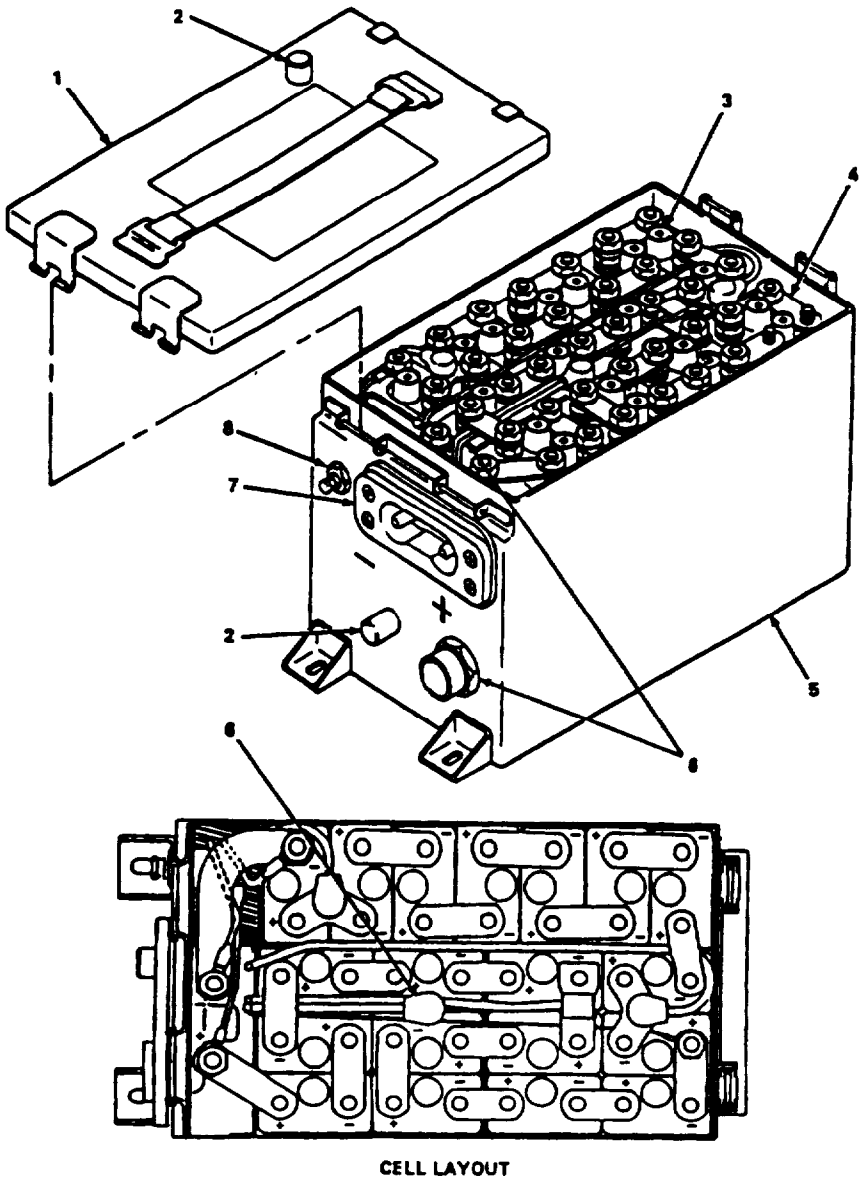
Physical Data:

Weight	27.6 lb. (12.5 kg)
Height	6.25 in. (158.8 mm)
Depth	13.25 in. (336.6 mm)
Width	7.18 in. (182.4 mm)
Connector	MS3509, Quick Disconnect type

Cell Data:

Type and Number	BB-475/A, 19 each
Weight	1.21 Ibs (0.55 kg)
Dimensions	5.71 in. (1.45 mm) Height, 2.75 in. (69.9 mm) Width, and 1.21 in. (30.7 mm) Depth

a. Battery BB-558/A. This light to medium-duty battery provides 24 Vdc at 17 ampere-hours. A self-heating circuit ensures operation at low temperatures.



1 Cover and Gasket. Keep out dirt/debris.

2 Case Vents. Prevent buildup of explosive gas during charging.

3 Cells. 19 cells, type BB-559/A

4 Terminal Links. 20 nickel-plated links connect cells in series.

5 Case. Stainless steal. Polyamide plastic sheets insulate; prevent cell movement.

6 Wiring Harness. Indudes heating and monitoring circuits, external connector.

7 Elec Receptacle. Disconnect.

8 Relay/Ckt Brkr. Provide time-control and current limiting of the heating function.

Figure 1-6. Battery-558/A, Major Components.

EQUIPMENT DATA

BATTERY BB-558/A

Electrical data:

Rating	17 ampere-hours for 1 hour at 89°F above 18 volts
Voltage (open circuit)	25 volts (fully charged, 24 hour rest)
Voltage (under loads of:)	
8.5 A at 80°F (26°C)	24V decreasing to 19.2V in 2 hours
17 A at 80°F (26°C)	24V decreasing to 18.0V in 1 hour
100 A at 80°F (26°C)	23V decreasing to 14.4V in 5 minutes
100 A at -22°F (-30°C).	22V decreasing to 14.4V in 3 minutes
Operating Range:	
Temperature	-50° to 165°F (-45° to 74°C) with self heating
Atmospheric Pressure	Sea level to 100,000 feet
Storage Range:	
Duration	Unlimited, regardless of state of charge
Temperature	-65° to 130°F (-54° to 54°C)

Physical Data:

Weight	38.5 lb. (17.5 kg)
Height..	7.95 in. (201.9 mm)
Depth..	12.7 in. (322.6 mm)
Width	6.65 in. (168.9 mm)
Connector	MS3509, Quick Disconnect type

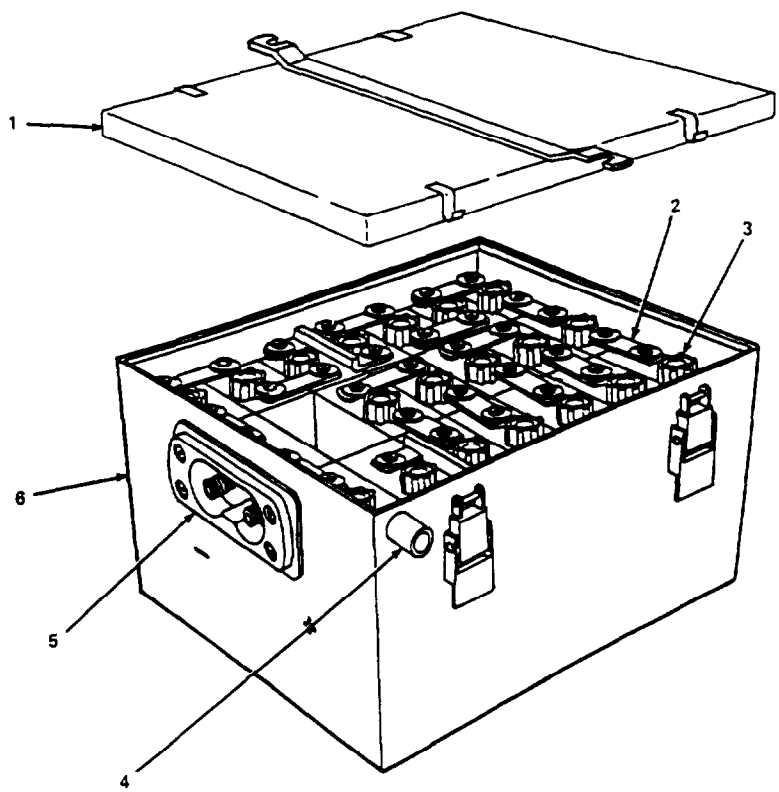
Cell Data:

Type and Number	BB-559/A, 19 each
Weight	1.50 lbs (0.68 kg)
Dimensions	6.76 in. (171.7 mm) Height, 2.31 in (58.6 mm) Width, and 1.29 in (32.7 mm) Depth

Special Features:

Self Heating	Uses two heating pads with sensors for controlled heating. 450 watts at 20 volts at temperatures below -5 ±5°F (-20 ± 2.8°C). Time limit on heating of approximately 4.5 minutes.
Overtemperature Warning	Thermal switch doses on temperature rise at 145±5°F (63±2.8°C).

f. **Battery BB-649A/A.** This medium-duty battery provides 24 Vdc at 18 ampere-hours.



1 **Cover and Gasket.** Keep out dirt/debris.

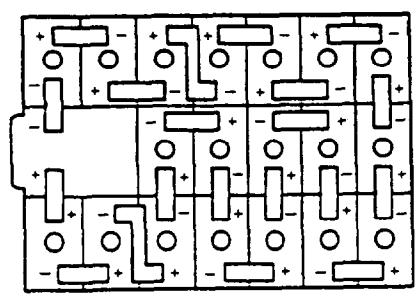
2 **Terminal Links.** 20 nickel-plated links connect cells in series.

3 **Cells.** 19 cells, type BB-648/A.

4 **Case Vents.** Prevent buildup of explosive gas during charging.

5 **Elec. Receptacle.** MS3509 Quick Disconnect.

6 **Case.** Epoxy-coated steel. Polyamide plastic sheets insulate; prevent cell movement.



CELL LAYOUT

Figure 1-7. Battery BB-649A/A, Major Components.

EQUIPMENT DATA

BATTERY BB-649A/A

Electrical data:

Rating	18 ampere-hours for 1 hour at 80°F above 18 volts
Voltage (open circuit)	25 volts (fully charged, 24 hour rest)
Voltage (under loads of:)	
11 A at 80°F (26°C)	24V decreasing to 19.2V in 2 hours
18.2 A at 80°F (26°C)	24V decreasing to 18.0V in 1 hour
180 A at 80°F (26°C)	23V decreasing to 14.4V in 5 minutes
50 A at -22°F (-30°C).	22V decreasing to 14.4V in 3 minutes
Operating Range:	
Temperature	-40° to 165°F (40° to 74°C)
Atmospheric Pressure..	Sea level to 100,000 feet
Storage Range:	
Duration	Unlimited, regardless of state of charge
Temperature	-65° to 130°F (-54° to 54°C)

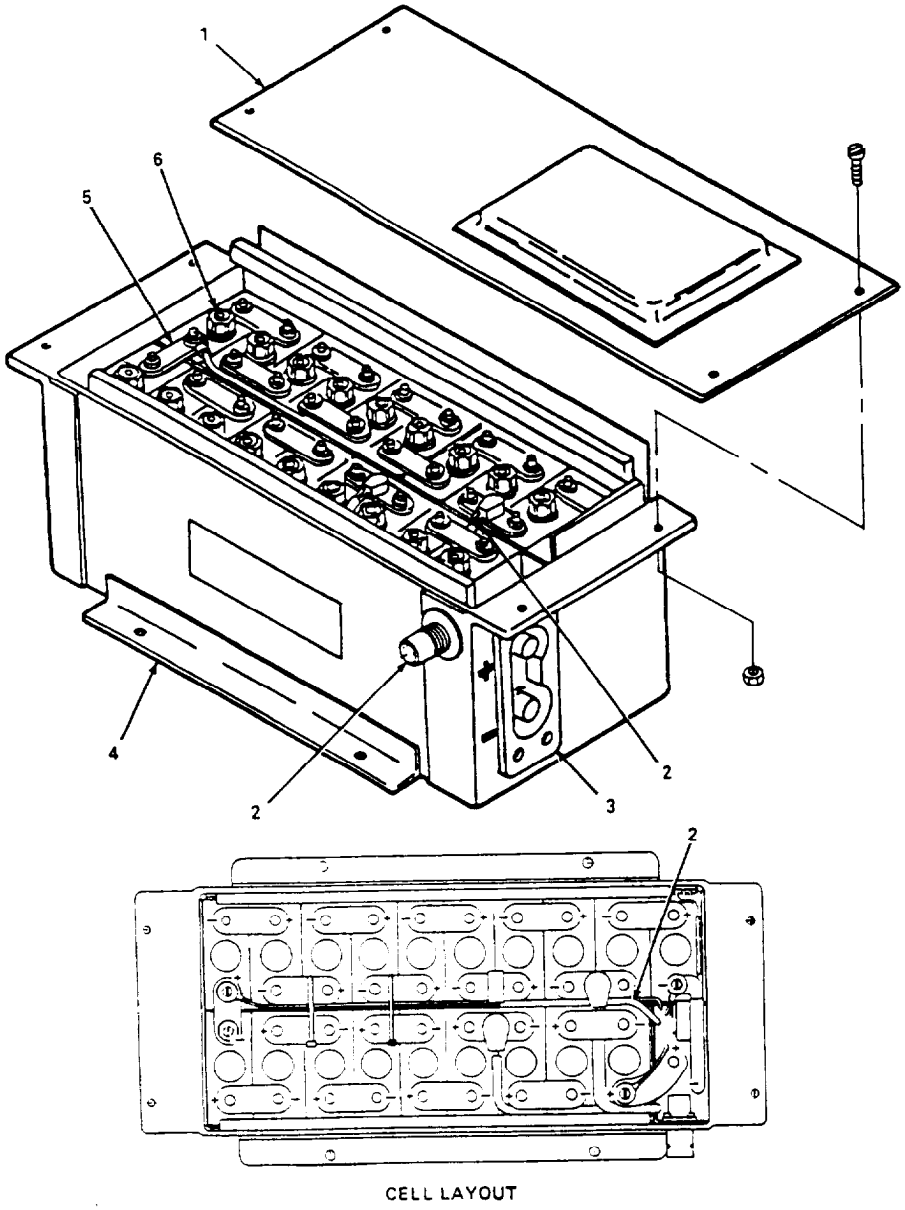
Physical Data:

Weight	49 lb. (22.3 kg)
Height..	6.06 in. (154 mm)
Depth	11.88 in. (301.6 mm)
With	9.75 In. (247.7 mm)
Connector	MS3509, Quick Disconnect type

Cell Data:

Type and Number..	BB-648/A, 19 each
Weight	2.0 lbs (0.91 kg)
Dimensions	5.44 in. (136 mm) Height, 3.11 in (79 mm) Width, and 1.66 In (42.1 mm) Depth

g. Batteries BB-664/A or BB-564/A. These light-to-mediumduty batteries provide 24 Vdc at 13 ampere-hours. The two batteries are nearly identical in construction; both use heating circuits and both have plastic fiberglass cases. However, they use different cell types and heating elements. The newer type BB-664/A is intended to replace the older type BB-564/A In all applications.



1 **Cover.** Keeps out dirt/debris.

2 **Wiring Harness.** Includes heating and monitoring circuits, external connector.

3 **Elec. Receptacle.** MS3509 Quick Disconnect.

4 **Case.** Plastic fiberglass. Polyamide plastic sheets insulate; prevent cell movement.

5 **Terminal Links.** 20 nickel-plated links connect cells in series.

6 **Cells.** 19 cells used.
BB-475/A in BB-664/A.
BB-652A/A in BB-564/A.

Figure 1-8. Batteries BB-664/A and BB-564/A, Major Components.

EQUIPMENT DATA

BATTERIES BB-664/A and BB-564/A*

Electrical data:

Rating	13 ampere-hours for 1 hour at 80°F above 18 volts
Voltage (open circuit)	25 volts (fully charged, 24 hour rest)
Voltage (under loads of:)	
6.5 A at 80°F (26°C)	24V decreasing to 19.2V in 2 hours
13.0 A at 80°F (26°C)	24V decreasing to 18.0V in 1 hour
120 A at 80°F (26°C)	23V decreasing to 14.4V in 5 minutes
75 A at -22°F (-30°C)	22V decreasing to 14.4V in 5 minutes
Operating Range:	
Temperature	-40° to 165°F (40° to 74°C)
Atmospheric Pressure	Sea level to 100,000 feet
Storage Range:	
Duration	Unlimited, regardless of state of charge
Temperature	-65° to 130°F (-54° to 54°C)

Physical Data:

Weight	27 lb. (12.3 kg)*
Height	6.50 in. (165.1 mm)*
Depth	14.50 in. (368.3 mm)
Width	7.25 in. (184.2 mm)
Connector	MS3509, Quick Disconnect type
Connector (Heater/Control)	MS27468T11B355

Ceil Data:

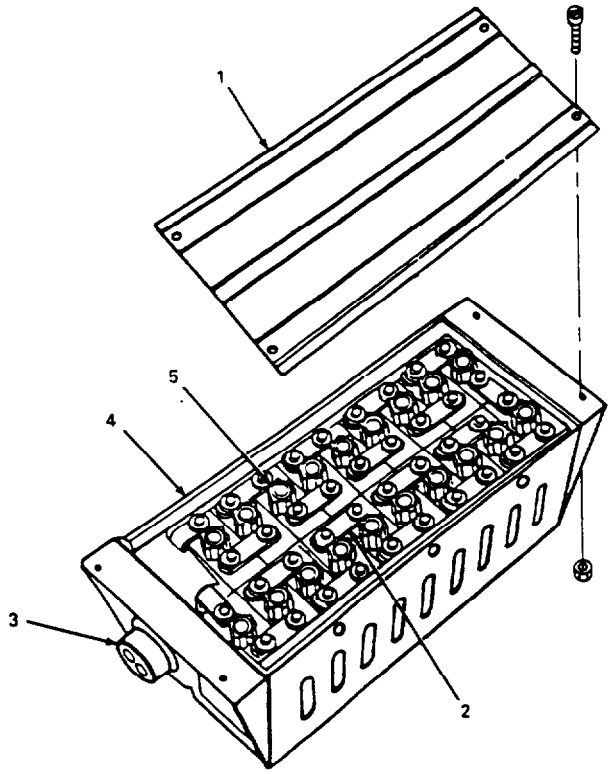
Type and Number	BB-475/A, 19 each*
Weight	1.21 lbs (0.55 kg)
Dimensions	5.71 in. (145 mm) Height, 2.75 in (69.9 mm) Width, and 1.21 in (30.7 mm) Depth

Special Features:

Internal Heaters	Uses heating elements with sensors for controlled heating. BB-664/A uses 3 heater blankets; BB-564/A uses two heater pads. 340 watts at 115 VAC at temperatures below 29 ±6° F (-1.7 ± 3.3°C)
Overtemperature Warning	Thermal switch opens on temperature rise at 135±5°F (57±3°C)

* BB-564/A is replaced by BB-664/A. The BB-564/A is 1 inch shorter and approximately 2 lbs lighter than the BB-664/A and uses the shorter BB-652A/A ceil.

h. Battery BB-678A/A. This light to mediumduty battery provides 24 Vdc at 13 ampere-hours.



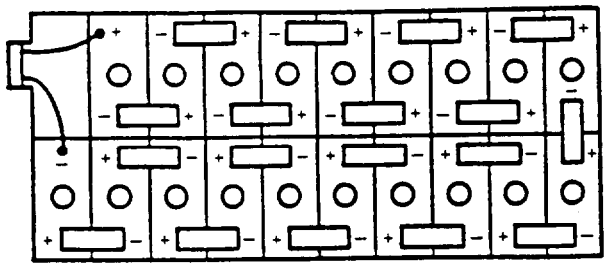
1 Cover. Keeps out dirt/debris.

2 Terminal Links. 18 nickel-plated links connect cells in series.

3 Elec. Receptacle. Canon Quick Disconnect.

4 Case. Plastic fiberglass. Polyamide plastic sheets insulate; prevent cell movement.

5 Cells. 19 cells, type BB-652A/A.



CELL LAYOUT

Figure 1-9. Battery BB-678A/A, Major Components.

EQUIPMENT DATA

BATTERY BB-678A/A

Electrical data:

Rating	13 ampere-hours for 1 hour at 80°F above 18 volts
Voltage (open circuit)	25 volts (fully charged, 24 hour rest)
Voltage (under loads of:)	
6.5 A at 80°F (26° C)	24V decreasing to 19.2V in 2 hours
13 A at 80°F (26° C)	24V decreasing to 18.0V in 1 hour
120 A at 80°F (26° C)	23V decreasing to 14.4V in 5 minutes
75 A at -40° F (-40° C)	22V decreasing to 14.4V in 5 minutes
Operating Range:	
Temperature	-40° to 165° F (-40° to 74° C)
Atmospheric Pressure	Sea level to 100,000 feet
Storage Range:	
Duration	Unlimited, regardless of state of charge
Temperature	-65° to 130° F (-54° to 54°C)

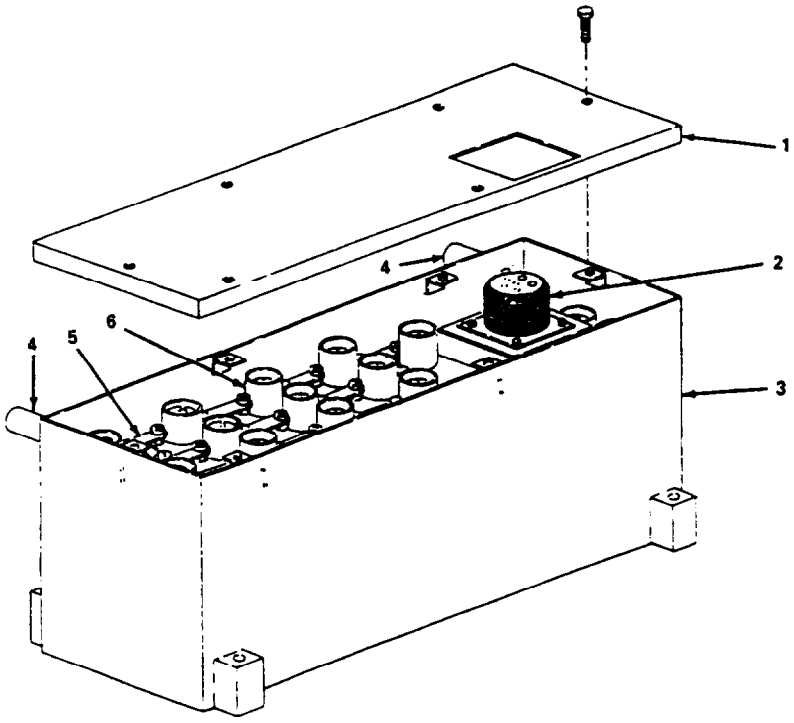
Physical Data:

Weight	24.8 lb. (11.3 kg)
Height	5.0 in. (127.0 mm)
Depth	14.48 in. (367.8 mm)
Width	5.96 in. (151.4 mm)
Connector	Canon, Quick Disconnect type

Ceil Data:

Type and Number	BB-652A/A, 19 each
Weight	1.15 lbs (0.52 kg)
Dimensions	4.72 in. (119.9 mm) Height, 2.75 in. (70.6 mm) Width,
and 1.20 in. (30.5 mm) Depth	

a. **Battery BB-708/U.** This light-duty battery provides 24 Vdc at 5.5 ampere-hours.



1 **Cover and Gasket.** Keep out dirt/debris.

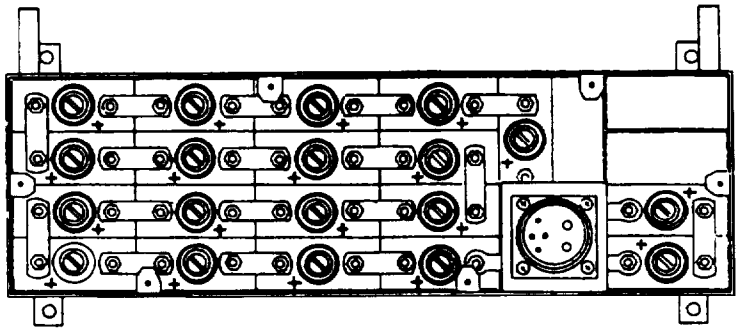
2 **Elec. Receptacle.** ITT Canon Quick Disconnect.

3 **Case.** Stainless steel. Polyamide plastic sheets insulate; prevent cell movement.

4 **Case Vents.** Prevent buildup of explosive gas during charging.

5 **Terminal Links.** 17 nickel-plated links plus 1 wire jumper connect cells in series.

6 **Cells.** 19 cells, type 5HM120.



CELL LAYOUT

Figure 1-10. Battery BB-708/U, Major Components.

EQUIPMENT DATA

BATTERY BB-708/U

Electrical data:

Rating	5.5 ampere-hours for 1 hour at 89°F above 18 volts
Voltage (open circuit)	25 volts (fully charged, 24 hour rest)
Voltage (under loads of:)	
2.75 A at 80°F (26°C)	24V decreasing to 19.2V in 2 hours
5.5 A at 80°F (26°C)	24V decreasing to 18.0V in 1 hour
50 A at 80°F (26°C)	23V decreasing to 14.4V in 5 minutes
50 A at -22°F (-30°C).	22V decreasing to 14.4V in 3 minutes
Operating Range:	
Temperature	-40° to 165°F (-40° to 74°C)
Atmospheric Pressure..	sea level to 100,000 feet
Storage Range:	
Duration	Unlimited, regardless of state of charge
Temperature	-65° to 130°F (-54° to 54°C)

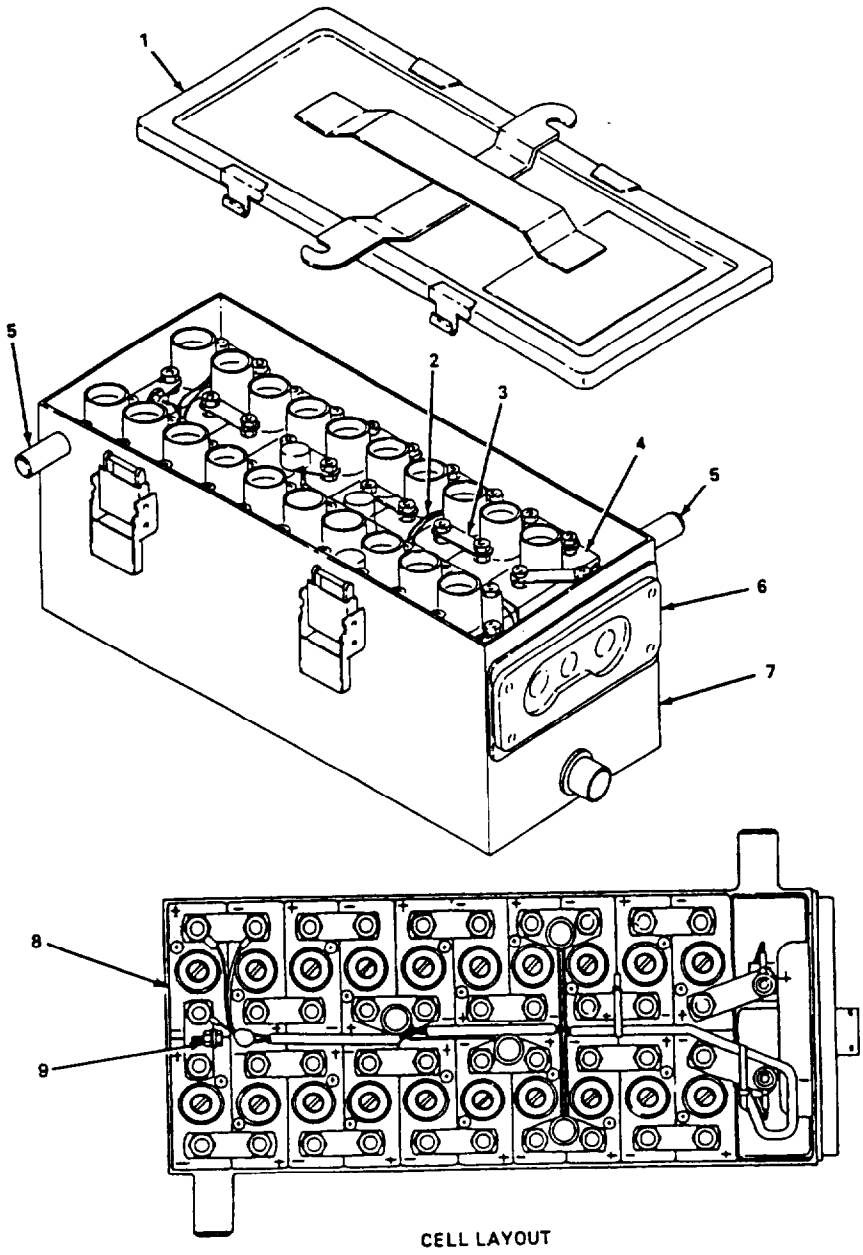
Physical Data:

Weight	15 lb. (6.81 kg)
Height..	5.25 in. (133.4 mm)
Depth	5.75 in. (146.1 mm)
Width	13.14 in. (333.8 mm)
Connector	ITT Canon, CAC2AQ2C-8S, Quick Disconnect type

Cell Data:

Type and Number..	5H120,19 each
Weight	0.5 lbs (0.23 kg)
Dimensions	4.09 in. (103.9 mm) Height, 2.19 in (55.6 mm) Width, and 0.95 in (24.1 mm) Depth

j. Battery BB-716/A (Marathon). This light-duty battery, identified as Marathon p/n 29147-5, provides 24 Vdc at 5.5 ampere-hours. it differs from the Saft version (paragraph k.) in minor details concerning ceils, receptacles, shims, and wiring harness.



1 **Cover and Gasket.** Keep out dirt/debris.

2 **Wiring Harness.** Includes monitoring circuits, external connector.

3 **Terminal Links.** 21 nickel-plated links connect cells in series.

4 **Standard Cells.** 19 cells, type 5HM120.

5 **Case Vents.** Prevent buildup of explosive gas during charging.

6 **Elec. Receptacle.** Quick Disconnect, Marathon p/n 16163-11.

7 **Case.** Epoxy-coated steel. Polyamide plastic sheets insulate; prevent cell movement.

8 **Low Capacity Cell.** Monitors battery charge state. Cell cover is black.

9 **Rectifier.** Bypasses low capacity cell; prevents damage during continued discharge.

Figure 1-11. Battery BB-716/A (Marathon P/N 29147-5), Major Components.

EQUIPMENT DATA

BATTERY BB-716/A (MARATHON)

Electrical data:

Rating	5.5 ampere-hours for 1 hour at 80°F above 18 volts
Voltage (open circuit)	26 volts (fully charged, 25 hour reset)
Voltage (under loads of:)	
5.5 A at 80°F (26°C)	24V decreasing to 18.0V in 1 hour
5.5 A at 80°F (26°C)	23V decreasing to 14.4V in 5 minutes
5.5 A at -22°F (-30°C).	20V decreasing to 12.5V in 3 minutes
Operating Range:	
Temperature	-40° to 165°F (-40° to 74°C)
Atmospheric Pressure	Sea level to 100,000 feet
Storage Range:	
Duration	Unlimited, regardless of state of charge
Temperature	-65° to 130°F (-54° to 54°C)

Physical Data:

Weight	17.5 lb. (7.9 kg)
Height..	6.0 in. (152.4 mm)
Depth..	13.63 in. (346.1 mm)
Width	7.5 in. (241.3 mm)
Connector	Quick Disconnect type, Marathon p/n 16163-11
Connector (control)	MS3474L12-1OPN

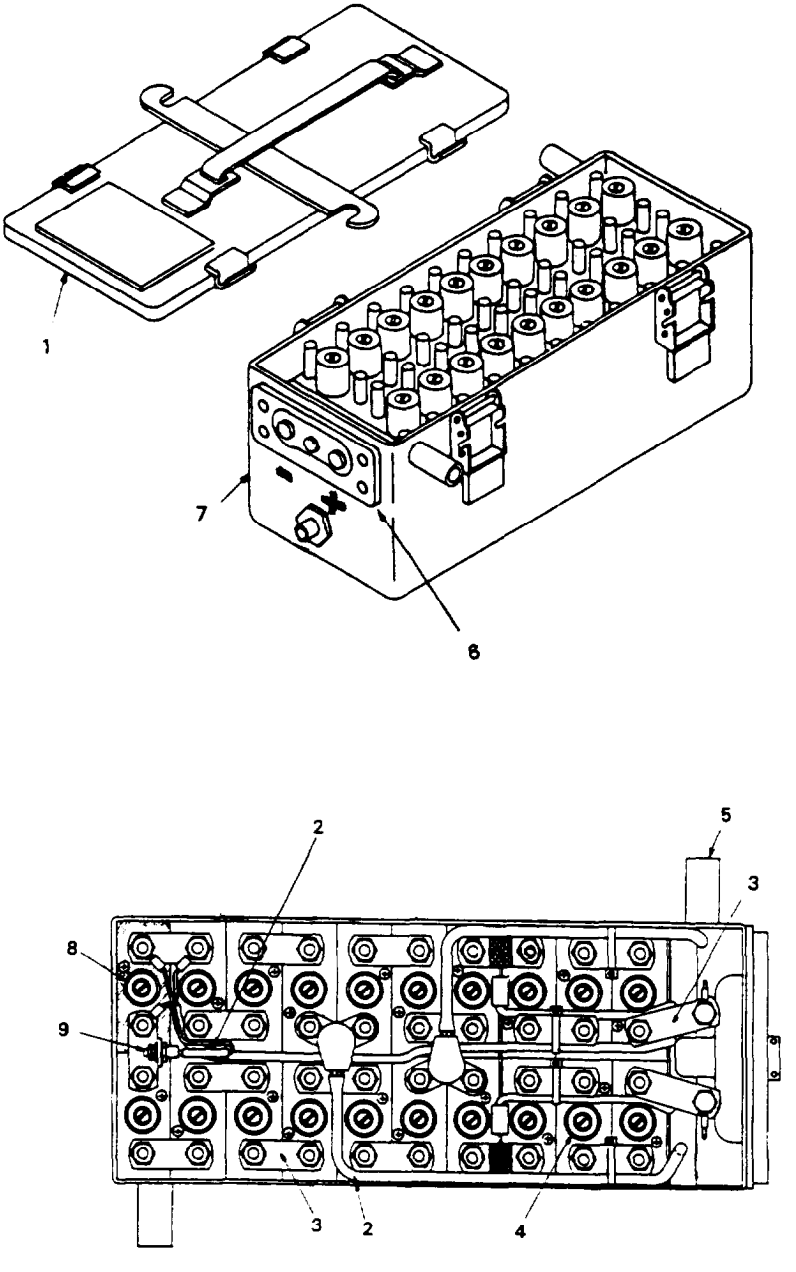
Ceil Data:

Type and Number..	5H120, 19 each, Low Capacity Cell, 1 each
Weight	0.5 lbs (0.23 kg)
Dimensions	4.09 in. (103.9 mm) Height, 2.19 in (55.6 mm) Width, and 0.95 in (24.1 mm) Depth

Special Features:

Overtempemture Warning	Thermal switches (2) in series open on temperature rise at 160°F (71°C)
Low Capacity Cell	Marathon p/n 29150-2. Rated at 3.6 ampere hours, 5.5 amperes for 36 minutes to 0.95 volts. Shunted with bypass diode to prevent cell reversal.

k. **Battery BB-716/A (Saft).** This lightduty battery, identified as Saft p/n 19653, provides 24 Vdc at 5.5 ampere-hours. it differs from the Marathon version (paragraph j.) in minor details concerning cells, receptacles, shims, and wiring harness.



1 **Cover and Gasket.** Keep out dirt/debris.

2 **Wiring Harness.** Includes monitoring circuits, external connector.

3 **Terminal Links.** 21 nickel-plated links connect cells in series.

4 **Standard Cells.** 19 Saft p/n 21131.

5 **Case Vents.** Prevent buildup of explosive gas during charging.

6 **Elec. Receptacle.** MS3509 Quick Disconnect.

7 **Case.** Epoxy-coated steel. Polyamide plastic sheets insulate; prevent cell movement.

8 **Low Capacity Cell.** Monitors battery charge state. Cell cover is black.

9 **Rectifier.** Bypasses low capacity cell; prevents damage during continued discharge.

Figure 1-12. Battery BB-716/A (Saft P/N 19653), Major Components.

EQUIPMENT DATA

BATTERY BB-716/A (SAFT)

Electrical data:

Rating	5.5 ampere-hours for 1 hour at 80°F above 18 volts
Voltage (open circuit)	26 volts (fully charged, 25 hour reset)
Voltage (under loads of:)	
5.5 A at 80°F (26°C)	24V decreasing to 18.0V in 1 hour
5.5 A at 80°F (26°C)	23V decreasing to 14.4V in 5 minutes
5.5 A at -22°F (30°C)	20V decreasing to 12.5V in 3 minutes
Operating Range:	
Temperature	-40° to 165°F (-40° to 74°C)
Atmospheric Pressure	sea level to 100,000 feet
Storage Range:	
Duration	Unlimited, regardless of state of charge
Temperature	-65° to 130°F (-54° to 54°C)

Physical Data:

Weight	17.5 lb. (7.9 kg)
Height	6.0 in. (152.4 mm)
Depth	13.63 in. (346.1 mm)
Width	7.5 in. (241.3 mm)
Connector	MS3509, Quick Disconnect type
Connector (control)	MS3474L12-10PN

Cell Data:

Type and Number	19 each, Saft p/n 21131; Low Capacity Cell, 1 each.
Weight	0.5 lbs (0.23 kg)
Dimensions	4.09 in. (103.9 mm) Height, 2.19 in (55.6 mm) Width, and 0.95 in (24.1 mm) Depth

Special Features:

Overtemperature Warning	Thermal switches (2) in series open on temperature rise at 160°F (71°C)
Low capacity cell	Saft p/n 21132. Rated at 3.6 ampere hours, 5.5 amperes for 36 minutes to 0.95 volts. Shunted with bypass diode to prevent ceil reversal.

1-10. Safety, Care, and Handling

NICAD batteries can be very hazardous if not maintained and handled properly. Observe all WARNINGS, CAUTIONS, and NOTES in this manual and familiarize yourself with emergency and first aid procedures in the event of an accident.

1-11. Differences Between Models

The NICAD batteries described in this manual are unique and are intended for use in specific aircraft. Refer to table 2-3 for a complete list of the batteries and the aircraft in which they are used. The partial list which follows outlines the aircraft applications for those batteries which are furnished in various sub-types:

- Battery BB-432A/A is used in Helicopter CH-47, Models A, B and C. Battery BB-432B/A is used in Helicopter CH-47D. Battery BB-532B/A uses a harness assembly which provides temperature and voltage monitoring.

- Battery BB-564/A or BB-664/A is used in Helicopter AH-64A. The BB-564/A uses BB-652/A cells; the BB-664/A uses BB-475/A cells. Battery BB-564/A is no longer procured and when one of these batteries is no longer serviceable, it is replaced by type BB-664/A.

- Battery BB-716/A is used in Helicopters UH-60A and EH-60A. This battery exists in two versions which are functionally identical and have the same type number but have minor physical differences. One of these versions is manufactured by Marathon and is identified by Marathon p/n 29147-5. The other version is manufactured by Saft and is identified by Saft p/n 19653. The physical differences between these two batteries are limited to the component cells, the electrical receptacles, the components of the monitoring circuits, and the shims. The Marathon battery uses 19 standard NICAD cells, 5HM120, plus a low-capacity analyzer cell, Marathon p/n 29150-2. The Saft battery uses 19 standard cells, Saft p/n 21131, plus a low-capacity analyzer cell, Saft p/n 21132. The Marathon battery uses a quick-disconnect receptacle identified by Marathon p/n 16163-11. The Saft battery uses quick-disconnect MS3509. The monitoring circuits use different sensors and the associated wiring harness is routed differently and has a different connector.

Section III. TECHNICAL PRINCIPLES OF OPERATION

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NOTE

Refer to TM 11-6140-203-14-1 for detailed operating characteristics and construction details of NICAD batteries.

1-12. General

A battery is a device which is used to supply electric power to operate various types of electrical equipment. It derives this ability by converting its stored chemical energy into an electrical current which is the direct result of chemical reactions taking place within the battery as it discharges. Some factors which determine the amount of power that a battery can produce are:

a. The active chemicals used and their particular electrochemical relationship.

b. The amounts of these active materials.

c. Their physical relationships to each other.

Various combinations of chemicals result in a number of different battery types, each with its own electrical-mechanical advantages and disadvantages.

1-13. Non-Rechargeable (Primary) Versus Rechargeable (Secondary) Batteries

One of the basic differences among battery types is whether the battery is to be used only once or is to be recharged. Batteries which are used and discarded are known as primary or non-rechargeable. Batteries which can be used repeatedly are known as secondary or rechargeable. The main factor which determines whether a particular battery system is primary or secondary is the natural relationship of the chemicals involved. In a primary battery, the active chemicals are used up in an essentially one-way, irreversible chemical reaction. However, after a secondary battery is discharged, the chemical reactions can be reversed by applying energy during the recharging process, resulting in the chemicals being restored to their original charged condition.

1-14. Typical Battery Construction

The term battery generally refers to a finished unit which is made from one or more ceils. A cell is the basic unit in which the chemical reactions take place to produce electric current. Although a battery can sometimes have only a single cell and terminals, it usually is an additive series combination of individual cells assembled into a common case and having a terminal connector and proper insulation. Each individual NICAD ceil has a nominal voltage of 1.2 volts. A nominal 6 volt battery, therefore, will contain 5

series-connected cells; a nominal 24 volt battery will contain either 19 or 20 series-connected cells. The principal parts and materials used to construct sealed NICAD cells are described in the following paragraphs.

a. Plates (Positive and Negative Electrodes. The electrodes contain the active materials (nickel and cadmium) which take part in the chemical reactions. The sintered plates of NICAD ceils are made by a process in which carbonized nickel powder is sintered at a high temperature to a metal grid or carrier. This welding together of the individual grains of nickel powder onto the grid results in a highly porous, thin structure known as "plaque". Positive (nickel) elctrodes are formed by soaking the plaque in a solution of nickel salts (the active material) and then subjecting the salt-impregnated plaque to electric current. Negative (cadmium) electrodes are formed by the same process, except that cadmium salts (the other active material) are used. An alternate form of negative electrode is made by applying the active material in a paste form.

b. Electrolyte. The electrolyte is an alkaline solution of potassium hydroxide in distilled water. its function is to complete the electrical circuit by providing a path for conducting the current that flows between the positive and negative plates. The electrolyte does not take part in the chemical reaction in NICAD batteries but acts only as an electrical charge (ion) carrier. A sealed cell has a limited amount of electrolyte, which cannot be changed. Therefore, a specific gravity measurement, as in a lead add battery has no value.

c Separator. A continuous separator system, composed of one layer of gas barrier film between two layers of nylon cloth, acts to mechanically separate the positive plates from the negative plates in the cell (so as to prevent a short circuit) while still permitting ionic flow (current) between the opposing polarity plates. To ensure complete isolation, the separator is slightly longer than the plates. The gas barrier membrane inhibits the reaction of oxygen formed at the positive plates with cadmium at the negative plates. This oxygen recombination reaction creates heat and suppresses ceil voltage. The gas barrier also helps assure complete charging of the cell and prevents overheating and thermal runaway.

d. Cell Assembly. The triple-layer separator is folded in a continuous sheet between alternate positive and negative tabbed plates to form a "stack-up". Terminals are welded to their respective plate tabs to form the "core". The ceil cover is placed over the two terminals, a cell support installed, and the appropriate hardware connected to the external and internal portions of the terminals. The core-cover assembly is then placed into the cell case and the cover is jointed to the case. The addition of the required amount of electrolyte and the installation of a vent plug completes the cell assembly.

e. Filler Caps. Vented ceils are provided with removable 6 ± 4 PSI filler caps for electrolyte adjustments and gas venting. Most of these are of the Camloc fast removal type; a few ceil types employ a screw type base. The filler cap consists of an externally threaded plug device and an interior venting device. The vent is comprised of an elastometric collar around a manifold system. The collar is designed to relieve the internal ceil pressure caused by gas evolved during overcharge. In addition, the collar prevents unwanted foreign substances from entering the cell. It also prevents leakage of electrolyte during discharge, even in the Inverted position.

1-15. Electrochemical Action

The electrodes used in NICAD cells allow changes in the chemical state of the active materials without any accompanying physical change. The active materials do not dissolve while undergoing the chemical reactions. This results in long-lasting electrodes as well as a constant energy output during discharge. The active material at the positive plate chemically changes from one form of nickel hydroxide to another, reversibly, depending on whether it is being discharged or charged. The active material at the negative plate changes from cadmium metal to cadmium hydroxide during discharge, and reversibly back to cadmium metal during charge.

1-16. Electrical Characteristics

a. Voltage (Volts). One of the bask ratings of a battery or ceil is its voltage. Voltage may be considered as electrical pressure or force, similar to water or air pressure. Volts is the term and unit of measurement which is used to describe the amount of pressure. Nominal, or average voltage of a particular cdl system, is determined by the chemicals used. Battery nominal voltage, in turn, is determined by the number and electrical arrangement of the cells it contains. NICAD ceils, regardless of size or shape, have a nominal voltage of 1.20 volts. Common battery voltages are 6.0, 12.0, and 24.0 volts. Further voltage references will be to cell voltages. Battery voltage will be the multiple of the number of ceils.

b. Open Circuit (No Load) Voltage. Open circuit voltage is the voltage of a ceil when it is not being discharged (i.e., it is at rest, no energy is being taken out). The open circuit voltage of a NICAD ceil will vary from approximately 1.0 volts to 1.4 volts, depending on its state of charge and the recent history of cell activity. Open circuit voltage by itself should not be used as a measure of state of charge, as a time factor must also be considered. However, a cell with very recent charge/discharge activity will usually exhibit the following open circuit voltage levels:

- Fully or nearly fully charged: 1.50 to 1.65 volts
- Partially discharged: 1.25 to 1.35 volts
- After 1 hour rest: 1.45 to 1.55 volts
- Fully discharged: 0.5 volt.

c. Closed Circuit Voltage (Load Voltage). Closed circuit voltage is the cell voltage during discharge (i.e., supplying energy to a load). Closed circuit voltage of a NICAD ceil is always lower than open circuit voltage prior to the start of discharge. it will generally range from 1.25 volts at the start of discharge and drop to 1.0 volt at the end of discharge (when ail capacity has been used). The exact value depends on such factors as temperature, length of time on discharge, and electrical size of the load (amperes).

d. Load Current (Amperes). Whereas a cell's voltage exists and can be measured under open circuit condition, current only flows through a completed circuit (dosed loop). Ampere is the term and unit of measurement which is used to describe the amount of the current. It may be thought of as the amount of fluid flow in pipe; the result of the electrical pressure-voltage. The number of amperes required (the discharge rate) is determined by the equipment being powered (or test circuit). The number of amperes that the cell can produce depends at least on its size, temperature, state of charge, and history. Current, unlike voltage, is not additive in a series battery.

1-17. Capacity (Ampere-Hours)

The capacity of a cell is the total amount of energy that the ceil can deliver to a load. Capacity rating is based on a fully charged ceil being discharged at room temperature to an endpoint closed-circuit voltage of usually one volt per cell. it is usually expressed in terms of ampere-hours. In theory, a 4 ampere-hour battery can provide 1 ampere for 4 hours, 4 amperes for 1 hour, or 8 amperes for 1/2 hour. However, very high currents reduce capacity. A 40-ampere load will only last for five minutes (3.33 ampere-hours).

1-18. Charge Characteristics

The NICAD cell is charged by applying a direct current (dc) source of proper polarity and magnitude, in effect, forcing energy into the cell. The characteristics outlined in the following paragraphs are of concern during charging.

a. Charge Acceptance. The ability of the cell or battery to accept charge is referred to as charge acceptance. If charge acceptance were 100 percent, then ail the energy of the input charge would be available for discharge. However, the generation of oxygen gas and conversion of some of the active material into a non-usable form results in less than full charge. Thus, to obtain 100% capacity and compensate for these losses, the nickel-cadmium ceil should be charged for an amount of time that will replace 120 to 140 percent of the previously discharged ampere-hours.

b. Charge Voltage. The charge voltage is the voltage which the ceil develops during charging. It generally ranges from 1.35 volts to 1.5 volts. Under normal charge conditions, the voltage will rise to approximate 1.4 volts at 10 to 20% state of charge. it then rises more slowly until 95% state of charge. At this point, it will rise quickly to reach a peak of about 1.55 to 1.65 volts and then drop slightly to an equilibrium level.

c. Ceil Temperature. During the major portion of a normal charge, the ceil temperature increases only slightly. As it approaches full charge, oxygen is generated at the positive plate, consuming input energy. Electrochemical recombination of this oxygen at the negative plate generates heat. The ceil temperature will rise somewhat and then level off. Charge acceptance is also affected by ceil temperature. If the cell is charged at a temperature higher than that specified in the instructions, the oxygen generation reaction takes place at a lower state of charge and, in effect, prohibits the cell from becoming fully charged. If the cell is charged at a temperature lower than that specified in the instructions, excess gas will be generated with the probability of opening the vent and expelling electrolyte.

d. Cell Pressure. As with cell temperature, ceil pressure stays low during most of the charge time and starts to rise as the ceil approaches full charge. The increase in pressure is due to the generation of oxygen at the positive plate. As the ceil becomes fully charged, hydrogen generation begins at the negative plate; however, because charge current falls, the pressure levels off at the opening pressure.

e. Overcharge. Overcharge is the continued charging of a ceil after it has become fully charged. It causes a rise in temperature, gas generation, and water loss. The amount of increase depends on the charge rate. Excessive overcharge can cause the expelling of electrolyte and ultimately ceil dry out due to water loss.

1-19. Discharge Characteristics

A ceil or battery is said to be discharging when it is supplying electrical energy to power an external load. Under normal load conditions, the discharge voltage (dosed circuit voltage) of a nickel-cadmium cell is quite uniform for the most part of the discharge period. It usually starts in the area of 1.3 volts and levels off between 1.20 and 1.25 volts until approximately the 90% to 95% point has been reached. The voltage then drops quite rapidly to 1.0 volt at the 100% point. The ceil has now converted most of its active material into the discharged state and can no longer supply energy. The two major factors which affect discharge are discharge rate and discharge temperature.

a. Discharge Rate. The discharge rate is the number of amperes of load current: in effect, how fast or how slow energy is being supplied by the cell. NICAD ceils, in general, can supply quite high currents, relative to their size. As discussed previously, the cell ampere-hour rating is based on the amount of current it can produce continuously for one hour. As this value of current is increased by multiples, lees than 100% of the active material is able to be converted to energy. Still, this means the cell can, if necessary, provide high currents for useful time periods. When the ceil is discharged at current lower than its one hour rating, most of the active material is converted to energy.

b. Discharge Temperature. NICAD cells may be discharged over a wide temperature range, the optimum usually considered to be 0°F to 110°F (-20°C to +45°C). Usable capacity is available beyond both extremes. Since the rate at which a chemical reaction can take place depends on the temperature of the chemicals involved, the cell discharge reactions slow down at cold temperatures. The capacity of a cell or battery which is cold-soaked at the lower extremes must be de-rated down to almost no activity at -40°F (-40°C). If a cell or battery has been fully charged within the specified temperature range and then elevated to higher temperatures for discharge soon after, there should be no appreciable loss of capacity. Occasional discharge at either temperature extreme does not result in a permanent loss of capacity.

CHAPTER 2

AVIATION UNIT MAINTENANCE (AVUM) INSTRUCTIONS

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Section I.	Repair Parts, Special Tools; Test, Measurement, and Diagnostic Equipment (TMDE); and Support Equipment	2-1
Section II.	Aviation Unit Preventive Maintenance Checks and Services (PMCS)	2-2
Sect&n Ill.	Aviation Unit Maintenance	2-7

OVERVIEW

This chapter contains preventive maintenance, troubleshooting corrective maintenance, and installation instructions performed by AVUM maintenance personnel as authorized by the Maintenance Allocation Chart (MAC), in Appendix B of this manual.

Section I. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

Paragraph		Page
2-1	Common Tools and Equipment..	2-1
2-2	TMDE and Support Equipment..	2-1
2-3	Repair Parts and Special Toads List..	2-1

2-1. Common Tools and Equipment

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

2-2. TMDE and Support Equipment

Refer to Maintenance Allocation Chart (MAC), in Appendix B of this manual for a list of all tools and support equipment required to perform AVUM procedures.

2-3. Repair Parts and Special Tools List

Repair parts are listed and illustrated in the Repair Parts and Special Tools List (RPSTL) TM 11-6140-203-23P.

Section II. AVIATION UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Paragraph		Page
2-4	General	2-2
2-5	PMCS Procedures	2-2

2-4. General

Aviation Unit Maintenance (AVUM) PMCS procedures are performed to ensure the aircraft nickel-cadmium (NICAD) batteries are in top operating condition. A comprehensive PMCS program can reduce equipment down time and increase the operational readiness of the equipment. Tables 2-1 and 2-2 contain PMCS procedures for all aircraft NICAD batteries.

2-5. PMCS Procedures

Aviation unit maintenance PMCS are provided in tables 2-1 and 2-2 for all the NICAD batteries. The numbers in the item No. column indicate the order in which the checks and services are to be performed. These numbers should be used when recording deficiencies and shortcomings on DA Form 2404, Equipment Inspection and Maintenance Worksheet. PMCS for unharnessed batteries are performed after every 25 flight hours or 30 days, whichever comes first. After 120 days, unharnessed batteries are removed from the aircraft and forwarded to Aviation Intermediate Maintenance (AVIM) shop for servicing. For batteries with control harnesses, batteries are removed from the aircraft and forwarded to the AVIM shop for servicing after 120 days of service or 100 hours of flight time, whichever comes first.

WARNING

Remove rings and jewelry from hands and wrists when servicing NICAD batteries. Metallic objects may accidently come in contact with terminals which may cause injury to personnel and damage to the battery. Use a nylon bristle brush when cleaning battery.

NOTE

It may be necessary to remove the battery from the aircraft in order to perform PMCS. Refer to the applicable aircraft technical manual for procedures to remove the battery.

NOTE

A tolerance of ± 10% is authorized for the scheduled preventive maintenance periods given in tables 2-1 and 2-2.

Table 1-1. AVUM Preventive Maintenance Checks and Services (PMCS) Procedures. (Unharnessed Batteries)

M - Monthly H - Hourly (Flight Hours) 120 Days

Item No.	Interval M	Interval H	Interval 120 Days	Item to be Inspected	Procedures
				AIRCRAFT NICAD BATTERIES BB-432A/A, BB-433A/A, BB-434/A, BB-476/A BB-649A/A, BB-678/A, AND BB-708/U	
1	•	25		Top Cover	Inspect top cover for dents, scratches, or other damage.
2	•	25		Battery Case	Inspect battery case for dents, cracks, chipped or scratched paint, and corrosion.
3	•	25		Connectors	Disconnect aircraft plugs and inspect connectors for damaged or missing pins, corrosion, and/or missing or loose hardware. Refer damage to higher level maintenance.
4	•	25		Terminal Links and Hardware	Inspect terminal links for white deposits (potassium carbonate) and remove all deposits with nylon bristle brush. Check all hardware and ensure all hardware is properly secured. Refer missing or loose hardware to higher level maintenance.
5	•	25		Battery Cells	Inspect the top of the cells for cracks or signs of leaking electrolyte. Refer damage or leaks to higher level maintenance.
6		50		Electrolyte Level	Check electrolyte level per paragraph 2-7c.
				NOTE Battery electrolyte is only used up as the result of overcharge during aircraft engine operation. Therefore, there is no need to check electrolyte because of "calendar" time. Electrolyte is inspected after 50 filght hours time only.	
7	•	25		Filler Caps	Check filler caps and ensure filler caps are secure. Check for potassium carbonate (whitish residue). Check rubber vent and locking mechanism. Refer damaged filler caps to higher level maintenance.

Table 2-1. AVUM Preventive Maintenance Checks and Services (PMCS) Procedures - continued.
(Unharnessed Batteries)
M - Monthly H - Hourly (Flight Hours) 120 Days

Item No.	Interval M	Interval H	Interval 120 Days	Item to be Inspected	Procedures
8	●	25		Battery Case Vents and Vent Tubing	Inspect battery case vents and vent tubing for blockage with foreign material. Remove and clean unit case and vent tubing.
9	●	25		Voltage Check	Using Multimeter AN/PSM-45A, measure battery voltage per paragraph 2-7a. Refer battery to higher level of maintenance if battery voltage is below 24 volts or except for the conditions given in paragraph 2-7a.
10	●			Electrical Leakage	Using Multimeter AN/PSM-45A, measure electrical leakage current from positive and negative terminals of battery connector to battery case (para 2-7b). If maximum acceptable values are exceeded refer to higher level of maintenance.
11			●	Servicing	Return battery to Aviation intermediate Maintenance (AVIM) for service.

Table 1-2. AVUM Preventive Maintenance Checks and Services (PMCS) Procedures (Batteries with Control Harnesses)
M - Monthly H - Hourly (Flight Hours) 120 Days

Item No.	Interval M	Interval H	Interval 120 Days	Item to be Inspected	Procedures
				AIRCRAFT NICAD BATTERIES BB-432B/A, BB-558/A, BB-564/A, BB-664/A AND BB-716/A	
				NOTE Battery BB-564/A only, PMCS is performed every 25 flight hours or 30 days whichever comes first.	
1	•	**50**		Top Cover	Inspect top cover for dents, scratches, or other damage. Refer damage to higher level maintenance.
2	•	**50**		Battery Case	Inspect battery case for dents, cracks, chipped or scratched paint, and corrosion. Refer damage to higher level of maintenance.
3	•	**50**		Connectors	Inspect connectors for damaged or missing pins, corrosion, and/or missing or loose hardware.
4	•	**50**		Terminal Links and Hardware	Remove cover and inspect terminal links for white deposits (potassium carbonate) and remove all deposits with nylon brush. Check all hardware and ensure all hardware is property secured. Refer damage to higher level maintenance.
5	•	**50**		Battery Cells	Inspect the top of the cells for cracks and/or signs of leaking electrolyte. Refer damage to higher level of maintenance.
6		**50**		Electrolyte Level	Check electrolyte level per paragraph 2-7c.
				NOTE Battery electrolyte is only used up as the result of overcharge during aircraft engine operation. Therefore, there is no need to check electrolyte because of "calendar" time. Electrolyte is inspected after 50 flight hours time only.	

Table 2-2. AVUM Preventive Maintenance Checks and Services (PMCS) Procedures (Batteries with Control Harnesses)

M - Monthly H - Hourly (Flight Hours) 120 Days

Item No.	Interval M	Interval H	Interval 120 Days	Item to be Inspected	Procedures
7	●	50		Filler Caps	Check filler caps for signs of potassium carbonate (whitish residue). Check rubber vent and locking mechanism. Refer damaged filler caps to higher level of maintenance. Check filler caps and ensure filler caps are secure. Refer missing or loose hardware to higher level of maintenance.
				NOTE Torque filler caps for Battery BB-716/A to 3-4 in.-lbs.	
8	●	50		Wiring Harness	Inspect wiring harness for damaged wiring and/or loose hardware. Refer damage or loose hardware to higher level of maintenance.
9	●	50		Battery Case Vents and Vent Tubing	Inspect battery case vents and vent tubing for blockage with foreign material. Remove and clear case vents and vent tubing.
10	●	50		Voltage Check	Using Multlimeter AN/PSM-45A, measure battery voltage per paragraph 2-7a. Refer battery to higher level of maintenance if battery voltage is below 24 volts (25.2 volts for Battery BB-716/A).
11	●	50		Electrical Leakage	Using Multimeter AN/PSM-45A, measure electrical leakage current from positive and negative terminals of battery connector to battery case (para 2-7b). If maximum acceptable values are exceeded, refer battery to higher level of maintenance.
12		100	●		Return battery to Aviation Intermediate Maintenance (AVIM) for servicing.

SECTION III. AVIATION UNIT MAINTENANCE

Paragraph		Page
2-6	Aviation Unit Maintenance (AVUM) Procedures	2-7
2-7	AVUM Test Procedures	2-8
2-8	External Vent Lines Check	2-10
2-9	Battery Exchange	2-10
2-10	Installation of NICAD Batteries	2-10
2-11	Voltage Regulator Check and Adjustment (for aircraft so equipped)	2-11

1.1. Aviation Unit Maintenance (AVUM) Procedures

This section contains AVUM procedures for aircraft NICAD batteries. These procedures consist of a voltage check, electrical leakage test, and electrolyte level check. Battery checks are performed with the battery disconnected from the aircraft. Observe all WARNINGS, CAUTIONS, and NOTES provided in this section and at the front of this manual. Refer to the applicable aircraft manual for removal and installation of NICAD batteries. Refer to table 2-3 for a listing of the aircrafts and the batteries installed in the aircraft.

Table 1-3. Battery and Aircraft Cross Reference

Aircraft	Battery
CH-47A, B, C	BB-432A/A
CH-47D	BB-432B/A
OV-1, UH-1, U-21	BB-433A/A
CH-54	BB-434/A
OH-58A, B, C	BB-476/A
OH-58D	BB-558/A
AH-64A	BB-564/A or BB-664/A
AH-I	BB-649A/A
OH-6A	BB-678A/A
OV-1D (Mission Gear Equipment)	BB-708/U
UH-60A, EH-60A	BB-716/A

1.2. AVUM TEST PROCEDURES (fig. 2-1)

These tasks cover: a. Voltage Check
b. Electrical Leakage Check
c. Electrolyte Level

INITIAL SETUP

Test Equipment

Multimeter AN/PSM-45A
(NSN 6625-00-135-2512)

Materials/Parts

Apron, Rubber (Item 2, Appendix C)
Gloves, Rubber (Item 8, Appendix C)
Goggles, Protective (Item 7, Appendix C)
Rags, Wiping (Item 12, Appendix C)

Personnel

Refer to the applicable aircraft MOS performing AVUM maintenance.

Equipment Condition

Battery disconnected from aircraft and top cover removed

WARNING

Make sure that adequate ventilation exists around the battery. Explosive gases can build up and cause serious injury or death and severe damage to equipment.

AVUM personnel are not to add electroly to the battery. Damage to battery and personnel injury may result.

Remove rings and jewelry from hands and wrists when servicing NICAD batteries. Metallic objects may accidentally come in contact with terminals which may cause injury to personnel and damage tobattery.

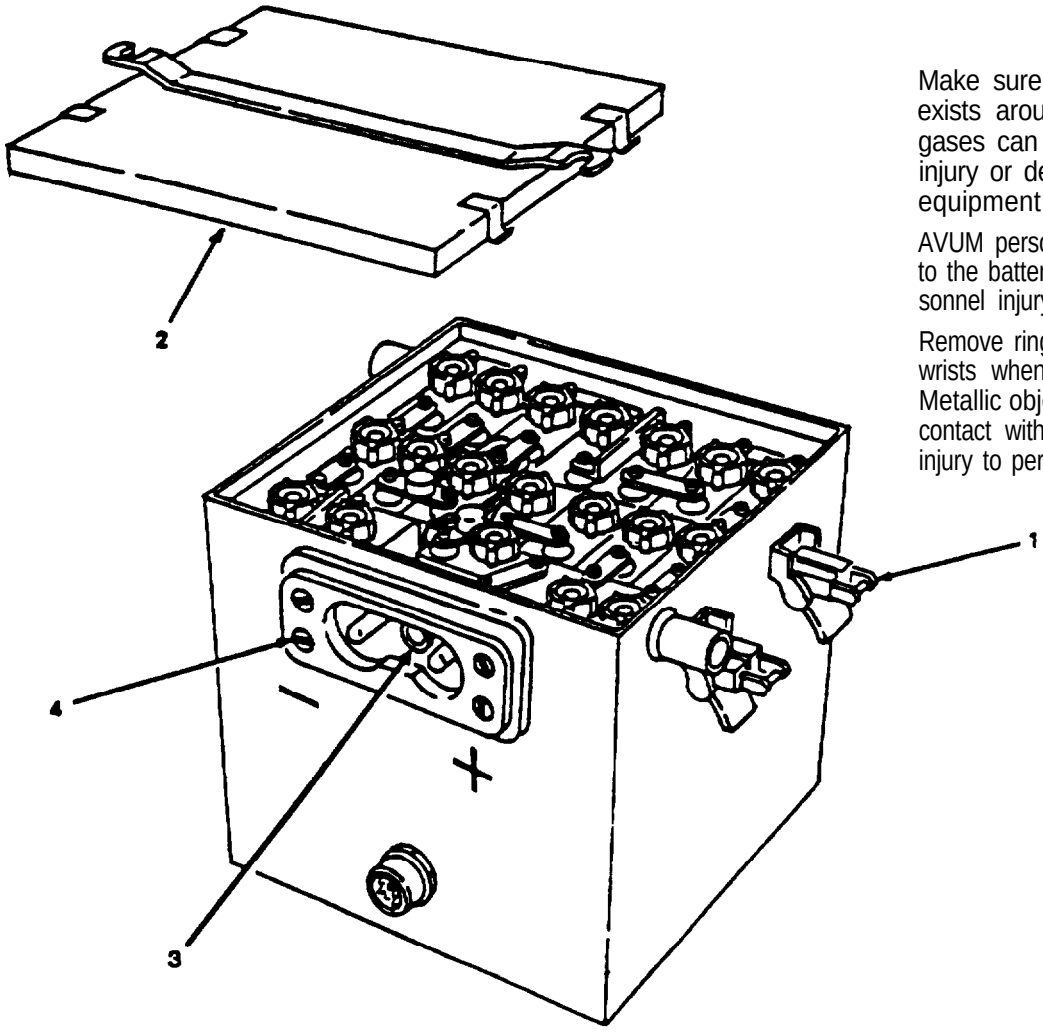

Figure 2-1. Battery Test (Typical).

a. Voltage Check.

NOTES

Do not make the following voltage check solely for the purpose of checking battery status. If a battery has not been charged within seven days or has operated on-board equipment, the minimum acceptable open voltage reading shall be 23.5 volts before requiring recharge and/or removal to a battery shop. The minimum voltage level under these conditions for Battery BB-716/A shall be 24.7 volts.

Battery voltage should be checked after a minimum flight time of 30 minutes and before battery is used to check out avionics equipment.

(1) Set multimeter to read DC volts.

(2) Place red lead on positive terminal on connector (3).

(3) Place black lead on negative terminal,

(4) Multimeter should read a minimum of 24 volts Or 25.2 volts for Battery BB-716/A. If voltage reading is not obtained, refer battery to AVIM for repair.

b. Electrical Leakage Check.

(1) Set multimeter to read milliamperes.

(2) Place red lead on positive terminal on connector (3).

(3) Place black lead on screw (4) or unpainted area of battery case such as latches (1).

(4) Adjust meter range to obtain an accurate reading and note reading.

(5) Place red lead on screw (4) or latches (1).

(6) Place black lead on negative terminal of connector (3).

(7) Adjust multimeter range to obtain an accurate reading and note reading.

(8) If either of the readings obtained in steps (4) and (7) above are greater than the current reading for the battery as specified below, refer the battery to AVIM for repair.

Battery	DC Current Reading (Milliamperes)
BB-432A/A, BB-432B/A	1
BB-433A/A	3
BB-434/A	3
BB-476/A	1
BB-558/A	2
BB-564/A	1
BB-649A/A	2
BB-664/A	1
BB-678A/A	2
BB-708/U	0.5
BB-716/A	0.5

(9) Install cover (2) and secure latches (1).

c. Electrolyte Level Check.

Be careful of possible spewing of electrolyte when making the electrolyte level check. Wear appropriate protective gear (goggles, gloves, apron).

NOTE

Do not perform the following electrolyte level check if the aircraft has just completed a flight. Allow the battery to rest for at least 30 minutes, but no longer than 60 minutes, before making this check. Over a period of time (longer than 60 minutes), electrolyte is absorbed into the battery and may not be visible.

(1) Access the NICAD battery compartment in the aircraft. Refer to the applicable aircraft manual for locations of NICAD battery compartments.

(2) Remove Battery filler caps and verify that electrolyte level is visible in the cell. If electrolyte is not visible in the cell DO NOT add water or electrolyte.

(3) If electrolyte is not visible, verify correct aircraft on-board charger or regulator settings on aircraft so equipped. Refer to the applicable aircraft manual for proper charger settings. This may impact electrolyte level. In every case, however, refer low electrolyte level to higher level maintenance.

NOTE

For Helicopter AH-64A containing Battery BB-564/A or BB-664/A, settings are 1.3 amperes for unmodified aircraft chargers, and 5.2 amperes for aircraft chargers containing updated A2 card.

1.3. External Vent Lines Check

a. Be sure that the vent lines (on aircraft so equipped) are free from stoppage.

b. f the vent lines are stopped or clogged, apply a low-air pressure (not to exceed 5 pounds per square inch (psi)) to clear the vents.

1.4. Battery Exchange

a. Remove the battery and return it to AVIM maintenance for reconditioning and exchange on a one-to-one basis.

b. Install a replacement in the aircraft and readjust the voltage regulator, as required, in accordance with paragraphs 2-10 and 2-11.

1.5. Installation of NICAD Batteries

WARNING

Make sure that adequate ventilation is provided for around the battery during installation. The buildup of explosive gases can cause serious injury or death to personnel and severe damage to equipment if the gases are ignited.

NOTE

For a battery used for the first time, ensure that the battery has been prepared for service by AVIM personnel as annotated on the battery service record card.

Installation of NICAD batteries will differ from aircraft system to aircraft system. For installation procedures of aircraft NICAD batteries, refer to the applicable manual covering the aircraft. (Refer to table 2-3 for a cross-reference of NICAD batteries and aircrafts.)

a. Securing Battery in Position. When installing the battery in its permanent position, ensure that all electrical connections are secure. Leads to the battery should be of sufficient size to carry the maximum current. The battery must be secured by holddown hardware.

b. Venting of Gases. During the charging cycle, some hydrogen and oxygen gases are evolved. When the battery is installed in a confined location, provide adequate ventilation to avoid accidental ignition of the gases.

1.6. Voltage Regulator Check and Adjustment (for aircraft so equipped)

Make certain that the test is performed in accordance with the instructions in the applicable aircraft manual in which the battery is being installed. The procedure and adjustment parameters can differ from one installation to another. The voltage regulator must be adjusted in accordance with the normal ground level ambient temperature for the season. This information is contained in the applicable aircraft manual.

CHAPTER 3

AVIATION INTERMEDIATE MAINTENANCE (AVIM) INSTRUCTIONS

		Page
	Overview	3-1
Section I.	Repair Parts, Special Tools; Test, Measurement and Diagnostic Equipment (TMDE); and Support Equipment	3-1
Section II.	Aviation Intermediate Troubleshooting Procedures	3-3
Section III.	NICAD Battery Service Instructions	3-17
Section IV.	Disassembly/Reassembly and Repair	3-43
Section V.	Servicing New Batteries	3-121

OVERVIEW

This chapter contains AVIM troubleshooting procedures, AVIM service instructions, procedures for servicing new batteries, and disassembly/reassembly and repair of batteries. A maintenance flow chart (fig. 3-6) is provided to illustrate the flow of maintenance actions performed at the AVIM shop.

Section I. REPAIR PARTS; SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

Paragraph		Page
3-1	Common Tools and Equipment..	3-1
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3-3	Repair Parts and Special Tools List..	3-2

3-1. Common Tools and Equipment

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

3-2. TMDE, Support Equipment, and Battery Shop Requirements

a. TMDE and Support Equipment. Refer to the Maintenance Allocation Chart (MAC) in Appendix B of this manual for a list of all tools and support equipment required to perform AVIM maintenance. Refer to Appendix D for instructions to fabricate special tools required for AVIM maintenance.

b. Battery Shop Requirements (Fixed). A fixed battery shop is a permanent structure containing the necessary features for battery maintenance. SAFETY is of prime importance for personnel and equipment operation. The following requirements are listed.

(1) Fire-containing wall structure.
(2) Proper lighting.
(3) Explosion-containing electrical structure.
(4) Exhaust fans.
(5) Electrical system to prevent charging without ventilation.
(6) Deluge shower and eye wash facility.
(7) Alkali resistant sink and work bench.
(8) Type B and C Fire extinguisher. CO2 Type fire extinguisher should not be used.
(9) Storage facilities.

(10) Personnel protective gear and clothing.

c . Battery Shop (Shelter Mounted). For shelter mounted battery shop, refer to the manuals listed below.

(1) Operator's Manual TM 11-4940-977-10
(2) Maintenance Manual TM 11-4940-477-24
(3) Parts Manual TM 11-4940-477-24P

3-3. Repair Parts and Special Tools List

Repair parts and special tools are listed and illustrated In the Repair Parts and Special Took List TM 11-6140-203-23P.

SECTION II. AVIATION INTERMEDIATE TROUBLESHOOTING PROCEDURES

Paragraph		Page
3-4	General	3-3
3-5	Aviation intermediate Troubleshooting Procedures	3-3

1.1. General

This section contains troubleshooting procedures to determine the probable cause of observed battery malfunctions. Tests or inspections are provided to isolate the faulty component and corrective actions are provided to eliminate the malfunction.

1.2. Aviation intermediate Troubleshooting Procedures

Refer to the symptom index to locate the troubleshootin procedures for the observed malfunction. Table 3-1 lists the common malfunction that may occur during operation or maintenance of the batteries. Perform the tests or inspections, and the recommended corrective actions in the order listed in the troubleshooting table. if the malfunction is corrected by a specific corrective action, do not continue with the remaining steps, if any. While pet-forming troubleshootin procedures on batteries BB-432B/A, BB-558/A, BB-564/A, BB-664/A, or BB-716/A, refer to figures 3-1 through 3-5 for wiring diagrams of battery harnesses.

SYMPTOM INDEX

Symptom		Page
1.	Low Voltage (less than 24 volts)	3-4
2.	Excessive Leakage of Electrolyte	3-4
3.	Low Electrolyte Level	3-4
4.	Corroded Terminal Links	3-4
5.	Cell to Battery Case Current Leak	3-5
6.	Aircraft Battery Fault indicator Lights (BB-432B/A)	3-5
7.	Aircraft Battery Fault indicator Lights (BB-558/A) and Faulty Low Temperature Operation	3-7
8.	Aircraft Battery Fault Indicator Lights (BB-564/A and BB-664/A)	3-12
9.	Aircraft Battery Fault indicator Lights (BB-716/A)	3-15

WARNING

Wear protective gear when troubleshooting batteries. Remove ail metal objects from wrists and fingers. Observe ail shop safety practices.

AVIM Troubleshooting Procedures

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. LOW VOLTAGE (less than 24 volts).

NOTE

BB-716/A minimum voltage is 25.2 volts.

Step 1. **Perform voltage check (para 2-7).**

Charge battery, check electrolyte level and test battery for current leakage.

Step 2. **Check cells for voltage uniformity and proper installation.**

Replace defective ceil(s) and service battery.

2. EXCESSIVE LEAKAGE OF ELECTROLYTE.

Step 1. **Check filler cap and O-ring for damage.**

Replace defective filler cap and O-ring.

Step 2. **Check for shorted cells.**

Replace shorted cells.

Step 3. **Check cells for voltage uniformity and proper installation.**

Replace defective cells(s) and service battery.

Step 4. **Check cells for distortion.**

Replace defective cell(s) and service battery.

Step 5. **Check all terminals for signs of damage, leakage, etc.**

Replace damaged cell terminals.

3. LOW ELECTROLYTE LEVEL.

Check cells for voltage uniformity and proper installation.

Charge battery and adjust electrolyte level.

4. CORRODED TERMINAL LINKS.

Step 1. **Check filler cap for tightness.**

Tighten any loose filler caps.

Step 2. **Check filler cap O-rings.**

Replace any filler cap O-rings that are cracked or deformed.

Table 3-1. AVIM Troubleshooting Procedures (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

4. CORRODED TERMINAL LINKS (cont).

Step 3. Inspect terminal links for scratches or wear.

Replace any terminal link that has scratches through the plating material to the base metal, or is worn through the plating material to the base metal.

5. CELL TO BATTERY CASE CURRENT LEAK.

Step 1. Check for electrolyte leakage on cells.

Remove any spilled electrolyte from tops of cells and battery case and retest.

Step 2. Check for potassium carbonate (white deposits) buildup.

Remove all potassium carbonate from battery using nylon bristle brush and retest.

Step 3. Check inside of battery case for signs of moisture or wetness.

Perform battery service procedures and retest.

6. AIRCRAFT BATTERY FAULT INDICATOR LIGHTS (BB-432B/A) (fig. 3-1).

NOTE

Perform the procedures contained in MALFUNCTIONS 1 through 5 above.

Step 1. Check thermistor resistance between pins A and C of wiring harness connector. Resistance versus battery temperature should be as specified below:

Temperature	Acceptable Resistance Range (ohms)
50°F (10°C)	1800-2400
60°F (16°C)	1356-1700
70°F (21°C)	1050-1300
80°F (27°C)	800-1000
90°F (32°C)	650-775
100°F (38°C)	500-625
110°F (43°C)	450-500

Replace wiring harness if resistance is not as specified.

Step 2. Check for continuity of thermal switch between pins D and E of wiring harness connector. Resistance should be 0.2 ohm maximum at temperature below 135°F (57.2°C).

Replace wiring harness if continuity is not present.

Step 3. Check for continuity between pin A of wiring harness and battery positive (+) terminal. Resistance should be 0.1 ohm maximum. Check that this red wire Is properly connected and retest.

Replace wiring harness if continuity is not present.

Table 3-1. AVIM Troubleshooting Procedures (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

6. AIRCRAFT BATTERY FAULT INDICATOR LIGHTS (BB-428/A) (fig. 3-1) (cont).

Step 4. Check for continuity between pin J of wiring harness and battery negative (-) terminal. Resistance should be 0.1 ohm maximum. Check that black wire is properly connected and retest.

Replace wiring harness if continuity Is not present.

Step 5. Check for continuity between pin F of wiring harness and cell 10 (+) terminal. Resistance should be 0.1 ohm maximum. heck that white wire is properly connected and retest.

Replace wiring harness if continuity is not present.

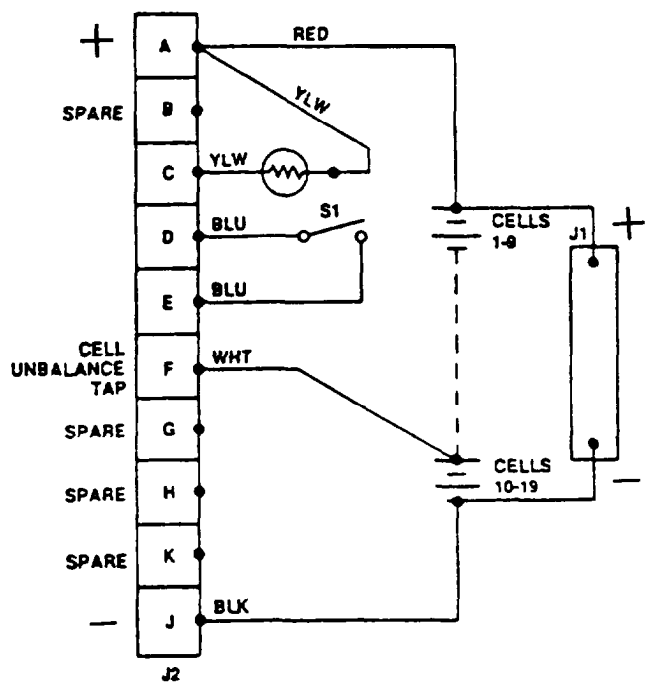


Figure 3-1. Battery M-432B/A Wiring Harness, Wiring Diagram.

Table 3-1. AVIM Troubleshooting Procedures (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

7. AIRCRAFT BATTERY FAULT INDICATOR LIGHTS (BB-558/A) AND FAULTY LOW TEMPERATURE OPERATION (fig. 3-2).

NOTE

Perform the procedures contained in MALFUNCTIONS 1 through 5 above.

All measurements must be made at room temperature, circuit breaker open, using an analog meter. Use a Simpson 260 or equivalent.

NOTE

BB-558/A batteries and or harnesses manufactured prior to 1992 do not have a connection to pin 14 of the wiring harness. If you are troubleshooting a battery manufactured before 1992, ignore all steps below which use pin 14 as a measuring source.

CAUTION

Do not energize the heaters above 0°F. Accidental tripping of time delay relay at room temperature may cause permanent damage. At room temperature, always check the harness assembly with the circuit breaker open.

Step 1. **Check resistance between pins 1 and 8 of wiring harness connector. Resistance should be greater than 1 megohm.**

Replace connector J2 if resistance Is not as specified.

Step 2. **Check resistance between pins 1 and 2 of wiring harness connector. Resistance should be greater than 1 megohm at temperature below 140°F**

Replace thermal switch HT-1 if reading is not as specified.

Step 3. **Check resistance between pins 1 and 3 of wiring harness connector. Resistance should be greater than 1 megohm.**

Replace time delay relay If reading Is not as specified.

Step 4. **Check resistance between pins 1 and 5 of wiring harness connector. Resistance should be greater than 1 megohm at temperature above 0°F.**

Replace thermal switch LT-2 If reading is not as specified.

Step 5. **Check resistance between pins 4 (positive) and 6 (negative) of wiring harness connector. Resistance should be greater than 1 megohm.**

Replace diode CR1 if reading is not as specified.

Step 6. **Check resistance between pins 4 (negative) and 6 (positive) of wiring harness connector. Resistance should be greater than 1 megohm.**

Replace diode CR2 if reading is not as specified.

Table 3-1. AVIM Troubleshooting Procedures (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
7. AIRCRAFT BATTERY FAULT INDICATOR LIGHTS (BB-558/A) AND FAULTY LOW TEMPERATURE OPERATION (fig. 3-2) (cont)
Step 7. Check resistance between pins 4 (positive) and 14 (negative) of wiring harness connector. Resistance should be greater than 1 megohm at temperature above 0°F. **Replace thermal switch LT-1 if reading Is not as specified.**
Step 8. Check resistance between pins 4 (positive) and 15 (negative) of wiring harness connector. Resistance should be between 5 and 13 ohms (1 ohm scale). **Replace heating strip B if reading is not as specified.**
Step 9. Check resistance between pins 6 (positive) and 14 (negative) of wiring harness connector. Resistance should be between 600 and 1000 ohms. **Replace wiring harness If resistance is open (greater than 1 megohm).**
Step 10. Check resistance between pins 6 (positive) and pin 1 (negative) of wiring harness connector. Resistance should be greater than 1 megohm. **Replace wiring harness if reading Is not as specified.**
NOTES To perform steps (11) and (12), fabricate a test fixture to hold an "AA" battery. Connect the test fixture in series with an ammeter. Obtain an "AA" alkaline battery BA-3030 (Item 20, Appendix C) and insert it into the fabricated battery holder. Steps (11) and (12) are applicable to extreme low temperature operations.
Step 11. Set the ammeter to the 10-ampere scale. Connect the positive lead (center button) of the "AA" battery to pin 6. Connect the negative lead through the ammeter to pin 15. Amperage reading should be between 0.3 - 0.6 amperes. **Replace strip heater A if reading is not as specified.**
Step 12. Using the test setup in step (11) above, reverse the connections to pins 6 and 15 (Pin 15 to "AA" positive and pin 6 to negative). Amperage reading should be zero. **Replace diode CR5 If reading Is not as specified.**

Table 3-1. AVIM Troubleshooting Procedures (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
7. AIRCRAFT BATTERY FAULT INDICATOR LIGHTS (BB-558/A) AND FAULTY LOW TEMPERATURE OPERATION (fig 3-2) (cont)
NOTE Steps 13 and 14 are applicable only to extreme low temperature operations.
Step 13. **Refer to the additional circuit In figure 3-2. Use a fresh 9-volt transistor-type battery BA-3090 (Item 21, Appendix C), shown as a source of voltage and a microammeter to measure current output. Use the equation and example shown in figure 3-2 to calculate the battery temperature. The calculated temperature value should be within ±25° F of the actual ambient temperature.** **Replace thermal sensor if reading Is not as specified.**
Step 14. **Check resistance between pins 7 (negative) and 8 (positive) of wiring harness connector. Resistance should be between 20 and 50K ohms (10K scale).** **Replace wiring harness if reading is not as specified.**
Step 15. **Check resistance between pins 6 (negative) and 14 (positive) of wiring harness connector. Resistance should be between 10 and 12K ohms (10K scale). If resistance is open (greater than 1 megohm) ignore readings as pin 14 is not connected.** **Replace wiring harness if reading is not as specified.**
Step 16. **Check resistance between pins 14 (negative) and 15 (positive) of wiring harness connector. Resistance should be greater than 1 megohm (10K scale).** **Repair or replace wiring harness if reading is not as specified (para 3-21).**
NOTE Make sure circuit breaker is open before performing the following step.
Step 17. **Check resistance between pin 15 (negative) and battery positive (+). Resistance should be greater than 1 megohm (1 OK scale).** **Repair or replace wiring harness if reading is not as specified (para 3-21).**
Step 18. **Check resistance between pin 9 and terminal link between cells 10 and 11 (fig. 1-6). Resistance should Indicate 0 (continuity) (R X 1 scale).** **Repair or replace wiring harness if reading is not as specified (para 3-21).**

Table 3-1. AVIM Troubleshooting Procedures (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
7. AIRCRAFT BATTERY FAULT INDICATOR LIGHTS (BB-558/A) AND FAULTY LOW TEMPERATURE OPERATION (fig 3-2) (cont)
Step 19. Check voltage between J2 harness connector shell and the + and - pins of J1. Voltage reading should be less than one volt. Repair or replace wiring harness if reading is not as specified (para 3-21).
Step 20. Check resistance between all pins (except 9 and 15) of wiring harness and battery case. Resistance should be greater than 1 megohm (10K scale). Repair or replace wiring harness if reading is not as specified (para 3-21).
Step 21. Check resistance between pin 15 and case ground. Resistance should be greater than 100K (10K scale). Repair or replace wiring harness if reading is not as specified (para 3-21).

Table 3-1. AVIM Troubleshooting Procedures (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

7. AIRCRAFT BATTERY FAULT INDICATOR LIGHTS (BB-558/A) (fig. 3-2) (cont)

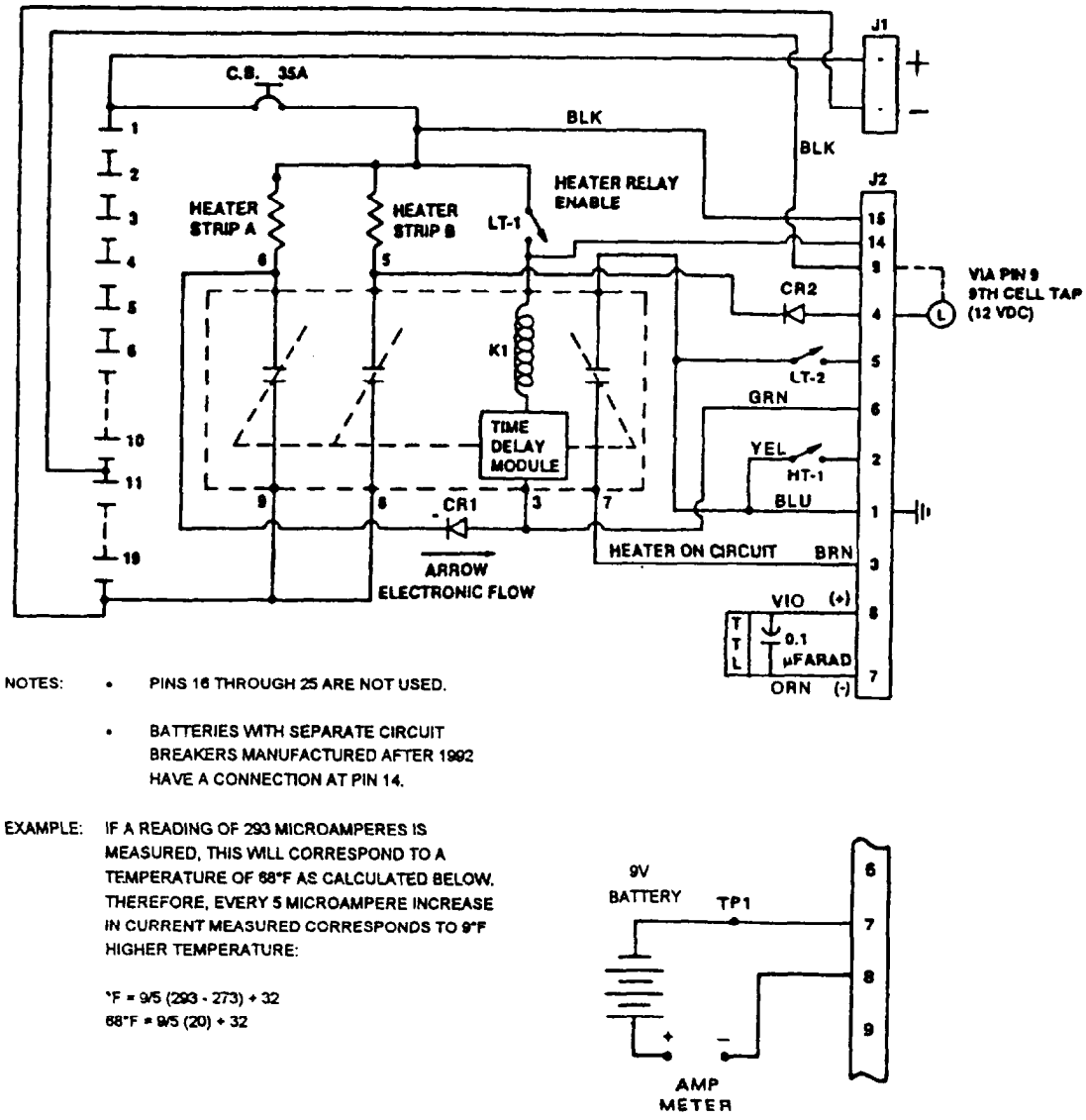


Figure 3-2. Battery BB-558/A Wiring Harness, Wiring Diagram.

Table 3-1. AVIM Troubleshooting Procedures (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

8. AIRCRAFT BATTERY FAULT INDICATOR LIGHTS (BB-564/A and BB664/A) (figs. 3-3 and 3-4).

NOTE

Perform the procedures contained in MALFUNCTIONS 1 through 5 above.

Step 1. Check resistance between pins 9 and 10 of wiring harness connector. Resistance should be greater than 1 megohm at temperatures above 32°F (0°C).

Replace wiring harness if there is continuity between pins 9 and 10.

Step 2. Check resistance between pins 9 and 11 of wiring harness connector. Resistance should be greater than 1 megohm at temperature above 32°F (0°C)

Replace wiring harness if there is continuity between pins 9 and 11.

Step 3. Check resistance between pins 9 and 12 of wiring harness connector. Resistance should be between 25 and 50 ohms.

Replace wiring harness if readings are not as specified.

Step 4. Check for continuity between pins 10 and 11 of wiring harness connector. Resistance should be 0.1 ohm maximum at temperatures above 32°F (0°C).

Replace wiring harness if resistance is greater than 0.2 ohm.

Step 5. Check resistance between pins 11 and 12 of wiring harness connector. Resistance should be greater than 1 megohm at temperature above 32°F (0°C).

Replace wiring harness if there is continuity between pins 11 and 12.

Step 6. Check resistance of thermistor, pins 6 and 7, of wiring harness connector. Resistance versus battery temperature should be as specified below.

Temperature	Acceptable Resistance Range (ohms)
50°F (10°C)	2760-2860
68°F (16°C)	2840-2930
70°F (21°C)	2910-2990
80°F (27°C)	2990-3050
90°F (32°C)	3060-3125
100°F (38°C)	3130-3200
110°F (43°C)	3200-3280

Replace wiring harness if resistances are not as specified.

Table 3-1. AVIM Troubleshooting Procedures (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

8. AIRCRAFT BATTERY FAULT INDICATOR LIGHTS (BB-564/A and BB-664/A) (figs. 3-3 and 3-4) (cont).

Step 7. Check resistance between pins 3 and 5 of wiring harness connector. Resistance should be greater than 1 megohm at battery temperature below 135° ± 9°F (57° ± 9° C).

Replace wiring harness if there is continuity between pins 3 and 5.

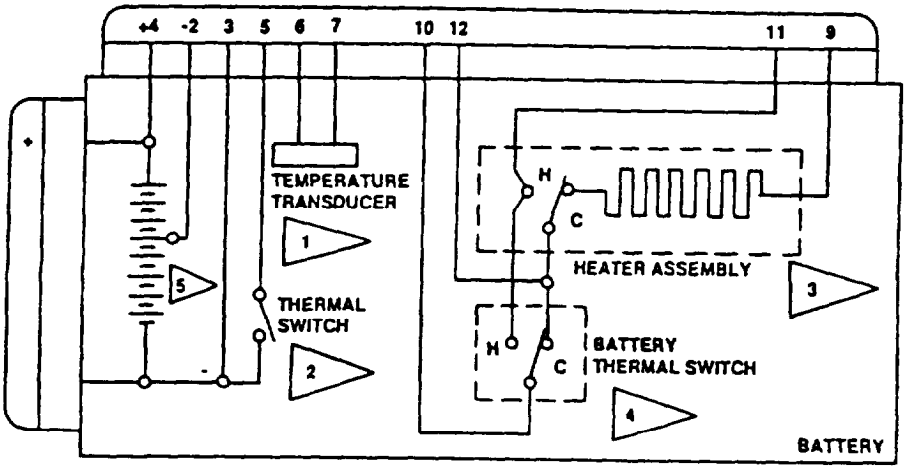
Step 8. Check battery voltage between pins 3 (negative) and 4 (positive) of wiring harness connector. Voltage should read total battery voltage. Check that red wire and black/green wires are properly connected.

Replace wiring harness if voltage is not as specified.

Step 9. Check battery voltage between pins 3 (negative) and 2 (positive) of wiring harness connector. Voltage should read half the battery voltage obtained In step 8 above ± 1.5 volts.

Check that white wire (BB-664/A) is properly connected to the 9th cell from negative end of battery.

Replace wiring harness if voltage is not as specified.



1 3000 OHMS ±10% AT ROOM TEMPERATURE (+20°C OR +68°F)

2 CONTACTS ARE OPEN BELOW +57°C (+134.6°F)

3 CONTACTS TRANSFER FROM C TO H WHEN TEMPERATURE RISES ABOVE +110°C (+230°F)

4 CONTACTS TRANSFER FROM H TO C WHEN TEMPERATURE DECREASES BELOW -5°C (+23°F)

5 TENTH CELL TAP

Figure 3-3. Battery BB-564/A Wiring Harness, Wiring Diagram.

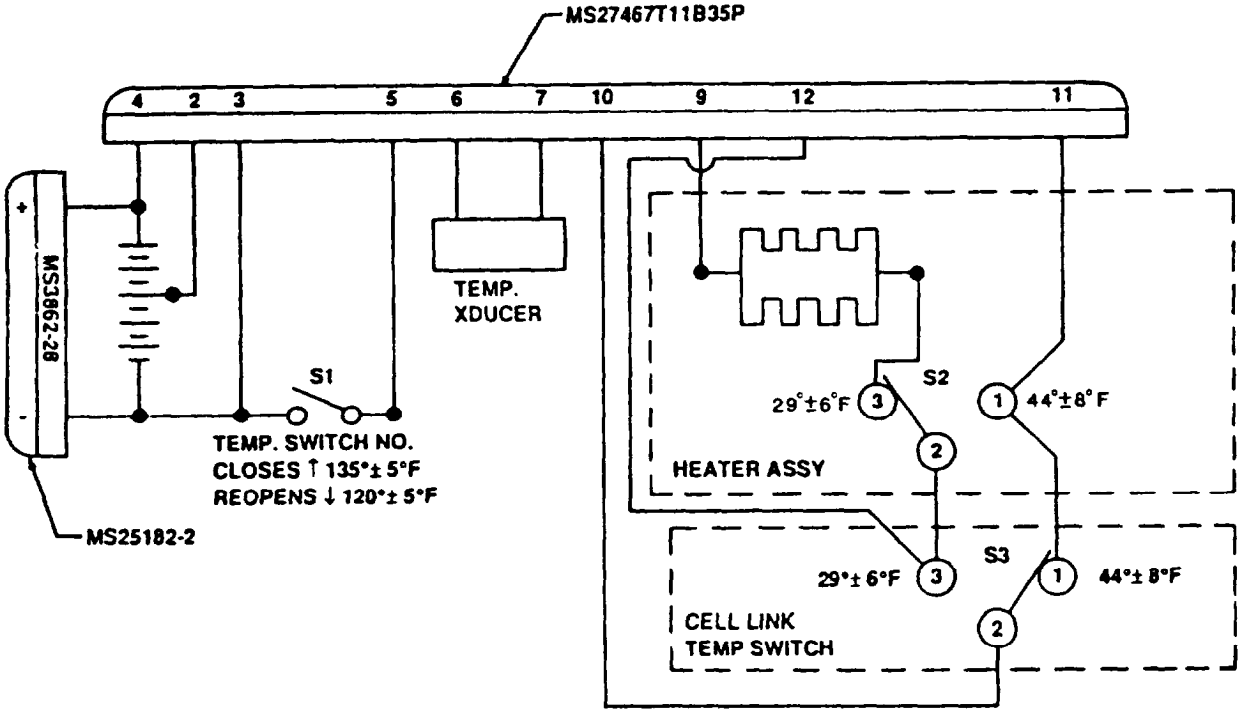


Figure 3-4. Battery BB-664/A Wiring Harness, Wiring Diagram.

Table 3-1. AVIM Troubleshooting Procedures (cont)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

9. AIRCRAFT BATTERY FAULT INDICATOR LIGHTS (BB-716/A) (fig. 3-5).

CAUTION

Connections to connector J1 should be made only through a test fixture. Connector J1 pins can be easily shorted using meter probes and may cause damage to the connector.

NOTE

Perform the procedures contained in MALFUNCTIONS 1 through 5 above.

Step 1. Check resistance between pins A and B of wiring harnessconnector. Resistance versus battery temperature should be as specified below.

Temperature	Acceptable Resistance Range (ohms).
50°F (10°C)	1800-2400
60°F (16°C)	1350-1700
70°F (21°C)	1050-1300
80°F (27°C)	800-1000
90°F (32°C)	650-775
100°F (38°C)	500-625
110°F (43°C)	450-500

Replace wiring harness if resistances are not as specified.

Step 2. Check resistance between pins J and K of wiring harness connector. Resistance versus battery temperature should be as specified in Step 1 above.

Replace wiring harness if resistances are not as specified.

Step 3. Check for continuity between pin G of wiring harness connector and battery positive (+) terminal. Resistance should be 0.2 ohm maximum. Check that red wire is properly connected.

Replace wiring harness if resistance is greater than 0.1 ohm.

Step 4. Check for continuity between pin D of wiring harness connector and battery negative (-) terminal. Resistance should be 0.1 ohm maximum. Check that black wire is properly connected.

Replace wiring harness if resistance is greater than 0.1 ohm.

Step 5. Check for continuity between pin C of wiring harness connector and the positive (+) post of reference cell (black top). Resistance should be 0.1 ohm maximum. Check that blue wire is properly connected.

Replace wiring harness if resistance is greater than 0.1 ohm.

Step 6. Check for continuity between pin H of wiring harness connector and negative (-) post of reference cell (black top). Resistance should be 0.1 ohm maximum. Check that green wire is properly connected.

Table 3-1. AVIM Troubleshooting Procedures (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	
9. AIRCRAFT BATTERY FAULT INDICATOR LIGHTS (BB-716/A) (fig. 3-5) (cont).	
Replace wiring harness if resistance Is greater than 0.1 ohm.	
Step 7. Check resistance between pin E of wiring harness connector and intercell connectors on which battery overtemperature switches are mounted. Resistance should be greater than 1 megohm.	
Replace wiring harness if resistance is not greater than 1 megohm.	
Step 8. Remove diode cathode (red) wire from negative terminal of cell No. (common with positive terminal of low capacity cell) by removing terminal nut. Set ohmmeter to diode position. Measure resistance in both directions between diode mounting link and terminal of red wire. The diode should conduct and give a signal from the meter with the black probe connected to the red wire and not conduct with the red probe on the red wire. Reconnect clamping diode.	
Replace wiring harness if resistance measurements are not as specified.	
Step 9. Check for continuity between pins E and F of wiring harness connector. Resistance should be 0.1 ohm maximum at temperatures below 166°F (71°C).	

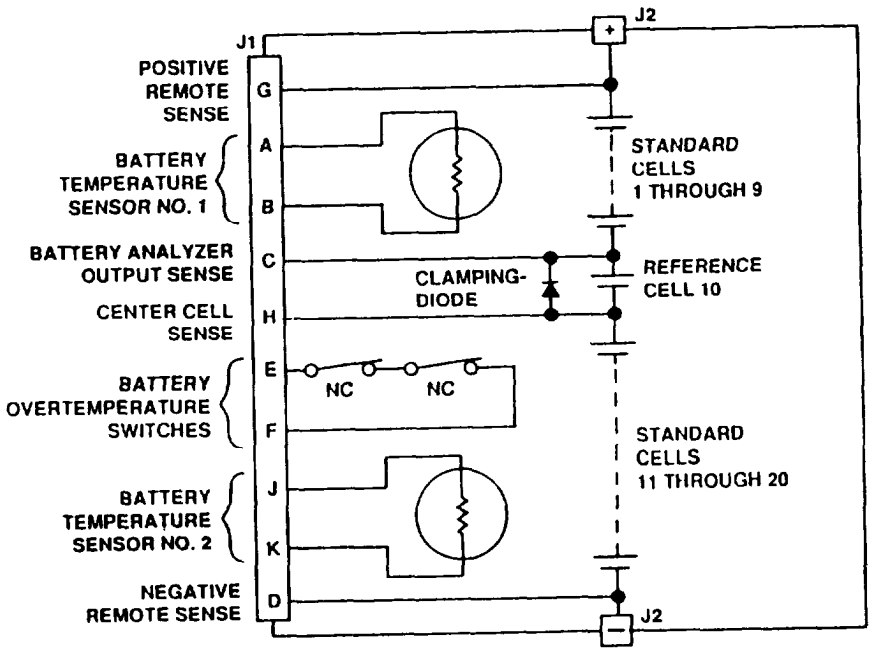


Figure 3-5. Battery BB-776/A Wiring Harness, Wiring Diagram.

Section III. NICAD BATTERY SERVICE INSTRUCTIONS

Paragraph		Page
	Overview	3-17
3-6	Battery Service Record	3-18
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3-9	Touchup Painting Instructions..	3-22
3-10	Battery Discharge Procedures..	3-22
3-11	Battery Charging Procedures	3-28
3-12	Battery Rest Time Before Adjusting Electrolyte Level After Charging..	3-34
3-13	Electrolyte Level Adjustment	3-34
3-14	Performance Test	3-39

OVERVIEW

This section contains all the procedures required to service NICAD batteries. Batteries must be serviced on a scheduled basis (120 days or 100 flight hours). Perform the required service procedures as shown in the block diagram (fig. 3-6) for batteries forwarded to the AVIM shop for routine maintenance. Batteries forwarded to AVIM shops for unscheduled maintenance, perform the applicable troubleshooting procedures (para 3-5). Record all service data on the sample chart (para 3-8).

NOTE

Refer to Section V of this manual for servicing new batteries.

3-6. Battery Service Record

a. Record Format. When servicing battery or placing a battery in service for the first time, prepare and use a format (in duplicate) similar to that shown below, to provide a record of each individual battery. This record will serve as a verification of maintenance accomplished. The date for the next capacity test due (column A) should be 120 days or 100 flight hours from the date of capacity test entered in column B of the battery service record.

Shop Historical Record of Battery Service.

1. Battery serial number		2. Name of manufacturer	3. Date of manufacture	4. Formation data	
Next capacity test due A.	Date of capacity test B.	Malfunction C.	Cell installed D.	Issued or installed in aircraft (serial no.) E.	Signature F.
11. Location					

b. Recording Procedure.

(1) Attach one copy of the record to the battery immediately upon receipt of the battery at the AVIM shop.

(2) File a duplicate copy of the record at the AVIM shop that performed the servicing.

(3) Make entries on the AVIM fife copy each time the battery is serviced.

(4) When records are filled, start a new copy. AVIM personnel should remove the old record from the battery and affix a current record to the battery. AVIM personnel should retain all duplicate record copies in their file.

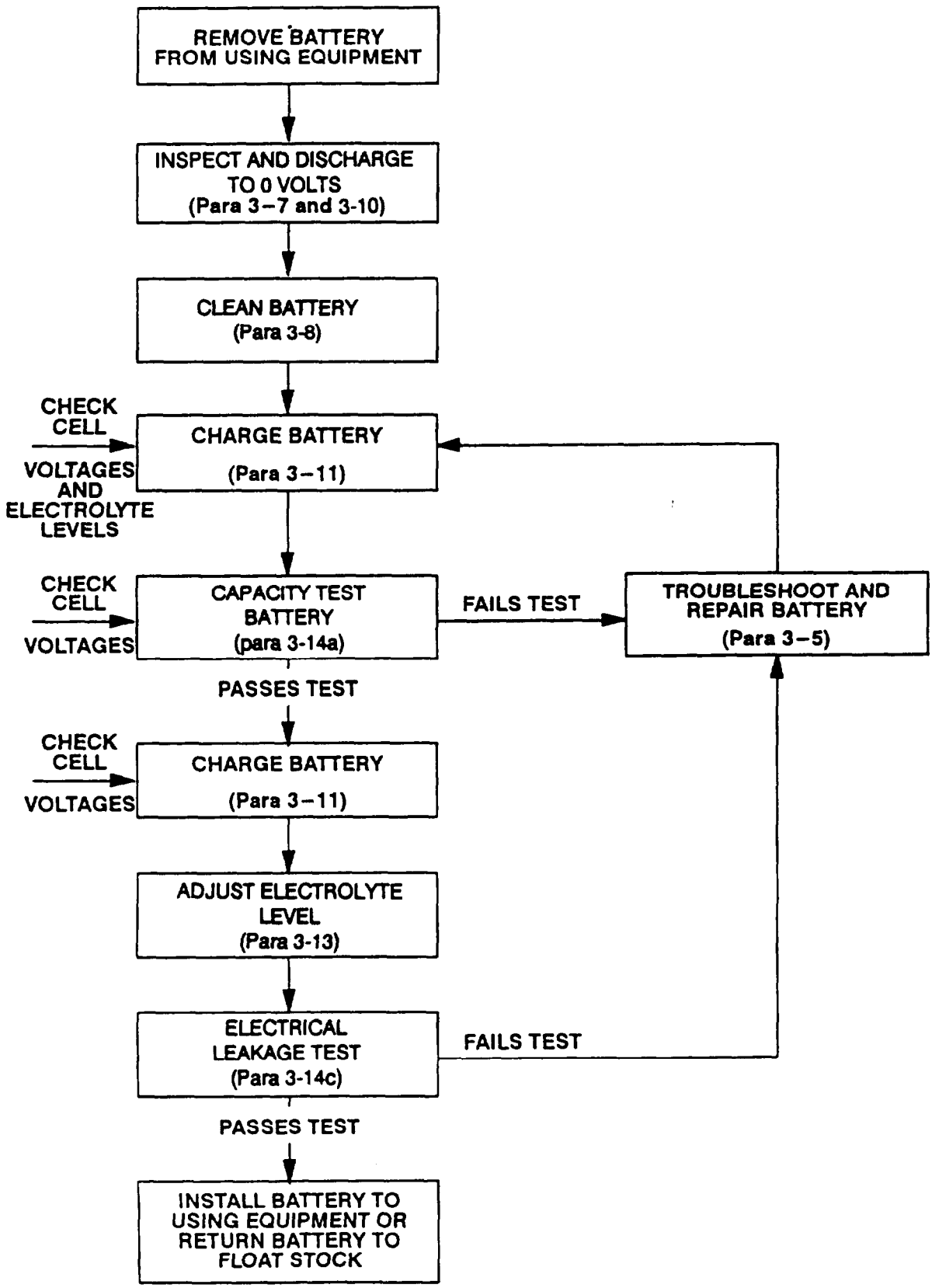


Figure 3-6. AVIM Maintenance Procedures.

WARNING

The electrolyte (potassium hydroxide) in the battery is very caustic and will burn your body. Wear rubber gloves, plastic or rubber apron, and a face shield when maintaining the battery. In case of accident, wash with water. Do not wear rings or other jewelry that might contact cell terminals.

1.1. Visual Inspection.

NOTE

Refer to Section IV of this chapter and specific maintenance paragraph covering proper hardware installation, parts replacement, and screw torque values.

Many causes of battery failure can be detected by visual inspection. Visual inspection is accomplished as follows:

a. Damage.

Release the snap fasteners, remove the cover, and check for the following:

(1) Battery case or cover scratched or dented.

(2) Battery case liners or cover gasket loose or damaged.

(3) Cell terminals or terminal screws bent or broken.

(4) Cell cases cracked.

(5) Fillercap warped or cracked.

(6) Connector bent or broken.

b. Improper Installation.

Check for improper installation:

(1) Fillercap improperly seated. For Battery BB-716/A, torque filler caps to 3-4 in.-lbs.

(2) Loose terminal screws, battery terminal links, or connector.

c. Loose Connections.

Check for loose connections.

(1) Battery terminal links between cells.

(2) Battery terminal links between cells and connector.

d. Electrolyte Leakage.

If electrolyte leakage is present and is not the result of an improperly installed fillercap or spillage, a cell case is probably cracked. Check for cracked cell cases (tops).

e. Corrosion or Deposits.

Corrosion or white deposits (potassium carbonate) are caused by gassing and bubbling of the electrolyte through the vent valves on the fillercaps. Check for either as follows:

(1) Check the top of the cell cases, cell terminals, battery terminal links, and fillercaps.

(2) Check the battery case and cover.

3-8. Cleaning.

CAUTION

Do not attempt to clean the nickel-cadmium battery with solvents, acids, or any chemical cleaner, damage to the cells, gaskets, and the liner can result. DO NOT disassemble the battery; clean only those parts that can be reached without disassembly.

White deposits (potassium carbonate) In the dry state are nonconductive and when in contact with nickel or nickel-plated material are noncorrosive. When moisture Is added to the powder, which occurs with drastic humidity changes, an electrical leakage path is established. Also, should the potassium carbonate come in contact with copper, which could occur if the nickel-plating is scratched, corrosion will set In. For these reasons, the battery must be carefully cleaned and kept free of potassium carbonate deposits.

a. Release the snap fasteners, as necessary, and remove the cover from the battery case.

b. Brush any deposits from the cell tops and intercell connectors with a nylon brush. DO NOT use a wire brush. Wipe off the loosened deposits.

C. Wipe the battery case with a clean cloth (use item 12, app C).

d. If electrolyte (potassium hydroxide) is spilled on the cells or in the battery (between the cells), clean the battery without disassembly as follows:

(1) Secure the filler caps on the cells to prevent water entry into cells.

(2) Set the battery on a clean surface, remote from any contaminants.

(3) Thoroughly wash the tops of the cells with distilled water. (If distilled water is not available, use drinking water.)

(4) After washing the tops of the cells, lay the battery on its side and raise the bottom of the battery a few inches to allow drainage of the excess water from between the cells.

(5) Allow the battery to remain in this position until dry. Compressed air may be used to speed the drying process, if available. Return to upright position.

e. Clean the fillercaps as follows:

(1) Use the fillercap wrench to turn each fillercap one-quarter turn counterclockwise and remove each fillercap from its cell.

(2) Wash each fillercap thoroughly in tap water. Completely dry each fillercap with a clean, dry, lint-free cloth and compressed air as necessary.

(3) Use the fillercap wrench to replace each fillercap on each cell, and then tighten by turning the fillercap one-quarter turn clockwise.

f. Foreign matter should not normally collect in the fillercap seat on the cell. To remove foreign matter from the fillercap seat; use either of the following methods:

(1) Remove the fillercap following steps e(1) and e(2) of this procedure. Use a clean, dry, lint-free cloth and very carefully remove any foreign matter that has accumulated in the fillercap seat. Make certain that none of the foreign matter falls into the cell.

(2) Cut the lugs off an old filler cap to make a cleaning tool. Place a clean, dry, lint-free cloth over the base of the flllercap without the lugs. Place doth over the fillercap seat to be cleaned and turn the flllercap and doth with fillercap wrench.

g. Check battery terminal link for accumulation of brownish discoloration. Clean with a dry non-metallic bristle brush.

3-9. Touchup Painting Instructions.

a. When the battery requires repainting, refinishing, or touchup painting, refer to Federal Standard No.595A for the matching color. SB 11-573 lists painting tools and miscellaneous supplies required for painting.

b. Refer to TB 43-0018 and TM 43-0139 for instructions on painting and preserving Electronics Command equipment. When performing touchup painting, a perfect match with the original paint surface may not be possible, because of a change in the original pigment as a result of oxidation and the differences in paint when manufactured. The prevention of corrosion and deterioration is the most Important consideration In touchup painting; appearance Is secondary. However, this does not mean that appearance of the equipment is not important. Touchup painting should be accomplished neatly and competently. Inspection personnel in the field should make allowances for slight color mismatch where minor touchup has been done; however, allowances should not be made for neglect, nor for painting in an unskillful manner, nor for cases where the need for refinishing is obvious.

c. When the finish on the battery box has become badly scarred or damaged, rust and corrosion can be prevented by touching up the bare surfaces. Use a very fine sandpaper to clean the surfaces down to the bare metal. Obtain a bright smooth finish.

d. Spray one coat of zinc chromate primer (NSN 8010-09-514-1861) (item 9, app C) to the smooth finish. When dry, apply one or two thin coasts of blue, semigloss, paint (NSN 8010-00-189-4873) to protect the battery box from further corrosion.

3-10. Battery Discharge Procedures.

Battery discharge procedures are described in subparagraphs a through d below. Use any method below available in your AVIM shop. Observe the following WARNINGS when discharging batteries.

WARNING

NICAD batteries contain potassium hydroxide (KOH) which is a caustic agent. Protective clothing (eye protection, rubber gloves, and rubber apron) should be worn when working with NICAD batteries. Skin contact with this caustic agent may result in injury to personnel.

Remove all metal objects from wrists and fingers before handling NICAD batteries. Metal objects may cause shorts between ceils and may cause Injury to personnel.

When shorting cells with metal spring clips, release the metal spring clips as soon as it is connected to the cell terminals. Apply shorting spring clips only to cells that have a discharge voltage under 0.5 volt. Make sure metal objects, including metal belt buckles do not come in contact with the battery terminals. Residual voltage remaining in the cells and battery terminals may cause injury to personnel.

a. Discharge Procedures for Batteries with Discharge Fixtures (fig. 3-7).

(1) Refer to table 3-2 below for list of discharge fixtures.

Table 3-2. Discharge Fixtures

Battery	Discharge Fixture
BB-432A/A, BB-432B/A	MX-10047/U
BB-433A/A	MX-8927A/U
BB-434/A	None Available
BB-476/A	MX-10049/U
BB-558/A	None Available
BB-564/A	None Available
BB-649A/A	MX-10668/U
BB-664/A	None Available
BB-678A/A	MX-10050/U
BB-708/U	None Available
BB-716/A	181BF104-1

(2) Remove cover.

(3) Place discharge fixture (1) over battery (2) with fixture front over battery connector (3).

(4) Push down firmly until fixture (1) uniformly covers battery (2) secure with latches (4).

(5) While battery is discharging, pilot light (5) lights.

(6) After pilot light goes off, allow fixture to stay connected for another 6-8 hours.

(7) After discharge, install shorting device between + and - terminals of battery connector (3).

(8) Unsnap latches (4) and remove discharge fixture (1).

(9) If battery requires maintenance, refer to maintenance section and specific procedures for the battery in Section IV.

(10) Refer to charging procedures (para 3-11) if battery is to be charged.

b. Discharge Procedures Using Analyzer Charger AN/USM-432. If discharge fixtures are not available, use the AN/USM-432 in the MAN DISC (manual discharge) position to discharge the battery to less than 5 volts.

(1) Monitor cell voltages with multimeter or AN/USM-432 voltmeter in 3V (3-volt) position.

(2) When the terminal voltage of any cell reaches 0.5 volt or lower, place a shorting device (metal spring strip) across the positive and negative terminals of that cell.

(3) Continue this procedure until all cells are shorted out.

(4) Shut the power off the AN/USM-432 and disconnect battery.

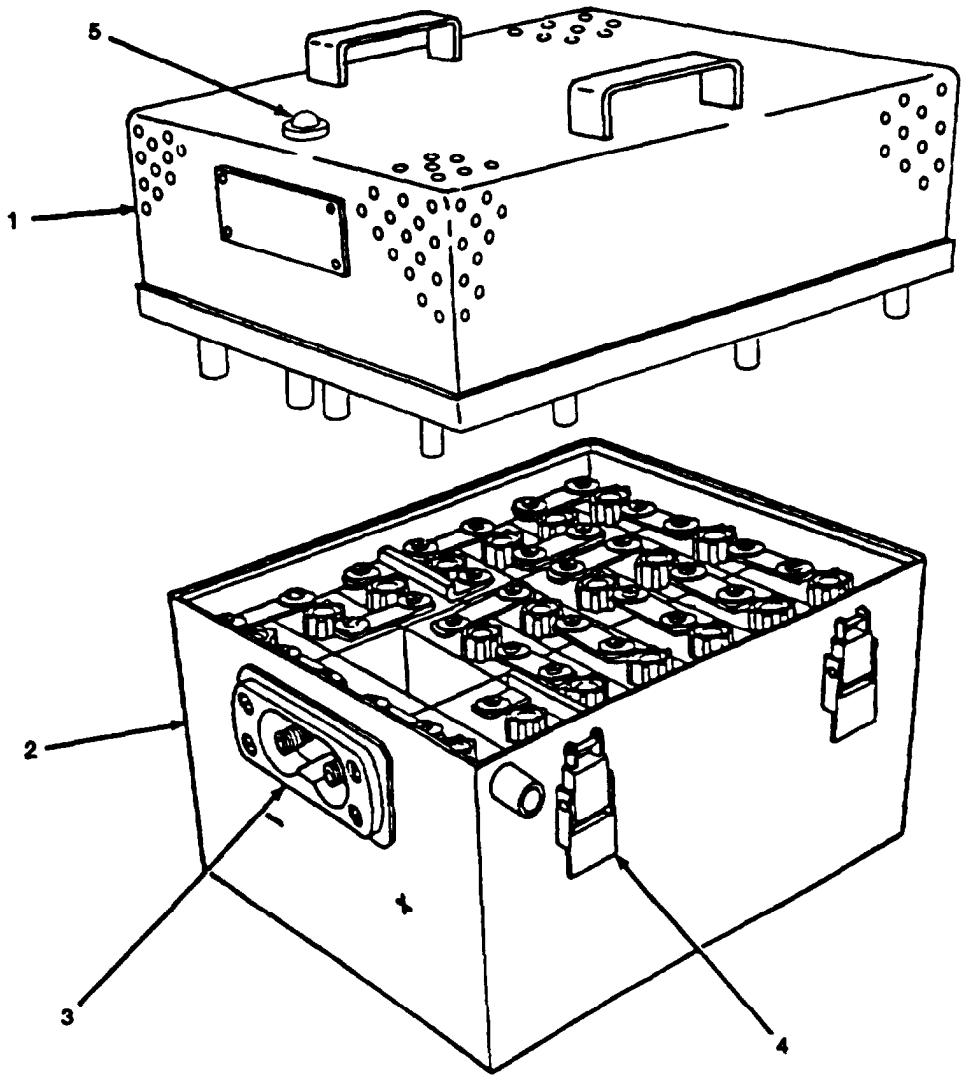


Figure 3-7. Discharging Battery Using Discharge Fixture (Typical).

(5) Allow cells to be shorted for a minimum of 3 hours. For best results leave cells shorted for 8 hours or more. At end of discharge, remove metal springs strips from cells.

(6) Install shorting device between t and - terminals of battery connector and place battery In storage.

(7) If servicing is to continue, remove shorting device from battery connector.

c. Discharge Procedures Using RF80GT (Christie). Discharge battery using the RF80GT as follows:

(1) Set the RF80GT discharge switch to DEEP to discharge battery to 5 volts or less.

(2) Monitor cells' voltages with a multimeter, or with the voltmeter on the RF80GT.

(3) When the terminal voltage of any cell reaches 0.5 volt or lower, place a shorting device (metal spring strip) across the positive and negative terminals of that cell.

(4) Continue this procedure with each succeeding cell until the overall battery voltage drops below 10 volts.

(5) Shut the power off the RF80GT and disconnect the battery.

(6) Connect individual shorting strips across the remaining battery cells. Allow the cells to remain shorted out for a minimum of 3 hours. For best results, leave cells shorted for 8 hours or more. At the end of discharge, remove metal spring strips from cells.

(7) Install shorting device between + and - terminals of battery connector and place battery in storage.

(8) If servicing is to continue, remove shorting device from battery connector.

d. Discharge Procedures Using Load Resistor. Use the following procedures when discharge fixtures or battery analyzers are not available.

CAUTION

Set variable resistor to its highest setting. Failure to comply will result in damage to multimeter.

(1) Connect the 0-7.5-ohm, 1000-watt variable resistor (item 13, Appendix C, Section II), two multimeters, toggle switch (item 14, Appendix C, Section II) as shown in figure 3-8.

(2) Set variable resistor to its highest setting (7.5 ohms).

(3) Make sure toggle switch is open. Connect battery to be discharged.

(4) Close and open the toggle switch as necessary while adjusting the 0- to 7.5-ohm variable resistor for a resistance value high enough to permit the discharge current to flow at approximately the 2- or 3-hour rate for the battery (table 3-3).

(5) Using the multimeter, monitor the terminal voltage of each cell during discharge. When the terminal voltage of a cell reaches 0.5 volt or lower, place a shorting device (spring metal strip) across the positive and negative terminals of that cell. Continue until all the cells are shorted.

(6) Disconnect the battery from the discharge circuit.

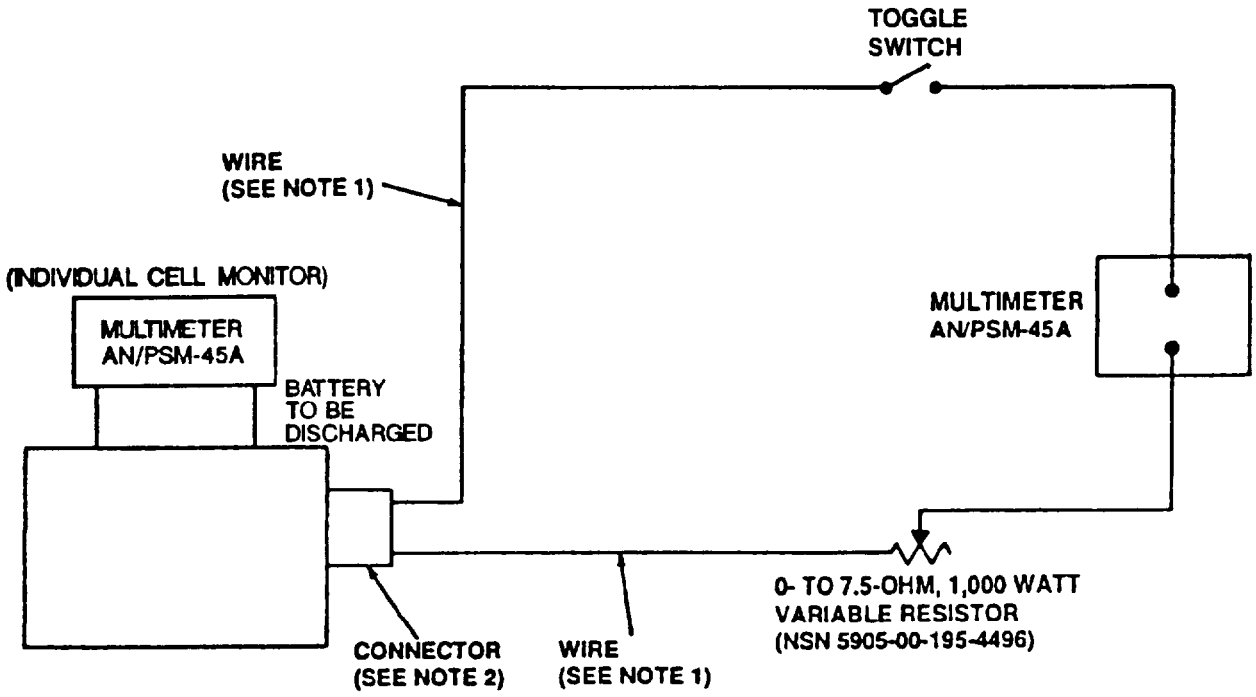
(7) Allow cells to be shorted for 3 hours minimum. For best results, leave cells shorted for 8 hours or more. At the end of discharge, remove metal spring strips from each cell.

(8) Install shorting device between + and - terminals of battery connector and place battery in storage.

(9) If servicing is to continue, remove shorting device from battery terminals.

Table 3-3. Discharge Current and Resistor Setting

Battery	2-Hour Discharge Rate (Amperes)	3-Hour Discharge Rate (Amperes)
BB-432A/A, BB-432B/A	5.5	
BB-433A/		10.0
BB-434/A		7.5
BB-476/A	6.5	
BB-558/A	8.5	
BB-564/A	6.5	
BB-649/A	10.5	
BB-664/A	6.5	
BB-678A/A	6.5	
BB-708/U	3.0	
BB-716/A	3.0	



NOTES:

1. WIRE MUST BE A MINIMUM OF 4 AWG.
2. CONNECTOR MS-25182-1 (NSN 5935-01-035-8391). IF DISCHARGING BB-678A/A, REFER TO AIRCRAFT MAINTENANCE MANUAL FOR PART NUMBER OF MATING CONNECTOR.

Figure 3-8. Manual Discharge, Connection Diagram.

3-11. Battery Charging Procedures

NICAD batteries can be charged using a constant voltage, constant current, or pulsed voltage method. All methods are acceptable. Refer to table 3-4, 3-5, or 3-6 for constant voltage or constant current rates. Refer to table 3-7 or 3-8 for charging rates using the pulsed voltage method. Whatever method is used, refer to the charging equipment technical manual for operating instructions.

If a battery received at the AVIM shop for charging has been in storage for less than 90 days and was placed in storage fully charged, all that should be required is a topping charge. The battery should be allowed to reach room temperature 0° -80°F (15° -27°C), then charged at the fast rate (tables 3-4 through 3-8) for one hour. The electrolyte level should be adjusted (para 3-13).

If a battery has been in storage for longer than 90 days, the battery should be charged at the slow rate until the individual cell voltages reach 1.5 volts or greater. After charging adjust the electrolyte level (para 3-13). if the state of charge of a battery is unknown, and there is not an immediate need for the battery, the battery should be discharged and then recharged.

WARNING

Explosive gases can be released during charging. Check to ensure that the charging area is well ventilated. Do not use matches or an open flame in the charging area. Guard against short circuits; resulting arcs can cause an explosion. Do not disconnect the charging cable from the battery until the battery charger has been turned off. Explosions or serious burns can result.

WARNING

PROTECTIVE GOGGLES MUST BE WORN BY MAINTENANCE PERSONNEL. Potassium hydroxide will fuse contact lenses to the surface of the eye on contact. Water will not aid in removal of contact lenses. This will result in eye damage or loss of eyesight.

WARNING

NICAD batteries contain potassium hydroxide (KOH) which is a caustic agent. Protective clothing (rubber gloves and rubber apron) must be worn when working with NICAD batteries. Failure to comply may cause injury to personnel.

WARNING

Remove all metallic objects from wrists and fingers before handling NICAD batteries. Shorting between ceils may result causing injury to personnel.

NOTE

During the charging procedures, if foaming is apparent around the ceil caps, stop the charging procedure. Adjust the electrolyte level of that cell, wipe off excess foam from the ceil, and continue with the charging procedure.

a. General Charging Procedures. The following procedures are general instructions for charging NICAD batteries. Refer to the charging equipment technical manuals for specific operating instructions. Before charging a battery whose state-of-charge is unknown, completely discharge the battery before attempting to charge it.

(1) Ensure all terminal links and hardware are properly installed and tight.

(2) Loosen but do not remove filler caps.

(3) Refer to table 3-4, 3-5, 3-6, 3-7, or 3-8 for charging rates for the specific battery being charged, and set the charger-analyzer or charging equipment accordingly.

(4) Remove shorting devices from battery connector and cells, and connect battery to charger-analyzer or charging equipment.

(5) Refer to the following specific charging methods (subpara b, c, d, or e, below) and for the charger-analyzer technical manual for operating instructions. Then begin charging battery.

(6) After charging has begun, check individual cell voltages. A very high voltage (over 1.8 volts) indicates the cell is low on electrolyte. Remove the filler caps on ceil(s) in question and slowly add sufficient distilled water. Do not overfill ceil(s). Overflowing electrolyte will require the battery to be completely serviced. Check that high cell voltages drop with the addition of distilled water.

(7) After charging is completed, shut down charger-analyzer and disconnect battery from the charger-analyzer.

(8) Refer to table 3-9 for battery rest time and check electrolyte level.

(9) Perform current leakage test.

(10) Check individual ceil voltages. if any ceils are not between 1.3 and 1.5 volts, refer to specific battery maintenance procedure and replace any defective ceil.

b. Constant Voltage Method. Table 3-4 provides the constant voltage charging rate required for different temperatures, numbers of cells, and the time to accomplish the charge cycle. For example, at a temperature of +80°F (26.6°C) and a battery containing 19 ceils, charge for two hours at 30 volts. Periodically, monitor the constant voltage charging rate by placing the test probes of a multimeter across the battery terminals and adjust the output of the battery charger, as necessary.

NOTES

1. When charging batteries using the constant voltage method (table 3-4), perform the general charging procedures contained in subparagraph a, above.

2. The 8-hour charge method is recommended for new batteries.

Table 3-4. Constant Voltage Charging Rates

Ambient Temperature F /C	2 Hour Charge Number of Battery Ceils 19	20	4 Hour Charge Number of Battery Cells 19	20	8 Hour Charge Number of Battery Ceils 19	20
-40-40	32.0	33.7	32.0	33.7	32.0	33.7
-20/-29	32.0	33.7	31.0	32.6	30.0	31.5
0/-17.7	32.0	33.7	31.0	32.6	29.0	30.5
32/0	31.0	32.6	30.0	31.6	29.0	30.5
50/10	31.0	32.6	30.0	31.6	29.0	30.5
80/26.6	30.0	31.6	29.0	30.5	28.0	29.5
100/37.7	29.0	30.5	28.0	29.5	28.0	29.5
120/49	28.0	29.5	27.0	28.4	27.0	28.4

c. Constant Current Method. Table 3-5 provides the constant current charging value required for the specific ampere-hour rating of a battery and the amount of time it takes to accomplish the charge cycle. For example, charge a 3-ampere-hour battery at 30 amperes for two hours; or charge the battery at 11.0 amperes for four hours; or charge the battery at 6.8 amperes for seven hours.

NOTE

1. When charging batteries using the constant current method (table 3-5), perform the general charging procedures in subparagraph 3-11 a, above.

2. The 7-hour charging method is recommended for new batteries. if the ceil voltages do not rise above 1.5 volts in 7 hours, up to 3 extra hours may be required to fully charge the battery.

Table 3-5. Constant Current Charging Rates.

Ampere-Hour Rating of Battery	Constant Current Charging Rates 2 Hours	4 Hours	7 Hours
5.5	3.6	1.8	1.1
10.0	6.5	3.5	2.2
13.0	8.2	4.1	2.6
17.0	11.0	6.0	3.7
20.0	13.0	7.0	4.4
30.0	20.0	11.0	6.8

d. 2-Step Constant Current Method. if an automatic constant current charger-analyzer is used, follow the instructions provided with the equipment. For manual P-step constant current charging, charge at the starting constant current charging rate given in table 3-6 below until a battery voltage of 29.5 volts is reached for a 19-cell battery (31 volts for a 20-cell battery). Then, reduce the charge rate to the finishing rate given in Table 3-6 and continue for 2 hours.

NOTE

When charging batteries using the 2-Step Constant Current Method, (table 3-6, perform the general charging procedures in subparagraph 3-11a, above.

Table 3-6. 2-Step Constant Current Charging Rates

Ampere-Hour Rating of Battery	Starting Rate (Amperes)	Finishing Rate (Amperes)
10.0	5.0 - 10.0	2.0
13.0	6.5 - 13.0	2.6
17.0	8.5 - 17.0	3.4
20.0	10.0 - 20.0	4.0
30.0	15.0 - 30.0	6.0
5.5	3.0 - 5.5	1.1

e. Reflex Charging Method.

(1) Table 3-7 provides the pulsed charging settings required when using AN/USM432. Pulse chargers come with a set of instructions for operation using this method. Follow the instructions provided with the pulse charging equipment together with the general charging instructions provided in subparagraph 3-11a, above.

NOTE

For early models of the AN/USM-432, graduated charge contrd switch S7 must be used to set the charge current. Later models of the AN/USM-432 can be set using the actual measured charge current.

NOTE

When ambient temperatures are 90°F or above, reduce charge rate by 50%. Adjust or reset charger timer required.

Table 3-7. Reflex Charging Settings for AN/USM-432.

Battery	Battery Amp-Hour Rating	Charge Amp-Hour Setting S7	Charge Current (Amps)	Discharge Switch S7	Discharge Current (Amps)	Cell Select
BB-432A/A	10.0	15	15	0-17	10	19
BB-432B/A	10.0	15	15	0-17	10	19
BB-433A/A	30.0	35	45	17-31	30	19
BB-434/A	18.2	25	30	17-31	20	19
BB-476/A	13.0	15	15	0-17	11	19
BB-558/A	17.0	20	26	17-31	15	19
BB-564/A	13.0	15	15	0-17	10	19
BB-649A/A	20.0	22	27	17-31	18	19
BB-664/A	13.0	20	15	0-17	11	19
BB-678A/A	13.0	15	15	0-17	10	19
BB-708/U	5.5	8-10	7.5	0-17	5	19 Discharge
BB-716/A	5.5	8-10	7.5	0-17	5	20 Charge

(2) Table 3-8 provides the pulsed charging settings required when using the RF80GT (Christie). Follow the instructions provided with this equipment together with the general charging instructions provided in subparagraph 3-11a, above.

Table 3-8. Suggested Settings for RF80GT

BATTERY		CHARGER-ANALYZER SETTINGS					
Nomenclature	1 Hour Amp-Hour Capacity Rating	Battery Rating Number Switch	Battery Type Switch	Battery Cable	Charge Hours	Charge Current (Amps)	Discharge Current (Amps)
BB432A/A, B/A	10	6	A	Yellow	1	20	10
BB476/A	13	5	A	Yellow	1	22	11
BB-564/A	13	5	A	Yellow	1	20	10
BB664/A	13	5	A	Yellow	1	20	11
BB-678/A	13	5	A	Yellow	1	20	10
BB-558/A	17	4	A	Twin	1	35	15
BB-649A/A	18.2	4	A	Twin	1	40	18
BB-434/A	20	4	A	Twin	1	40	20
BB-433A/A	30	3	A	Twin	1	60	30
BB-708/U	5.5	6	A	Yellow	1	10	5
BB-716/A	5.5	6	A	Yellow	1	10	5

NOTES: When ambient temperatures are 90°F or above, reduce charge rate by 50%. Adjust or reset charger timer as required.

Cable adapters are required for the BB708/A and BB678A/A since they do not have the standard MS3509 (Elcon type) aircraft battery connectors.

All batteries listed above have 19 cells, except for BB716/A. For commerical types use settings provided on charger-analyzer.

Use "B" setting for battery type with appropriate adjustments in charge time and current if excess overheating and gassing occurs during charge.

3-12. Battery Rest Time Before Adjusting Electrolyte Level After Charging.

a. After batteries have been fully charged, before checking electrolyte levels, they must rest for the minimum and maximum times as indicated in table 3-9. If the maximum time Is exceed, the battery must be brought back to a fully charged state and allowed to rest again before performing the electrolyte level check.

b. The maximum rest time must be strictly adhered to. After the battery has been removed from the battery charger, it will discharge gases trapped between the separators and plates during the rest period. As this gas discharge process progresses, electrolyte solution is absorbed into the battery plates In place of the gases. If the battery has rested longer than the maximum period of time, absorption could bring the electrolyte level to the point that inspection would indicate that more electrolyte should be added. Correction of the electrolyte level under these conditions could overfill the cell and cause spewing when the battery Is brought to a full charge when installed in an aircraft for service.

Table 3-9. Battery Rest Time.

Battery	Sitting Time before Electrolyte Level Check (Minutes) Minimum	Maximum
BB-432A/A	60	180
BB-432B/A	60	180
BB-433A/A	60	180
BB-434/A	60	180
BB-476/A	60	120
BB-558/A	30*	120*
BB-564/A	30	60
BB-664/A	60	120
BB-649A/A	60	120
BB-678A/A	30	60
BB-708/U	30	60
BB-716/A	30	60

* For BB-558/A a special SAFT supplied syringe may be used to adjust electrolyte level during charge (para 3-13b).

3-13. Electrolyte Level Adjustment

CAUTION

For batteries requiring electrolyte adjustment, be sure to perform the charging procedures given in paragraph 3-11. These procedures must be followed to prevent overfilling cells that have marginal headspace. Overfilling will cause spewage of electrolyte level and this will result in damage to the battery. Do not adjust electrolyte level after a battery has been discharged. The correct electrolyte level cannot be determined when the battery has been discharged. Conversely, never allow electrolyte to fall below the cell level indicators when the battery is in a charged condition. Low electrolyte levels in the charged condition will cause the cells to heat up, and this will result in their destruction.

CAUTION

Do not spill electrolyte on the battery. Spilled electrolyte can cause corrosion of connectors and short-circuiting between cells, which will result in damage to the battery.

NOTE

An inherent characteristic of NICAD battery cells is that the electrolyte is absorbed within the plates and separators to a point where it is not visible from the top of the cells when the battery is at a low state of charge or in a discharged condition. When the battery is recharged, the electrolyte level will rise and reach its maximum height at full charge. The correct level of electrolyte is 0.25 - 0.125 inch above the top of the plates of a fully charged ceil that has been at rest for the time specified in table 3-9.

a. All Batteries Except BB-558/A (fig. 3-9). Refer to subparagraph b, below, for adjusting electrolyte level in Battery BB-558/A.

(1) Refer to table 3-9 for required sitting time of battery after charging has been completed.

(2) Remove all filler caps (1) using filler cap wrench.

(3) Fill syringe (2) with distilled water (item 4, Appendix C). Refer to Appendix D for procedures to modify a syringe if one already modified is not available.

(4) Insert syringe (2) into ceil (3) until it rests on cell baffle (4).

(5) Slowly squeeze the bulb on syringe (2) until the bulb is empty or the electrolyte is just below the mouth of the cell (3). Do not overfill cell.

NOTE

Battery BB-716/A reference cells have the same electrolyte level (0.25 - 0.125 inch) above the baffle as for standard cells with the following exception. Reference cells on batteries that were manufactured prior to 1991 have cells with recessed baffles that required electrolyte level of 0.94 - 1.06 inches above the baffle.

(6) Release bulb to withdraw all liquid that is 0.25 - 0.125 inch above the top of the cell baffle.

(7) If no liquid is withdrawn, repeat steps (3) through (6).

(8) Repeat steps (3) through (7) for all ceils.

(9) Install filler caps (1) and tighten using filler cap wrench.

(10) Thoroughly rinse out syringe.

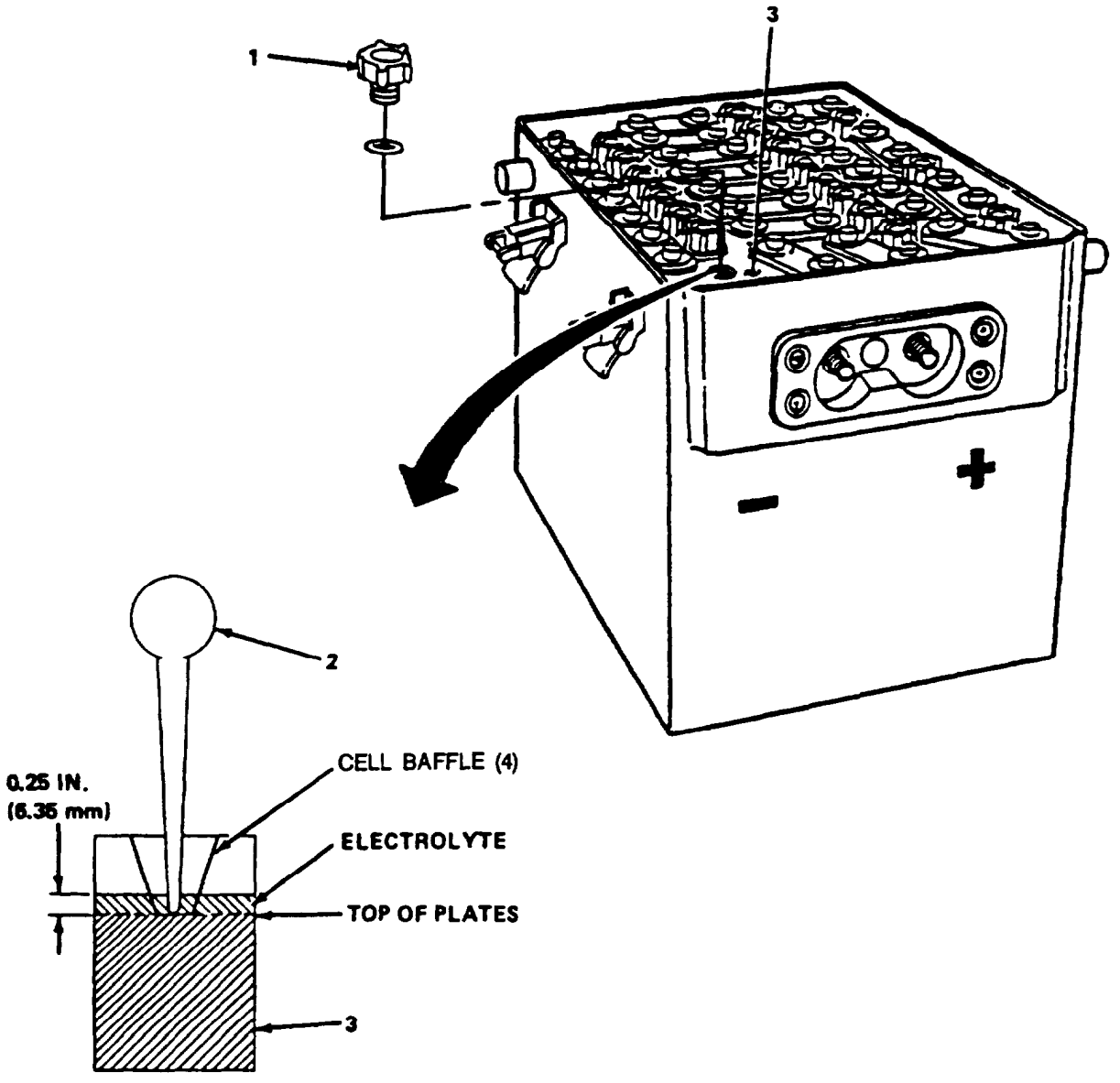


Figure 3-9. Electrolyte Level Adjustment (All batteries except BB-558/A.

b. Battery BB-558/A Electrolyte Adjustment Procedure (fig. 3-10).

(1) Loosen filler caps (1) using special filler cap wrench that comes equipped with the battery.

NOTE

A special syringe is required to check and adjust the electrolyte level in Battery BB-558/A. The syringe is part of a maintenance kit that is provided with the new battery. The syringe P/N 020915/004 (09052) is also available directly from the manufacturer.

(2) After the battery is fully charged, overcharge at 1.7 amperes for 4 hours. During last 0.5 hour of overcharge at 1.7 amperes, check and adjust the electrolyte level using the syringe as shown in figure 3-10.

(3) Install syringe (2) in cell (3) with plunger (4) fully depressed. The shoulder of the nozzle should rest on the vent valve seat as shown in figure 3-10.

(4) Withdrawn plunger (4) part way and check for electrolyte in syringe.

(5) If electrolyte is drawn into syringe, then the electrolyte level in the cell is too high. Withdraw plunger until no additional electrolyte is withdrawn. The electrolyte level is now adjusted property. Proceed to step 11.

(6) If electrolyte is not drawn into syringe, electrolyte level is too low. Remove syringe from cell.

(7) Draw a measured amount, approximately 5cc of distilled water (item 4, Appendix C) into syringe.

(8) Install syringe (2) in cell (3) and depress plunger fully.

(9) Withdraw plunger (4) part way and check for electrolyte in syringe. If electrolyte is drawn into syringe, continue to withdraw plunger until no additional electrolyte is drawn into the syringe. Remove syringe and proceed to step 10.

(10) Repeat steps (7) through (9) if electrolyte is not drawn into syringe (2).

(11) Repeat steps (3) through (5) for remaining cells.

(12) Install all filler caps (1) and tighten using special filler cap wrench.

(13) Thoroughly rinse out syringe.

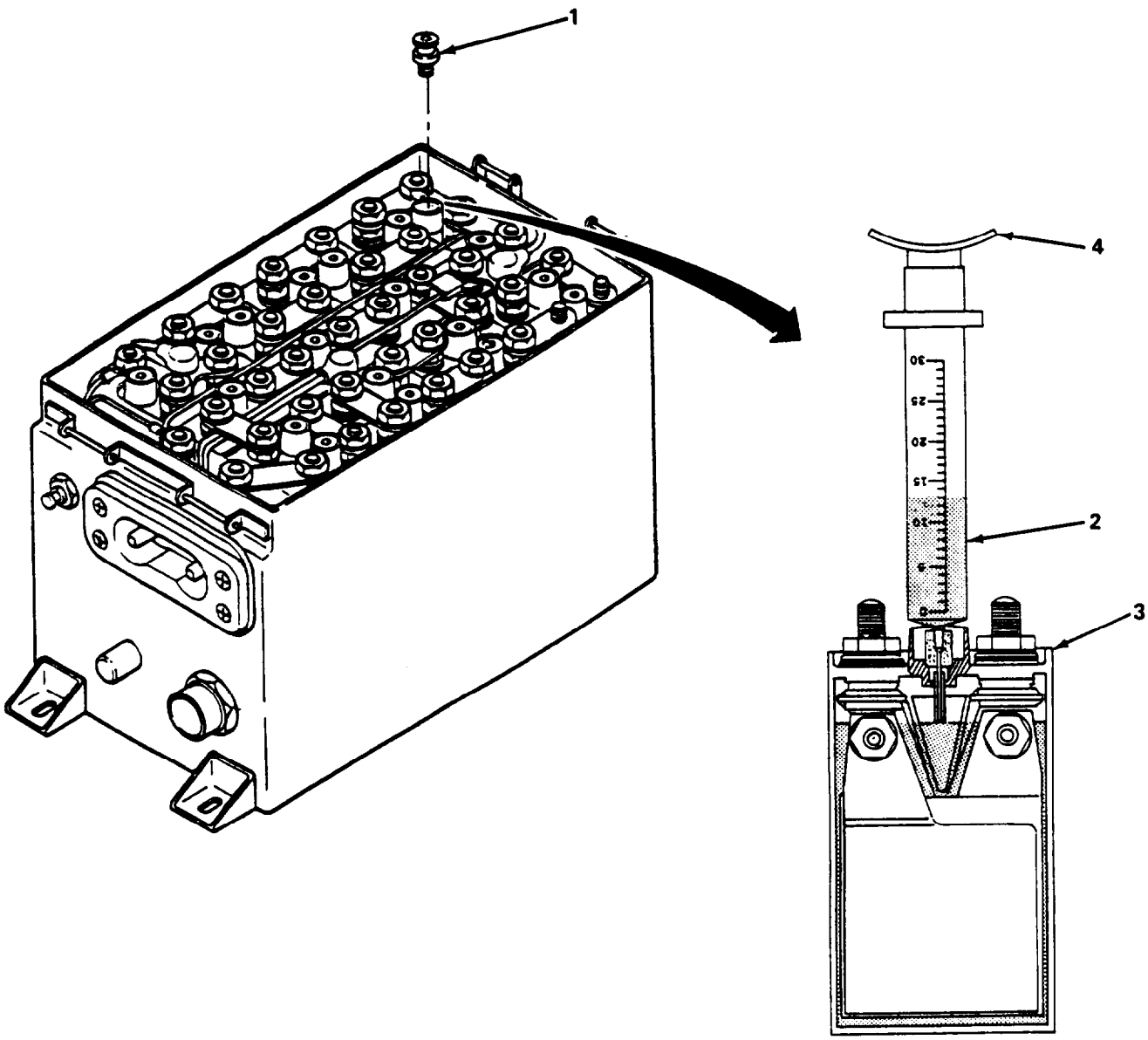


Figure 3-10. Electrolyte Level Adjustment, Battery BB-558/A.

3-14. Performance Test. Performance testing consists of discharge capacity and electrical tests. A battery that passes both tests is considered to be serviceable.

a. Discharge Capacity Test. Discharge capacity test may be performed by manually discharging the battery using the variable resistor, using the AN/USM-432 or the RF80GT (Christie) Charger-Analyzer.

NOTE

After charging the battery (para 3-11), allow the battery to rest (para 3-12, and check the electrolyte level (para 3-13).

(1) Manual Discharge Test.

CAUTION

Multimeter AN/PSM-45A has a maximum DC current capability of 10 amperes. Do not exceed this current limit while performing the discharge capacity test. Failure to observe this will cause damage to the multimeter.

(a) Refer to table 3-10 or 3-11 for the discharge time, current rate, and variable resistor value for the battery to be tested.

(b) Connect the toggle switch (item 14 Appendix C, Section II), variable resistor (item 13 Appendix C, Section II), and test equipment as shown in figure 3-8. Two Multimeters AN/PSM-45A are required.

(c) Close the toggle switch and begin the discharge capacity test.

(d) When the battery has been discharged for 90% of the specified time, at the rate indicated in table 3-10 or 3-11, measure the closed circuit battery terminal voltage and then (as quickly as possible) the individual cell voltages. Continue reading the cell voltages until the specified time is reached. The battery terminal voltage should be as specified in table 3-10 or 3-11. If any cell is less than 1 volt, stop discharging and mark for replacement the cell(s) that measure less than 1 volt.

(e) If all cells are 1 volt or greater, stop discharging.

(9 Recharge battery (para 3-11). Allow battery to rest (para 3-12) and adjust the electrolyte level (para 3-13). Proceed to subparagraph c, below.

(2) Discharge Test Using the AN/USM-432.

(a) Set the AN/USM-432 discharge current at the 1-hour rate as shown in table 3-6. The AN/USM-432 will discharge a battery at the preset 1-hour rate until an end voltage of 0.95 V/cell is reached. Cell voltages should be monitored during the 55th to 60th minute of discharge to look for low cells. If at least 60 minutes of discharge is obtained, then, “PASS” will be indicated and the charger-analyzer will automatically switch to final charge when the end voltage is reached.

(b) If the discharge is less than 60 minutes, the “FAIL” indicator lights and the equipment shuts off.

(c) The actual capacity which is reported in minutes should be recorded on the battery service record card.

CAUTION

Do not start final charge if battery temperature exceeds 120°F. Failure to observe this may cause cell damage.

(d) Final charge of the battery using the AN/USM-432. The AN/USM-432 will recharge the battery for 1 hour and then shut off. Cell voltage checks and electrolyte level adjustments should then be made before the battery is placed in service.

(3) Discharge Test Using the RF80GT (Christie).

(a) Set discharge current at 1 hour rate of Table 3-8. The RF80GT will discharge the battery at the preset 1 hour rate until an end voltage of 0.95 V/cell, in the "LONG CYCLE" mode is reached. Cell voltages should be monitored after 0.9 hour of discharge (55 minutes) for low cell voltages. If at least 60 minutes of discharge is attained, then the charger-analyzer will automatically switch to final charge when the end voltage is reached.

(b) If the discharge is less than 60 minutes, the "BATTERY REJECT" light goes on and the charger-analyzer will continue to discharge the battery at the 10-hour (C/10) rate for the time on the charge timer.

(c) The actual capacity of the battery is reported in tenths of an hour and should be recorded on the battery service record card.

(d) Final charge the battery using the RF80GT. The RF80GT will recharge most batteries in one hour and then shutoff providing a 'BATTERY OK" indication if more than 60 minutes was obtained on the performance test. Cell voltage checks and electrolyte level checks should be made before placing the battery in storage.

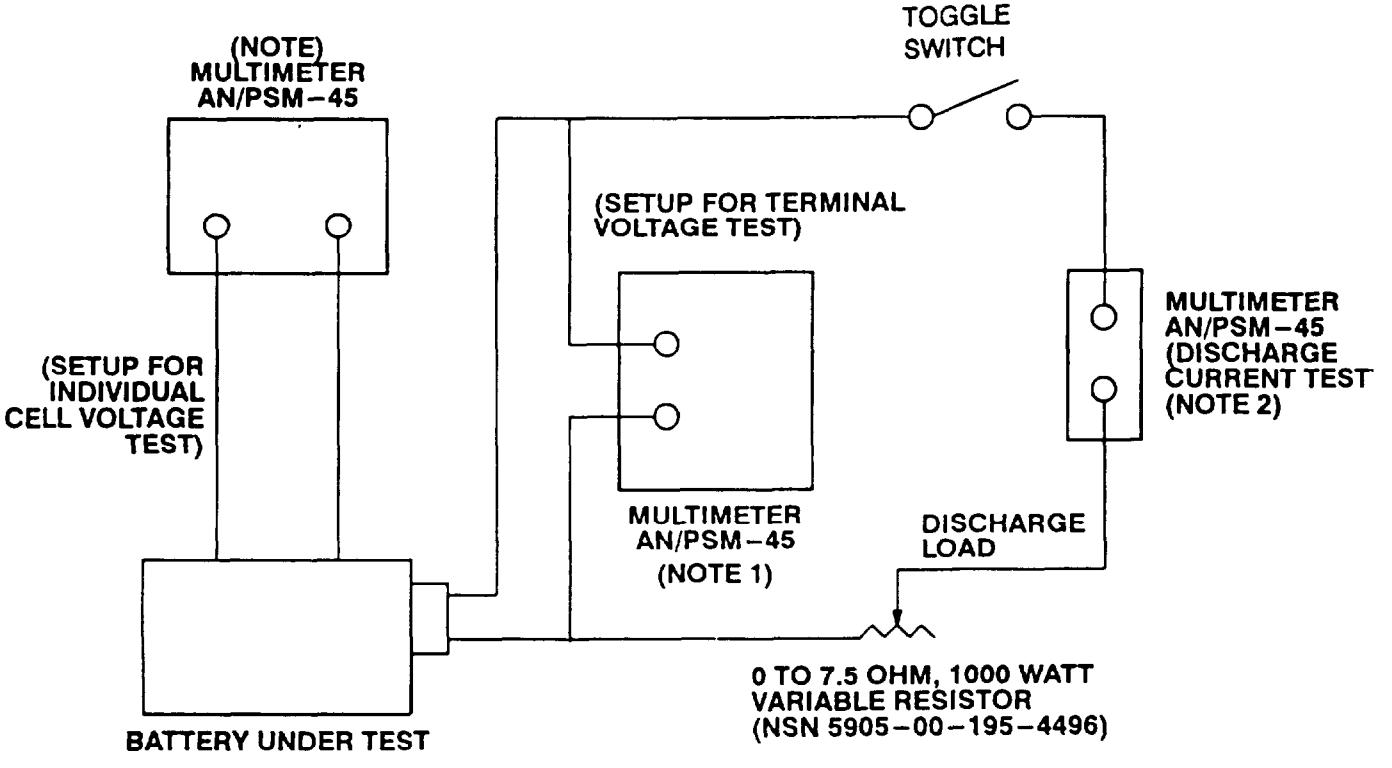
Table 3-10. 2-Hour Discharge Capacity Test

Battery Type	Ampere-Hour Rating	O-to 7.5-Ohm Variable Resistor (NSN 5905-00-195-4496) Adjusted to Following Approx Value (Ohms)	Average Discharge Current for 2 Hours (Amperes)	Minimum Closed Circuit Terminal Voltage Reading at End of 2-Hour Discharge (Volts)
BB-432A/A	10	4.3	5.5	19
BB-432B/A	10	4.3	5.5	19
BB-434/A	20	2.3	10.0	19
BB-476/A	13	3.6	6.5	19
BB-649A/A	18.2	2.3	10.0	19
BB-558/A	17	2.8	8.5	19
BB-564/A	13	3.6	6.5	19
BB-664/A	13	3.6	6.5	19
BB-678A/A	13	3.6	6.5	19
BB-708/U	5.5	7.5	3.0	19
BB-716/A	5.5	7.5	3.0	19

Table 3-11. 3-Hour Discharge Capacity Test

Battery Type	Ampere-Hour Rating	0- to 7.5-Ohm Variable Resistor (NSN 5905-00-195-4496) Adjusted to Following Approx Value (Ohms)	Average Discharge Current for 3 Hrs* (Amperes)	Minimum Closed Circuit Terminal Voltage Reading at End of 3-Hour Dis-Charge (Volts)
BB-433A/A	30	2.4	10.0	19
BB-434/A	20	3.1	7.5	19

* NOTE: BB-433A/A discharge should last more than 3 hours and 25 minutes.



NOTES

1. **MULTIMETER AN/PSM-45 IS CONNECTED AS NECESSARY TO MONITOR VOLTAGE.**
2. **LIMIT TO 10 AMPERES MAXIMUM.**

Figure 3-11. Discharge Capacity Test, Connection Diagram.

b. Discharge Capacity Test for Battery BB-716/A. Battery BB-716/A contains a low capacity reference cell that must be checked separately and more often than the standard cell.

(1) Reference cell must provide a minimum of 36 minutes above 0.5 volts at the 1 -hour rate of discharge (3-14a(2) or 3-14a(3)), or 72 minutes at the 2-hour rate (Table 3-10) to be acceptable.

(2) When reference cell reaches 0.3-0.5 volt, short it out and continue discharge for the 19 standard cells.

(3) When beginning final charge, be sure to change “number of cells” to “20” from "19" used during discharge. Charge in accordance with paragraph 3-11. Cell voltage checks and electrolyte adjustment should be made before the battery is placed in service. Do not start final charge if battery temperature exceeds 120°F (48.8°C).

c. Electrical Leakage Test.

(1) Set multimeter to read milliamperes.

(2) Place red lead on positive terminal of battery connector.

(3) Place black lead on a clean, paint-free surface of the battery case. If the battery case is not metal, place the black lead on a paint-free metal surface on which the battery case is mounted.

(4) Adjust multimeter range to obtain an accurate reading and note reading. A freshly serviced battery should indicate zero amperes or zero leakage. If a battery indicates a current leakage, perform the troubleshooting procedures in Section 11 of this chapter.

d. Fillercap Vent Valve Test

(1) Fabricate the fillercap vent valve tester as shown in figure D-4. (Use a test cell that has been flushed clean and is empty of electrolyte.)

(2) Before testing, wash the fillercap thoroughly in detergent and water.

(3) After washing, rinse the fillercap with clean water and dry with air blower.

(4) Place the fillercap to be tested on the test cell.

(5) Connect the air regulator to a compressed air outlet and adjust the air pressure until it builds up in the test cell. The fillercap vent valve should open between 2 psi and 10 psi.

(6) If the fillercap vent valve does not open between 2 psi and 10 psi, discard the fillercap. If the fillercap vent valve does open between 2 psi and 10 psi, remove the O-ring from the fillercap, replace with a new O-ring, and return the fillercap to stock for reissue.

Section IV. DISASSEMBLY/REASSEMBLY AND REPAIR

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3-20	Battery BB-476/A	3-60
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3-15. General

This section contains general repair procedures, disassembly/reassembly, and repair procedures for NICAD batteries. Refer to the specific paragraph for maintenance of a specific NICAD battery. Observe all WARNINGS, CAUTIONS, and NOTES provided in this section and at the front of this manual. Table 3-12 below contains a cross reference of NICAD batteries and cells installed.

NOTES

1. **Disassemble a battery ONLY to the extent necessary to perform a repair or to service. NICAD batteries must be tested upon completion of all repair procedures.**

2. **When replacing cells in NICAD batteries, they MUST be replaced with cells from the same manufacturer and have as close to the same manufacture date as possible.**

Table 3-12. Battery and Cell Cross Reference

Battery	Cell
BB-432A/A	BB-599A/A
BB-432B/A	BB-599A/A
BB-433A/A	BB-600A/A
BB-434/A	BB-601A/A
BB-476/A	BB-475A/A
BB-556/A	BB-559/A
BB-564/A	BB-652A/A
BB-649A/A	BB648/A
BB-664/A	BB-475/A
BB-678A/A	BB-652A/A
BB-708/U	5H120
BB-716/A	5H120

3-16. General Repair Procedures

General repair procedures for NICAD batteries consist of cover gasket installation, battery liner installation, and installing cells into a battery case. Refer to the applicable paragraph in this section for specific maintenance on a particular NICAD battery.

a. Installing Cover Gasket.

(1) Ensure that the cover is clean and dry.
(2) Lay the cover on a clean, flat surface and thoroughly clean the side of the cover to be cemented.
(3) Apply a layer of cement (item 1, appendix C) to the cleaned area of the cover.
(4) Apply a layer of cement to the cleaned side of the cover gasket.
(5) Position the cover gasket on the cover, with the cemented area of both the cover and the cover gasket mating.
(6) Firmly press (by hand) the cover gasket in place on the cover.
(7) Allow at least two hours for the cement to dry before installing the cover on the battery.

b. Installing Battery Care Liner.

NOTE

If necessary to replace any liner, use polyamide plastic sheet (item 11, Appendix C).

(1) Ensure that the battery case is dean and dry.
(2) Cut the battery case liner or insulator to the same size as the one removed and install the replacement battery case liner in the battery case.

c. Installing Cells in Battery Case.

NOTE

Each battery must be constructed of cells made by the same manufacturer and must carry the same stock number. Do not mix cells made by different manufacturers or cells with different stock numbers from the same manufacturer to retrofit a battery.

(1) Replace the liners. Using the appropriate cell layout diagram shown in chapter 1 for the specific battery, replace all cells in the battery case. If a cell is difficult to insert, apply a light coat of petroleum jelly or teflon spray to the sides of the cell case and press firmly into place with the polarity symbols in the correct direction. (Cells are connected in series (positive to negative)). Using polymide plastic sheets (item 11, Appendix C) shim cells as necessary for a tight fit.

(2) Replace all terminal hardware in the following sequence:
- Intercell connector.
- Belleville washer.
- Flatwasher.
- Screw (fingertight).

NOTE

Torque hardware before applying corrosion preventive compound.

(3) Torque all connections as specified in the applicable battery maintenance paragraph. After reassembly, coat all hardware with corrosion preventive compound (item 3, Appendix C).

(4) For Battery BB-708, torque nylon filler caps to 3/4 in.-lbs. and steel filler caps to 5/6 in.-lbs.; and for Battery BB-716/A, torque nylon filler caps to 3/4 in.-lbs. and steel filler caps to 5/6 in.-lbs.

3-17. Batteries BB-432A/A and BB-432B/A

This task covers: a. Disassembly/Reassembly b. Repair C. Test

INITIAL SETUP

Tools and Test Equipment

Multimeter AN/PSM-45A
Battery Service Tool Kit (NSN 5180-00-542-5812)
Tool Kit, Electrical Repairer
(NSN 5180-00-323-4915)
Cell Puller (Appendix D)

Materials/Parts

Apron, Rubber (Item 2, Appendix C)
Gloves, Rubber (Item 8, Append& C)
Goggles, Protective (Item 7, Append& C)
Rags, Wiping (Item 12, Appendix C)
Corrosive Resistant Compound
(Item 3, Appendix C)
Brush, Nylon Bristle (Item 16, Appendix C)

Personnel

MOS68F

General Safety Instructions

Wear protective gear. Remove all metal objects from wrists and fingers. Observe all warnings and cautions.

References: TM 11-6140-203-23P.

a. Disassembly/Reassembly (fig. 3-12).

(1) Unsnap four latches (1) and remove cover (2).

(2) Discharge battery (para 3-10).

NOTE

Steps (3) through (10) are battery BB-432B/A only.

(3) Tag lead (3).

(4) Remove two screws (4), washers (5) spring washers (6) lead (3) and link (7).

(5) Tag leads (8) and (9).

(6) Remove two screws (10), washers (11), spring washers (12) two leads (8) and (9) and link (13).

(7) Tag lead (14).

(8) Remove two screws (15) washers (16) spring washers (17) lead (14) and link (18).

(9) Remove two screws (19). washers (20) spring washers (21), and temperature sensor and link (22).

(10) Remove two screws (23) washers (24) spring washers (25) and thermal switch and link (26).

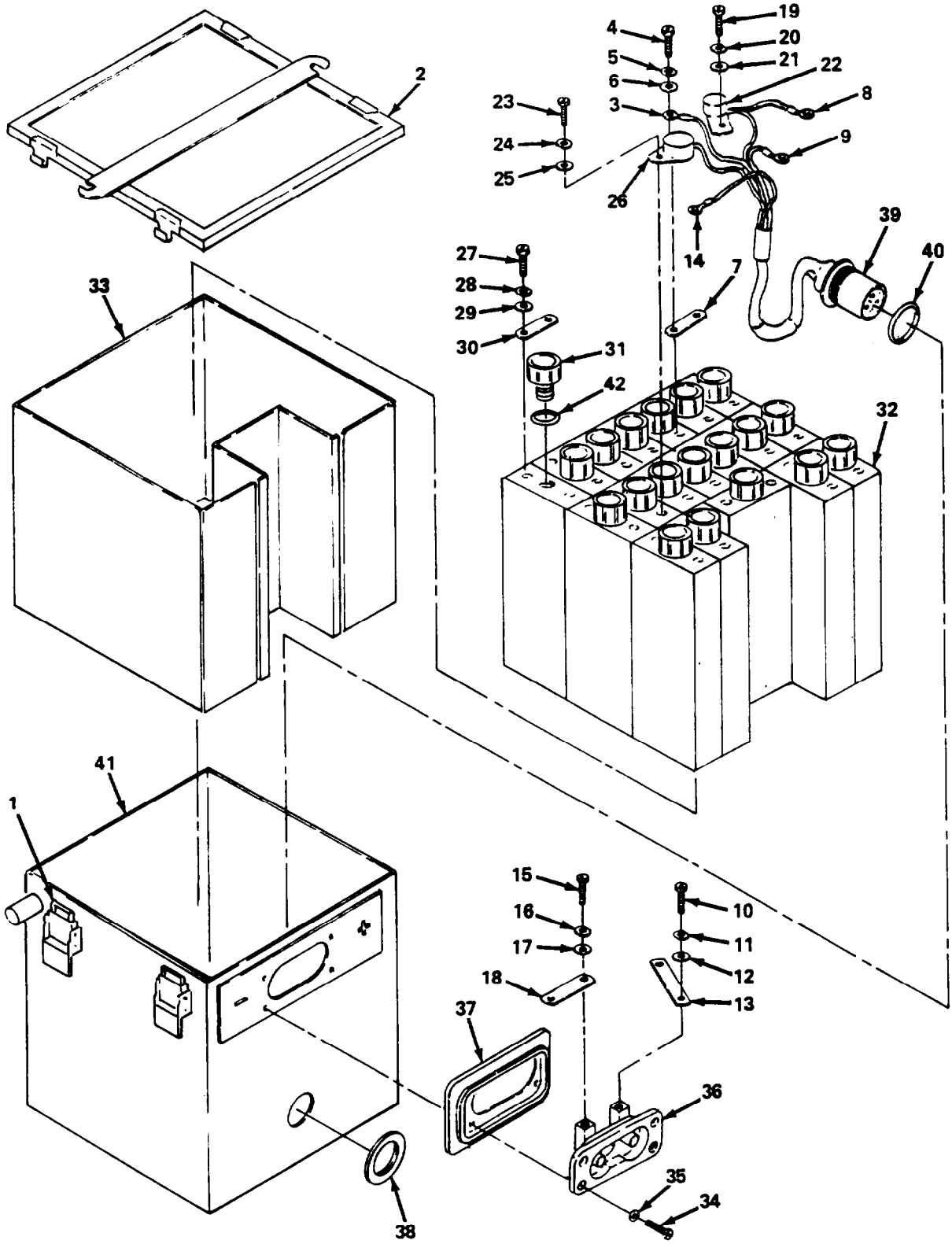

Figure 3- 12. Battery BB-432A/A or BB-432B/A Disassembly.

3-17. Batteries BB-432A/A and BB-432B/A (Cont)

(11) Remove two screws (27) washers (28) spring washers (29) and link (30).

(12) Repeat step (11) for remaining links.

(13) Loosen but do not remove filler caps (31).

NOTE

If a cell puller cannot be fabricated, screw a stud of the correct size into each of the terminals on the cell and pull the cell straight up using two pairs of pliers.

(14) Install cell puller (refer to appendix D) on cell (32) and secure with two screws (27).

NOTE

Remove cells starting with cell at approximately the center of the battery.

(15) Remove cell (32) and remove cell puller from cell.

(16) Repeat steps (14) and (15) for remaining cells.

(17) Remove shims (33).

CAUTION

When removing gasket, do not let scraper gouge battery case.

(18) Remove four screws (34) and washers (35) and remove connector (36) and gasket (37).

(19) Remove safety wire securing nut (38).

(20) Remove nut (38) and remove wiring harness (39) and O-ring (40).

(21) Tighten all filler caps (31).

(22) Wash shims (33) with clean water and dry thoroughly.

(23) Inspect shims (33) and replace any piece which is damaged using polyamide plastic sheet cut to appropriate size.

CAUTION

Do not allow water to enter cell. Water entering the cell will dilute and contaminate electrolyte.

(24) Wash each cell (32) with clean water and dry thoroughly.

(25) Remove potassium carbonate from cells (32) using nylon bristle brush.

(26) Rewash cells (32) as needed and dry thoroughly.

3-17. Batteries BB-432A/A and BB-432B/A (cont)

(27) Inspect each ceil for cracks, distorted case, discoloration and electrolyte contamination. Replace any cdl that is cracked, discolored with bum spots, or contains contaminated electrolyte.

(28) Invert the cell for 2 minutes.

(29) After two minutes, lay the cell down, on blotter or paper towel, for 30 seconds on each of its sides. Any wetting of the blotter or paper towel is cause to consider the cell unserviceable and it should be replaced.

(36) Clean battery case (41) and cover (2) with water and dry thoroughly.

(31) Inspect battery case (41) and cover (2) for scratches, dents, and corrosion. Remove corrosion and repaint battery case and cover as needed (para 3-9).

(32) Remove filler caps (31) and O-rings (42) and clean with clean water and dry thoroughly.

(33) Inspect O-rings (42) and replace if cracked or deformed.

(34) Install filler caps (31) and O-rings (42) and tighten with filler cap wrench.

(35) Inspect connector (36) and gasket (37) and replace if cracked or otherwise damaged.

(36) Inspect wiring harness (39) and replace if insulation on wiring is cracked or burned or wiring harness Is otherwise damaged.

CAUTION

Do not hit cells to install, a firm push from the top is all that should be required. If ceils are hard to install, check cell layout for orientation of cells, and retry.

(37) Install wiring harness (39) and O-ring (46) and secure with nut (38). Safety wire nut.

(38) Refer to figure 1-2 for battery cell layout and install battery cells (32).

NOTE

Each battery must be constructed of cells made by the same manufacturer and must carry the same stock number. Do not mix cells made by different manufacturers or cells with different stock numbers.

(39) Install shims (33) to obtain a tight fit.

(46) Verify all cells (32) are property installed and polarity is correct.

(41) Install connector (36) and gasket (37) and secure with four screws (34) and washers (35).

(42) Install thermal switch and link (26) and secure with two screws (23) washers (24) and spring washers (25). Torque screws (23) to 20-25 in-lb.

(43) Install temperature sensor and link (22) and secure with two screws (19), washers (20), and spring washers (21). Torque screws (19) to 20-25 in-lb.

(44) Install link (18) and lead (14) and secure with two screws (15), washers (16), and spring washers (17). Torque screw connected to cell to 20-25 in.-lbs. Torque screw securing connector (36) to 35-50 in.-lbs.

(45) Install link (13) and two leads (8) and (9) and secure with two screws (10), washers (11), and spring washers (12). Torque screw cpmmected tp ce;; tp 20-25 in.-lbs. Torque screw securing conector (36) to 35-50 in.-lbs.

(46) Install link (7) and lead (3) and secure with two screws (4), washers (5), and spring washers (6). Torque screws (4) to 20-25 in-lb.

(47) Install link (30) and secure with two screws (27), washers (28), and spring washers (29). Torque screws (27) to 20-25 in-lb.

(48) Repeat step (47) for remaining links.

CAUTION

In the following step, use corrosion preventive compound sparingly and only as required. Apply corrosion preventive compound when batteries are used in a corrosive atmosphere or when the battery is placed in storage. Overuse of corrosion preventive compound may leak into the cell causing cell contamination.

(49) Coat terminal links and hardware with corrosion preventive compound (Item 3, Appendix C).

(50) Install cover (2) and secure with four latches (1).

(51) Return battery to administrative storage.

b. Repair. Repair of Battery BB-432NA or BB-432B/A consists of removal and replacement of the following items:

- Connector
- Wiring harness (BB-432B/A only)
- Cell BB-599/A
- Terminal link
- Filler cap

WARNING

When performing removal and replacement procedures, make sure the battery is completely discharged. Remove all jewelry and metal objects from fingers and wrists.

NOTE

Disassemble the battery only to the extent necessary to perform a repair or service.

3-17. Batteries BB-432A/A and BB-432B/A (Cont)

(1) Discharge battery (para 3-10).

(2) To remove any of the above items, refer to the exploded view (fig. 3-12) and the appropriate sections of paragraph 3-17a.

(3) Upon completion of repair, perform the test procedures contained In paragraph 3-17c, below.

NOTE
Performance test not required when replacing filler caps.

c. Test.

(1) Charge battery (para 3-11).

(2) Test the BB-432B/A wiring harness in accordance with the procedures contained in Table 3-1 (MALFUNCTION 6).

(3) Test battery in accordance with the procedures contained in paragraph 3-14.

3-18. Battery BB-433A/A

This task covers: a. Disassembly/Reassembly b. Repair c. Test

INITIAL SETUP

Tools

Battery Service Tool Kit (NSN 5180-00-542-5812)
Tool Kit, Electrical Repair (NSN 5186-00-323-4915)

Materials/Parts

Apron, Rubber (Item 2, Appendix C)
Gloves, Rubber (Item 8, Appendix C)
Goggles, Protective (Item 7, Appendix C)
Brush, Nylon Bristle (Item 6, Appendix C)
Rags, Wiping (Item 12, Appendix C)
Corrosive Resistant Compound (Item 3, Appendix C)

Personnel

MOS 68F

General Safety Instructions
Wear Protective gear. Remove all metal objects from wrists and fingers. Observe all WARNINGS and CAUTIONS.

BB-433A/A weighs 76 pounds. Two personnel are required to lift the battery. Failure to comply with this warning will cause injury to personnel.

References: TM 11-6140-203-23P

a. Disassembly/Reassembly (fig. 3-13).

(1) Unsnap four latches (1) and remove cover (2).

(2) Discharge battery (para 3-10).

WARNING

Remove all metal objects from fingers and wrists before working on nickel-cadmium batteries. Severe injuries from electrical bums could occur if metal objects on fingers and wrists accidentally short out battery.

Wear protective eyewear and clothing when working on nickel-cadmium batteries. If accidental contact with electrolyte occurs, wash contaminated area immediately with clean water and seek medical attention.

(3) Remove screw (3) washer (4) and spring washer (5).

(4) Remove screw (6) washer (7) and spring washer (8) and remove terminal link (9).

(5) Repeat steps (3) and (4) as necessary and remove remaining terminal links.

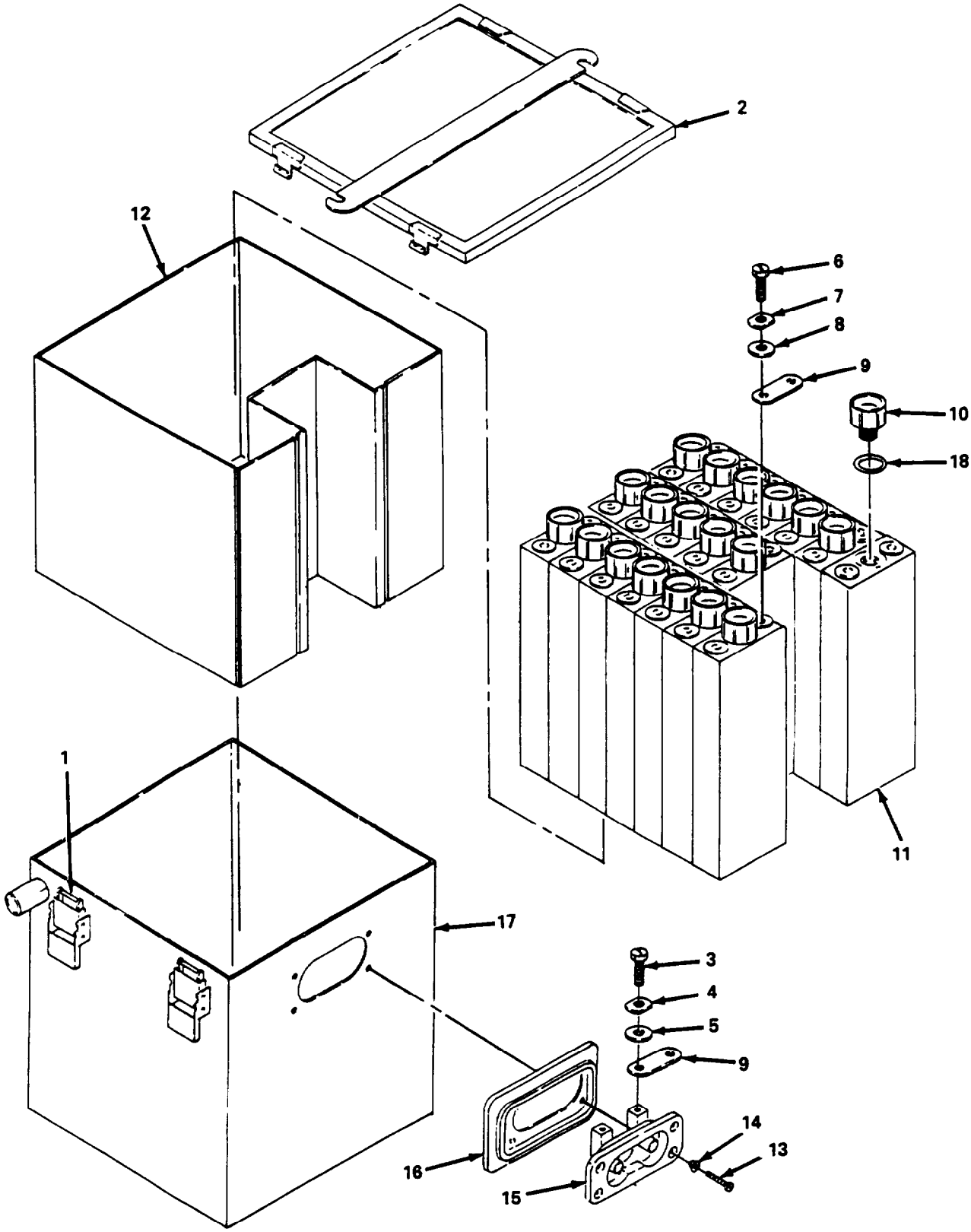

Figure 3-13. Battery BB-433A/A Disassembly.

3-18. Battery BB-433A/A (Cont)

(6) Loosen but do not remove filler caps (10).

NOTE

If a cell puller cannot be fabricated, screw a stud of the correct size into each of the terminals on the cell and pull the cell straight up using two pair of pliers.

(7) Install cell puller, (refer to Append& D), on cell (11) and secure with two screws (3) and (6).

NOTE

Remove cells starting with cell at approximately the center of the battery.

(8) Remove cell (11) and remove cell puller from cell.

(9) Repeat steps (7) and (8) for remaining cells.

(10) Remove shims (12).

CAUTION

When removing gasket, do not let scraper gouge battery case.

(11) Remove four screws (13) and washer (14) and remove connector (15) and gasket (16).

(12) Tighten all filler caps (10).

(13) Wash shims (12) with clean water and dry thoroughly.

(14) Inspect shims (12) and replace any piece which is damaged using polyamide plastic sheet cut to appropriate size.

CAUTION

Do not allow water to enter cell. Water entering the cell will dilute and contaminate electrolyte.

(15) Wash each cell (11) with clean water and dry thoroughly.

(16) Remove potassium carbonate from cells (11) using nylon bristle brush.

(17) Rewash cells (11) as needed and dry thoroughly.

(18) Inspect each cell for cracks, distorted case, discoloration and electrolyte contamination. Replace any cell that is cracked, discolored with burn spots, or contains contaminated electrolyte.

(19) Invert the cell for 2 minutes.

(20) After two minutes, lay the cell down, on blotter or paper towel, for 30 seconds on each of its sides. Any wetting of the blotter or paper towel is cause to consider the cell unserviceable and should be replaced.

3-18. Battery BB-433A/A (Cont)

(21) Clean battery case (17) and cover (2) with water and dry thoroughly.

(22) Inspect battery case (17) and cover (2) for scratches, dents, and corrosion. Remove corrosion and repaint battery case and cover as needed (para 3-9).

(23) Remove filler caps (10) and O-rings (18) from cells (11) and clean filler caps (10) thoroughly with water.

(24) Inspect O-rings (18) and replace if cracked, ripped, or otherwise damaged.

(25) Install filler caps (10) and O-rings (18) and tighten with filler cap wrench.

(26) Install gasket (16) and connector (15) and secure with four screws (13) and washers (14).

CAUTION

Do not hit cells to install, a firm push from the top is all that should be required. If cells are hard to install, check cell layout for orientation of cells, and retry.

(27) Refer to figure1-3 for battery cell layout and install battery cells (11).

NOTE

Each battery must be constructed of cells made by the same manufacturer and must carry the same stock number. Do not mix cells made by different manufacturers or cells with different stock numbers from the same manufacturer to retrofit a battery.

(28) Install shims (12) to obtain a tight fit.

(29) Verify all cells (11) are properly installed and polarity is correct.

(30) Install terminal links (9) and secure with spring washers (8) and (5), washers (7) and (4), and screws (6) and (3). Torque screws to 35-50 in-lb.

(31) Verify all terminal links are properly installed.

CAUTION

In the following step, use corrosion preventive compound sparingly and only as required. Apply corrosion preventive compound when batteries are used in a corrosive atmosphere or when the battery is placed in storage. Overuse of corrosion preventive compound may leak into the cell causing cell contamination.

(32) Coat terminal links and hardware with corrosion preventive compound (Item 3, Appendix C).

(33) Install cover (2) and secure with four latches.

(34) Return battery to administrative storage.

3-18. Battery BB-433A/A (Cont)

b. Repair. Repair of Battery BB-433A/A consists of removal and replacement of the following items:

- Connector
- Cell BB-600/A
- Terminal link
- Filler cap

WARNING

When performing removal and replacement procedures, make sure the battery is completely discharged. Remove all jewelry and metal objects from fingers and wrists.

NOTE

Disassemble the battery only to the extent necessary to perform a repair or to service.

(1) Discharge battery (para 3-10).

(2) To remove any of the above items, refer to the exploded view (fig. 3-13) and the appropriate sections of paragraph 3-18.a.

(3) Upon completion of repair, perform the test procedures contained in paragraph 3-18c below.

NOTE

Performance test not required when replacing filler caps.

c. Test.

(1) Charge battery (para 3-11).

(2) Test battery In accordance with the procedures contained In paragraph 3-14.

3-19. Battery BB-434/A

This task covers: a. D&assembly/Reassembly b. RepaIr C. Test

INITIAL SETUP

Tools and Test Equipment

Multimeter AN/PSM-45A
Battery Service Tool Klt (NSN 5180-00-542-5812)
Tool kit, Electrical Repairer
(NSN 5180-90-323-4915)
Cell Puller (Appendix D)

Materials/Parts

Apron, Rubber (Item 2, Appendix C)
Gloves, Rubber (Item 8, Appendix C)
Goggles, Protective (Item 7, Appendix C)
Rags, Wiping (Item 12, Appendix C)
Corrosive Resistant Compound
(Item 3, Appendix C)
Brush, Nylon Bristle (Item 16, Appendix C)

Personnel

MOS68F

General Safety Instructions

Wear protective gear. Remove all metal objects from wrists and fingers. Observe warnings and cautions

References: TM 11-6140-203-23P

a. Disassembly/Reassembly (fig. 3-14).

(1) Unsnap four latches (1) and remove cover (2).

(2) Discharge battery (para 3-10).

(3) Remove screw (3), washer (4) and spring washer (5).

(4) Remove screw (6), washer (7) and spring washer (8) and remove terminal link (9).

(5) Repeat steps 3 and 4 as necessary and remove remaining terminal links.

(6) Loosen but do not remove filler caps (10).

NOTE

If a cell puller cannot be fabricated, screw a stud of the correct size into each of the terminals on the cell and pull the cell straight up using a couple of pairs of pliers.

(7) Install cell puller (refer to Appendix D) on cell (11) and secure with two screws (3) and (6).

(8) Remove cell (11) and remove cell puller from cell (11).

(9) Repeat steps (7) and (8) for remaining cells.

(10) Remove shims (12).

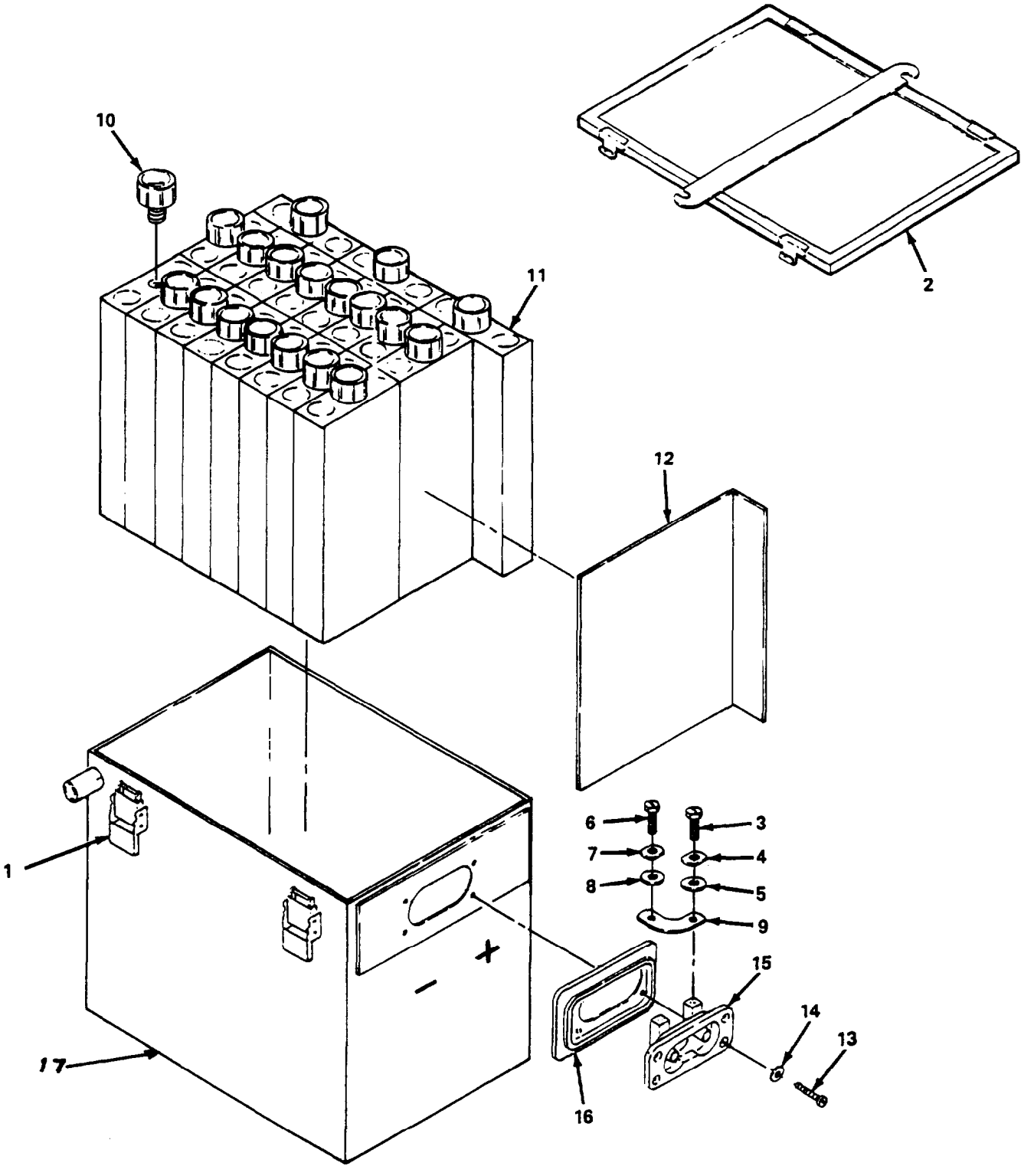

Figure 3-14. Battery BB-434/A Disassembly.

3-19. Battery BB-434/A (Cont)

CAUTION

When removing gasket, do not let scraper gouge battery case.

(11) Remove four screws (13) and washers (14) and remove connector (15) and gasket (16).

(12) Tighten all filler caps (10).

(13) Wash shims (12) with clean water and dry thoroughly.

(14) Inspect shims (12) and replace any piece which is damaged using polyamide plastic sheet cut to appropriate size.

CAUTION

Do not allow water to enter cell. Water entering the cell will dilute and contaminate electrolyte.

(15) Wash each cell (11) with clean water and dry thoroughly.

(16) Remove potassium carbonate from cells (11) using nylon bristle brush.

(17) Rewash cells (11) as needed and dry thoroughly.

(18) Inspect each cell for cracks, distorted case, discoloration, and electrolyte contamination. Replace any cell that Is cracked, discolored with burn spots, or contains contaminated electrolyte.

(19) Invert the cdl for 2 minutes.

(20) After two minutes, lay the cell down, on blotter or paper towel, for 30 seconds on each of its sides. Any wetting of the blotter or paper towel is cause to consider the cell unserviceable.

(21) Clean battery case (17) and cover (2) with water and dry thoroughly.

(22) Inspect battery case (17) and cover (2) for scratches, dents, and corrosion. Remove corrosion and repaint battery case and cover as needed (para 3-9).

(23) Remove filler caps (10) from cells (11) and clean filler caps thoroughly with water.

(24) Install filler caps (10) and tighten with filler cap wrench.

(25) Install gasket (16) and connector (15) and secure with four screws (13) and washers (14).

CAUTION

Do not hit cells to Install, a firm push from the top is all that should be required. If cells are hard to install, check cell layout for orientation of cells, and retry.

(26) Refer to figure 1-4 for battery cell layout and install battery cells (11).

3-19. Battery BB-434/A (Cont)

NOTE

Each battery must be constructed of cells made by the same manufacturer and must carry the same stock number. Do not mix cells made by different manufacturers or cells with different stock numbers from the same manufacturer to retrofit a battery.

(27) Install shims (12) as needed to obtain a tight fit.

(28) Verify all cells (11) are properly installed and polarity Is correct.

(29) Install terminal links (9) and secure with spring washers (8) and (5) washers (7) and (4), and screws (6) and (3). Torque screws to 32-50 in-lb.

CAUTION

In the following step, use corrosion preventive compound sparingly and only as required. Apply corrosion preventive compound when batteries are used in a corrosive atmosphere or when the battery is placed in storage. Overuse of corrosion preventive compound may leak into the cell causing cell contamination.

(30) Coat terminal links and hardware with corrosion resistant compound (item 3, Appendix C).

(31) Install cover (2) and secure with four latches (1).

(32) Return battery to administrative storage.

b. Repair. Repair of Battery BB-434/A consists of removal and replacement of the following items:

- Connector
- Cell BB-601A/A
- Terminal link
- Filler cap

WARNING

When performing removal and replacement procedures, make sure the battery is completely discharged. Remove all jewelry and metal objects from fingers and wrists.

NOTE

Disassemble the battery only to the extent necessary to perform a repair or service.

(1) Discharge battery (para 3-10).

(2) To remove any of the above items, refer to the exploded view (fig. 3-14) and the appropriate sections of paragraph 3-19a.

3-19. Battery BB-434/A (Cont)

(3) Upon completion of repair, perform the test procedures contained in paragraph 3-19c below.

NOTE

Performance test not required when replacing filler caps.

c. Test.

(1) Charge battery (pare 3-11).

(2) Test battery In accordance with the procedures contained in paragraph 3-14.

3-20. Battery BB-476/A

This task covers: a. Disassembly/Reassembly b. Repair c. Test

INITIAL SETUP

Tools and Test Equipment

Multimeter AN/PSM-45A
Battery Service Tool Kit (NSN 5160-00-542-5812)
Tool kit, Electrical Repairer
(NSN 5180-00-323-4915)
Cell Puller (Appendix D)

Materials/Parts

Apron, Rubber (Item 2, Appendix C)
Gloves, Rubber (Item 8, Appendix C)
Goggles, Protective (Item 7, Appendix C)
Rags, Wiping (Item 12, Appendix C)
Corrosive Resistant Compound
(Item 3, Appendix C)
Brush, Nylon Bristle (Item 16, Appendix C)

Personnel

MOS68F

General Safety Instructions

Wear protective gear. Remove all metal objects from wrists and fingers. Observe warnings and cautions

References: TM 11-6140-203-23

a. Disassembly/Reassembly (fig. 3-15).

(1) Unsnap four latches (1) and remove cover (2).

(2) Discharge battery (para 3-10).

(3) Remove two screws (3), washers (4), and terminal link (5).

(4) Repeat step (3) for remaining terminal links.

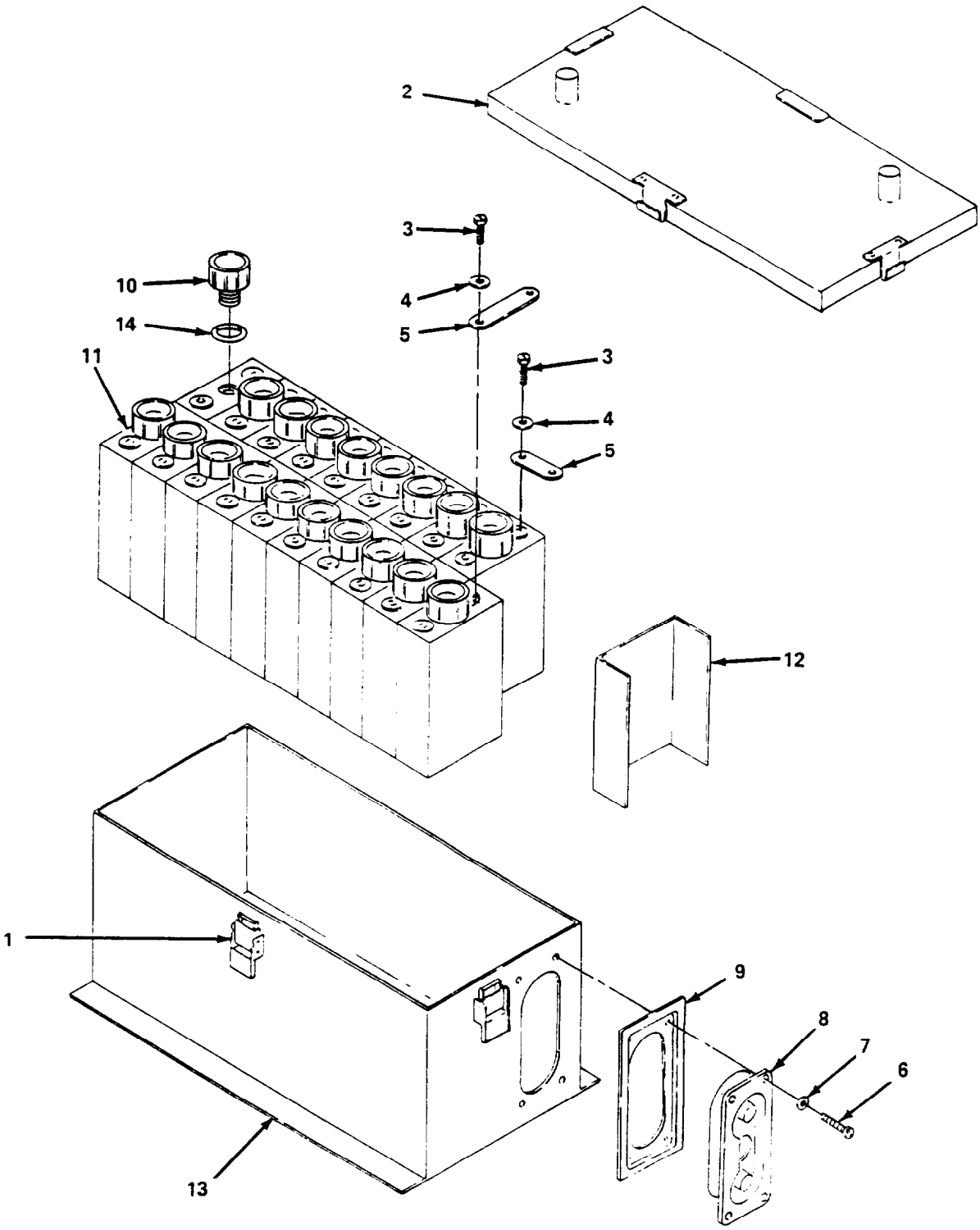

Figure 3-15. Battery BB-476/A Disassembly.

3-20. Battery BB-476/A (Cont)

(5) Remove four screws (6), washers (7), and remove connector (8) and gasket (9).

(6) Loosen but do not remove filler caps (10).

NOTE

If a cell puller cannot be fabricated, screw a stud of the correct size into each of the terminals on the cell and pull the cell straight up using two pairs of pliers.

(7) Install cell puller (refer to Appendix D) on cell (11) and secure with two screws (3).

NOTE

Remove the cells starting with cell at approximately the center of the battery.

(8) Remove cell (11).

(9) Remove cell puller from cell (11).

(10) Repeat steps (7) (8) and (9) for remaining cells as needed.

(11) Remove shims (12).

(12) Tighten all filler caps (10).

(13) Wash battery case (13) cover (2), and shims (12) with clean water and dry thoroughly.

(14) Inspect shims (12) and replace any piece which is damaged. Cut new pieces of shims as needed from sheets of polyamide.

(15) Inspect battery case (13) and cover (2) for scratches, dents, and corrosion. Remove all corrosion and repaint battery case and cover, as needed (para 3-9).

CAUTION

Do not allow water to enter cell. Water entering the cell will dilute and contaminate electrolyte.

(16) Wash each cell (11) with clean water and dry thoroughly.

(17) Remove all potassium hydroxide (white deposits) from cells using nylon bristle brush.

(18) Rewash cells as needed, and dry thoroughly.

(19) Inspect each cell for cracks, distorted case, discoloration, and electolyte contamination. Replace any cell that is cracked, discolored with burn spots, or contains contaminated electrolyte.

(20) Invert the cell for two minutes.

(21) After two minutes, lay the cell on each of its sides for 30 seconds on a blotter or paper towel. Any wetting of the blotter or paper towel is cause to consider the cell unserviceable.

3-20. Battery BB-476/A (Cont)

(22) Remove filler caps (10) and O-rings (14).

(23) Wash filler caps (10) and dry thoroughly.

(24) Inspect filler caps and replace if cracked or otherwise damaged.

(25) Inspect O-rings (14) and replace if cracked or deformed.

(26) Install filler caps (10) and O-rings (14). Tighten using filler cap wrench.

(27) Ensure gasket mounting surface is clean and free of old gasket material.

(28) Install connector (8) and gasket (9) and secure with four screws (6) and washers (7)

NOTE

Each battery must be constructed of cells made by the same manufacturer and must carry the same National Stock Number. Do not mix cells made by different manufacturers or with different National Stock Numbers.

CAUTION

Do not hit cells to install, a firm push from the top is all that should be required. If cells are hard to install, check cell layout for orientation of cells and retry.

(29) Refer to figure 1-5 for cell layout and install cells (11).

(30) Install shims (12) as needed, to obtain a tight fit.

(31) Verify all cells (11) are properly installed and polarity is correct.

(32) Install terminal link (5) and secure with two screws (3) and washers (4). Torque screws securing connector to 35-50 in.-lbs. Torque all other screws to 20-25 in.-lbs.

(33) Repeat step (32) for remaining terminal links.

(34) Verify all terminal links are properly installed.

CAUTION

In the following step, use corrosion preventive compound sparingly and only as required. Apply corrosion preventive compound when batteries are used in a corrosive atmosphere or when the battery is placed in storage. Overuse of corrosion preventive compound may leak into the cell causing cell contamination.

(35) Apply corrosion preventive compound (Item 3, Appendix C) to terminal links and hardware.

3-20. Battery BB-476/A (Cont)

(36) Install cover (2) and secure with four latches (1).

(37) Return battery to administrative storage.

b. Repair. Repair of Battery BB-476/A consists of removal and replacement of the foilowing items:

- Connector
- Cell BB-475A/A
- Terminal link
- Filler cap

WARNING

When performing removal and replacement procedures, make sure the battery is completely discharged. Remove all jewelry and metal objects from fingers and wrists.

NOTE

Disassemble the battery only to the extent necessary to perform a repair or service.

(1) Discharge battery (para 3-10).

(2) To remove any of the above items, refer to the exploded view (fig. 3-15) and the appropriate sections of paragraph 3-20a.

(3) Upon completion of repair, perform the test procedures contained in paragraph 3-20c, below.

NOTE

Performance list not required when replacing filler caps.

c. **Test.**

(1) Charge battery (para 3-11).

(2) Test battery in accordance with the procedures contained in paragraph 3-14.

3-21. Battery BB-558/A

This task covers: a. Disassembly/Reassembly b. Repair c. Wiring Harness Repair d. Test

INITIAL SETUP

Tools and Test Equipment

Battery Maintenance Kit (NSN 5180-01-295-1925)
Multimeter AN/PSM-45A
Battery Service Tool Kit (NSN 5180-00-542-5812)
Tool kit, Electrical Repairer
(NSN 5180-00-323-4915)
Cell Puller (Appendix D)

Materials/Parts

Apron, Rubber (Item 2, Appendix C)
Gloves, Rubber (Item 8, Appendix C)
Goggles, Protective (Item 7, Appendix C)
Rags, Wiping (Item 12, Appendix C)
Corrosive Resistant Compound
(Item 3, Appendix C)
Brush, Nylon Bristle (Item 16, Appendix C)
Alcohol (Item 18, Appendix C)

Personnel

MOS68F

General Safety Instructions

Wear protective gear. Remove all metal objects from wrists and fingers. Observe warnings and cautions

References: TM 11-6140-203-23

a. Disassembly/Reassembly (fig. 3-16).

(1) Unsnap two latches (1) and open and remove cover (2).

(2) Discharge battery (para 3-10).

WARNING

Remove all metal objects from fingers and wrists before working on nickel-cadmium batteries. Severe injuries from electrical burns could occur if metal objects on fingers and wrists accidentally short out battery.

Wear protected eyewear and clothing when working on nickel-cadmium batteries. If accidental contact with electrolyte occurs, wash contaminated area immediately with clean water and seek medical attention.

(3) Tag two leads (3) and (4).

(4) Remove two nuts (5) and washers (6) and remove two leads (3) and (4) and link (7).

(5) Tag lead (8).

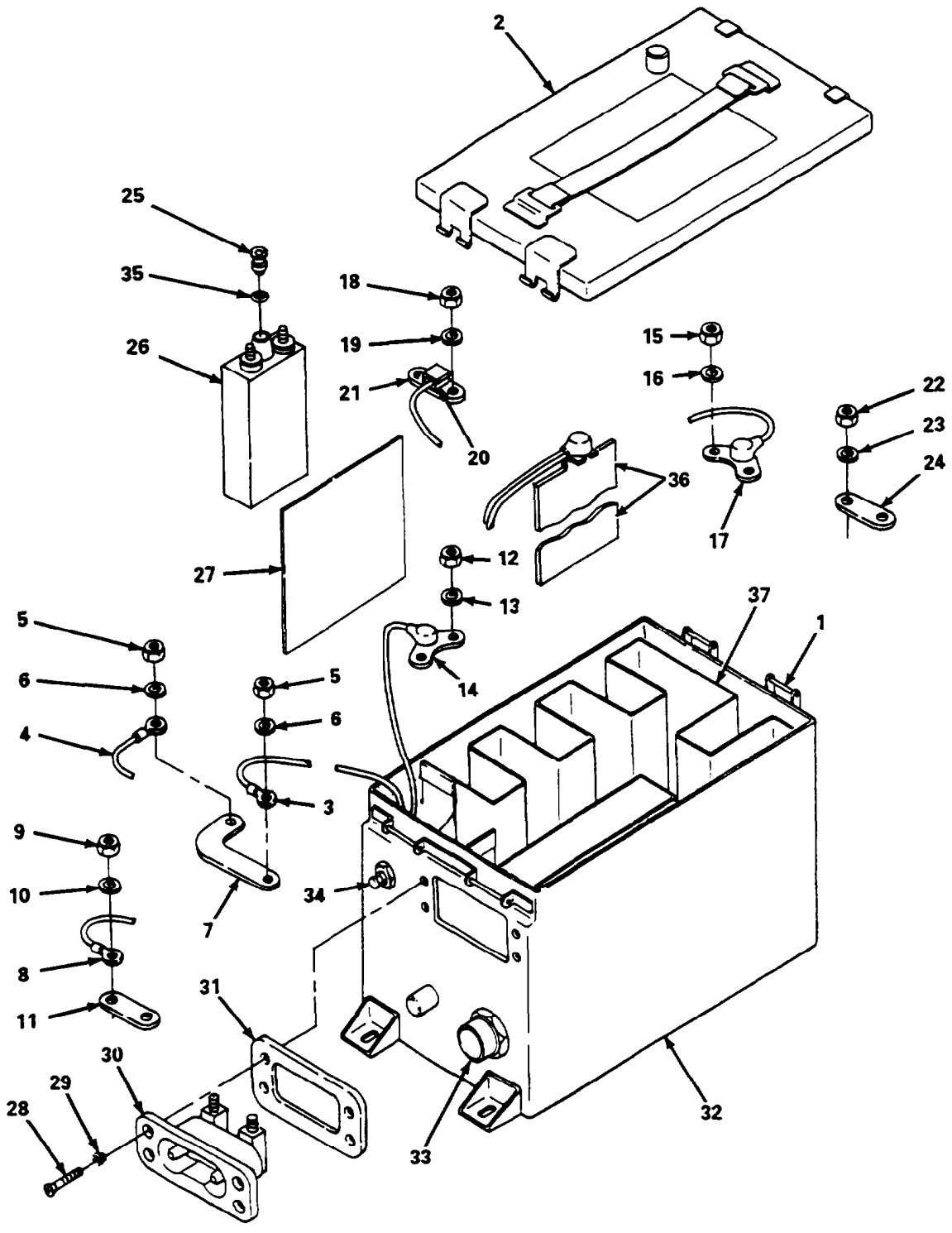

Figure 3-16. Battery BB-558/A Disassembly.

3-21. Battery BB-558/A (Cont)

(6) Remove two nuts (9) and washer (10) and remove lead (8) and link (11).

(7) Remove two nuts (12) and washer (13) and remove thermostat and link (14).

(8) Remove two nuts (15) and washer (16) and remove thermostat and link (17).

(9) Remove two nuts (18) and washer (19) and remove thermostat sensor (20) and link (21).

(10) Remove two nuts (22) and washer (23) and remove link (24).

(11) Repeat step (10) for remaining links.

(12) Move wiring harness leads out of way.

(13) Loosen but do not remove filler caps (25).

(14) Install cell puller (provided with BB-558/A) on battery cell.

NOTE

Remove the cells starting with cell at approximately the center of the battery.

(15) Remove cell (26) and remove cell puller from cell.

(16) Repeat steps (14) and (15) for remaining cells.

(17) Remove shims (27).

(18) Remove four screws (28) and washers (29) and remove connector (30) and gasket (31).

NOTE

The wiring harness cannot be removed from the battery case without cutting leads. If there is nothing wrong with the wiring harness, do not remove it.

(19) Clean battery case (32) and cover (2) with clean water and dry thoroughly. Inspect battery case and cover for cracks or dents, and replace if damaged.

(20) Inspect wiring harness (33) for cracked or burned insulation or damaged connector pins. If wiring harness is damaged and needs to be replaced, cut the leads from connector, remove nut securing connector and remove. Remove nut and washer securing circuit breaker (34) and remove. Refer to subparagraph b, below, for wiring harness installation procedures.

(21) Inspect connector (30) and replace if terminals are burned or connector is otherwise damaged.

(22) Clean links (24) with clean water and dry thoroughly.

(23) Remove potassium carbonate (white deposits) using nylon bristle brush.

3-21. Battery BB-558/A (Cont)

(24) Inspect links (24) and replace if plating material is worn through to base metal or link (24) is otherwise damaged.

(25) Tighten filler caps (25).

CAUTION

Do not allow water to enter cell. Water entering the cell will dilute and contaminate electrolyte.

(26) Wash each cell (26) with clean water and dry thoroughly.

(27) Remove potassium carbonate (white deposits) with nylon bristle brush.

(28) Rewash ceils (26) as needed, and dry thoroughly.

(29) Inspect each cell (26) for cracks, distorted case, discoloration and electrolyte contamination. Replace any cell that is cracked, discolored with burn spots, or contains contaminated electrolyte.

(30) Invert the cell for two minutes.

(31) After two minutes, lay each cell down, on blotter or paper towel, for 30 seconds on each of its skies. If there is any wetting of blotter or paper towel, check filler cap and/or O-ring for damage. Replace any damaged filler cap and/or O-ring.

(32) Clean filler caps (25) and O-rings (35).

(33) Clean filler caps (25) with clean water and dry thoroughly.

(34) Inspect filler caps (25) and replace if damaged.

(35) Inspect O-rings (35) and replace if cracked or deformed.

(36) Install filler caps (25) and O-rings (35) and tighten with filler cap wrench.

(37) Ensure cover gasket mounting surface is clean and free of old gasket material.

CAUTION

Be very careful when installing cells and heater blankets. Install the cells one at a time making sure heater blankets are properly positioned and not damaged during cell installation.

(38) Refer to figure 1-6 for cell layout and install cells (26). Note placement of thermostat and thermal plate (36) and heater blankets (37) during installation and install during cell installation.

(39) Install shims (27) to obtain a tight fit. When installing shims between heating elements and cells, install one shim at a time and place subsequent shims between first shim and cell and not between first shim and heating element.

3-21. Battery BB-558/A (Cont)

(46) Install connector (30) and gasket (31) and secure with four screws (28) and washers (29).

(41) Install temperature sensor (20) and link (21) and secure with two nuts (18) and washers (19).

(42) install thermostat and link (17) and secure with two nuts (15) and washers (16). Torque nuts to 80-94 in-lb.

(43) Install thermostat and link **(14)** and secure with two nuts **(12)** and washers (13). Torque nuts to 80-94 in-lb.

(44) Install link (11) and lead (8) and secure with two nuts (9) and washer (10). Torque nuts to 80-94 in-lb.

(45) Install link (7) and leads (3) and (4) and secure with two nuts (5) and washer (6). Torque nuts to 80-94 in-lb.

(46) Install link (24) and secure with two nuts (22) and washer (23). Torque nuts to 80-94 in-lb.

(47) Repeat step (46) for remaining links.

CAUTION

In the following step, use corrosion preventive compound sparingly and only as required. Apply corrosion preventive compound when batteries are used in a corrosive atmosphere or when the battery is placed in storage. Overuse of corrosion preventive compound may leak into the cell causing cell contamination.

(48) Apply corrosion preventive compound (Item 3, Appendix C) to terminal links and hardware.

(49) Install and close cover (2) and secure with two latches (1).

(50) Return battery to administrative storage.

b. Repair. Repair of Battery BB-558/A consists of removal and replacement of the following items:

- Connector
- Wiring Harness
- Cell BB-559/A
- Terminal link
- Filler cap

3-21. Battery BB-558/A (Cont)

WARNING

When performing removal and replacement procedures, make sure the battery is completely discharged. Remove all jewelry and metal objects from fingers and wrists.

NOTES

Disassemble the battery only to the extent necessary to perform a repair or service.

Refer to subparagraph c, below, for wiring harness repair.

(1) Discharge battery (para 3-10).

(2) To remove any of the above items, refer to the exploded view (fig. 3-16) and the appropriate sections of paragraph 3-21 a. For wiring harness repair, refer to subparagraph c, below.

(3) Upon completion of repair, perform the test procedures contained in paragraph 3-21d, below.

NOTE

Performance test not required when replacing filler caps.

c. Wiring Harness Repair.

(1) Wiring Harness Replacement (figure 3-17).

(a) Unsnap two latches (1) and open and remove cover (2).

(b) Discharge battery (para 3-10).

WARNING

Remove all metal objects from fingers and wrists before working on nickel-cadmium batteries. Severe injuries from electrical bums could occur if metal objects on fingers and wrists accidentally short out battery.

Wear protective eyewear and clothing when working on nickel-cadmium batteries. If accidental contact with electrolyte occurs, wash contaminated area immediately with clean water and seek medical attention.

(c) Tag two leads (3) and (4).

(d) Remove two nuts (5) and washers (6) and remove leads (3) and (4) and link (7).

(e) Remove two nuts (8) and washers (9) and remove thermostat (43) and link (10),

3-21. Battery BB-558/A (Cont)

(9 Remove two nuts (11) and washers (12) and remove thermostat (45) and link (13).

(g) Remove two nuts (14) and washers (15) and remove temperature sensor (16) and link (17).

(h) Tag lead (18).

(i) Remove two nuts (19) and washer (20) and remove lead (18) and link (21).

(j) Tag lead (22).

(k) Remove two nuts (23) and washers (24) and remove lead (22) and link (25).

(l) Remove two nuts (26) and washer (27) and remove link (28).

(m) Repeat step (1) for remaining links.

(n) Install cell puller (refer to Appendix D) on cell (29) and secure with two nuts (26).

NOTE

Remove cells starting with cell at approximately the center of the battery.

(o) Remove cell (29) and remove cell puller from cell.

(p) Repeat step (o) for remaining cells.

CAUTION

Use extreme caution when removing cells so as not to damage heating elements (30) and thermal plate (31).

(q) Remove shims (32).

NOTE

In order to remove wiring harness, the leads coming from connector must be cut.

(r) Cut leads from connector (33).

(s) Remove nut (34) and remove connector (33).

(t) Remove nut (35) and washer (36) and remove circuit breaker assembly (37) and wiring harness.

(u) Remove nut (42) and remove thermostat (43) from link (10). Check step (e).

(v) Remove nut (44) and remove thermostat (45) from link (13). Check step (9.

(w) Remove nut (46) and remove thermostat (47) from thermal plate (31).

(x) Install circuit breaker (37) and secure with nut (35) and washer (36).

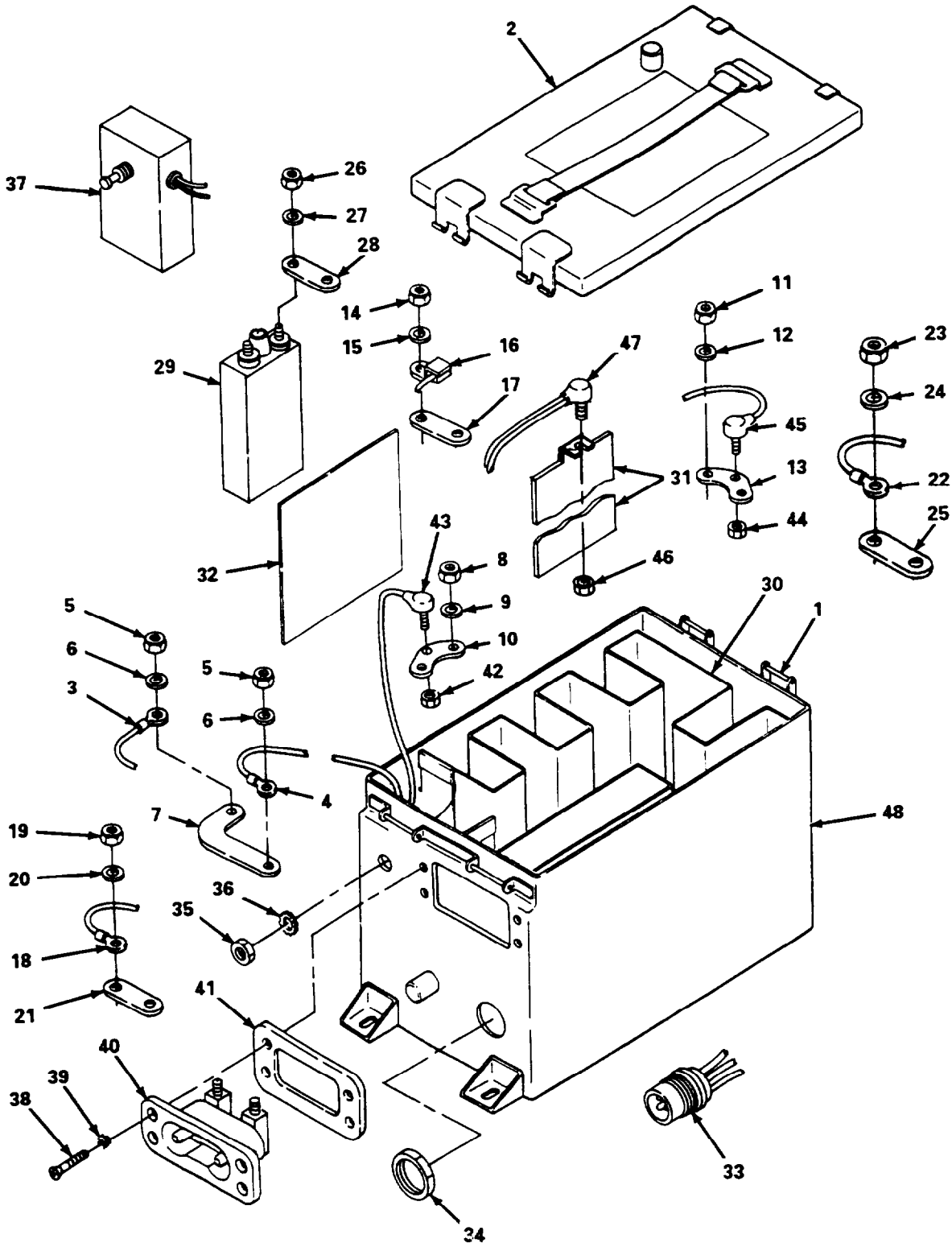

Figure 3-17. BB-558/A Wiring Harness Replacement.

3-21. Battery BB-558/A (Cont)

(y) Strip ail leads on replacement connector without terminal lugs approximately 0.125 in. (3.17 mm) back.

(z) Install connector (33) and secure with nut (34).

(aa) Install any shims (32) that were originally installed on the bottom of the battery case (48).

(ab) Position heater elements (30) in battery case (48).

(ac) Route all leads out of battery case (48) through connector (46) mounting hole.

(ad) Refer to figure 1-6 and install cells (29) and thermal plate (31). Install cells one at a time, making sure not to damage heating elements (30).

(ae) Install thermostat (47) on thermal plate (31) and secure with nut (46).

(af) Install thermostat (45) on link (13) and secure with nut (44).

(ag) install thermostat (43) on link (10) and secure with nut (42).

(ah) Refer to listing below for wiring interconnections.

(ai) Slide heat shrink tubing over appropriate wires prior to splicing.

Wire Marker Numbers
4, 6
6, 27
9, 21
10, 22
12, 30
16, 24, 33
18, 5
19, 8
16, 2, 32
17, 25, 28, 7
14, 29, 31, 23, 3

(aj) Install wires leads in splice and crimp splice to secure.

(ak) Repeat step (aj) for all remaining leads.

(al) Clean splices and wires with alcohol.

(am) Slide heat shrink tubing over splice and wires and heat to shrink tubing in place.

(an) Install shims (32) to obtain a tight fit. When installing shims between cells (29) and heating element (30), install the first shim between cell (29) and heating element very carefully and install all remaining shims between the first shim that was installed and cell.

3-21. Battery BB-558/A (Cont)

(ao) Install link (25) and lead (22) and secure with two nuts (23) and washers (24). Torque nuts to 80-94 In-lb.

(ap) Install link (21) and lead (18) and secure with two nuts (19) and washers (20). Torque nuts to 80-94 in-lb.

(aq) Install link (17) and temperature (16) and secure with two nuts (14) and washers (15). Torque nuts to 80-94 in-lb.

(ar) Install thermostat and link (13) and secure with two nuts (11) and washers (12). Torque nuts to 80-94 in-lb.

(as) Install thermostat and link (10) and secure with two nuts (8) and washers (9). Torque nuts to 80-94 in-lb.

(at) Install link (7) and two leads (3) and (4) and secure with two nuts (5) and washers (6). Torque nuts to 80-94 in-lb.

(au) Install link (28) and secure with two nuts (26) and washers (27). Torque nuts to 80-94 in-lb.

(av) Repeat step (au) for remaining links.

(aw) Install and close cover (2) and secure with two latches (1).

(2) Wiring Harness Connector Replacement (fig. 3-18).

WARNING

Remove all metal objects from fingers and wrists More working on nickel-cadmium batteries. Severe Injuries from electrical burns could occur if metal objects on fingers and wrists accidentally short out battery.

Wear protective eyewear and clothing when working on nickel-cadmium batteries. If accidental contact with electrolyte occurs, wash contaminated area immediately with dean water and seek medical attention.

(a) Discharge battery (para 3-10).

(b) Remove two nuts (1) and washers (2) and remove link (3).

(c) Repeat step (b) for links on the first three ceils closest to wiring harness connector (4).

(d) Install cell puller, refer to Appendix D, on ceil (5) and secure with two nuts (1).

(e) Remove cell (5) and remove cdl puller from cell.

3-21. Battery BB-558/A (Cont)

(9 Repeat step (e) for two remaining cells closest to wiring harness connector (4).

(g) Strip ail leads on new wiring harness connector (4) and leads in battery case approximately 0.125 In. (3.17 mm) back.

(h) Tag leads going to wiring harness connector (4) and cut all leads.

(l) Remove nut (6) securing wiring harness connector (4) and push wiring harness connector into battery case (7).

(j) Slide heat shrink tubing over appropriate wires.

(k) Install wire leads in splice, and crimp splice to secure.

(l) Repeat step (k) for remaining leads.

(m) Clean all splices and leads with alcohol.

(n) Slide heat shrink tubing over splice and heat to shrink tubing in place.

(o) Install wiring harness connector (4) and secure with nut (6).

(p) Install three cells (5). Be careful not to pinch any leads or damage heating elements.

(q) Install link (3) and secure with two nuts (1) and washers (2). Torque nuts to 80-94 in-lb.

(r) Repeat step (q) for remaining links.

(3) Thermostat Replacement (fig. 3-19).

(a) Unsnap two latches (1) and open and remove cover (2).

(b) Discharge battery (para 3-10).

WARNING

Remove all metal objects from fingers and wrists before working on nickel-cadmium batteries. Severe injuries from electrical burns could occur if metal objects on fingers and wrists accidentally short out battery.

Wear protective eyewear and clothing when working on nickel-cadmium batteries. If accidental contact with electrolyte occurs, wash contaminated area immediately with clean water and seek medical attention.

(c) Remove two nuts (3) and washers (4) and remove terminal link (5) and thermostat (6).

(d) Remove nut (7) and remove thermostat (6) from link (5).

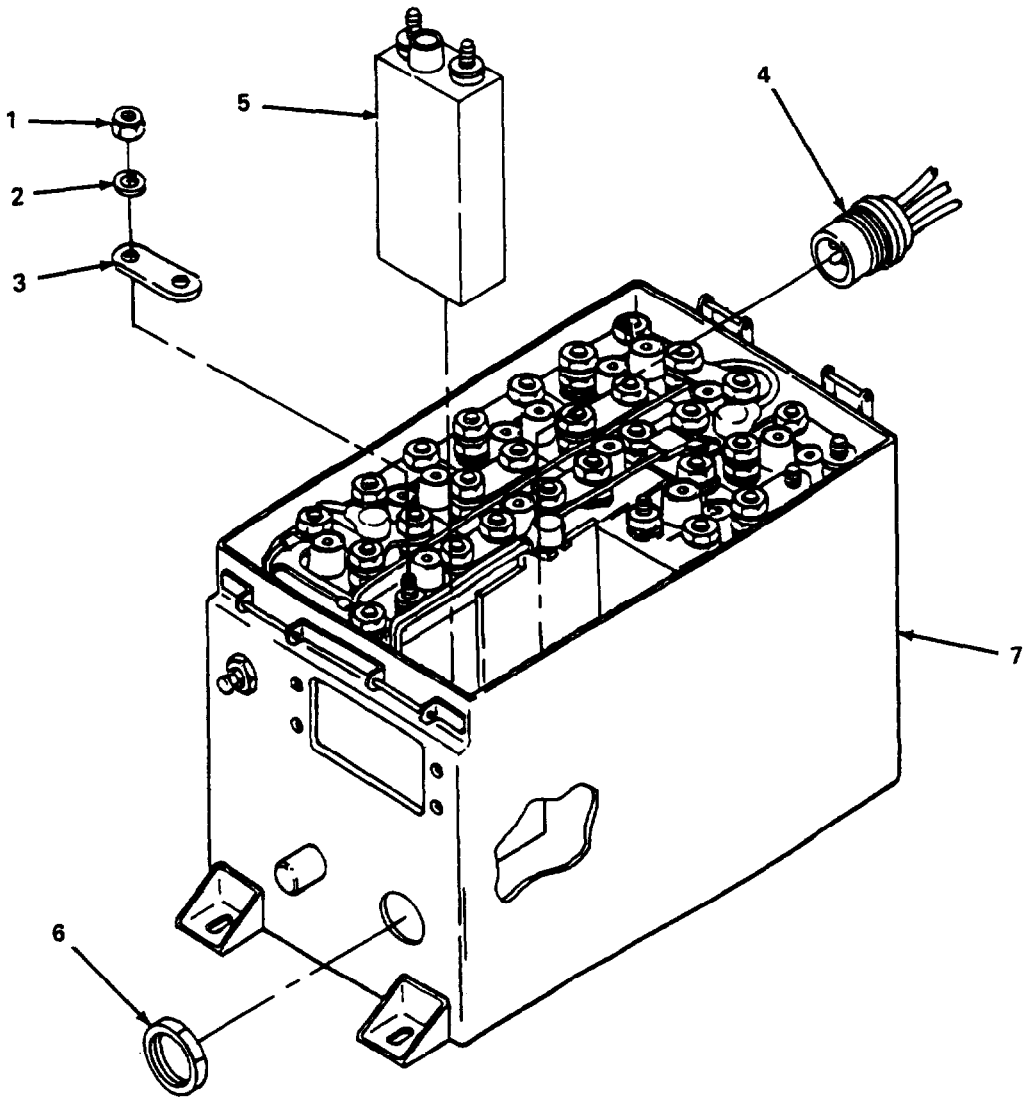

Figure 3-18. BB-558/A Wiring Harness Connector Replacement.

3-21. Battery BB-558/A (Cont)

(e) Tag and cut leads going to thermostat (6).

(9 Strip leads on new thermostat (6) and leads in battery case, approximately 0.125 In. (3.17 mm) back.

(g) Slide heat shrink tubing over leads.

(h) Clean splices and leads with alcohol.

(i) Install leads in splices and crimp slices to secure.

(j) Slide heat shrink tubing over splices and heat to shrink tubing in place.

(k) Install new thermostat (6) on link (5) and secure with nut (7).

(l) Install link (5) and thermostat (6) and secure with two nuts (3) and washers (4). Torque nuts to 80-94 in-lb.

(m) Install and close cover (2) and secure with two latches (1).

(4) Heater Element Replacement (figure 3-20).

(a) Unsnap two latches (1) and open and remove cover (2).

(b) Discharge battery (para 3-10).

WARNING

Remove all metal objects from fingers and wrists before working on nickel-cadmium batteries. Severe injuries from electrical burns could occur if metal objects on fingers and wrists accidentally short out battery.

Wear protective eyewear and clothing when working on nickel-cadmium batteries. If accidental contact with electrolyte occurs, wash contaminated area immediately with clean water and seek medical attention.

(c) Tag two leads (3) and (4).

(d) Remove two nuts (5) and washers (6) and remove two leads (3) and (4) and link (7).

(e) Tag lead (8).

(f) Remove two nuts (9) and washer (10) and remove lead (8) and link (11).

(g) Remove two nuts (12) and washer (13) and remove thermostat and link (14).

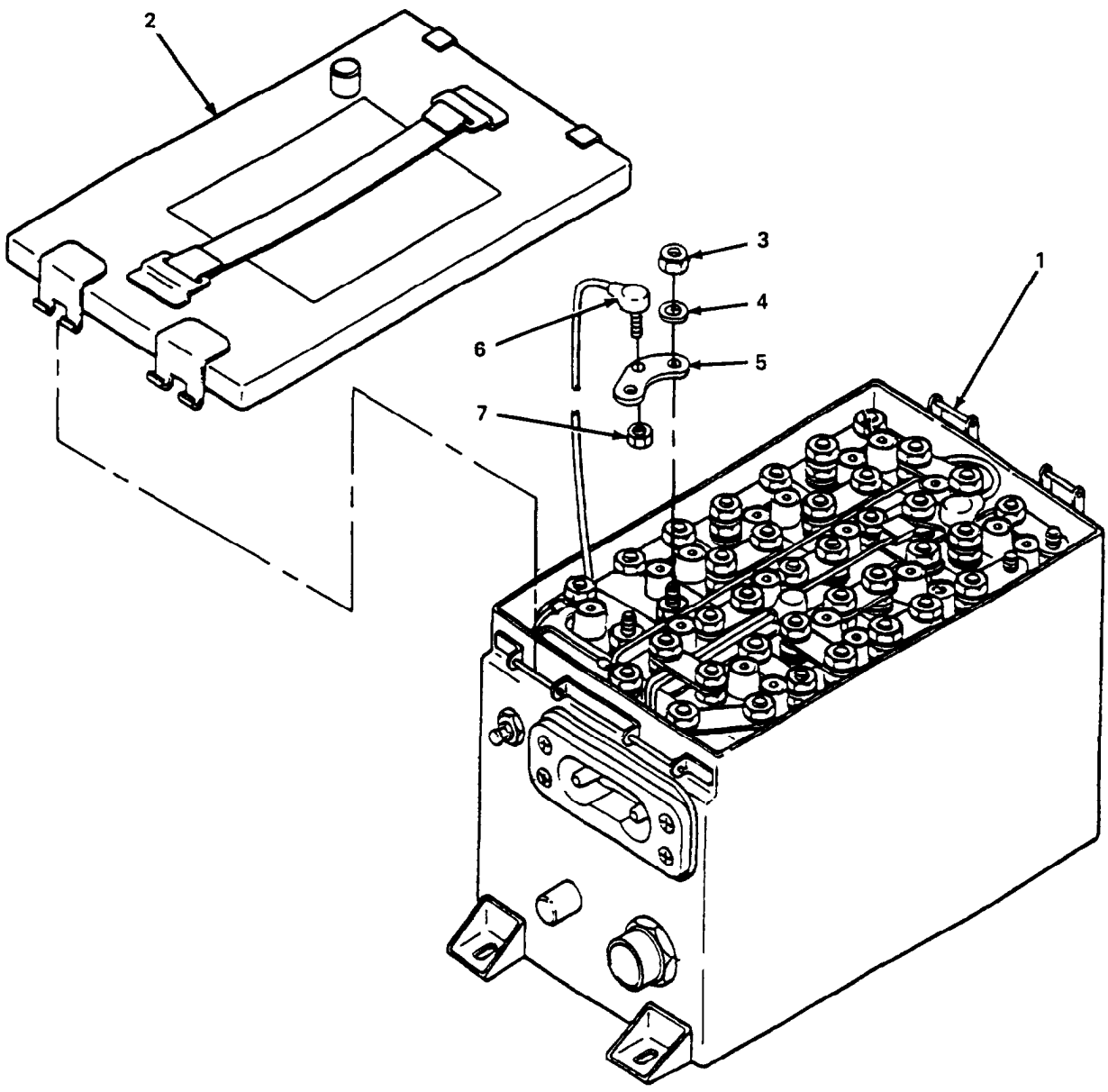

Figure 3-19. Battery 558/A Wiring Harness Thermostat Replacement.

3-21. Battery BB-558/A (Cont)

(h) Remove two nuts (15) and washer (16) and remove thermostat and link (17).

(i) Remove two nuts (18) and washer (19) and remove temperature sensor (20) and link (21).

(j) Remove two nuts (22) and washer (23) and remove link (24).

(k) Repeat step (j) for remaining links.

(l) Move wiring harness leads out of way.

(m) Install cell puller (refer to Appendix D) on cell (26) and secure with two nuts (22).

NOTE

Remove the cells starting with cell at approximately the center of the battery.

(n) Remove cell (26) and remove cell puller from cell.

(o) Repeat steps (m) and (n) for remaining cells.

(p) Remove shims (29).

(q) Tag and cut leads going to heating element (27) being replaced.

(r) Strip leads on new heating element (27) and leads in battery case approximately 0.125 inch (3.17 mm) back.

(s) Slide heat shrink tubing over leads.

(t) Install leads in splices and crimp slices to secure.

(u) Clean splices and leads with alcohol.

(v) Slide heat shrink tubing over splices and heat to shrink tubing in place.

CAUTION

Be very careful when installing cells and heater elements. Install the cells one at a time making sure heater elements are properly positioned and not damaged during cell installation.

(w) Refer to figure 1-6 for cell layout and install cells (26). Note placement of thermostat and thermal plate (28) and heater elements (27) during installation, and install during cell installation.

(x) Install shims (29) to obtain a tight fit. When installing shims between heating elements and cells, install one shim at a time and place subsequent shims between first shim and cell and not between first shim and heating element.

(y) Install temperature sensor (20) and link (21) and secure with two nuts (18) and washers (19).

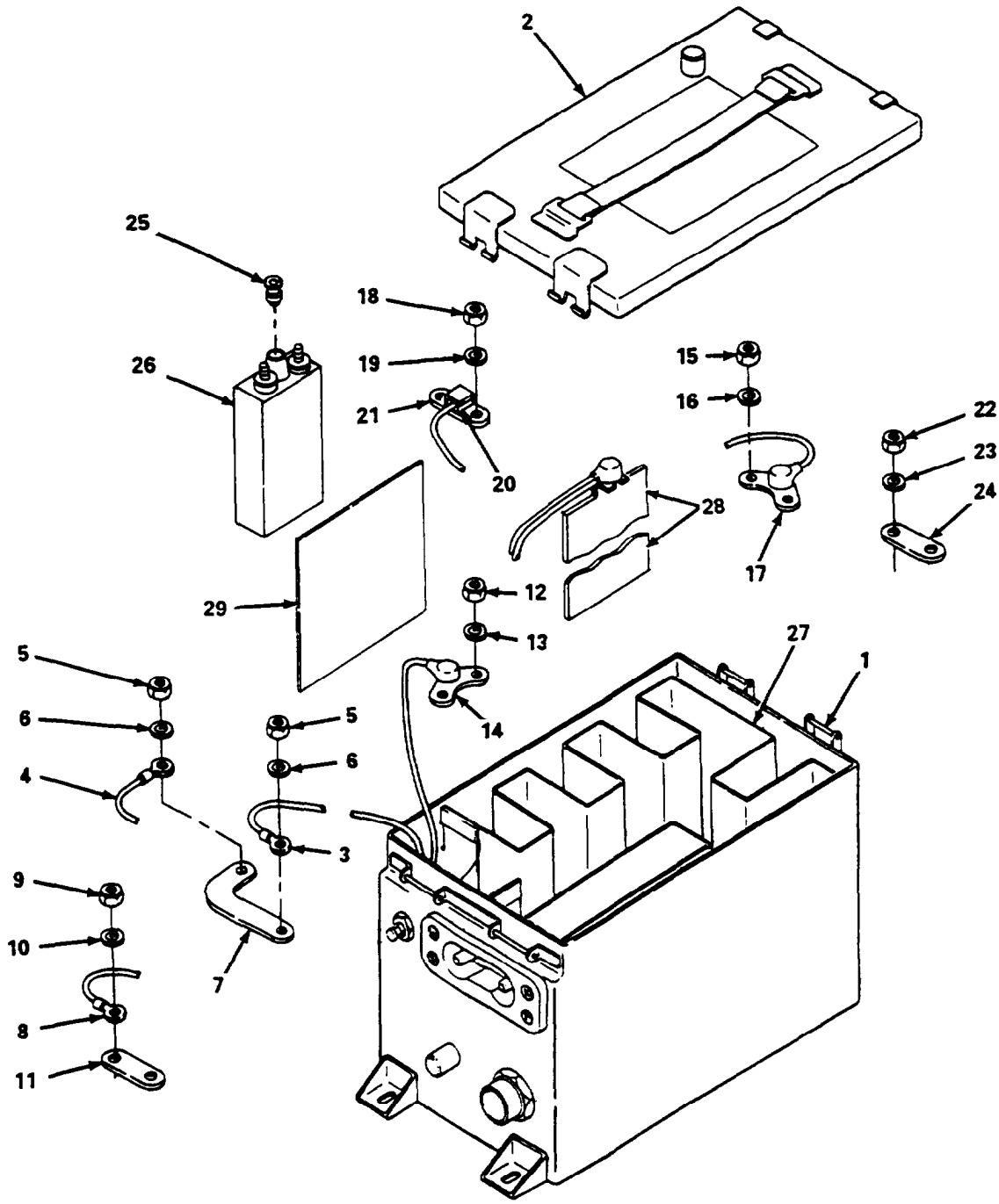

Figure 3-20. Battery BB-558/A Heater Element Replacement.

3-21. Battery BB-558/A (Cont)

(z) Install thermostat and link (17) and secure with two nuts (15) and washers (16). Torque nuts to 80-94 in-lb.

(aa) Install thermostat and link (14) and secure with two nuts (12) and washers (13). Torque nuts to 80-94 in-lb.

(ab) Install link (11) and lead (8) and secure with two nuts (9) and washer (10). Torque nuts to 80-94 in-lb.

(ac) install link (7) and leads (3) and (4) and secure with two nuts (5) and washer (6). Torque nuts to 80-94 In-lb.

(ad) Install link (24) and secure with two nuts (22) and washer (23). Torque nuts to 80-94 in-lb.

(ae) Repeat step (ad) for remaining links.

(af) Install and close cover (2) and secure with two latches (1).

(5) Thermostat and Thermal Plate Replacement (fig. 3-21).

(a) Unsnap two latches (1) and open and remove cover (2).

(b) Discharge battery (para 3-10).

WARNING

Remove all metal objects from fingers and wrists before working on nickel-cadmium batteries. Severe injuries from electrical burns could occur if metal objects on fingers and wrists accidentally short out battery.

Wear protective eyewear and clothing when working on nickel-cadmium batteries. If accidental contact with electrolyte occurs, wash contaminated area immediately with clean water and seek medical attention.

(c) Remove two nuts (3) and washers (4) and remove link (5).

(d) Remove two nuts (6) and washers (7) and remove link (8).

(e) Install cell puller (refer to Appendix D) on cell (9) and secure with two nuts (3)

(9 Remove cell (9) and remove cell puller from cell.

(g) Remove any loose shims.

(h) Remove nut (10) and remove thermostat (11) from thermal plate (12).

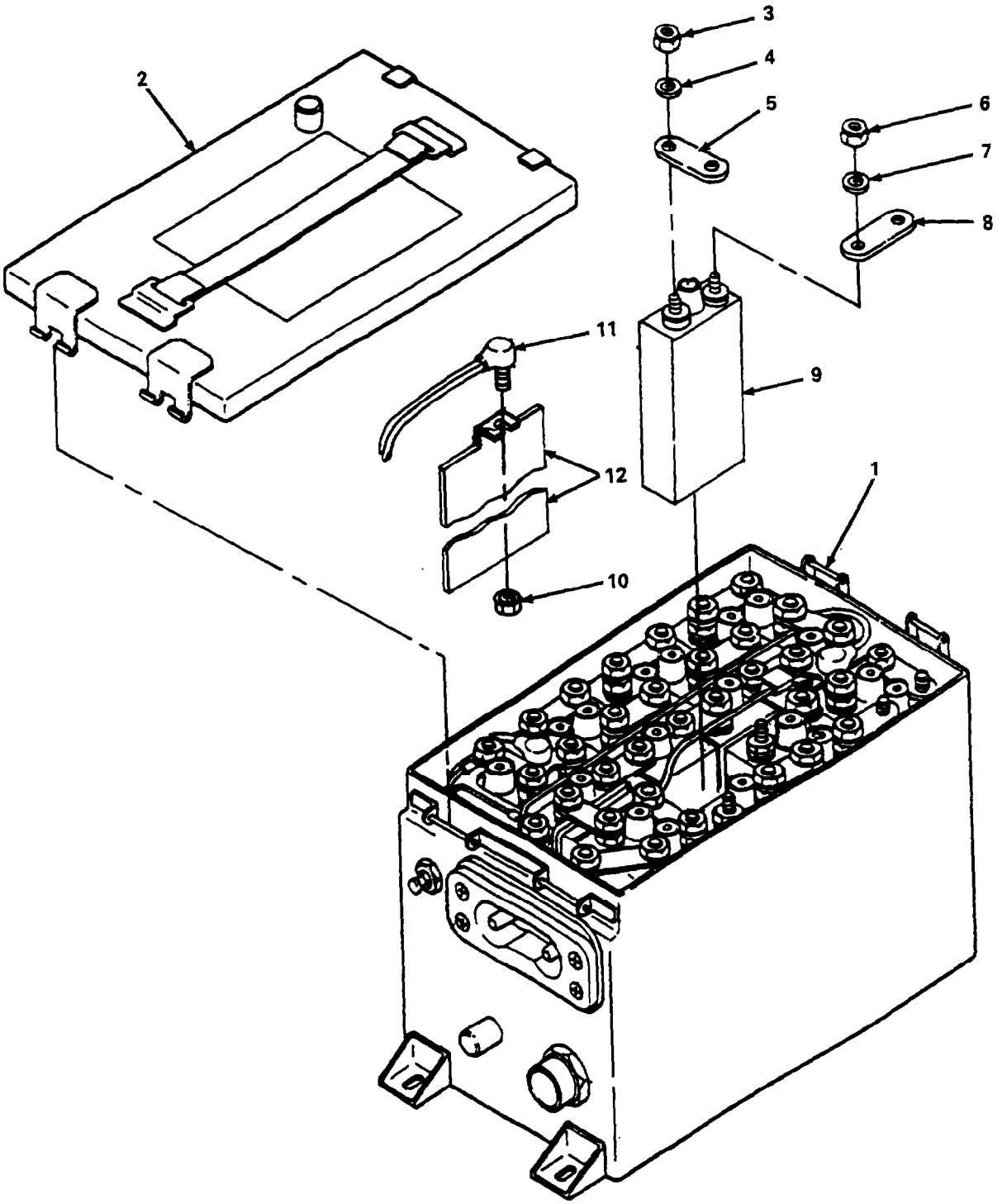

Figure 3-21. *Battery* BB-558/A Thermostat and Thermal *Plate Replacement.*

3-21. Battery BB-558/A (Cont)

(i) Inspect thermal plate and replace if cracked or corroded.

(j) Tag and cut leads going to thermostat (11).

(k) Strip leads on new thermostat (11) and leads in battery case approximately 0.125 in. (3.17 mm) back.

(l) Slide heat shrink tubing over leads.

(m) Install leads In splices and crimp splices to secure.

(n) Clean splices and leads with alcohol.

(o) Slide heat shrink tubing over splices and heat to shrink tubing in place.

(p) Install thermostat (11) on thermal plate (12) and secure with nut (10).

(q) Install thermal plate (12).

(r) Carefully Install cell (9) be sure not to damage heating element.

(s) Install any shims, removed to obtain a tight fit. Be careful when installing shims between cdl (9) and heating elements, install the first shim between the cell (9) and heating element and install all remaining shims between the first shim installed and cell (9).

(t) Install link (8) and secure with nut (6) and washer (7). Torque nuts to 80-94 in-lb.

(u) Install link (5) and secure with nut (3) and washer (4). Torque nuts to 80-94 in-lb.

(v) Install and close cover (2) and secure with two latches (1).

(6) Temperature Sensor Replacement (fig. 3-22).

(a) Unsnap two latches (1) and remove cover (2).

(b) Discharge battery (para 3-10).

WARNING

Remove all metal objects from fingers and wrists before working on nickel-cadmium batteries. Severe Injuries from electrical burns could occur if metal objects on fingers and wrists accidentally short out battery.

Wear protective eyewear and clothing when working on nickel-cadmium batteries. If accidental contact with electrolyte occurs, wash contaminated area immediately with clean water and seek medical attention.

3-21. Battery BB-558/A (Cont)

(e) Strip leads on new temperature sensor (5) and leads in battery case approximately 0.125 in. (3.17 mm) back.

(f) We heat shrink tubing over leads.

(g) Install leads in splices and crimp splices to secure.

(h) Clean splices and leads with alcohd.

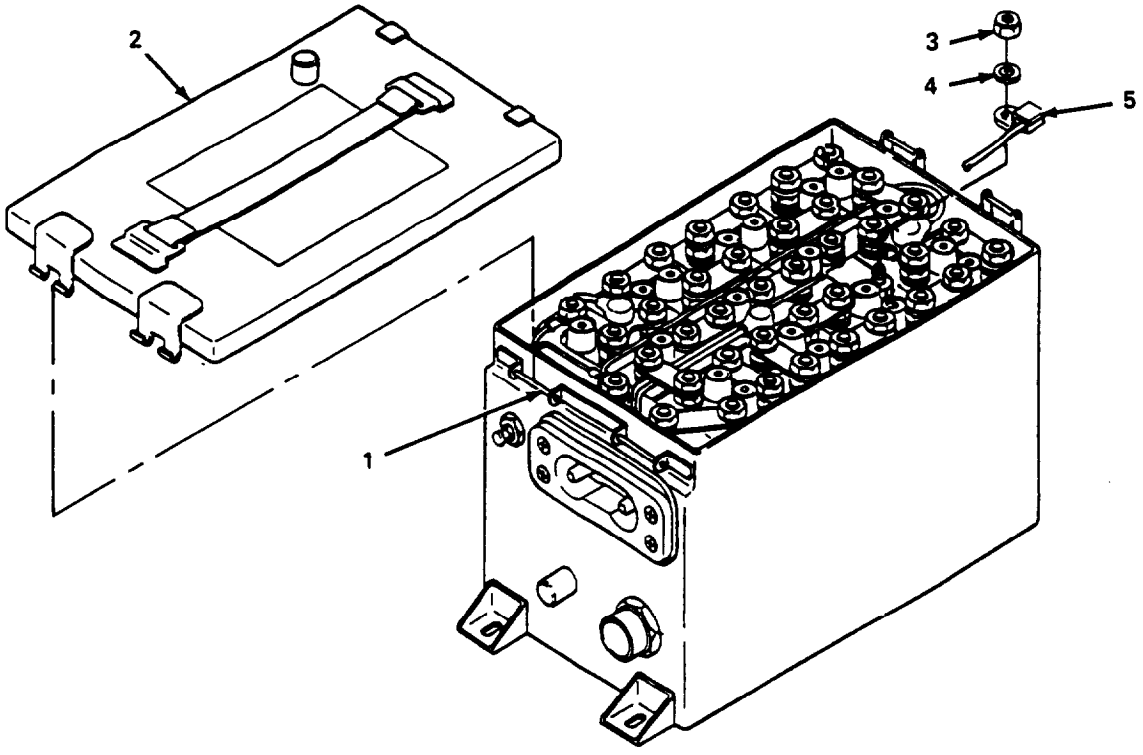

Figure 3-22. Battery BB-558/A Wiring Harness Temperature Sensor Replacement

(i) Slide heat shrink tubing over splices and heat to shrink tubing.

(j) Install temperature sensor (5) and secure with nut (3) and washer *(4).* Torque nut to 80-94 lb-in.

(k) Install shorting device on battery cells and allow battery to sit for at least 36 to 72 hours.

(l) Install and close cover (2) and secure with two latches (1).

3-21. Battery BB-558/A (Cont)

(l) Install and close cover (2) and secure with two latches (1).

(7) Circuit Breaker Replacement (fig. 3-23).

(a) Unsnap two latches (1) and open and remove cover (2).

(b) Discharge battery completely (para 3-10).

WARNING

Remove all metal objects from fingers and wrists before working on nickel-cadmium batteries. Severe injuries from electrical burns could occur if metal objects on fingers and wrists accidentally short out battery.

Wear protective eyewear and clothing when working on nickel-cadmium batteries. If accidental contact with electrolyte occurs, wash contaminated area Immediately with clean water and seek medical attention.

(c) Remove two nuts (3) washers (4) two black leads (5) and link (6).

(d) Remove one nut (7) and washer (8) securing red lead (9).

(e) Remove two nuts (10) and washer (11) and remove link (12).

(f) Install cell puller (refer to Appendix D) on cell (13) and secure with two nuts (3).

(g) Remove cell (13) and remove cell puller from cell.

(h) Remove nut (14) and washer (15) and remove circuit breaker (16).

(i) Tag and cut five leads from circuit breaker (16).

(j) Strip leads on new circuit breaker (16) and leads In battery case approximately 0.125 In. (3.17 mm) back.

(k) Slide heat shrink tubing over leads.

(l) Install leads in splices and crimp slices to secure.

(m) Slide heat shrink tubing over splices and heat to shrink tubing.

(n) Install circuit breaker (16) and secure with nut (14) and washer (15).

(o) Install cell (13) being careful not to damage heating elements.

(p) Install link (12) and secure with two nuts (10) and washer (11). Torque nuts to 80-94 in-lb.

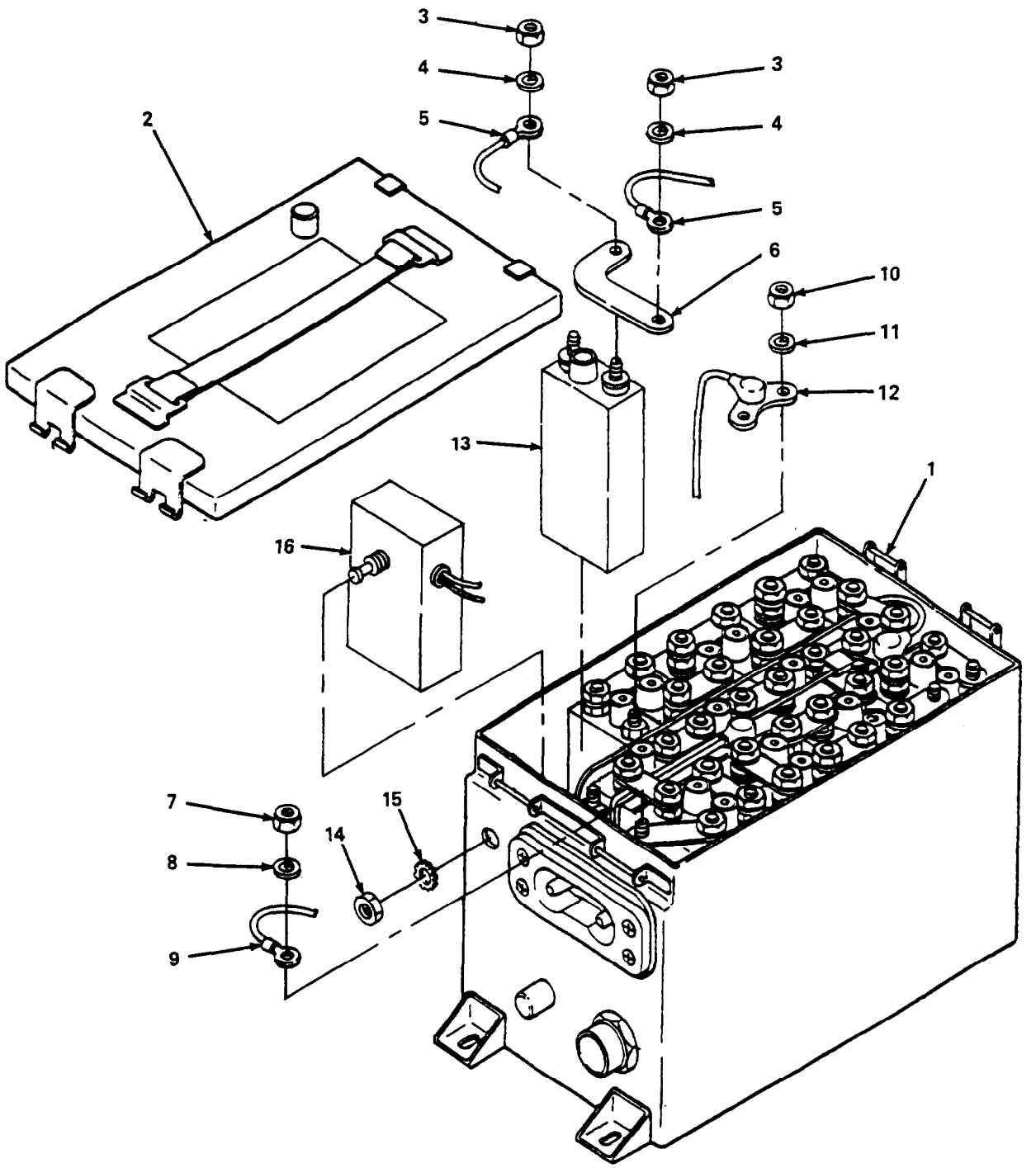

Figure 3-23. Battery BB-558/A Circuit Breaker Replacement,

3-21. Battery BB-558/A (Cont)

(q) Install red lead (9) and secure with nut (7) and washer (8). Torque nut to 80-94 in-lb.

(r) Install link (6) and two black leads (5) and secure with two nuts (3) and washers (4). Torque nuts to 80-94 in-lb.

(s) install and close cover (2) and secure with two latches (1).

d. Test.

(1) Charge battery (para 3-11).

(2) Test wiring harness in accordance with the procedures contained in Table 3-1, MALFUNCTION 7.

(3) Test battery in accordance with the procedures contained in paragraph 3-14.

3-22. Battery BB-564/A

This task covers: a. Disassembly/Reassembly b. Repair C. Test

INITIAL SETUP

Toots and Test Equipment

Multimeter AN/PSM-45A
Battery Service Tool Kit (NSN 5180-00-542-5812)
Tool kit, Electrical Repairer
(NSN 5180-00-323-4915)
Cell Puller (Appendix D)

Materials/Parts

Apron, Rubber (Item 2, Appendix C)
Gloves, Rubber (Item 8, Appendix C)
Goggles, Protective (Item 7, Appendix C)
Rags, Wiping (Item 12, Appendix C)
Corrosive Resistant Compound
(Item 3, Appendix C)
Brush, Nylon Bristle (Item 16, Appendix C)

Personnel

MOS68F

General Safety Instructions

Wear protective gear. Remove all metal objects from wrists and fingers. Observe warnings and cautions

References: TM 11-6140-203-23

a. Disassembly/Reassembly (fig. 3-24).

(1) Remove four screws (1) and nuts (2) and remove cover (3).

(2) Discharge battery (para 3-10).

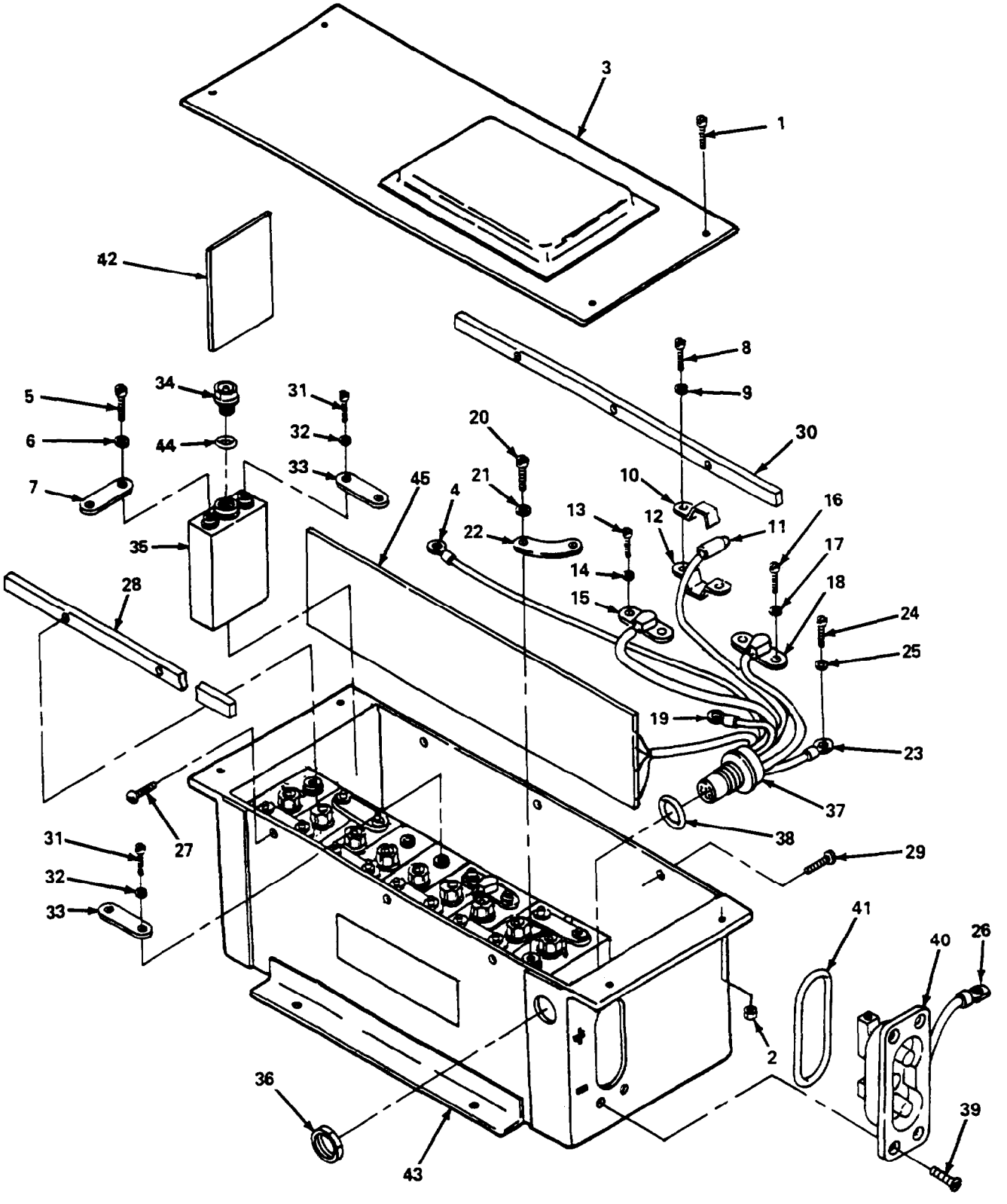

Figure 3-24. Battery BB-564/A Disassembly.

3-22. Battery BB-564/A (Cont)

WARNING

Remove all metal objects from fingers and wrists before working on nickel-cadmium batteries. Severe injuries from electrical bums could occur if metal objects on fingers and wrists accidentally short out battery.

Wear protected eyewear and clothing when working on nickel-cadmium batteries. If accidental contact with electrolyte occurs, wash contaminated area immediately with clean water and seek medical attention.

(3) Remove wire ties.

(4) Tag lead (4).

(5) Remove screw (5) and washer (6) and remove lead (4) and link (7).

(6) Remove two screws (8) and washers (9) and remove clamp (10), temperature sensor (11), and link (12).

(7) Remove two screws (13) and washers (14) and remove thermal switch link (15).

(8) Remove two screws (16) and washers (17) and remove thermal switch link (18).

(9) Tag lead (19).

(10) Remove two screws (20) and washers (21) and remove lead (19) and link (22).

(11) Tag lead (23).

(12) Remove screw (24) and washer (25) and remove lead (23) and connector lead (26).

(13) Remove three screws (27) and remove holddown bar (28).

(14) Remove three screws (29) and remove holddown bar (30).

(15) Remove two screws (31) and washers (32) and remove link (33).

(16) Repeat step (15) for remaining links.

(17) Loosen but do not remove filler caps (34).

NOTE

If a cell puller cannot be fabricated, screw a stud of the correct size into each of the terminals on the cell and pull the cell straight up using two pairs of pliers.

(18) Install cell puller (refer to Appendix D) on ceil (35), and secure with two screws (31).

3-22. Battery BB-564/A (Cont)

(19) Remove cell (35) and remove cell puller from cell.

(20) Repeat steps (18) and (19) for remaining cells.

(21) Remove nut (36) and remove wiring harness (37) and gasket (38).

(22) Remove four screws (39) and remove connector (40) and gasket (41).

(23) Remove shims (42).

(24) Wash battery case (43) and cover (3) with dean water and dry thoroughly.

(25) Inspect battery case (43) and cover (3) for scratches and corrosion. Remove corrosion and repaint battery case (43) and cover (3) as needed (para 3-9).

(26) Inspect connector (40) and replace if terminals are burnt or damaged or connector (40) Is cracked or otherwise damaged.

(27) Wash shims (42) with clean water and dry thoroughly.

(28) Inspect shims (42) and replace if cracked or missing pieces.

(29) inspect wiring harness (37) and replace if insulation on leads is cracked or burnt or wiring harness is otherwise damaged.

(30) Tighten all filler caps (34).

CAUTION

Do not allow water to enter cells. Water entering the cells will dilute and contaminate electrolyte.

(31) Wash all cells with dean water and dry thoroughly.

(32) Remove potassium carbonate (white deposits) from cells (35) using nylon bristle brush.

(33) Rewash cells (35) as needed and dry thoroughly.

(34) Inspect each cell (35) for cracks, distorted case, discoloration, and electrolyte contamination. Replace any cell that is cracked, discolored with bum spots, or contains contaminated electrolyte.

(35) Invert each cell for two minutes.

(36) After two minutes, lay each cell down, on blotter or paper towel for 30 seconds on each of its sides. Any wetting of the blotter or paper towel is cause to consider the cell unserviceable.

(37) Clean links (7) (22) and (33) with clean water and dry thoroughly.

(38) Remove potassium carbonate (white deposits) from links (7), (22), and (33) using nylon bristle brush.

3-22. Battery BB-564/A (Cont)

(39) Rewash links (7), (22), and (33) as needed and dry thoroughly.

(40) Inspect links (7) (22) and (33) and replace if plating material is worn through to base metal or link is otherwise damaged.

(41) Remove filler caps (34) and O-rings (44).

(42) Wash filler caps (34) with clean water and dry thoroughly.

(43) Inspect filler caps (34) and replace if cracked or otherwise damaged.

(44) inspect O-rings (44) and replace if cracked or deformed.

(45) Install filler caps (34) and O-rings (44) and tighten using filler cap wrench.

(46) Install wiring harness (37) and gasket (38) and secure with nut (36).

(47) Refer to figure 1-8 for cell layout.

(48) Position heating element (45) down center of battery case (43) and install two cells (35) to hold it place.

(49) Install remaining cells (35) one at a time being careful not to damage heating element.

(50) Install shims (42) to ensure a tight fit. When installing shims between heating element (45) and ceils (35), install the first shim and installing remaining shims between first shim installed and cells (35).

(51) Install holddown bar (30) and secure with three screws (29).

(52) Install holddown bar (28) and secure with three screws (27).

(53) Install connector (40) and gasket (41) and secure with four screws (39).

(54) Install connector lead (26) and lead (23) and secure with screw (24) and washer (25). Torque screw to 20-25 in-lb.

(55) Install link (22) and lead (19) and secure with two screws (20) and washers (21). Torque screw secured to connector (40) to 35-50 in.-ibs. Torque all other screws to 20-25 in.-tbs.

(56) Install thermal switch an link (18) and secure with two screws (16) and washers (17). Torque screws to 20-25 in-lb.

(57) Install thermal switch and link (15) and secure with two screws (13) and washers (14). Torque screws to 20-25 in-lb.

(58) Install link (12) and temperature sensor (11), and clamp (10) and secure with two screws (8) and washers (9). Torque screws to 20-25 in-lb.

(59) Install link (7) and lead (4) and secure with two screws (5) and washers (6). Torque screws to 20-25 in-lb.

3-22. Battery BB-564/A (Cont)

(60) Install links (33) and secure with two screws (31) and washers (32). Torque screws to 20-25 in-lb.

CAUTION

In the following step, use corrosion preventive compound sparingly, and only as required. Apply corrosion preventive compound when batteries are used in a corrosive atmosphere or when the battery is placed in storage. Overuse of corrosion preventive compound may leak into the cell causing cell contamination.

(61) Apply corrosion preventive compound (item 3, Appendix C) to the terminal links and hardware.

(62) install cover (3) with screws (1) and nuts (2).

(63) Return battery to administrative storage.

b. Repair. Repair of Battery BB-564/A consists of removal and replacement of the following items:

- Connector
- Wiring Harness
- Cell BB-652A/A
- Terminal link
- Filler cap

WARNING

When performing removal and replacement procedures, make sure the battery is completely discharged. Remove all jewelry and metal objects from fingers and wrists.

NOTE

Disassemble the battery only to the extent necessary to perform a repair or service.

(1) Discharge battery (para 3-10).

(2) To remove any of the above items, refer to the exploded view (fig. 3-24) and the appropriate sections of paragraph 3-22a.

(3) Upon completion of repair, perform the tests contained in paragraph 3-22c below.

NOTE

Performance test not required when replacing filler caps.

c. Test.

(1) Charge battery (para 3-11).

(2) Test the BB-564/A wiring harness in accordance with the procedures contained in Table 3-1 (MALFUNCTION 8).

(3) Test battery in accordance with the procedures contained in paragraph 3-14.

3-23. Battery BB-649A/A

This task covers: a. Disassembly/Reassembly b. Repair C. Test

INITIAL SETUP

Tools and Test Equipment

Multimeter AN/PSM-45A
Battery Service Tool Kit (NSN 5180-00-542-5812)
Tool Kit, Electrical Repairer
(NSN 5180-00-323-4915)
Cell Puller (Appendix D)

Materials/Parts

Apron, Rubber (Item 2, Appendix C)
Gloves, Rubber (item 8, Appendix C)
Goggles, Protective (Item 7, Appendix C)
Rags, Wiping (Item 12, Appendix C)
Corrosive Resistant Compound
(Item 3, Appendix C)
Brush, Nylon Bristle (Item 16, Appendix C)

Personnel

MOS68F

General Safetv Instructions

Wear protective gear. Remove all metal objects from wrists and fingers. Observe warnings and cautions

References: TM 11-6140-203-23P

a. Disassembly/Reassembly (fig. 3-25).

(1) Unsnap four latches (1) and remove cover (2).

(2) Discharge battery (para 3-10).

(3) Remove screw (3) washer (4), and spring washer (5).

(4) Remove screw (6) washer (7), and spring washer (8) and remove terminal link (9).

(5) Repeat steps (3) and (4) as necessary and remove remaining terminal links.

(6) Loosen but do not remove filler caps (10).

NOTE

if a cell puller cannot be fabricated, screw a stud of the correct size into each of the terminals on the cell and pull the cell straight up using two pairs of pliers.

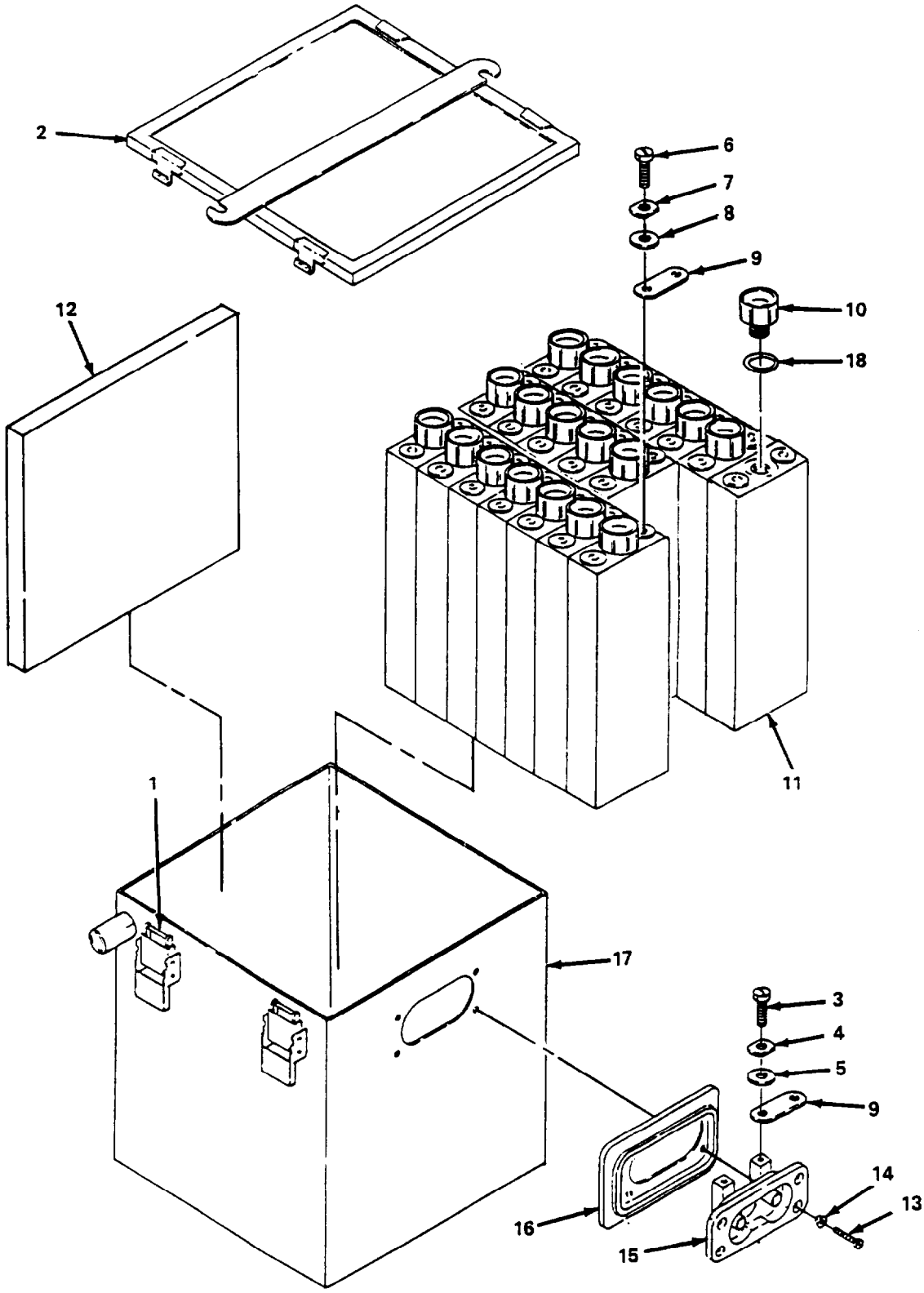

Figure 3-25. Battery BB-649A/A Disassembly.

3-23. Battery BB=649A/A (Cont)

(7) Install ceil puller (refer to Appendix D) on cell (11) and secure with two screws (3) and (6).

NOTE

Remove cells starting with ceil at approximately the center of the battery.

(8) Remove cell (11) and remove ceil puller from cell.

(9) Repeat steps (7) and (8) for remaining ceils.

(10) Remove shims (12).

CAUTION

When removing gasket, do not let scraper gouge battery case.

(11) Remove four screws (13) and washers (14) and remove connector (15) and gasket (16).

(12) Tighten all filler caps (10).

(13) Wash shims (12) with clean water and dry thoroughly.

(14) Inspect shims (12) and replace any piece which is damaged, using polyamide plastic sheet cut to appropriate size.

CAUTION

Do not allow water to enter cell. Water entering the cell will dilute and contaminate electrolyte.

(15) Wash each cell (11) with clean water and dry thoroughly.

(16) Remove potassium carbonate (white deposits) from cells (11) using nylon bristle brush.

(17) Rewash cells (11) as needed, and dry thoroughly.

(18) Inspect each cell for cracks, distorted case, discoloration, and electroiyte contamination. Replace any cell that is cracked, discolored with burn spots, or contains contaminated electroiyte.

(19) Invert the cell for two minutes.

(20) After two minutes, lay the cell down, on blotter or paper towel, for 30 seconds on each of its sides. Any wetting of the blotter or paper towel is cause to consider the cell unserviceable, unless the leak was from around the terminal. Replace a cell which is leaking around a terminal.

(21) Clean battery case (17) and cover (2) with water and dry thoroughly.

(22) Inspect battery case (17) and cover (2) for scratches, dents, and corrosion. Remove corrosion and repaint battery case and cover as needed (para 3-9).

3-23. Battery BB-649A/A (Cont)

(23) Remove filler caps (10) and O-rings (18) for cells (11) and clean filler caps thoroughly with water.

(24) Inspect O-rings (18) and replace if cracked, ripped, or otherwise damaged.

(25) Install filler caps (10) and O-rings (18) and tighten with fker cap wrench.

(26) Install gasket (16) and connector (15) and secure with four screws (13) and washers (14).

CAUTION

Do not hit cells to Install, a firm push from the top is all that should be required. If cells are hard to install, check cell layout for orientation of cells and retry.

(27) Refer to figure 1-7 for battery cell layout and install cells (11).

NOTE

Each battery must be constructed of cells made by the same manufacturer and must carry the same national stock number. Do not mix cells made by different manufacturers or cells with different national stock number from the same manufacturer to retrofit a battery.

(28) Install shims (12) to obtain a tight fit.

(29) Verify all cells (11) are properly installed and polarity is correct.

(36) Install terminal links (9) and secure with spring washers (8) and (5) washers (7) and (4) and screws (6) and (3). Torque screws (6) and (3) to 35-50 in-lb.

(31) Verify all terminal links are properly installed.

(32) Install shorting device on battery cells and allow battery to sit for at least 24 hours.

CAUTION

In the following step, use corrosion preventive compound sparingly and oniy as required. Apply corrosion preventive compound when batteries are used in a corrosive atmosphere or when the battery Is placed in storage. Overuse of corrosion preventive compound may leak Into the ceil causing cell contamination.

(33) Coat terminal links and hardware with corrosion preventive compound (Item 3, Appendix C).

(34) Install cover (2) and secure with four latches (1).

3-23. Battery BB-649A/A (Cont)

b. Repair. Repair of Battery 136649A/A consists of removal and replacement of the following Items:

- o Connector
- o Cell BBXH8/A
- o Terminal link
- o Filler cap

WARNING

When performing removal and replacement procedures, make sure the battery is completely discharged. Remove all jewelry and metal objects from fingers and wrists.

NOTE

Disassemble the battery only to the extent necessary to perform a repair or service.

(1) Discharge battery (para 3-10).

(2) To remove any of the above items, refer to the exploded view (fig. 3-25) and the appropriate sections of paragraph 3-23a.

(3) Upon completion of repair, perform the test procedures contained in paragraph 3-23c, below.

NOTE

Performance test not required when replacing filler caps.

c. Test.

(1) Charge battery (para 3-11).

(2) Test battery in accordance with the procedures contained in paragraph 3-14.

3-24. Battery BB-664/A

This task covers: a. Disassembly/Reassembly b. Repair c. Test

INITIAL SETUP

Tools and Test Equipment

Multimeter AN/PSM45A
Battery Service Tools Kit (NSN 5166605425612)
Tool kit, Electrical Repairer
(NSN 5160-00-323-4915)
Ceil Puller (Appendix D)

Materials/Parts

Apron, Rubber (item 2, Appendix C)
Gloves, Rubber (item 8, Appendix C)
Goggles, Protective (item 7, Appendix C)
Rags, Wiping (item 12, Appendix C)
Corrosive Resistant Compound
(item 3, Appendix C)
Brush, Nyton Bristle (item 16, Appendix C)

Personnel

MOS66F

General Safety instructions

Wear protective gear. Remove ail metal objects from wrists and fingers. Observe warnings and cautions

References: TM 11-6140-203-23P

a. Disassembly/Reassembly (fig. 3-26).

(1) Remove four screws (1) and nuts (2) and remove cover (3).

(2) Discharge battery (para 3-10).

WARNING

Remove ail metal objects from fingers and wrists before working on nickel-cadmium batteries. Severe injuries from electrical bums could occur if metal objects on fingers and wrists accidentally short out battery.

Wear protected eyewear and clothing when working on nickel-cadmium batteries. If accidental contact with electrolyte occurs, wash contaminated area immediately with clean water and seek medical attention.

(3) Remove three screws (4) securing holddown bar (5).

(4) Remove three screws (6) securing holddown bar (7).

(5) Remove ail wire ties.

(6) Remove two screws (6) and washers (9) securing thermal switch and link (10).

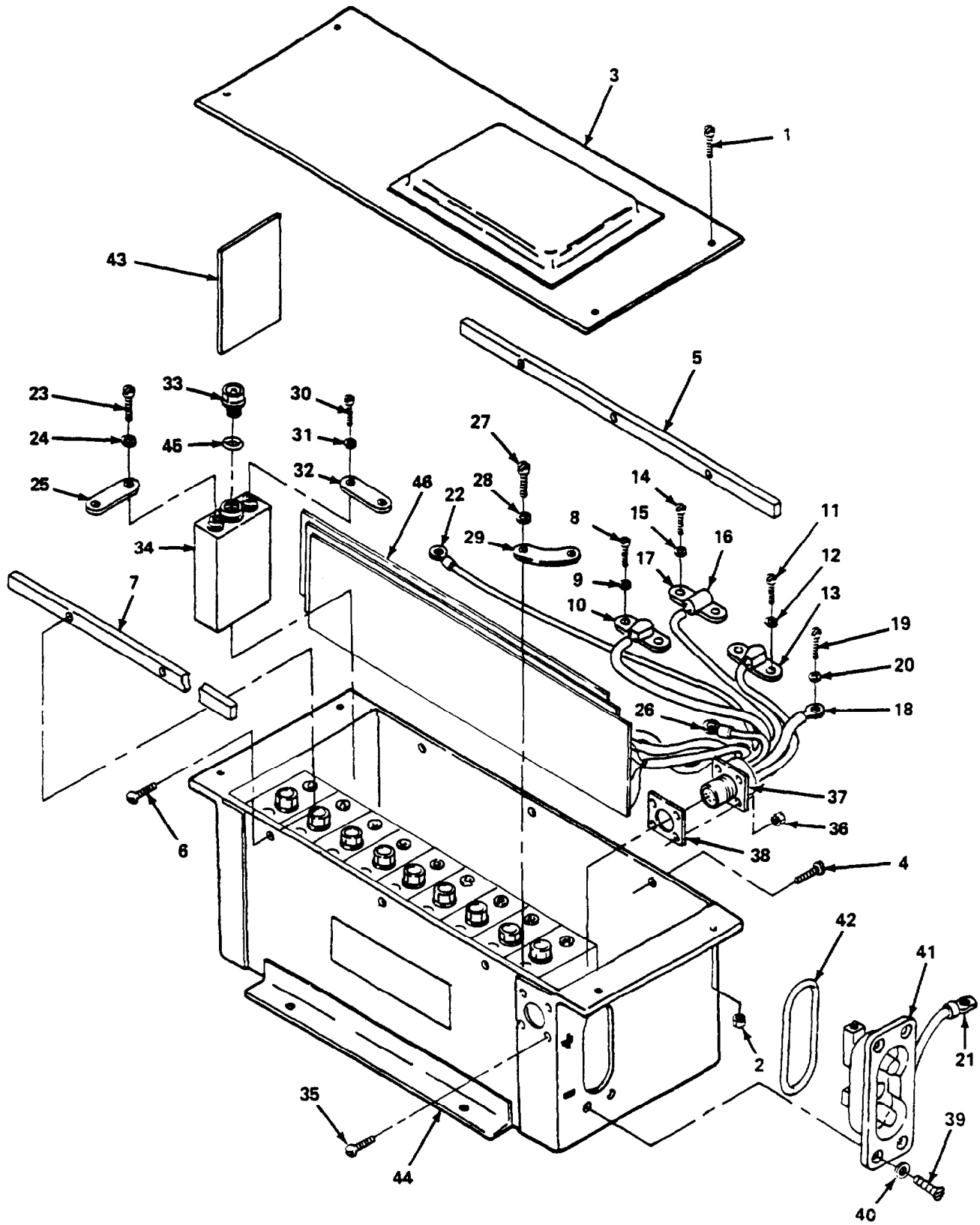

Figure 3-26. Battery BB-664/A Disassembly.

3-24. Battery BB-664/A (Cont)

(7) Remove two screws (11) and washers (12) securing thermal switch and link (13).

(6) Remove two screws (14) and washers (15) securing temperature sensor (16) and link (17).

(9) Tag lead (18).

(10) Remove screw (19) and washer (20) securing connector lead (21) and lead (18).

(11) Tag lead (22).

(12) Remove two screws (23) and washers (24) and remove link (25) and lead (22).

(13) Tag lead (26).

(14) Remove two screws (27) and washers (28) and remove link (29) and lead (26).

(15) Remove two screws (30) and washers (31) and remove link (32).

(16) Repeat step (15) for remaining terminal links.

(17) Loosen but do not remove filler caps (33).

NOTE

If a ceil puller cannot be fabricated, screw a stud of the correct size into each of the terminals on the ceil and pull the ceil straight up using two pairs of pliers.

(18) install ceil puller (refer to Appendix D) on ceil (34) and secure with two screws (30).

(19) Remove ceil (34) and remove ceil puller from ceil.

(20) Repeat steps (18) and (19) for remaining ceils.

(21) Tighten ail ceil filler caps (33).

(22) Remove four screws (35) and nuts (36) securing wiring harness (37) and remove wiring harness and gasket (38).

(23) Remove four screws (39) and washers (40) and remove connector (41) and gasket (42).

(24) Remove shims (43).

(25) Wash battery case (44) and cover (3) with clean water and dry thoroughly.

(26) inspect battery case (44) and cover (3) for scratches and corrosion. Remove ail corrosion and repaint battery case and cover as needed (para 3-9).

(27) inspect shims (43) and replace any shims which are cracked or otherwise damaged.

3-24. Battery BB-664/A (Cont)

CAUTION

Do not allow water to enter ceil. Water entering the ceil will dilute and/or contaminate electrolyte.

(28) Wash ceils (34) with clean water and dry thoroughly.

(29) Remove all potassium carbonate (white deposits) from cells (34) using nylon bristle brush.

(36) Rewash ceils (34) as needed.

(31) Inspect each cell (34) for cracks, distorted case, discdoration, and electrolyte contamination. Replace any ceil that is cracked, discolored with burn spots, or contains contaminated electrdyte.

(32) invert the cells (34) for two minutes.

(33) After two minutes, lay each ceil down on blotter or paper towel, for 30 seconds on each of its sides. Any wetting of blotter or paper towel is cause to consider the ceil unserviceabie and should be replaced.

(34) Using filler cap wrench, remove filler caps (33) and O-rings (45).

(35) Wash ail filler caps (33) in clean water and dry thoroughly.

(36) inspect O-rings (45) and replace if cracked or deformed.

(37) inspect filler caps (33) and O-rings (45) and tighten using filler cap wrench.

(38) Ensure ail gasket mounting surfaces are clean and old gasket material is removed.

(39) install connector (41) and gasket (42) and secure with four screws (39) and washers (40).

(46) Install wiring harness (37) and gasket (38) and secure with four screws (35) and nuts (36).

(41) Refer to figure 1-8 or cell layout.

NOTE

Each battery must be constructed of ceils manufactured by the same manufacturer and must carry the same stock numbers. Do not mix cells made by different manufacturers or ceils with different stock numbers.

CAUTION

Do not hit ceils to install. A firm push is ail that should be required. if ceils are hard to install, check ceil layout for orientation of ceils and retry.

(42) Install two ceils (34) making sure heating elements (46) are properly positioned.

3-24. Battery BB-664/A (Cont)

(43) Install remaining cells (34) being careful not to damage heating elements (46).

(44) Install shims (43) as needed to obtain a tight fit. if installing shim between heating elements (46) and cells (34), install one shim between heating element and cell and additional shims between shim and cell.

(45) Install link (29) and lead (26), as tagged, and secure with two screws (27) and washers (28). Torque screw connected to connector (41) to 35-50 in.-ibs. Torque ail other screws to 20-25 in.-lbs.

(46) Install link (25) and lead (22), as tagged, and secure with two screws (23) and washers (24). Torque screws to 20-25 in-lb.

(47) Install connector lead (21) and lead (18), as tagged, and secure with screw (19) and washer (20). Torque screw to 20-25 in-lb.

(48) Install link (17) and temperature sensor (16) and secure with two screws (14) and washers (15). Torque screws to 20-25 in-lb.

(49) Install thermal switch and link (13) and secure with two screws (11) and washers (12). Torque screws to 20-25 in-lb.

(50) Install link (32) and secure with two screws (30) and washers (31). Torque screws to 20-25 in-lb.

(51) Repeat step (50) for remaining links (32).

(52) Install holddown bar (7) and secure with three screws (6).

(53) Install holddown bar (5) and secure with three screws (4).

CAUTION

In the following step, use corrosion preventive compound sparingly and only as required. Apply corrosion preventive compound when batteries are used in a corrosive atmosphere or when the battery is placed in storage. Overuse of corrosion preventive compound may leak into the cell causing cell contamination.

(54) Coat terminal links and hardware with corrosion preventive compound (item 3, Appendix C).

(55) Install cover (3) with screws (1) and nuts (2).

(56) Return battery to administrative storage.

b. Repair. Repair of Battery BB-664/A consists of removal and replacement of the following items:

- Connector
- Wiring harness
- Ceil 88-475/A
- Terminal link
- Filler cap (no electrical test required)

3-24. Battery BB-664/A (Cont)

WARNING

When performing removal and replacement procedures, make sure the battery is completely discharged. Remove ail jewelry and metal objects from fingers and wrists.

NOTE

Disassemble the battery only to the extent necessary to perform a repair or service.

(1) Discharge battery (para 3-10).

(2) To remove any of the above items, refer to the exploded view (fig. 3-26) and the appropriate sections of paragraph 3-24.a.

(3) Upon completion of repair, perform the test procedures contained in paragraph 3-24c, below.

NOTE

Performance test not required when replacing filler caps.

c. Teat.

(1) Charge battery (para 3-11).

(2) Test wiring harness in accordance with the procedures contained in Table 3-1, MALFUNCTION 8.

(3) Test battery in accordance with procedures contained in paragraph 3-14.

3-25. Battery BB-678A/A

This task covers: a. Disassembly/Reassembly b. Repair c. Test

INITIAL SETUP

Tools and Test Equipment

Multimeter AN/PSM-45A
Battery Service Tools Kit (NSN 5180-00-542-5812)
Tools kit, Electrical Repairer
(NSN 5180-00-323-4915)
Ceil Puller (Appendix D)

Materials/Parts

Apron, Rubber (item 2, Appendix C)
Gloves, Rubber (item 8, Appendix C)
Goggles, Protective (item 7, Appendix C)
Rags, Wiping (item 12, Appendix C)
Corrosive Resistant Compound
(item 3, Appendix C)
Brush, Nylon Bristle (item 16, Appendix C)

Personnel

MOS68F

General Safety instructions

Wear protective gear. Remove ail metal objects from wrists and fingers. Observe warnings and cautions

References: TM 11-6140-203-23P

a. Disassembly/Reassembly (fig. 3-27).

(1) Remove four screws (1), nuts (2) and washers (3) and remove cover (4).

(2) Discharge battery (para 3-10).

WARNING

Remove ail metal objects from fingers and wrists before working on nickel-cadmium batteries. Severe injuries from electrical burns could occur if metal objects on fingers and wrists accidentally short out battery.

Wear protective eyewear and clothing when working on nickei-cadmium batteries. if accidental contact with electrdyte occurs, wash contaminated area immediately with clean water and seek medical attention.

(3) Tag leads (5) and (6).

(4) Remove screw (7) and washer (8) securing lead (5).

(5) Remove screw (9) and washer (10) securing lead (6).

(6) Remove two screws (11) and washer (12) and remove link (13).

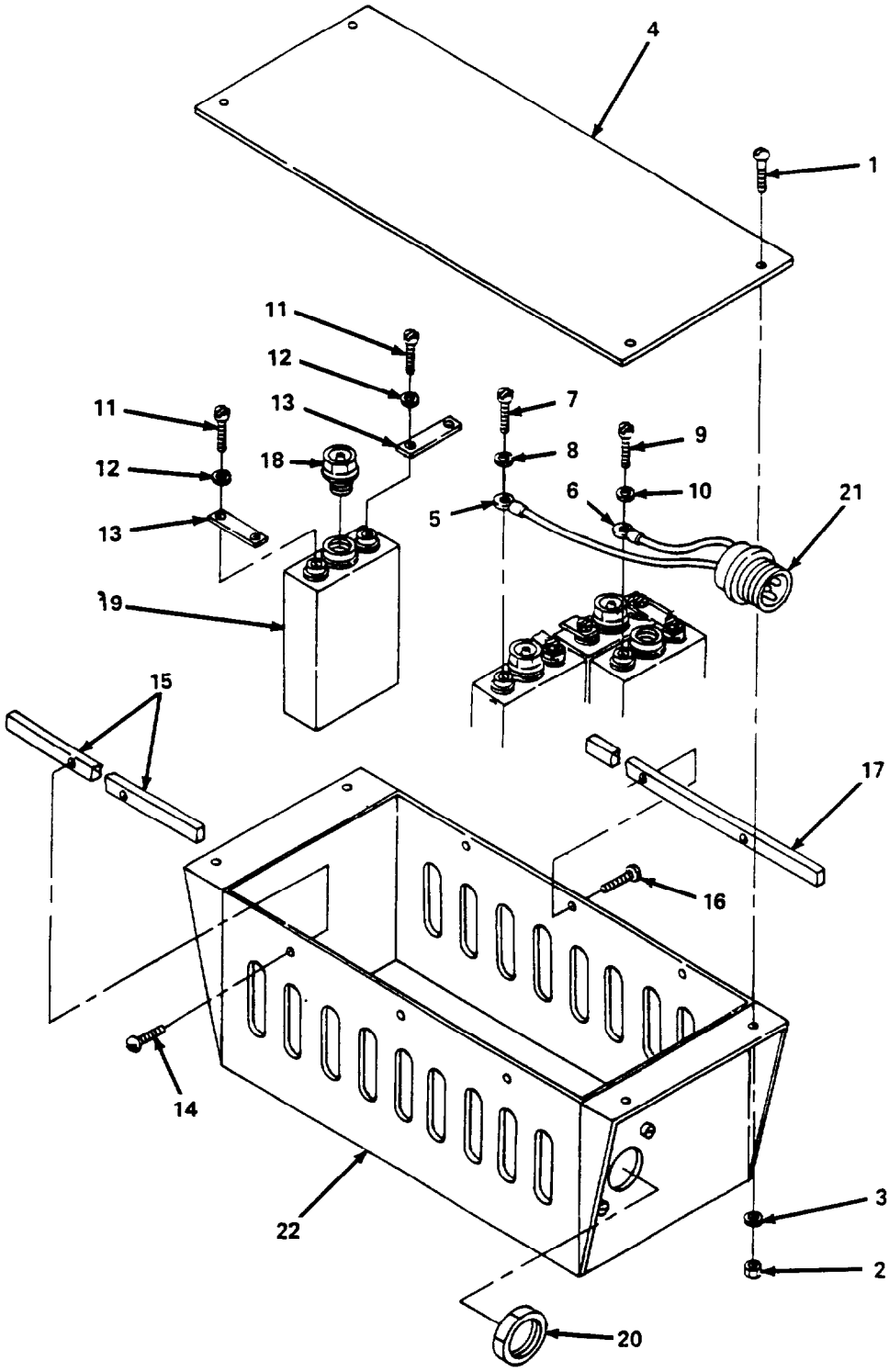

Figure 3-27. Battery BB-678A/A Disassembly.

3-25. Battery BB-678A/A (Cont)

(7) Repeat step (6) for remaining links.

(8) Remove three screws (14) and remove holddown bar (15).

(9) Remove three screws (16) and remove holddown bar (17).

(10) Loosen but do not remove filler caps (18).

NOTE

If a cell puller cannot be fabricated, screw a stud of the correct size into each of the terminals on the cell and pull the ceil straight up using two pairs of pliers.

(11) install ceil puller (refer to Appendix D) on ceil (19) and secure with two screws (11).

NOTE

Remove cells starting with cell at approximately the center of the battery.

(12) Remove cell (19) and remove ceil puller from ceil (19).

(13) Repeat steps (11) and (12) and remove remaining ceils.

(14) Remove safety wire securing nut (20).

(15) Remove nut (20) and remove connector (21).

(16) Tighten ail filler caps (18).

(17) Wash battery case (22) and cover (4) with water and dry thoroughly.

(18) inspect battery case (22) and cover (4) for scratches, corrosion, and dents. Remove ail corrosion and touch up paint as needed (para 3-9).

CAUTION

Do not allow water to enter ceil. Water entering the ceil will dilute and/or contaminate dectrdyte.

(19) Wash each ceil with water and dry thoroughly.

(20) Remove potassium carbonate (white deposits) from top of ceil (19) using nylon bristle brush.

(21) Rewash ceils (19) as needed and dry thoroughly.

(22) Inspect each ceil (19) for cracks, distorted case, discoloration, and electrdyte contamination. Replace any ceil that is cracked, discolored with burn spots, or contains contaminated electrolyte.

(23) Invert each cell for two minutes.

3-25. Battery BB-678A/A (Cont)

(24) After two minutes, lay the cell down on blotter or paper towel, for 30 seconds on each of its sides. Any wetting of the blotter or paper towels Is cause to consider the cell unserviceable.

(25) Remove filler caps (18) from cells (19) and clean all filler caps with water and dry thoroughly. Ensure there Is no dirt or debris in vent of filler caps.

(26) Install filler caps (18) in cells (19) and tighten with filler cap wrench.

(27) Inspect connector (21) and replace if pins are damaged or electrical leads are burnt, or Insulation is cracked or missing.

(28) Install connector (21) and secure with nut (20). Replace safety wire. See step (14).

NOTE

Each battery must be constructed of cells manufactured by the same manufacturer and must carry the same stock number. Do not mix cells made by different manufacturers or cells with different stock numbers from the same manufacturer to retrofit a battery.

CAUTION

Do not hit cells to install. A firm push is all that should be required. If cells are hard to install, check cell layout for orientation of cells and loosen but do not remove filler caps.

(29) Refer to figure 1-9 for cell layout and install battery ceils (19).

(36) Verify all ceils are properly installed and polarity is correct.

(31) Install lead (5) and secure with screw (7) and washer (8). Torque screw to 20-25 in-lb.

(32) Install lead (6) and secure with screw (9) and washer (10). Torque screw to 20-25 in-lb.

(33) Install terminal link (13) and secure with two screws (11) and washers (12). Torque screws to 20-25 In-lb.

(34) Repeat step (33) for remaining terminal links,

CAUTION

In the following step, use corrosion preventive compound sparingly and only as required. Apply corrosion preventive compound when batteries are used in a corrosive atmosphere or when the battery is placed In storage. Overuse of corrosion preventive compound may leak in to the cell causing ceil contamination.

(35) Apply corrosion preventive compound (Item 3, Appendix C) to links and hardware.

(36) Install cover (4) and secure with four screws (1) nuts (3), and washers (2).

(37) Return battery to administrative storage.

3-25. Battery BB-678A/A (Cont)

b. Repair. Repair of Battery BB-678A/A consists of removal and replacement of the following Items:

- connector
- Cell BBa2/A
- Terminal link
- Filler cap

WARNING

When performing removal and rep&cement procedures, make sure the battery is completely discharged. Remove all jewelry and metal objects from fingers and wrists.

NOTE

Disassemble the battery only to the extent necessary to perform a repair or service.

(1) Discharge battery (para 3-10).

(2) To remove any of the above Items, refer to the exploded view (fig. 3-27) and the appropriate sections paragraph 3-25a.

(3) Upon completion of repair, perform the test procedures contained In paragraph 3-25c, below.

NOTE

Performance test not required when replacing filler caps.

c. Teat.

(1) Charge battery (para 3-11).

(2) Test battery in accordance with the procedures contained in paragraph 3-14.

3-26. Battery BB-706/U

This task covers: a. Disassemmbly/Reassembly b. Repair c. Test

INITIAL SETUP

Tools and Test Equipment

Multimeter AN/PSM45A
Battery Service Tool Kit (NSN 5180-00-542-5812)
Tool kit, Electrical Repairer
(NSN 5180-00-323-4915)
Cell Puller (Append& D)

Materials/Parts

Apron, Rubber (Item 2, Append& C)
Gloves, Rubber (Item 8, Appendix C)
Goggles, Protective (Item 7, Appendix C)
Rags, Wiping (Item 12, Append& C)
Corrosive Resistant Compound
(Item 3, Appendix C)
Brush, Nylon Bristle (Item 16, Appendix C)

Personnel

MOS68F

General Safety Instructions

Wear protective gear. Remove all metal objects from wrists and fingers. Observe warnings and cautions

References: TM 11-6140-203-23P

a. Disassembly/Reassembly (fig. 3-28).

(1) Remove six screws (1) and remove cover. (2).

(2) Discharge battery (para 3-10).

WARNING

Remove all metal objects from fingers and wrists before working on nickel-cadmium batteries. Severe injuries from electrical bums could occur if metal objects on fingers and wrists accidentally short out battery.

Wear protective eyewear and clothing when working on nickel-cadmium batteries. If accidental contact with electrolyte occurs, wash contaminated area Immediately with clean water and seek medical attention.

(3) Remove two nuts (3) and washers (4) and remove lead (5).

(4) Remove nut (6) and washer (7) securing lead (8).

(5) Remove nut (9) and washer (10) securing lead (11).

(6) Remove two nuts (12) and washers (13) and remove link (14).

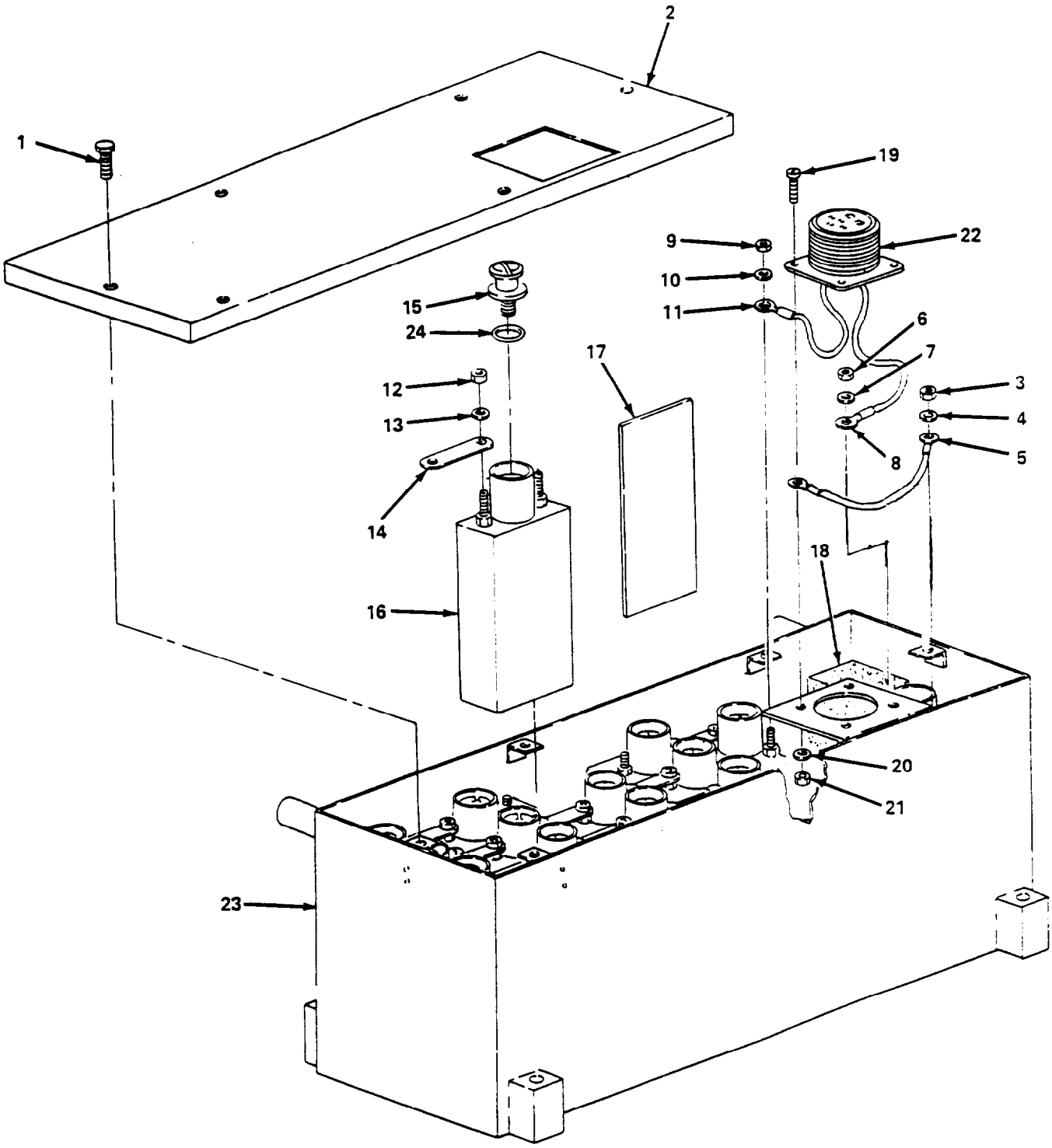

Figure 3-28. Battery BB-708/U Disassembly.

3-26. Battery BB-708/U (Cont)

(7) Repeat step (6) for remaining links.

(8) Loosen but do not remove filler caps (15).

NOTE

Remove cells starting with the cell at approximately the center of the battery.

(9) Remove cell (16) and remove cell puller from cell.

(10) Repeat steps (8) and (9) for remaining cells.

(11) Remove shims (17) and spacer blocks (18).

(12) Remove four screws (19) lockwasher (20) and nuts (21) and remove connector assembly (22).

(13) Tighten all filler caps (15). Torque steel filler caps to 5/8 in.-lbs. and nylon filler caps to 3/4 in.-lbs.

(14) Wash battery case (23) and cover (2) with clean water and dry thoroughly.

(15) Inspect battery case (23) and replace if cracked or excessively damaged.

(16) Inspect cover (2) and replace if cracked or excessively damaged.

(17) Wash shims (17) and spacer Mocks (18). Replace if cracked or pieces are missing. Replace spacer blocks if cracked, corroded, or otherwise damaged.

CAUTION

Do not allow water to enter cells. Water entering the cells will dilute electrolyte and contaminate electrolyte.

(18) Wash cells (16) with clean water and dry thoroughly.

(19) Clean potassium carbonate (white deposits) from cells (16) using nylon bristle brush.

(20) Rewash cells (16) as needed and dry thoroughly.

(21) Inspect each cell (16) for cracks, distorted case, discoloration, and electrolyte contamination. Replace any cell (16) that is cracked, discolored with burn spots, or has contaminated electrolyte.

(22) Invert each ceil (16) for two minutes.

(23) After two minutes, lay each cell down on blotter or paper towel, for 30 seconds on each of its sides. Any wetting of the blotter or paper towel is reason to consider the cell unserviceable.

(24) Remove filler caps (15) and O-rings (24).

(25) Wash all filler caps (15) in clean water and dry thoroughly.

3-26. Battery BB-706/U (Cont)

(26) Inspect filler caps (15) and replace if damaged.

(27) Inspect O-rings (24) and replace if cracked or deformed.

(28) Install filler caps (15) and O-rings (24) and tighten. Torque steel filler caps to 5/8 in.-lbs. and nylon filler caps to 3/4 in.-lbs.

(29) Inspect connector assembly (22) and replace if insulation on leads (8) and (11) is cracked or burned or connector is otherwise damaged.

(30) Clean terminal links (14) with clean water.

(31) Remove potassium carbonate (white deposits) from links (14) using nylon bristle brush.

(32) Inspect links (14) and replace if plating material is worn through to base metal or links (14) are otherwise damaged.

(33) Install connector assembly (22) and secure with four screws (19) washers (20) and nuts (21).

NOTE

Each battery must be constructed of cells made by the same manufacturer and must carry the same stock numbers. Do not mix cells made by different manufacturers or ceils with different stock numbers.

CAUTION

Do not hit cells, to install, a firm push from the top Is all that should be required. If cells are hard to install, check ceil layout for proper orientation, and loosen but do not remove filler caps.

(34) Refer to figure 1-10 for cell layout and Install cells (16) and spacer blocks (18).

(35) Verify proper orientation of cells (16) and polarity.

(36) Install shims (17) as needed to obtain a tight fit.

(37) Install link (14) and secure with two nuts (12) and washers (13). Torque nuts to 20-25 In-lb. Repeat for remaining links.

(38) Install lead (11) and secure with nut (9) and washer (10). Torque nut to 20-25 In-lb.

(39) Install lead (8) and secure nut (6) and washer (7). Torque nut (6) to 20-25 In-lb.

(40) Install lead (5) and secure with two nuts (3) and washers (4). Torque nuts (3) to 20-25 in-lb.

(41) Install shorting device on battery cells and allow battery to sit for at least 24 hours.

3-26. Battery BB-708/U (Cont)

CAUTION

In the following step, use corrosion preventive compound sparingly and only as required. Apply corrosion preventive compound when batteries are used In a corrosive atmosphere or when the battery is placed in storage. Overuse of corrosion preventive compound may leak into the cell causing ceil contamination.

(42) Coat links and hardware with corrosion preventive compound (Item 3, Appendix C).

(43) Install cover (2) and secure with six screws (1).

b. Repair. Repair of Battery BB-708/U consists of removal and replacement of the following items:

- Connector
- Cell 5H120
- Terminal link
- Filler cap

WARNING

When performing removal and replacement procedures, make sure the battery is completely discharged. Remove all jewelry and metal objects from fingers and wrists.

NOTE

Disassemble the battery only to the extent necessary to perform a repair or service.

(1) Discharge battery (para 3-10).

(2) To remove any of the above items, refer to the exploded view (fig. 3-28) and the appropriate sections of paragraph 3-28a.

(3) Upon completion of repair, perform the test procedures contained in paragraph 3-28c, below.

NOTE

Performance test not required when replacing filler caps.

c. Teat.

(1) Charge battery (para 3-11).

(2) Test battery In accordance with procedures contained In paragraph 3-14.

3-27. Battery BB-716/A

This task covers: a. Disassembly/Reassembly b. Repair c. Test

INITIAL SETUP

Tools and Test Equipment

Multimeter AN/PSM-45A
Battery Service Tools Kit (NSN 5186665425812)
Tools kit, Electrical Repairer
(NSN 5180-00-323-4915)
Cell Puller (Appendix D)

Materias/Parts

Apron, Rubber (Item 2, Appendix C)
Gloves, Rubber (Item 8, Appendix C)
Goggles, Protective (Item 7, Appendix C)
Rags, Wiping (Item 12, Append& C)
Corrosive Resistant Compound
(Item 3, Appendix C)
Brush, Nylon Bristle (Item 16, Appendix C)

Personnel

MOS66F

General Safety Instructions

Wear protective gear. Remove all metal objects from wrists and fingers, Observe warnings and cautions

References: TM 11-6140-203-23P

NOTE

Subparagraph a. below, contains the disassembly/reassembly procedures for Marathon Battery BB-716/A, Mentiffed as Marathon p/n 29147-5. Subparagraph b. below, outlines the parallel procedures for Saft Battery 88-716/A, identified as Saft p/n 19653.

a. Marathon Battery BB-716//A Disassambly/Reassembly (fig. 3-29).

(1) Unsnap four latches (1) and remove cover (2).

(2) Discharge battery completely (para 3-10).

WARNINGS

Remove all metal objects from fingers and wrists before working on nickel-cadmium batteries. Severe Injuries from electrical bums could occur if metal objects on fingers and wrists aciddentally short out battery.

Wear protective eyewear and clothing when working on nickel-cadmium batteries. If accidental contact with electrolyte occurs, wash contaminated area immediately with dean water and seek medical attention.

(3) Tag blue lead (3) and red lead (4).

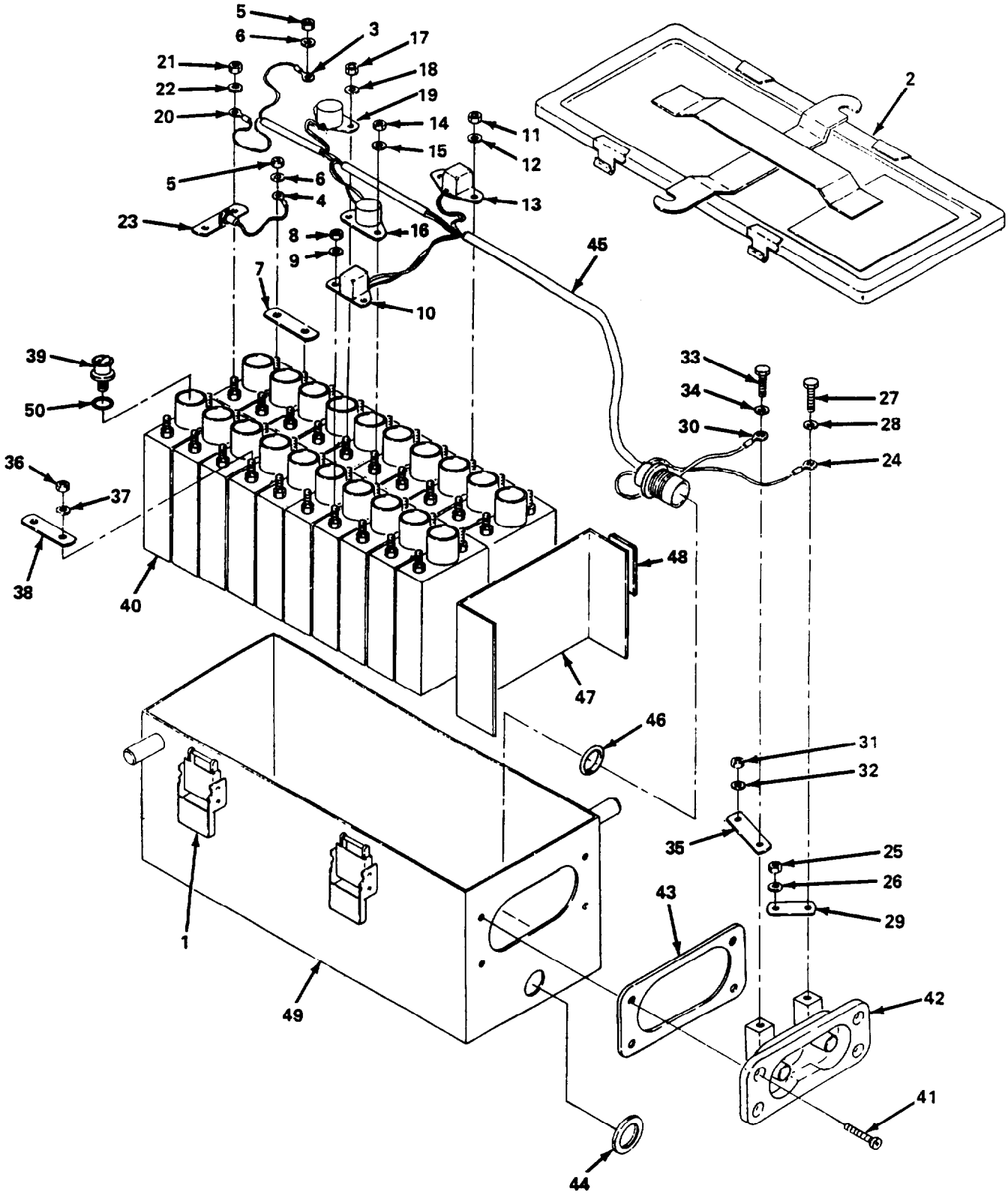

Figure 3-29. Battery BB-716/A (Marathon) Disassembly.

3-27. Battery BB-716/A (Cont)

(4) Remove two nuts (5) and washers (6) and remove leads (3) and (4) and llnk (7).

(5) Remove two nuts (8) and washers (9) and remove temperature sensor link (10).

(6) Remove two nuts (11) and washers (12) and remove temperature sensor and link (13).

(7) Remove two nuts (14) and washers (15) and remove thermal switch and link (16).

(8) Remove two nuts (17) and washers (18) and remove thermal switch and link (19).

(9) Tag lead (20).

(10) Remove two nuts (21) and washers (22) and remove clamping diode assembly and link (23).

(11) Tag lead (24).

(12) Remove nuts (25) washers (26) screw (27) and washer (26) and remove lead (24) and link (29).

(13) Tag lead (30).

(14) Remove nut (31), washer (32), screw (33), and washer (34) and remove lead (30) and link (35).

(15) Remove all wire ties.

(16) Remove two nuts (36) and washer (37) and remove link (38).

(17) Repeat step (16) for remaining links.

(18) Loosen, but do not remove filler caps (39).

NOTE

If a cell puller cannot be fabricated, screw a stud of the correct size into each of the terminals on the cell and pull the cell straight up using two pair of pliers.

(19) Install cell puller (refer to Appendix D) on cell (49) and secure with two nuts (36).

(20) Remove cell (40) and remove ceil remover from cell.

(21) Repeat steps (19) and (20) for remaining cells.

(22) Tighten filler caps (39). Torque nylon filler caps to 3/14 in.-lbs. and steel filler caps to 5/8 in.-lbs.

(23) Remove four screws (41) and remove connector (42) and gasket (43).

(24) Remove nut (44) and remove wiring harness (45) and gasket (46).

(25) Remove spacer (47) and shims (48).

3-27. Battery BB-716/A (Cont)

(26) Wash battery case (49) and cover (2) with clean water and dry thoroughly.

(27) Inspect battery case (49) and cover (2) for scratches and corrosion. Replace a battery case (49) or cover (2) which Is excessively damaged. Repaint battery case (49) and cover (2) as needed (para 3-9).

(28) Inspect wiring harness (45) and replace if insulation on wiring is cracked or burnt or if wiring harness (45) Is otherwise damaged.

(29) Clean all links wlth dean water and dry thoroughly.

(30) Remove potassium carbonate (white deposits) from links using nylon bristle brush.

(31) Replace any link if pianting material has worn through to base metal or if link Is otherwise damaged.

CAUTION

Do not allow water to enter cells. Water entering the cells will dilute and contaminate electrdyte.

(32) Wash cells (40) with dean water and dry thoroughly.

(33) Remove potassium carbonate (white deposits) from cell (40) using nylon brlstle brush.

(34) Rewash cells (40) as needed and dry thoroughly.

(35) Inspect each cell (40) for cracks, distorted case, discoloration, and electrdyte contamination. Replace any cell that Is cracked, discolored with burn spots, or contains contaminated electrdyte.

(36) Invert ceils (40) for two minutes.

(37) After two minutes, lay the cell down, on blotter or paper towel for 30 seconds on each of its sides. Any wetting of the blotter or paper towel is cause to consider the cell unserviceable.

(38) Remove filler caps (39) and O-rings (50).

(39) Wash filler caps (39) with clean water and dry thoroughly.

(40) Inspect filler caps (39) and replace if damaged.

(41) Inspect O-rings (50) and replace if cracked or deformed.

(42) Install filler caps (39) and O-rings (50) and tighten. Torque nylon filler caps to 3/4 in.-lbs. and steel filler caps to 5/8 in.-lbs.

(43) Inspect connector (42) and replace if cracked or otherwise damaged.

(44) Inspect spacer (47) and replace if cracked.

(45) Inspect shims (48) and replace if cracked and missing pieces.

3-27. Battery BB-716/A (Cont)

(46) Install wiring harness (45) and gasket (46) and secure with nut (44). Move wiring harness leads out of way.

(47) Install connector (42) and gasket (43) and secure with four screws (41).

(48) Install spacer (47).

NOTE

Each battery must be constructed of cells made by the same manufacturer and must carry the same stock number. Do not mix ceils made by different manufacturers or cells with different stock numbers.

CAUTION

Do not hit ceils to install, a firm push from the top is all that should be required. If ceils are difficult to install, check cell layout for proper orientation and loosen, but do not remove filler caps.

(49) Refer to figure 1-11 for cell layout and install cells (40).

(50) Install shims (46) as needed to obtain a tight fit.

(51) Install link (35) and lead (30) and secure with nut (31) washer (32) screw (33) and washer (34). Torque nuts (31) and screw (33) to 20-25 In-lb.

(52) Install link (29) and lead (24) and secure with nut (25) washer (26) screw (27) and washer (28). Torque nut (25) and screw (27) to 20-25 in-lb.

(53) Install clamping diode assembly and link (23) and lead (20) and secure with two nuts (21) and washers (22). Torque nuts (21) to 20-25 in-lb.

(54) Install thermal switch and link (19) and secure with two nuts (17) and washers (18). Torque nuts (17) to 20-25 In-lb.

(55) Install thermal switch and link (16) and secure with two nuts (14) and washers (15). Torque nuts (14) to 20-25 in-lb.

(56) Install temperature sensor and link (13) and secure with two nuts (11) and washers (12). Torque nuts (11) to 20-25 In-lb.

(57) Install temperature sensor and link (10) and secure with two nuts (8) and washers (9). Torque nuts (8) to 20-25 in-lb.

(58) install link (7) and two leads (3) and (4) and secure with two nuts (5) and washers (6). Torque nuts (5) to 20-25 in-lb.

(59) Install link (38) two nuts (36) and washers (37). Torque nuts (36) to 20-25 in-lb.

(60) Repeat step (59) for remaining links.

3-27. Battery BB-716/A (Cont)

(61) Install wire ties.

CAUTION

In the following step, use corrosion preventive compound sparingly and only as required. Apply corrosion preventive compound when batteries are used in a corrosive atmosphere or when the battery is placed In storage. Overuse of corrosion preventive compound may leak into the cell causing ceil contamination.

(62) Coat terminal links and hardware with corrosion preventive compound (Item 3, Appendix C).

(63) Install cover (2) with four latches (1).

(64) Return battery to administrative storage.

b. Saft Battery BB-716/A Disassembly/Reassembly (fig. 3-29). Disassembly/reassembly of Saft Battery BB-716/A, identified as Saft p/n 19653, is essentially the same as the disassembly/reassembly procedures for Marathon Battery BB-716/A, Identified as Marathon p/n 29147-5 (subpara a., above). Disassembly/reassembly of the Saft battery is obvious by inspection of the battery and referring to figure 3-29.

(1) Discharge the battery prior to disassembly (para 3-10).

(2) Observe all WARNINGS, CAUTIONS, and NOTES contained in the disassembly/reassembly procedures for the Marathon battery (subpara a., above).

(3) Make sure ceils that are replaced are from the same manufacturer and must carry the same national stock number. Refer to figure 1-12 for cell layout.

(4) Refer to figure 1-12 for routing of the wiring harness.

c. Repair. Repair of Battery BB-716/A consists of removal and replacement of the following items:

- Connector
- Wiring harness
- Marathon cell 5H120 or Saft cell p/n 21131
- Terminal link
- Filler cap

WARNING

When performing removal and replacement procedures, make sure the battery is completely discharged. Remove all jewelry and metal objects from fingers and wrists.

NOTE

Disassemble the battery only to the extent necessary to perform a repair or to service.

(1) Discharge battery (para 3-10).

(2) To remove any of the above Items, refer to the exploded view (fig. 3-29) and the appropriate sections of paragraph 3-27a or 3-27b above.

(3) Upon completion of repair, perform the procedures contained in paragraphs 3-37c, below.

NOTE

Performance test not required when replacing filler caps.

d. Test.

(1) Discharge battery (para 3-10).

(2) Test wiring harness In accordance with the procedures contained In Table 3-1, MALFUNCTION 9.

(3) Test battery In accordance with the procedures contained In paragraph 3-14.

Section V. SERVICING NEW BATTERIES

Paragraph		Page
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3-30	Preparing New Battery for Setvice	3-124
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3-32	Cell Replacement, New Batteries	3-126
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OVERVIEW

This section contains information and procedures required to pack/unpack and prepare new batteries for use.

3-28. Unpacking.

a. When packed for domestic shipment, the batteries are packed as follows:

(1) Singly In a cardboard carton with fill pads (fig. 3-30). (When packed for export, wooden blocks are inserted in the filler pads.)

(2) Several cartons may be packaged in a larger wooden case (fig. 3-31) with each battery enclosed in a separate container.

b. Remove the contents as follows:

CAUTION

Do not attempt to pry off the wooden cover. Remove nails from the cover and lift cover off. Batteries can be damaged by the prying tool.

(1) Remove carton from wooden packing case, when applicable.

(2) Slit the gummed tape on top of the cardboard carton.

(3) Remove the battery from the cardboard carton. If the battery fits tightly into the carton, hold the carton down when lifting the battery.

NOTE

Retain all packaging material for future use.

3-29. Checking Unpacked Equipment.

a. Inspect the equipment for any damage Incurred during shipment. If the equipment has been damaged, report the damage on SF 364.

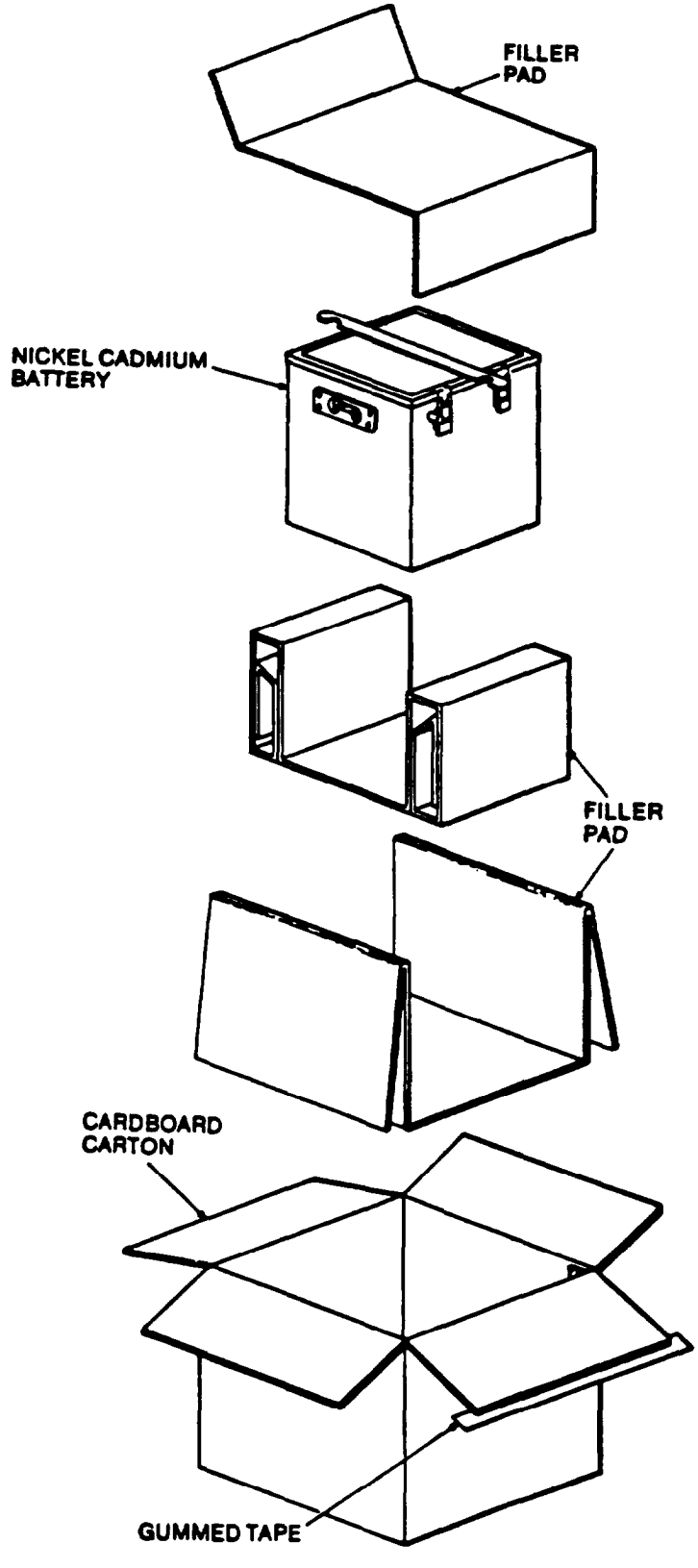

Figure 3-30. Typical Nickel-Cadmium Battery Packaging (Single).

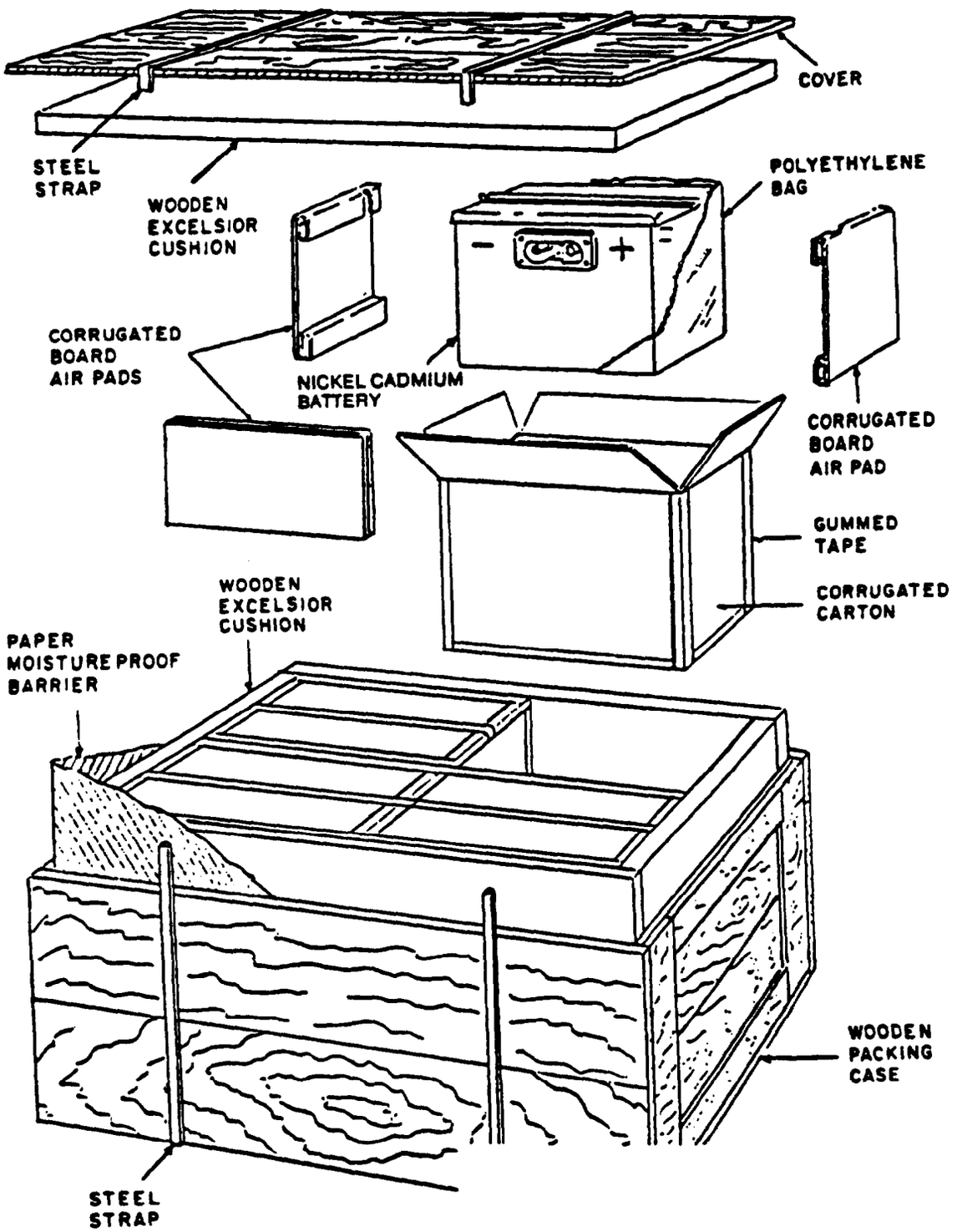

Figure 3-31. Typical Nickel-Cadmium Battery Packaging (Multiple).

b. Check to see that the equipment is complete as listed on the packing slip. if the packing slip is not available, refer to components and dimensions in Chapter 1. Report ail discrepancies in accordance with procedures given in DA Pam 738-750. Shortages of a minor assembly or part that does not affect proper functioning of the equipment should not prevent use of the equipment.

3-30. Preparing New Battery for Service. A new battery is a battery that has never been placed in use or is a battery taken out of storage for use. Perform the tasks given in steps a through g of this procedure to prepare a new battery for service.

a. Initial inspection. Remove the cover and perform the following internal checks:

(1) Damage. See whether any electrolyte (potassium hydroxide) has spilled into the battery case or shipping container. This condition could be a sign of a damaged ceil.

(2) Electrical Connections. Check ail electrical connections for tightness. Test ail screws on the terminals to ensure tightness. Refer to section IV of this chapter and the specific maintenance paragraph that describes proper terminal screw torque. Check any wiring for proper connection. Poor electrical contact can result in damage to the battery.

(3) Electrolyte Level. The batteries are normally shipped with the proper amount of electrolyte. Do not add distilled water or electrolyte until after the battery has been charged. When a battery has been discharged or allowed to stand unused over a period of time, the electrdyte becomes absorbed into the plates. The batteries are shipped discharged and, therefore, the electrdyte level can seem to be low. Charging the battery should cause this level to rise to the proper mark, which is just above the tops of the plates (approximately 0.25 inch (6.36 mm)). Do not charge ceils of different capacities together. Adjust efectrdyte level if necessary, in accordance with instructions in paragraph 3-13.

b. Cleaning of battery.

CAUTION

Do not use solvents for cleaning; damage to the battery box liners and the cover gasket can result. Do not use a wire brush because short circuiting between the ceil terminals will occur and cause damage to the ceil cases, the fillercaps, and the battery terminal links.

(1) Wipe off the battery box and its cover with a cleaning cloth (item 12, Appendix C). Be sure that ail fillercaps are tight.

(2) Brush the top of the ceils, the fillercaps, and the battery terminal links with a nylon brush. There may be white deposits (potassium carbonate) on the top of the ceils that should be removed by brushing with a nylon brush and washing the battery with tap water. Dry the battery with a clean, lint-free cloth and compressed air, as necessary.

c. Checking Polarity Position of Cells. Check the polarity position of each ceil or group of ceils to ensure that they are connected properly. The polarity of each ceil is indicated by a plus (+) sign molded into the ceil cover adjacent to the appropriate ceil post. For the ceil layout for a specific battery, refer to the ceil layout of that specific battery (chapter 1).

WARNING

Be extremely careful when tightening the terminal screws and studs. Bodily injury and damage to the equipment can result if the torque wrench accidently causes a short circuit.

d. Tightening of Terminal Screws. Refer to section IV of this chapter and specific maintenance paragraph that describes proper terminal screw torque.

e. Cleaning of Fillercaps. Clean fillercaps as described in paragraph 3-8.

3-31. Preparing a Battery Containing All New Cells for Service. Perform the procedures given in a through f below to assemble a battery containing ail new ceils and prepare it for service.

a. Initial inspection. Remove ceil packaging material and make the following checks:

(1) Damage. See whether any electrolyte liquid has spilled into the shipping materials. This may be the sign of a damaged ceil.

(2) Vent Caps. Clean and test ceil vent caps in accordance with para 3-8.

(3) Electrical Connections. Remove shorting strap from ceils. Polish terminal surface with fine emery cloth or sandpaper to remove any oxide coating.

b. Checking Electrolyte Level. The ceils are normally shipped with the proper amount of electrolyte. Do not add additional 31% KOH electrolyte or water until after the battery has been charged. However, if the ceils contain an excess amount of electrolyte while in the discharged state, this should be removed charging begins. Follow procedures of paragraph 3-13 for electrolyte level adjustment.

c. Assembly of Battery.

(1) Place ceils in battery case observing proper polarity. Positive terminals are marked with a plus (t) sign molded into the ceil case. Some ceils may also have the ceil cover near the positive terminal dyed red. For the ceil layout for a specific battery, refer to chapter 1.

(2) Attach interceil connectors that have been previously cleaned of all corrosion preventive compound and lightly polish with fine emery cloth or sandpaper following the specific ceil layout of chapter 1.

(3) Tighten terminal screws, referring to section IV of this chapter and to the specific maintenance paragraph to determine proper screw terminal torque.

(4) Perform a final inspection before charging, checking ail battery ceils for proper polarity and voltage. Also check that ail ceils are from the same manufacturer.

CAUTION

Do not charge ceils unsupported or out of battery case. Damage to ceils may result.

d. Charging. Charging a battery that contains new ceils that have not been previously formed (particularly those from the Marathon Battery Co.) requires a slightly different procedure than normal for the very first charge. Specifically, a brand new cell may require an input of up to 3 times its rated capacity before it is fully formed. With any of the charging methods given below, individual cell voltages should be read during the first 2 minutes of charge.

(1) Constant Current Method. Reject the battery if any cell is shorted, measures less than 1.0 volt, or has reversed polarity. Very high ceil voltage readings, above 1.6 volts, may indicate either dirty or loose connections or a dry ceil. if a ceil is dry, adding a small quantity of 31% KOH electrolyte will immediately lower the voltage. Bad connections can be checked by comparing the voltage readings taken on the terminal screws with those taken at the interceil links. The difference should not exceed 0.02 volts with 30 amperes flowing or 0.04 volts with 60 amperes flowing. Cell voltage should also be read during the last 10 minutes of the initial charge to determine if ail ceils are uniform within 0.1 volts of the average of the entire battery. Electrolyte level should also be checked to determine if electrolyte is visual in all ceils. Charge at the C/2 rate for 3 hours (for 30 Ah, BB600A/A cells charge at 15A). Then lower the charging current to the C/5 rate (for 30 Ah, BB600A/A ceils charge at 6.0A), continue charge until battery voltage remains constant for 2 consecutive hourly readings and/or ail ceils are above 1.5 volts. Do not exceed 6 hours of charging time at the C/5 rate.

(2) Pulse Charging Method with the AN/USM-432. Set charger in Manual Charge Mode at a CHARGE-AMPERE-HOUR setting two-thirds (2/3s) of normal. For example, with a BB433A/A battery which would normally be set at "30-35, (which would give a current of 45 amperes) use a setting of "22" (which would give a current of 30 amperes). After one hour of charge, turn timer clockwise to provide a second hour. Determine when charger goes into topping mode. With charge in topping mode, increase CHARGE-AMPERE-HOUR setting to the normal value and continuing in the topping mode for a minimum of 4 hours, turning the charge clock back to the start position as required. Cell voltage and electrolyte levels should be checked for uniformity periodically, as previously described. For indications of dry ceils and/or high resistance connections, the voltage change (from cell to ceil) must be compared between the pulse 'ON' and "OFF" periods.

(3) Reflex Charging Method with the RF80GT. Set up the unit in accordance with table 3-8. Set the charger to a current equal to the rated capacity of the battery (for a BB433A/A set to 30 amperes), switch to reflex mode and charge for 2 hours. To complete initial formation charge, reduce current to C/2 rate (15 amperes for 30 Ah BB433A/A) and charge for 4 additional hours in reflex mode.

Note

The Ammeter-zeroing which is used to indicate full charge on the RF80GT may not occur because of the lower than normal current setting. Full charge may be checked by switching to the constant current mode for 5 minutes and checking that ail ceil voltages are above 1.5 volts. Ceil voltages and electrolyte levels should be checked for uniformity periodically as previously described. For indications of dry ceils and/or high resistance connections, the voltage change (from ceil to ceil) must be compared between the "positive and negative' pulse periods.

e. Performance Test. Performance testing shall be in accordance with paragraph 3-14 except if an AN/USM432 or RF60GT is used, the discharge shall be at the one hour rate.

f. Final Charge. if the battery has passed both the capacity and leakage tests, then it can be given its final charge In accordance with the normal procedure for the specific charger-analyzer used However, if the battery temperature exceeds 120 F, allow sufficient time for the battery to cool before starting the final charge. After completing the final charge, check ail ceil voltages, adjust the electrolyte level per paragraph 3-13.

3-32. Cell Replacement, New Batteries. For new batteries failing the performance test (para 3-14) due to low cell voltage(s), the following procedure should be followed:

a. Check for a minimum of 40% overcharge, either by using the longer charge methods for constant voltage or current, or by the settings on charger/analyzer. If the 40% overcharge was not provided, charge the battery again ensuring a minimum 40% overcharge; then, repeat the performance test.

b. If a ceil fails again, it must be replaced with a ceil from the same manufacturer of the other ceils in the battery and with as close to the same manufacture date as possible. Refer to section IV of this chapter and the specific maintenance paragraph covering ceil removal procedures.

c. Most ceils are provided in packages of 19 each. Once a ceil has been removed, the remainder can be saved for replacement needs in other batteries. it is essential in such instances, to ensure that these ceils are used only in batteries where the other ceils were manufactured by the same manufacturer as the replacement ceils.

3-33. Preparation for Shipment.

NOTE

NICAD batteries must be shipped completely discharged.

a. Service the battery in accordance with the procedures in section III of this manual.

b. Close off battery vents with tape or plastic plugs.

c. install shorting spring and warning tag.

d. install protective caps on ail connectors.

e. Pack battery in original packing material. See to figures 3-30 and 3-31.

3-34. Storage Procedures.

NOTE

NICAD batteries if serviced and prepared properly can be stored for an indefinite period of time. if it is known that a battery will be in storage for 90 days or more, discharge the battery completely.

a. Service the battery in accordance with the procedures in section III of this chapter.

b. Indicate what state of charge the battery is in when placed in storage.

c. The batteries should be stored in a non-corrosive atmosphere between -65° to 120° F (-54° to 49°C). The temperature should never exceed 160° F (71° C).

d. The storage area should be well ventilated and dry.

e. The batteries should not be stored directly on the ground.

APPENDIX A

REFERENCES

A-1. Scope

This appendix lists all forms, field manuals, technical manuals, and miscellaneous publications referenced in this manual.

A-2. Forms

Transportation Discrepancy in Shipment Report (DISREP)	SF 361
Report of Discrepancy (ROD)	SF 364
Quality Deficiency Report (QDR)	SF 368
Recommended Changes to Publications	DA Form 2028
Equipment Inspection and Worksheet	DA Form 2404
The Army Maintenance Management System (TAMMS)	DA Pam 738-750
The Army Maintenance Management System (TAMMS) (Aircraft).	DA Pam 738-751

A-3. Technical Manuals

Painting Instructions for Field Use	TM 43-0139
Operator's and Organizational Maintenance Manual: Battery Charger Analyzer AN/USM-432	TM 11-6130-413-12
Operator's, Organizational, Direct Support, and General Support Maintenance Manual Aircraft and Nonaircraft Nickel-Cadmium Batteries (General)	TM 11-6140-203-14-1
Aviation Unit and Intermediate Maintenance Repair Parts and Special Tools List for Aircraft Nickel-Cadmium Batteries	TM 11-6140-203-23P
Procedures for Destruction of Electronic Materiel to Prevent Enemy Use	TM 750-244-2

A-4. Miscellaneous Publications

Consolidated Index of Army Publication and Blank Forms	DA PAM 25-30

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. Maintenance Allocation Chart

a. General. The Maintenance Allocation Chart (MAC) assigns maintenance functions in accordance with the Three Levels of Maintenance concept for Army Aviation. These maintenance levels (categories) - Aviation Unit Maintenance (AVUM), Aviation Intermediate Maintenance (AVIM), and Depot Maintenance (Depot) - are depicted on the MAC as:

AVUM, which corresponds to an O Code in the Repair Parts and Special Tools List (RPSTL)

AVIM, which corresponds to an F Code in the Repair Parts and Special Toots List (RPSTL)

DEPOT, which corresponds to a D Code In the Repair Parts and Special Tools List (RPSTL)

b. Maintenance Activity Assignments. The maintenance activities to be performed below depot and in the field are assigned as follows:

(1) Aviation Unit Maintenance (AVUM). AVUM activities are staffed and equipped to perform high-frequency "On-Aircraft" maintenance tasks required to retain or return aircraft systems to a serviceable condition. The maintenance capability of the AVUM will be governed by the Maintenance Allocation Chart (MAC) and limited by the amount and complexity of ground support equipment (GSE), facilities required, authorized manning strength, and critical skills available. The range and quantity of authorized spare modules/components will be consistent with the mobility requirements dictated by the air mobility concept. (Assignments of maintenance tasks to divisional company size aviation units will consider the overall maintenance capability of the division, the requirement to conserve personnel and equipment resources, and air mobility requirements.)

(a) Company Size Aviation Units. These units perform those tasks which consist primarily of preventive maintenance and maintenance repair and replacement functions associated with sustaining a high level of aircraft operational readiness. Perform maintenance inspections and servicing to include preflight, daily, intermediate, periodic (or phased), and special inspections as authorized by the MAC or higher headquarters. Identify the cause of equipment/system malfunctions using applicable technical manual troubleshooting instructions, built-in-test equipment (BITE), installed aircraft instruments, or test, measurement, and d&gnostic equipment (TMDE). Replace worn or damaged modules/components that do not require complex adjustments or system alinement and which can be removed/installed with available skills, tools, and ground support equipment. Perform operational and continuity checks and make minor repairs to the electrical system. Inspect, service, and make operational, capacity, and pressure checks to hydraulic systems. Perform servicing, functional adjustments, and minor repair/replacement to the flight control, propulsion, power train, and fuel systems. Accomplish airframe repair that does not require extensive disassembly, jigging, or alinement. The manufacture of airframe parts will be limited to those items which can be fabricated with tools and equipment found In current air mobile tool and shop sets. Evacuate unserviceable modules/components and end Items beyond the repair capability of AVUM to the supporting AVIM.

(b) Less than Company Size Aviation Units. Aviation elements organic to brigade, group, battalion headquarters, and detachment size units are normally small and have less than ten aircraft assigned. Maintenance tasks performed by these units will be those which can be accomplished by the aircraft crew chief or assigned aircraft repair person and will normally be limited to preventive maintenance, inspections, servicing, spot painting, stop drilling, application of nonstress patches, minor adjustments, module/component fault diagnosis, and replacement of selected modules/components. Repair functions will normally be accomplished by the supporting AVIM unit.

(2) Aviation Intermediate Maintenance (AVIM). AVIM activities provide mobile, responsive "One-Stop" maintenance support. (Maintenance functions which are not conducive to sustaining air mobility will be assigned to depot maintenance.) AVIM may perform all maintenance functions authorized to be done at AVUM. Repair of equipment for return to user will emphasize support or operational readiness requirements. Authorized maintenance includes replacement and repair of modules/components and end items which can be accomplished efficiently with available skills, tools, and equipment. AVIM establishes the Direct Exchange (DX) program for AVUM units by repairing selected items for return to stock when such repairs cannot be accomplished at the AVUM level. The AVIM level inspects, troubleshoots, performs diagnostic tests, repairs, adjusts, calibrates, and alines aircraft system modules/components. AVIM units will have the capability to determine the serviceability of specified modules/components removed prior to the expiration of the Time Between Overhaul (TBO) or finite life. Module/component disassembly and repair will support the DX program and will normally be limited to tasks requiring cleaning and the replacement of seals, fittings, and items of common hardware. Airframe repair and fabrication of parts will be limited to those maintenance tasks which can be performed with available tools and test equipment. Unserviceable repairable modules/components and end items which are beyond the capability of AVIM to repair will be evacuated to Depot Maintenance. AVIM will perform aircraft weight and balance inspections and other special inspections which exceed AVUM capability. Provides quick response maintenance support, including aircraft recovery and air evacuation, on-the-job training, and technical assistance through the use of mobile maintenance contact teams. Maintains authorized operational readiness float aircraft. Provides collection and classification services for serviceable/unserviceable material. Operates a cannibalization activity in accordance with AR 710-2. The aircraft maintenance company within the maintenance battalion of a divisions will perform AVIM functions consistent with air mobility requirements and conservation of personnel and equipment resources. Additional intermediate maintenance support will be provided by the supporting nondivisional AVIM unit.

B-2. Use of the Maintenance Allocation Chart (Sect. II)

a. The Maintenance Allocation Chart assigns maintenance functions to the lowest category of maintenance based on past experience and the following considerations:

(1) Skills available.

(2) Work time required.

(3) Tools and test equipment required and/or available.

b. Only the lowest category of maintenance authorized to perform a maintenance function is Indicated. If the lowest maintenance category cannot perform all tasks of any single maintenance function (e.g., test, repair) then the higher maintenance level(s) that can accomplish additional tasks will also be indicated.

c. A maintenance function assigned to a maintenance category will automatically be authorized to be performed at any higher maintenance category.

d. A maintenance function that cannot be performed at the assigned category of maintenance for any reasons may be evacuated to the next higher maintenance category. Higher maintenance categories will perform the maintenance functions of lower maintenance categories when required or directed by the commander that has the authority to direct such tasking.

e. The assignment of a maintenance function will not be construed as authorization to carry the related repair parts of spares in stock. Information to requisition or otherwise secure the necessary repair parts will be as specified in the associated Repair Parts and Special Tools List (RPSTL).

f. Normally there will be no deviation from the assigned level of maintenance. In cases of operational necessity, maintenance functions assigned to a maintenance level may, on a one-time basis and at the request of the lower maintenance level, be specifically authorized by the maintenance officer of the level of rnaintenance to which the function Is assigned. The special tools, equipment, etc. required by the lower level of maintenance to

perform this function will be furnished by the maintenance level to which the function is assigned. This transfer of a maintenance function to a lower maintenance level does not relieve the higher maintenance level of the responsibility for the function. The higher level of maintenance will provide technical supervision and Inspection of the function being performed at the lower level.

g. Changes to the Maintenance Allocation Chart will be based on continuing evaluation and analysis by responsible technical personnel and on reports received from field activities.

B-3. Maintenance Functions

Maintenance Functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. lest. To verify serviceability by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition; i.e., to dean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. To maintain, within prescribed limits, by bringing Into proper or exact position, or by setting the operating characteristics to specified parameters.

e. Aline. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on Instruments or test, measurement, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing Into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services' or other maintenance actions? to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operation condition as prescribed by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild Is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

[1] Services - inspect, test, service, adjust, aline, calibrate, or replace.
[2] Actions -welding, grinding, riveting, straightening, facing, remachining, or resurfacing.

B-4. Group Number and Component Assembly (Columns 1 and 2, Respectively)

a. Group Number (Column 1). Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Component/Assembly (Column 2). Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance Is authorized.

B-5. Maintenance Function (Column 3)

Column 3 lists the functions to be performed on the items listed In Column 2.

B-6. Maintenance Categories and Work Times (Column 4)

The maintenance categories (levels) AVUM, AVIM, and DEPOT are listed on the Maintenance Allocation Chart with individual columns that include the work times for maintenance functions at each maintenance level. Work time presentations such as '0.1' indicate the average time it requires a maintenance level to perform a specific maintenance function. If a work time has not been established, the columnar presentation shall indicate "__•__"• Maintenance levels higher than the level of maintenance indicated are authorized to perform the indicated function.

B-7. Tools and Test Equipment (Column 5 and Section III)

Common tool sets (not individual tools), special tools, test, and support equipment required to perform maintenance functions are listed alphabetically In Section Ill with a reference number to permit cross-referencing to column 5 in the MAC. In addition, the maintenance category authorized to use the device Is listed along with the item National Stock Number (NSN) and, if applicable, the tool number to aid in identifying the tool/device.

B-8. Remarks (Column 6 and Section IV)

Remarks (identified by an alphabetic code in column 6) and other notes (Identified by a number in parentheses In the applicable column) are listed in Section IV to provide a ready reference to the definition of the remark/note.

Section II. MAINTENANCE ALLOCATION CHART FOR AIRCRAFT NICKEL-CADMIUM BATTERIES AIRCRAFT BATTERY GROUP

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL AVUM	AVIM	DEPOT	(5) TOOLS	(6) REMARKS
00	Aircraft Battery Group						
01	Battery, Storage BB-432AJA, BB-4328/A	Inspect	0.1				A
		Inspect		0.2		3	A
		Service	0.2			2	A
		Service		1.2		1 thru 12, 16	A
		Test	0.6			2, 3, 18	A
		Test		5.0		1 thru 12, 16	A
		Replace	0.4				B
		Repair		3.0		3, 16	A
		Overhaul		6.0		1 thru 12, 16, 18	
0101	Battery, Storage (CELL) BB-599/A	Inspect		0.2			
		Service		1.2		1 thru 12, 16, 18	
		Replace		1.0		3	
		Repair		0.2		3, 18	C
0 2	Battery, Storage BB-433A/A	Inspect	0.1				A
		Inspect		0.2		3	A
		Service	0.2			2	A
		Service		1.2		1 thru 12, 17, 18	A
		Test	0.6			2	A
		Test		5.0		1 thru 12, 17	A
		Replace	0.4				B
		Repair		3.0		3, 18	A
		Overhaul		8.0		1 thru 12, 17, 18	
0201	Battery, Storage (CELL) BB-600/A	Inspect		0.2		3	
		Service		1.2		1 thru 12, 17, 18	
		Replace		1.0		3, 18	
		Repair		0.2		3, 18	C

Section II. MAINTENANCE ALLOCATION CHART
FOR
AIRCRAFT NICKEL-CADMIUM BATTERIES AIRCRAFT BATTERY GROUP

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL AVUM	AVIM	DEPOT	(5) TOOLS	(6) REMARKS
0 3	Battery, Storage BB-434JA	Inspect	0.1				A
		Inspect		0.2		3	A
		Service	0.2			2	A
		Service		1.2		1 thru 12, 18	A
		Test	0.6			2	A
		Test		5.0		1 thru 12, 18	A
		Replace	0.4				B
		Repair		3.0		3, 18	A
		Overhaul		8.0		1 thru 12, 18	
0301	Battery, Storage (CELL) BB-601/A	Inspect		0.2		3	
		Service		1.2		1 thru 12 18	
		Replace		1.0		3, 18	
		Repair		0.2		3, 18	C
04	Battery, Storage BB-476/A	Inspect	0.1				A
		Inspect		0.2		3	C
		Service	0.2			2	A
		Service		1.2		1 thru 12, 18	C
		Test	0.6			2	A
		Test		5.0		1 thru 12, 18	C
		Replace	0.4				B
		Repair		3.0		3, 18	C
		Overhaul		8.0		1 thru 12, 18	
0401	Battery, Storage (CELL) BB-475/A	Inspect		0.2		3	
		Service		1.2		1 thru 12, 18	
		Replace		1.0		1 thru 12, 18	
		Repair		0.2		3, 18	C

Section II. MAINTENANCE ALLOCATION CHART
FOR
AIRCRAFT NICKEL-CADMIUM BATTERIES AIRCRAFT BATTERY GROUP

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL AVUM	AVIM	DEPOT	(5) TOOLS	(6) REMARKS
05	Battery, Storage BB-558/A	Inspect	0.1				A
		Inspect		0.2		3	A
		Service	0.2			2	A
		Service		1.2		1 thru 12, 18	A
		Test	0.6			2	A
		Test		5.0		1 thru 12, 18	A
		Replace	0.4				B
		Repair		3.0		3	
		Overhaul		8.0		1 thru 12, 18	
0501	Battery, Storage (CELL) BB-559/A	Inspect		0.2		3	
		Service		1.2		1 thru 12, 18	
		Replace		1.0		3, 18	
		Repair		0.2		3, 18	C
0502	Wiring Harness	Inspect	0.1				
		Replace		1.5		3,18	
		Repair		0.8		3, 18	
06	Battery, Storage BB-564/A	Inspect	0.1				A
		Inspect		0.2		3	A
		Service	0.2			2	A
		Service		1.2		1 thru 12, 18	A
		Test	0.6			2	A
		Test		5.0		1 thru 12, 18	A
		Replace	0.4				D
		Repair		3.0		3, 18	
		Overhaul		8.0		1 thru 12, 18	
0601	Battety, Storage (CELL) BB-652A/A	Inspect		0.2		3	
		Service		1.2		1 thru 12, 18	
		Repair		0.2		3, 18	C

Section II. MAINTENANCE ALLOCATION CHART FOR AIRCRAFT NICKEL-CADMIUM BATTERIES AIRCRAFT BATTERY GROUP

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL AVUM	AVIM	DEPOT	(5) TOOLS	(6) REMARKS
7	Battery, Storage	Inspect	0.1				A
	BB-649A/A	Inspect		0.2		3	A
		Service	0.2			2	A
		Service		1.2		1 thru 13	A
		Test	0.6			2	A
		Test		5.0		1 thru 13, 18	A
		Replace	0.4				B
		Repair		3.0		3, 18	A
		Overhaul		8.0		1 thru 12, 16	
0701	Battery, Storage (CELL)	Inspect		0.2		3	
	BB-648/A	Service		1.2		1 thru 13, 18	
		Replace		1.0		3, 18	
		Repair		0.2		3, 18	C
08	Battery, Storage	Inspect	0.1				A
	BB-664/A	Inspect		0.2		3	A
		Service	0.2			2	A
		Service		1.2		1 thru 12, 18	A
		Test	0.6			2	A
		Test		5.0		1 thru 12 18	A
		Replace	0.4				B
		Repair		3.0		3, 18	A
		Overhaul		8.0		1 thru 12, 18	
0801	Battery, Storage (CELL)	Inspect		0.2		3	
	BB-475/A	Service		1.2		1 thru 12, 18	
		Replace		1.0		3, 18	
		Repair		0.2		3, 18	C

Section II. MAINTENANCE ALLOCATION CHART FOR AIRCRAFT NICKEL-CADMIUM BATTERIES AIRCRAFT BATTERY GROUP

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL AVUM	AVIM	DEPOT	(5) TOOLS	(6) REMARKS
09	Battery, Storage	Inspect	0.1				A
	BB-678A/A	Inspect		0.2		3	A
		Service	0.2			2	A
		Service		1.2		1 thru 12, 15.18	A
		Test	0.6			2	A
		Test		5.0		1 thru 12, 15	A
		Replace	0.4				B
		Repair		3.0		3,18	A
		Overhaul		8.0		1 thru 12, 15, 18	
0901	Battery, Storage (CELL)	Inspect		0.2		3	
	BB-652/A	Service		1.2		1 thru 12, 18	
		Replace		1.0		3, 18	
		Repair		0.2		3, 18	C
IO	Battery, Storage	Inspect	0.1				A
	BB-708/U	Inspect		0.2		3	A
		Service	0.2			2	A
		Service		1.2		1 thru 12, 18	A
		Test	0.6			2	
		Test		5.0		1 thru 12, 18	
		Repair	0.4				
		Repair		3.0		3,18	
		Overhaul		8.0		1 thru 12, 18	
001	Battery, Storage (CELL) PIN 19804-008, 21127	Inspect		0.2		3	
		Service		1. 2		1 thru 12, 18	
		Replace		1, 0		3, 18	
		Repair		0. 2		3, 18	C

Section II. MAINTENANCE ALLOCATION CHART FOR AIRCRAFT NICKEL-CADMIUM BATTERIES AIRCRAFT BATTERY GROUP

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL AVUM	AVIM	DEPOT	(5) TOOLS	(6) REMARKS
11	Battery, Storage BB-716/A	Inspect	0.1			3	
		Inspect		0.2		2	
		Service	0.2			1 thru 12, 18	
		Service		1.2		2	
		Test	0.6			1 thru 12	
		Test		5.0		3	
		Raplace	0.4			3, 18	
		Repair		3.0		1 thru 12, 18	
		Overhaul		8.0			
1101	Battery, Storage (CELL) P/N 19804-014	Inspect		0.2		3	
		Service		1.2		1 thru 12, 18	
		Replace		1.0		3,18	
		ReQJr		0.2		3, 18	C
1102	Low capacity Cell	Inspect		0.2		3	
		Service		1.2		1 thru 12, 18	
		Replace		1.0		3, 18	
		Repair		0.2		3, 18	C

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

FOR

AIRCRAFT NICKEL-CADMIUM BATTERIES AIRCRAFT BATTERY GROUP

TOOL OR TEST EQUIPMENT REF CODE	MAINTE-NANCE LEVEL	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUM-BER
1	AVIM	Fixture, Battery Discharge and Cell Voltage Balancing MX-8927A/U for BB-433/A Battery	6110-00-014-6225	
2	AVUM, AVIM	Multimeter AN/PSM-45(A)	6625-00-135-2512	
3	AVIM	Tool Kit, Battery Service TK-90/G	5180-00-542-5812	
4	AVIM	Analyzer-Charger AN/ASM-137 (Note 1) or AN/USM-432	6625-00-759-2882	
5	AVIM	Analyzer-Char er AN/ASM-137A (Note 1) or AN USM-432(A)	6625-00-238-4433	
6	AVIM	Cable Assembly, Power Electrical CX-11934/U, No.4 AWG (Note 2)	6150-00-935-8722	
7	AVIM	Cable Assembly, Power Electrical CX-11779/U, No. 2/0 AWG (Note 2)	6150-00-410-9880	
8	AVIM	Charger, Battery FF-1451/G or AN/USM-432	6130-00-985-8157	
9	AVIM	Charger, Battery PP-1659/G or	6130-00-985-8185	
10	AVIM	Generator Set, Gasoline Engine 3KW, 28V DC, MIL-G-52428 (Note 3)	6115-00-475-0029	Not used
11	AVIM	Power Supply PP-1104C/G (Note 4)	6130-00-542-6385	Not used
12	AVIM	Relay, Reverse Current Cutoff (Note 4)	5945-00-824-5575	Used with PPL 104
13	AVIM	Fixture, Battery Discharge and Cell Voltage Balancing MX-10068/U for BB-649/A and BB-649A/A		
14	AVIM	Fixture, Battery Discharge and Cell Voltage Balancing MX-10050/U for 678/A		

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

FOR

AIRCRAFT NICKEL-CADMIUM BATTERIES AIRCRAFT BATTERY GROUP

15	AVIM	Fixture, Battery Discharge and Cell Voltage Balancing MX-10047/U for BB-432A/A, and BB-432/A	6140-01-034-0332	
16	AVIM	Fixture, Battery Discharge and Cell Voltage Balancing MX-8921A/U for BB-433/A, BB-433/A, BB-693/U, and BB-693A/U	6140-01-014-6225	
17	AVIM	Tool Kit, Electrical Repairer	5180-00-323-4915	

NOTES:
1. Analyzer-Charger AN/ASM-137 or AN/ASM-137 is used to charge and analyze aircraft storage batteries.
2. Cable assemblies, Power Electrical CX-11779/U and CX-11934/U are required for charging aircraft storage batteries equipped with Elcon receptable MIL-C-18148A (ASG), CX-11934/U can be used up to 100 amperes dc.
3. Generator set, gasoline engine is used for charging where 115-230-volt ac power is not available
4. Reverse current relay must be connected to the output of Power Supply PP-1104C/G to prevent battery from discharging through the power supply in the event of power failure.

Section IV. Remarks

REMARKS CODE	REMARKS
A	Consult specific aircraft manual for maintenance and/or Progressive Phased Maintenance (PPM) requirements.
B	New battery will be prepared by AVIM
C	Limited to replacement of connector hardware and filler caps.
D	BB-564/A to be replaced by BB-664/A when unserviceable.

APPENDIX C

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

C-1. Scope

This appendix lists expendable supplies and materials you need to operate and maintain the Aircraft Nickel-Cadmium Batteries. These items are authorized to you by CTA 50-970, Expendable items (Except Medical, Class V, Repair Parts, and Heraldic items).

C-2. Explanation of Columns

a. Column (1) - Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the mater&i (e.g., "Use adhesive, item 1, Append& D').

b. Column (2) - Level. This column Identifies the lowest level of maintenance that requires the listed item. (Enter as applicable).

AVUM - Aviation Unit Maintenance
AVIM - Aviation intermediate Maintenance

c. Column (3) - National Stock Number. This is the National Stock Number assigned to the item; use it to request or requisition the item.

d. Column (4) - Description. This is the Federal item name and, if required, a description to identify the item.

e. Column (5) - Unit of Measure (U/M). This is the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in., pr). if the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description Part No. and CAGEC	(5) U/M
1	AVUM	8040-00-664-4318	Adhesive, Rubber Base, General Purpose, EC2141 (76381)	Pt
2	AVUM	8415-00-715-0450	Apron, Impermeable, Battery Worker's MIL-A-41801 (81349)	Ea
3	AVUM	8030-00-903-0931	Corrosion Preventive Compound, Nox Rust X-110 (02847)	Pt
4	AVIM	8810-00-682-6867	Distilled or Deionized Water, 243 (24774)	Gal.
5	AVIM	8810-00-543-4041	Electrolyte (KOH), Approximately 31 Percent by Weight Premixed Solution in 500 CC Polyethylene Bottle, 1.305 +/-0.005 Specific Gravity at +80°F (+27°C)	B+1
6	AVUM	4240-00-202-9473	Faceshield, Industrial, 8 in. Lg. FED-L-0036, Style B, Size 3, LF 36 (81348)	Ea
7	AVUM	4240-00-190-8432	Goggles, Industrial, Chemical Type GGG-G-521, Type ii (81348)	Pr
8	AVUM	8515-01-149-8842	Gloves, Rubber, Surgeons, E-007 (89875)	1 Pr
9	AVUM	8010-00-514-1861	Paint-Touchup, Primer Coating, Zinc Chromate Yellow, 30 Minutes Drying Time, Use: Metal, Rigid Plastic, and Glass, FED Spec TT-P-00600, 16-Ounce Can, 1319 (87187)	Can
10	AVUM	8010-00-598-5936	Paint-Touchup, Enamel, Semigloss, Olive Drab Color No. X-24087, Rust Inhibiting, Use: as a One or Two Coat Painting System over Properly Cleaned and Treated Metal, FED Spec TT-E-485 Type II, Packed in Pressurized 12 Ounce Can, TTE485 (81348)	Can
11	AVIM	9330-00-877-2872	Polyamide Plastic Sheet, L-P-410 (81348)	Ea

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description Part No. and CAGEC	(5) U/M
12	AVUM	7920-00-205-1711	Rags, Wiping	Pk
13	AVIM	5905-00-195-4496	Resistor, Variable, 0- to 7.5-Ohm, 1,000 Watts (For Building Battery Loads), MILR22 (81349)	Ea
14	AVIM	5930-00-224-4938	Switch, Toggle, DPST, 60 Amp, 250 V, 1143J (05664)	Ea
15	AVIM	5970-01-143-4820	Tubing, Heat Shrink 0.125 in.	Ft
		5970-00-161-6796	Tubing, Heat Shrink 0.25 In.	Ft
		5970-00-142-2282	Tubing, Heat Shrink 0.50 in.	Ft
16	AVUM	1005-00-494-6602	Brush, Nylon Bristle	Ea
17	AVIM	5975-00-074-2072	Wire Ties	Pk
18	AVIM	6810-00-753-4993	Alcohol, isopropyl	Cn
19	AVIM	8010-00-169-4673	Paint-Touchup, Semigloss, Blue	Can
20	AVIM	6135-00-930-0030	Battery BA-3030	Pkg
21	AVIM	6135-01-063-1978	Battery BA-3090	Pkg

APPENDIX D

ILLUSTRATED LIST OF MANUFACTURED ITEMS

This appendix includes complete instructions for making items authorized to be manufactured or fabricated at Aviation Intermediate Maintenance (AVIM).

All bulk materials needed for manufacture of an item are listed by part number or material in a tabular list on the illustration.

INDEX

Item	Figure
Ceil Puller, Screw Type Ceil	D-1
Ceil Puller, Hex Nut Type Ceil	D-2
Electrolyte Level Checker	D-3

Material: Nickel-Plated Corrosion Resistant Steel, 1 in. x 0.75 in. x .089 in., Qty 2; Nickel Plated Corrosion Resistant Steel, 2 in. x 0.5 in. x 0.030 (22 AWG), Qty 2; American Standard Truss Head Rivet, Nickel-Plated Steel, Qty 4; Web Belt, 400 lb Test, 8 In. x 0.75 in. x 0.125 in.

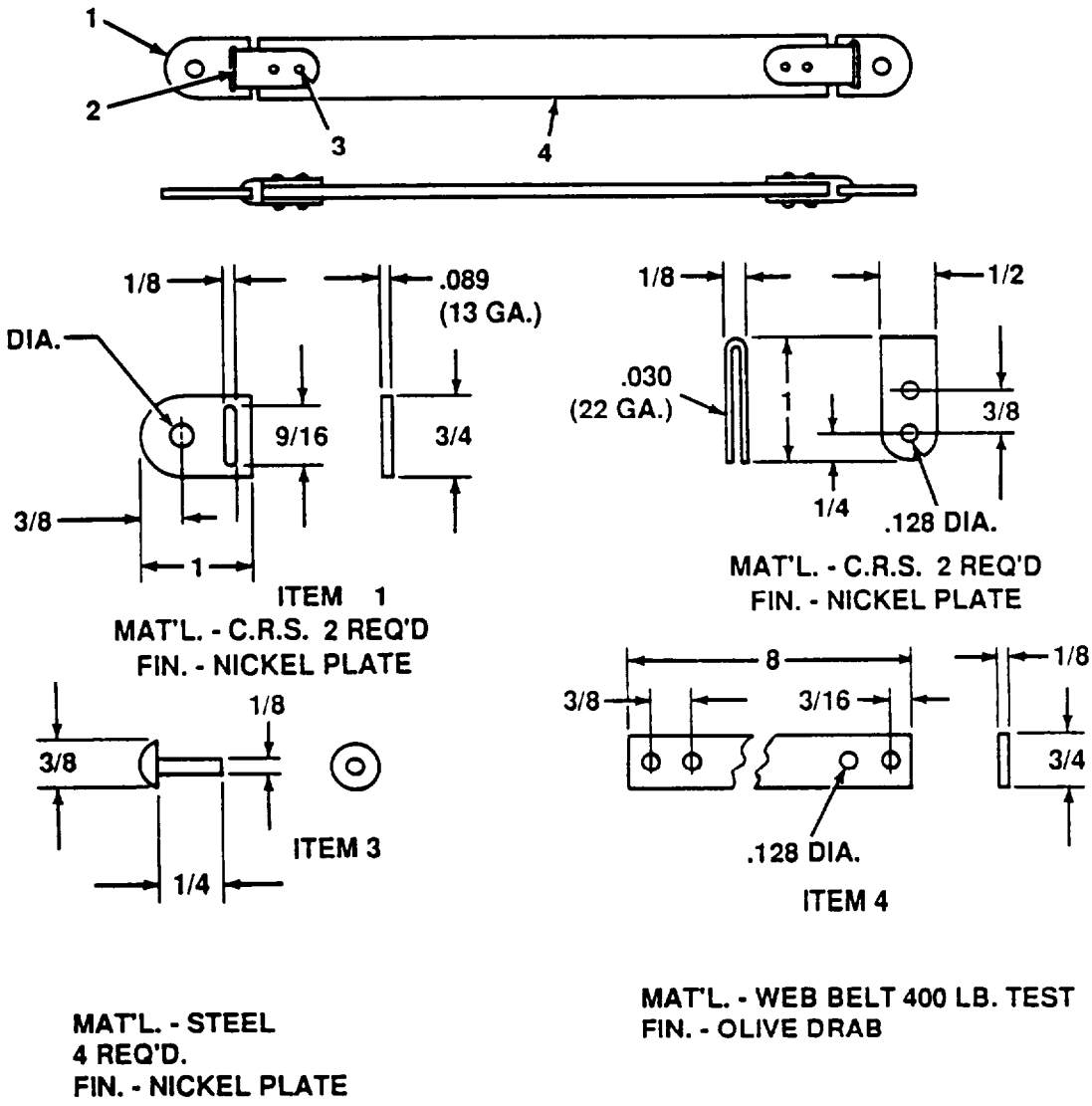

Figure D-1. Cell Puller, Screw Type Cell.

NOTES

1. All dimensions are in inches.
2. Cut ail items to proper size.
3. Drill ail holes and slots as dimensioned.
4. Install item 1 on item 2.
5. Install item 4 on item 2 and secure with item 3.
6. Repeat for other side.

Material: Nickel-Plated Corrosion Resistant Steel, 0.5 in. Diameter x 4.0 in. Long; Nickel Plated Corrosion Resistant Steel, 0.125 in. Diameter x 3.0 in. Long.

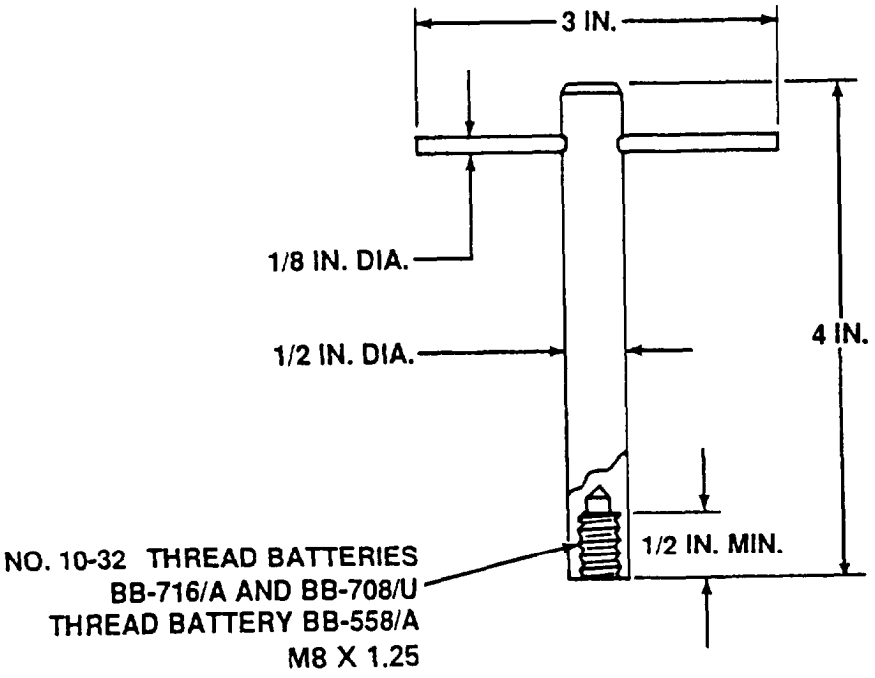

Figure D-2. Cell Puller, Hex Nut Type.

NOTES

1. **All dimensions are in inches.**
2. **Drill and tap end as indicated.**
3. **Drill hole to accommodate handle.**

Material: Syringe

BATTERY	DIMENSION 'A' IN.
BB-432A/A	0.25
BB-432B/A	0.25
BB-433A/A	0.25
BB-434/A	0.25
BB-476/A	0.25
BB-564/A	0.25
BB-649A/A	0.25
BB-664/A	0.25
BB-678A/A	0.25
BB-7068U	0.25
BB-716/A	0.3125 - 0.4375 STANDARD CELL 0.9375 - 1.0625 REFERENCE CELL

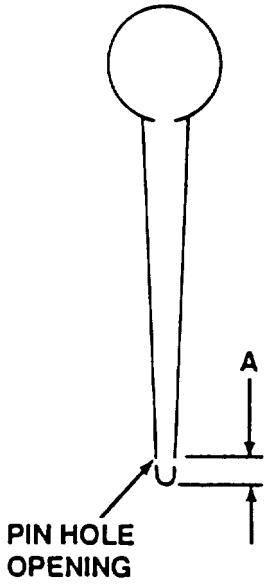

Figure D-3. Electrolyte Level Checker.

NOTES

1. All dimensions are in Inches.
2. Pierce hole In syringe at height indicated using a heated pin.
3. Allow pin to cool before removing.

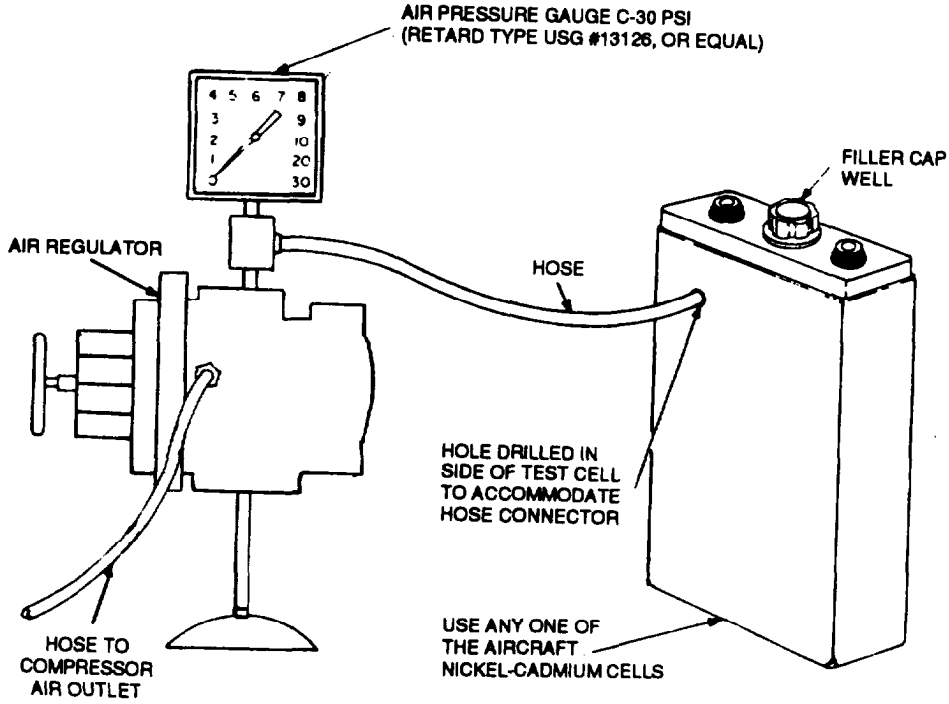

Figure D-4. Filler Cap Vent Valve Tester

APPENDIX E

GLOSSARY

Ampere Hours - A unit of electrical measurement used to describe the capacity of a cell or battery.

Cadmium - Blue-white metallic chemical element which Is sintered to a woven wire screen to form the negative plate in a battery cell.

Capacity - A measure of the stored electrical energy that is available from a fully charged battery. Generally expressed in ampere-hours.

Cell Pressure - Pressure generated due to the production of oxygen during the charging procedure.

Cell Temperature - The temperature of the cell during charging and discharging states. The faster the cell is charged or discharged, the higher the temperature will be. Overtemperature of the cell can damage it.

Charge Acceptance - The ability of a cell or battery to accept a charge.

Charge Retention - The amount of capacity retained (or deliverable) by a fully charged battery after it has been stored for a stated period of time. Sometimes called shelf life.

Charge Voltage - The voltage the cell reaches during charging cycle. The nominal voltage ranges from 1.35 to 1.50 volts.

Closed Circuit Voltage - The instantaneous voltage of a cell or battery when a load Is first applied.

Discharge Temperature - The temperature range at which a cell or battery will produce its optimum performance. The nominal range Is between 0° -100° F (-20° -45° C).

Discharge Rate - The magnitude of current removed from a cell or battery, expressed in amperes, or milliamperes.

Electrolyte - A conductive medium that provides for the movement of ions (current flow) between the positive and negative plates of a cell.

Load Current - Current that flows through a completed circuit. The unit of measure for current is amperes.

Ion - An electrically charged atom or group of atoms.

Negative Plate - The plate from which electrons flow through the external circuit when the battery is discharging. In the nickel-cadmium cell or battery it Is the plate that contains cadmium which Is oxidized during discharge.

Nickel-Oxide - A compound comprised of nickel and oxygen.

Open Circuit Voltage - The voltage of a battery at rest, that is, with no charge or discharge current flowing.

Overcharge - Continuing the charge after replacing the ampere-hours of capacity that had been removed previously during discharge. Overcharging Is needed in order to make up for the inefficiency of charge.

Oxidation - The release of electrons by the cell's active material. In a nickel-cadmium cell or battery, it's the release of electrons at the negative plate to the external circuit during discharge.

Plaque - A porous sintered sheet into whose pores active materials are Introduced preparatory to cutting it Into the plate dimensions required for a particular size ceil.

Plate - One of the two cell components at which the electrochemical reactions take place and In which chemical energy is stored.

Positive Plate - The plate to which electrons flow through the external circuit when the battery is discharging. In the nickel-cadmium cell or battery it is the plate that contains the nickel oxide which is chemically reduced to a lower oxidation state during discharge.

Potassium Hydroxide (KOH) - A chemical compound which is mixed with pure water In exact proportions to form the electrdyte used In nickel-cadmium cells.

Sinter - To heat a material at a high temperature in a reducing atmosphere. Sintering is used to bond the nickel powder to the woven wire screen used in NICAD cells.

Separator - A material that is used to prevent metallic contact between the negative and positive plates in a cell.

Thermal Runaway - This phenomenon Is sometimes observed during the overcharging phase of a constant voltage charge, especially at elevated temperatures. As the cell or battery temperature rises, there Is a slight decrease in cell or battery resistance and voltage decreases. These changes cause the cell or battery current to rise, which in turn causes the cell or battery temperature to rise and the cell or battery resistance and voltage to decrease. If this cycle continues, sufficient heat will be generated to destroy the separator material In the cells and ultimately destroy the battery.

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Warnings	a

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION

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Commander
Stateside Army Depot
ATTN: AMSTA-US
Stateside, N.J. 07703-5007

DATE SENT
10 July 1975

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-5840-340-12	23 Jan 74	Radar Set AN/PRC-76

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PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2^0 IFF antenna lag rather than 1^0. REASON: Experience has shown that with only a 1^0 lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing stress to the drive train. Hunting is minimized by adjusting the lag to 2^0 without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 dB" to "3 dB". REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 dB (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step f above." REASON: To replace the cover plate.
		FO-3		Zone C 3. On J1-2, change "+24 VDC" to "+5 VDC". REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.

SAMPLE

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SSG I. M. DeSpiritof 999-1776

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By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the Secretary of the Army
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