TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

NONAIRCRAFT NICKEL CADMIUM BATTERIES

HEADQUARTERS, DEPARTMENT OF THE ARMY

7 NOVEMBER 1979

WARNINGS
DANGEROUS CHEMICALS ARE USED IN NICKEL-CADMIUM BATTERIES

The electrolyte used in nickel-cadmium batteries contains potassium hydroxide (KOH), which is a caustic chemical 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. Use rubber gloves, rubber apron, and protective goggles when handling the electrolyte. If accidental contact with the electrolyte is made, use ONLY clean water and immediately (seconds count) flush contaminated areas. Continue flushing tenth large quantities of clean water. Seek medical attention without delay for eyes.

EXPLOSIVE GASES ARE GENERATED BY NICKEL CADMIUM BATTERIES

Hydrogen and oxygen gases are generated in explosive proportion while the nickel-cadmium battery is being charged. Charge the nickel-cadmium battery in a well-ventilated area to reduce concentrations of explosive gases. Turn off the battery charger before connecting or disconnecting the nickel-cadmium battery to prevent arcing. Do not use matches or an open flame in the charging area. Arcs, flames, or sparks in the charging area will ignite the gases and cause an explosion. The battery box cover must be removed and the battery case vent plug (if used) must be open when charging.

DO NOT MIX SULPHURIC ACID AND KOH

The electrolyte used in nickel-cadmium batteries reacts violently to the sulfuric acid used in the more common lead-acid types of batteries. DO NOT add sulfuric acid electrolyte to the battery; the mixing of the acid and 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 nickel cadmium 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 nickel-cadmium batteries on contact.

WARNINGS
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 (CO_2).

TIGHTENING TERMINAL SCREWS AND STUDS

Be extremely careful when tightening terminal screws and studs. Bodily injury and damage to the equipment may result if the torque wrench accidentally causes a short circuit.

FIRE FIGHTING SAFETY PRACTICE

CO_2 is an acceptable fire extinguishing agent once a fire has developed. In no case should CO_2 be directed into a battery compartment to effect cooling or displace explosive gases. The static electricity generated by the discharge of the extinguishers could explode hydrogen/oxygen gases trapped in the battery compartment.

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NO. 11-6140-203-14-3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *7 November 1979*

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REPORTING OF ERRORS

You can improve this manual by recommending improvements using DA Form 2028-2 located at the back of the manual. Simply tear out the self-addressed form, fill it out as shown on the sample, fold it where shorn, and drop it in the mail.

If there are no blank DA Forms 2028-2 in the back of the manual, use the standard DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forward to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703.

In either case, a reply will be furnished direct to you.

LIST OF ILLUSTRATIONS

***This manual supersedes TM 11-6140-203-15-3, 1 December 1969, including all changed**

CHAPTER 1
INTRODUCTION

1-1. Scope

a. This manual is one of the series of three and it covers the specific data and maintenance allocation for each nonaircraft nickel-cadmium battery. Refer to TM 11-6140-203-15-1, for general information pertaining to the description, functioning, operation, and maintenance of nickel-cadmium batteries. Refer to TM 1 11-6140-203-14-2 for the specific data and maintenance allocation for each aircraft nickel-cadmium battery.

b. TM 11-6140-203-20P-3 and TM 11-6140203-34P-3 contain the repair parts and special tools lists for nonaircraft nickel-cadmium batteries.

c. Appendix D is current as of 8 November 1978.

1-2. Indexes of Publications

a. *DA Pam 310-4*. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. *DA Pam 310-7*. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

1-3. Forms and Records

a. *Reports of Maintenance and Unsatisfactory Equipment*. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed and prescribed by TM 38-750.

b. *Report of Packaging and Handling Deficiencies*. Fill out and forward DO Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DLAR 4145.8.

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

1-4. Administrative Storage

A nonaircraft nickel-cadmium battery can be placed in administrative storage because of no immediate operational need and the necessity to reduce the maintenance workload; or to hold it ready while the associated end item of equipment is in the repair or overhaul process. The nickel-cadmium battery is handled differently under each set of circumstances.

a. *Normal Administrative Storage Procedures*. The following procedure applies when a nickel-cadmium battery is being placed in normal administrative storage.

(1) Remove the nickel-cadmium battery from the end item of equipment.

(2) Perform the cleaning procedures in paragraph 4-7.

(3) Place the nickel-cadmium battery in the administrative storage area making sure that the connector terminals are not accidentally short circuited. It is not necessary to discharge the nickel-cadmium battery since the charge will be lost through normal leakage and it will be deep-cycle discharged and recharged prior to returning to service. Protect from freezing and excessive heat.

(4) When the nickel-cadmium battery is to be returned to service, perform the full quarterly or every 100 cycles service procedure contained in paragraph 5-7.

b. Hold-Ready Administrative Storage Procedures. The following procedure applies when a nickel-cadmium battery is placed in a hold-ready administrative storage while the end item of equipment is in the repair or overhaul process.

(1) Remove the nickel-cadmium battery from the equipment.

(2) Perform those quarterly or every 100-cycle service procedures contained in paragraph 5-7 which service and deep-cycle discharge the nickel-cadmium battery. Leave the shorting device connected across the terminals of each cell.

(3) Place the nickel-cadmium battery in the ready hold administrative storage area. Protect from freezing and excessive heat.

(4) When the nickel-cadmium battery is required for installation in the repaired or overhauled end item of equipment, remove it from administrative storage. Remove the shorting device from across the terminals of each cell.

(5) Charge the nickel-cadmium battery in accordance with the instructions contained in paragraph 5-5.

(6) Install the nickel-cadmium battery in the end item equipment.

1-5. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

1-6. Reporting Equipment Improvement Recommendations

EIR's will be prepared using Standard Form 368. Instructions for preparing EIR's are provided in TM 38-750. EIR's should be mailed direct to Commander, US Army Communications and Electronics Materiel Readiness Command, AMEN: DRSEL-ME MQ, Fort Monmouth, NJ 07703. A reply will be furnished direct to you.

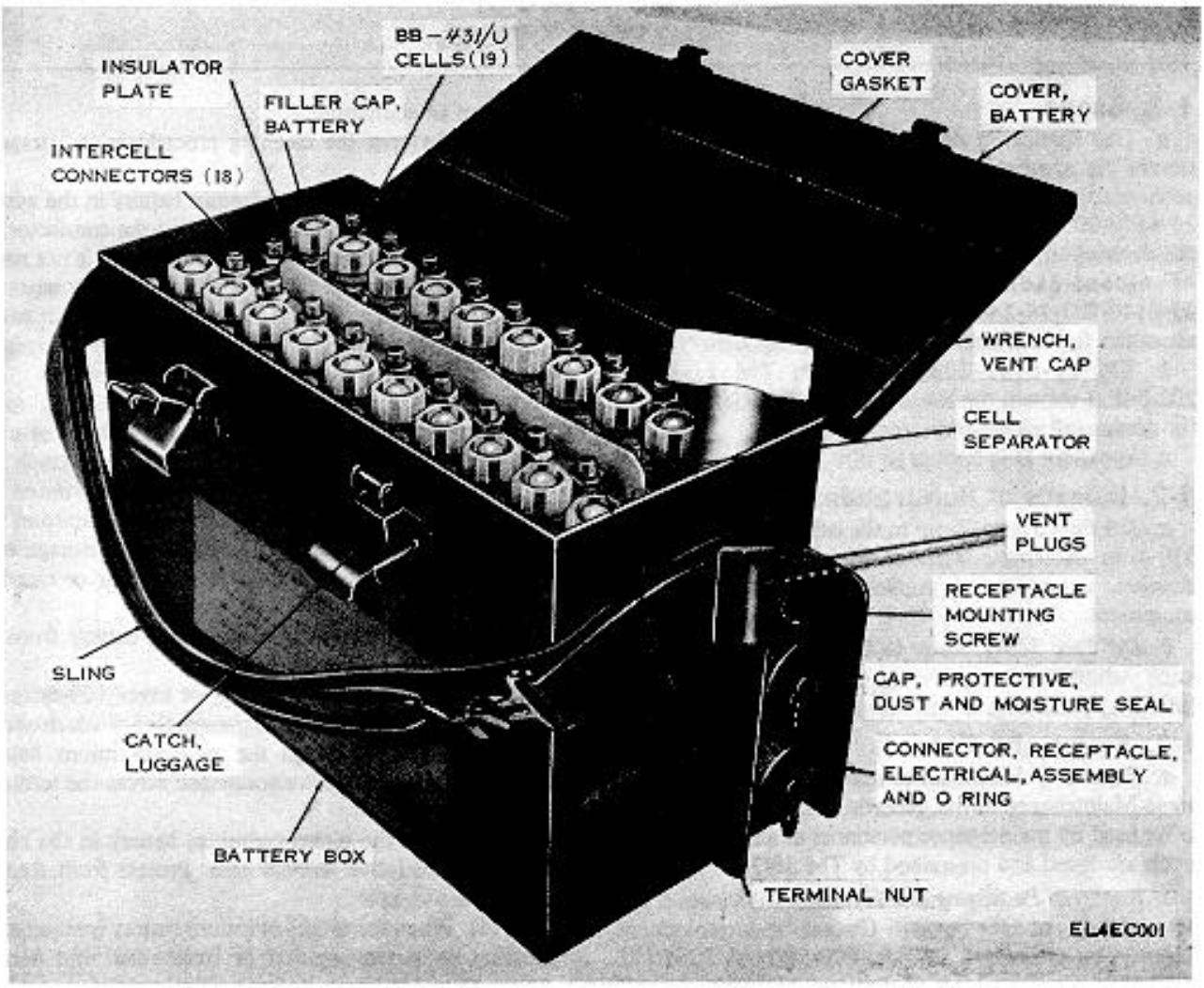

Figure 2-1. Battery, Storage B-422/U Cover Removed.

CHAPTER 2
SPECIFIC DATA FOR EACH INDIVIDUAL BATTERY TYPE

SECTION I. BATTERY STORAGE BB-422/U

2-1. Tabulated Data for BB-422/U (fig. 2-1)

Type ..... Nickel cadmium (vented).
Number of Cells ..... 19.
Type of cell ..... B8431/U.
Electrolyte ..... Potassium hydroxide (KOH), 31 percent (by weight) in distilled water.
Operating- Range:
  Temperature ..... -40°C F. (-40° C.) to 125° F. (51.7° C.).
  Atmospheric pressure ..... Sea level to 10,000 feet (20.6 inches of mercury ±0.1).
Storage:
  Duration ..... Unlimited, regardless of state of charge.
Temperature ....-65° F. (-53.9° C.) to 165° F. (73.9° C.).
Atmospheric pressure ..... Sea level to 50,000 feet 3.4 inches of mercury ±0.1).
Electrical Data:
  Rating ..... 14 ampere-hous.
  Current at rated load (2.8 amperes):
  Temperatures between 0. F. (-17.8° C.), and 125° F. (51.7° C.) ..... 2.8 amperes for approximately 5 hours.
  Temperatures between 0° F. (-17.8° C.), and -40° F. (-40° C.) ..... 2.8 amperes for approximately 3 hous.
Voltage:
  Open circuit ..... .Approximately 25 volts (fully charged, with a 24-hour rest period).
Under rated load (2.8 amperes):
  Temperatures between 75° F. (23.9° C.) and 84° F. (28.9° C.) ..... 22 volts for approximately 5 hous.
Temperatures between 0° F. (-17.8° C.) and -40° F. (-40° C.) ..... 22 volts for approximately 3 hours.
Battery terminal links:
  Material ..... Nickel-plated copper.
  Number ..... 18.
Cell plate materials:
  Positive ..... Nickel Oxide
Negative (charged) ..... Cadmium.
Separator material ..... Plastic laminate.
Cell case material Molded nylon or Acrylonitile, Butediene-Styrene (ABS).

2-2. Weight and Dimensions of BB-422/U

Battery, Storage BB-422/U (NSN 6140-00-789-2118) weighs 32 pounds. The battery is 711/32 inches high, 53/4 inches wide and 12Yt6 inches deep. Refer to figure 2-1 for BB-422/U parts location.

2-3. Physical Characteristics of BB-431/U (Cell)

The overall dimensions of Battery, Storage BB-431/U (cell) (NSN 6140-00-014-6583) are 661/64 inches high, 27/" inches wide, 15/64 inches deep, and it weighs 11/2s pounds. Refer to figures 2-2,and 2-3 for parts location and cell layout for the BB-422/U.

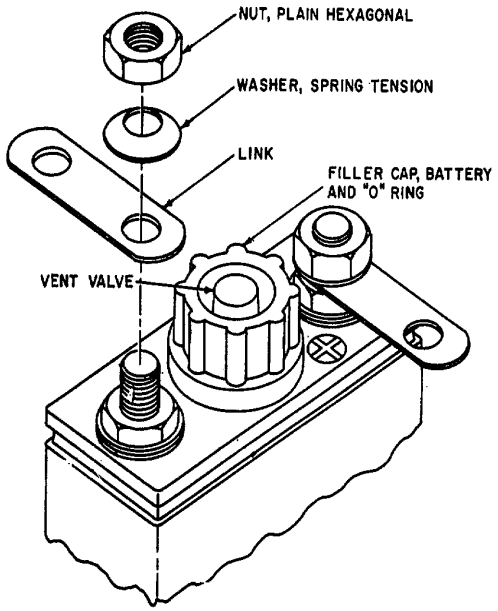

Figure 2-2. Battery, Storage BB-431/U (Cell), Parts Location.

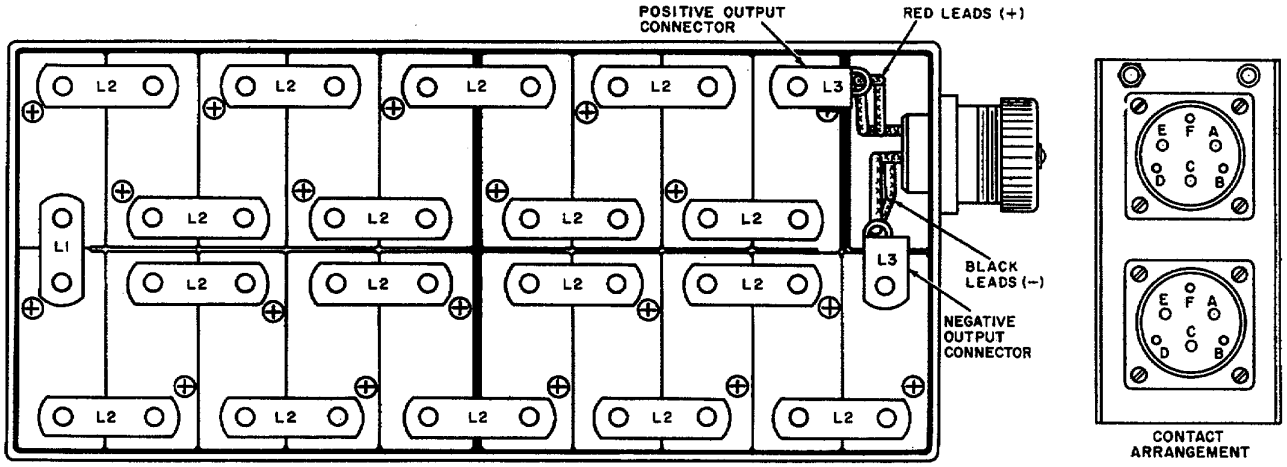

Figure 2-3. Battery, Storage BB-422/U, Cell Layout

SECTION II. BATTERY, STORAGE BB-429/U

2-4. Tabulated Data for BB-429/U (fig. 2-4)

Type ..... Nickel-cadmium (vented).
Number of cells 5

Type of cell B418/U
Electrolyte ..... Potassium hydroxide (KOH), 31 percent (by weight) in distilled water.
Operating range: .....
- Temperature ..... -65° F. (-53.9° C.) to 125° F. (51.70 C.).
- Atmospheric pressure .... Sea level to 10,000 feet (20.6 inches of mercury ±0.1).

Storage:
- Duration ..... Unlimited, regardless of state of ..... charge.
- Temperature ..... -65° F (53.9° C.) to 165° F (73.9° C.).
- Atmospheric pressure .... Sea level to 50,000 feet (3.4 inches of mercury ±0.1).

Electrical data: .....
- Rating ..... 14 ampere-hours.

Current at rated load (2.8 amperes):
- Temperatures between 0 F. (-17.8° C.) and between 125° F. (51.7° C.)..... 2.8 amperes for approximately 5 hours.
- Temperatures between 0°F. (-17.8° C.) and -40° F. (40° C.) ..... 2.8 amperes for approximately 3 hours.

Under rated load (2.8 amperes):
- Temperatures between 75° F. (25° C.) and 85° F. (29.4° C.)..... 6.0 volts for approximately 5 hours.
- Temperatures between 0° F. (-17° C.) and -40° F. (-40° C.) ..... 5.7 volts for approximately 3 hours.

Intercell connector:
- Material ..... Nickel-Plated copper.
- Number ..... 4.

Cell plate materials:
- Positive (charged)..... Nickel oxide.
- Negative (charged) .... Cadmium.

Separator material ..... Plastic laminated.
Cell case material..... Mold nylon or Acrylonitrile-Butadiene-Styrene.

Voltage:
- Open circuit ..... Approximately 6.5 volts (fully charged, with a 24-hour rest period).

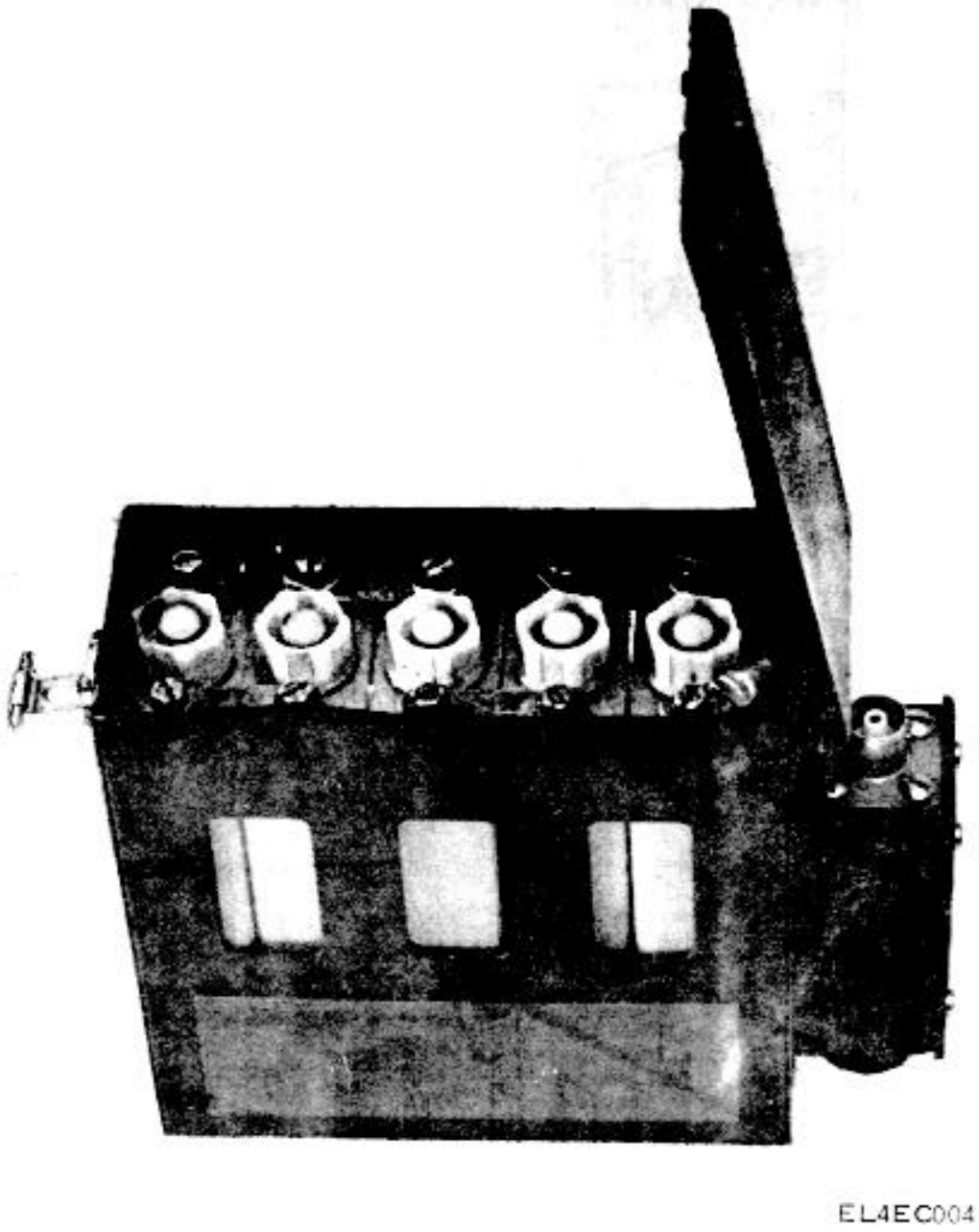

Figure 2-4. Battery, Storage BB-429/U, Cover Removed.

2-5. Weight and Dimensions of BB-429/U

Battery, Storage BB-429/U (NSN 6140-00-996-3746) weighs approximately 7 pounds. The battery is $6^{1}/_{4}$ inches high, $2^{29}/_{64}$ inches wide, and $7^{3}/_{64}$ inches deep. Refer to figure 2-5 for BB-429/U parts location.

2-6. Physical Characteristics of BB-418/U (Cell)

The overall dimensions of Battery, Storage BB-418/U (cell) (NSN 6140-00-855-7634) are $5^{3}/_{4}$ inches high, $2^{1}/_{4}$ inches wide, and 1 inch deep, and it weighs $1^{1}/_{8}$ pound. Refer to figures 2-5 and 2-6 for BB-418/U parts location and BB-429/U cell layout respectively.

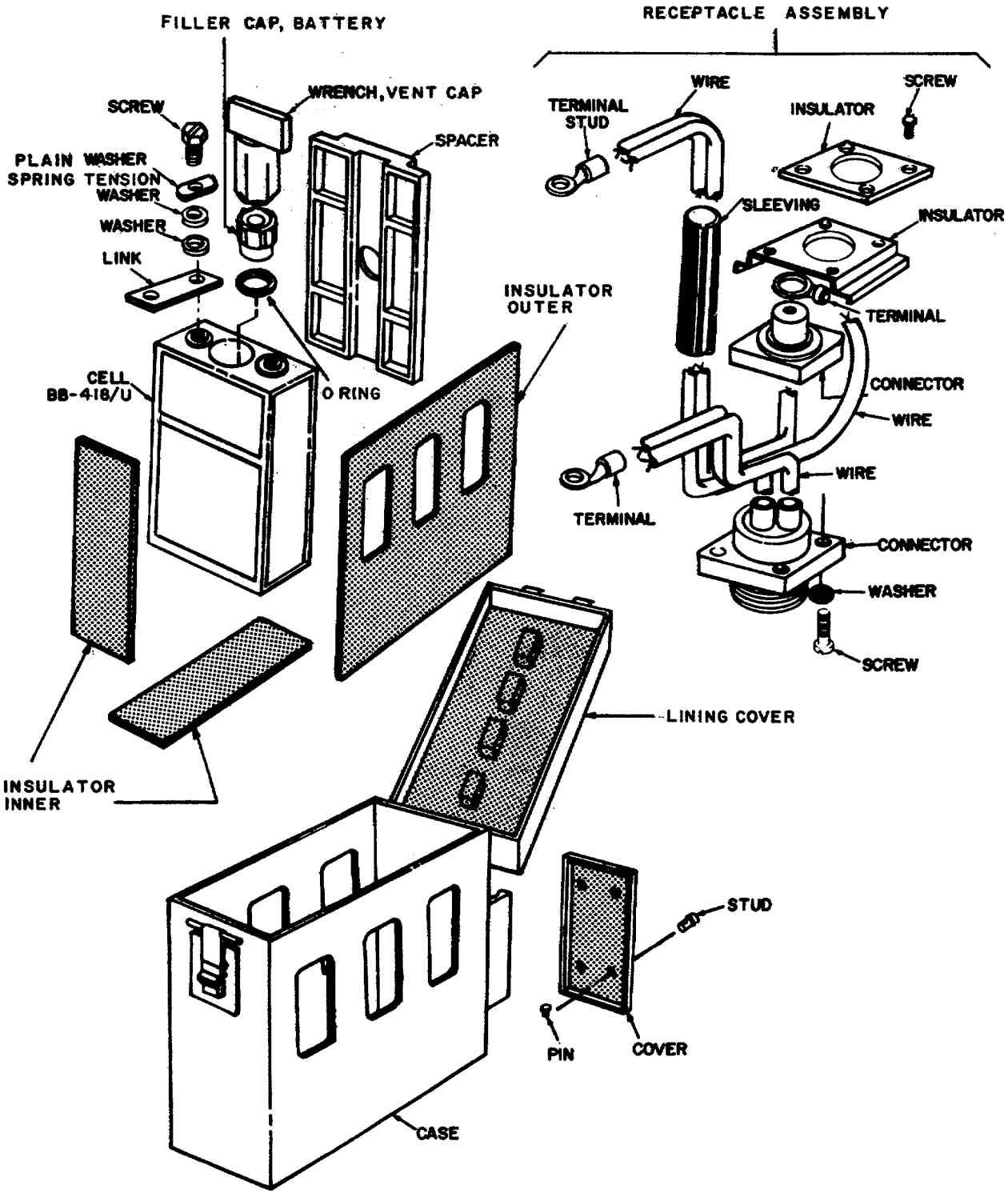

Figure 2-5. Battery, Storage BB-429/U, Parts Location.

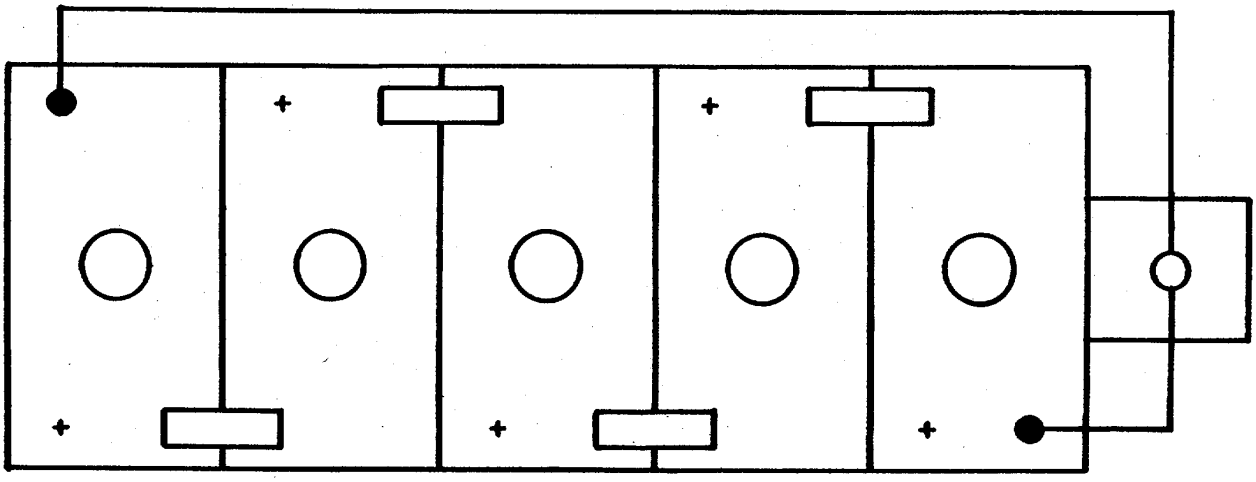

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Figure 2-6. Battery, Storage BB-429/U, Cell Layout

SECTION III. BATTERY, STORAAGE BB-501/U

2-7. Tabulated Data for BB-501/U (fig. 2-7)

Type..... Nickel-cadmium (vented).
Number of cells 20
Nomenclature of cell..... Battery, Storage BB-613/U
Electrolyte ..... Potassium hydroxide (KOH) 31 percent (by weight(in distilled water.

Operating Range:
- Temperature..... -40 ° F.(-40 ° C.) to 165 ° F. (75.0 ° C.)
- Atmospheric Pressure.... Sea level to 10,000 feet 20.6 inches of mercury +/-0.1)

Storage:
- Duration..... Unlimited, regardless of state of charge
- Temperature..... -80 ° F. (-62 ° C.) to 165 ° F. (75 ° C.)
- Atmospheric Pressure..... Sea level to 50,000 feet (3.4 inches of mercury+/-0.1).

Electrical Data:
- Rated 5-hour discharge capacity at temperature of :
  - Approximately 75 ° F. (23.9 ° C.)..... 14.0 ampere-hours at 24 volts or
  - Approximately 0 ° F. (-17.8 ° C.) ..... 12.6 ampere-hours at 24 volts or 25.2 ampere hours at 12 volts
  - Approximately -40 ° F. (-40 ° C) ..... 8.4 ampere hours at 24 volts or 16.8 ampere-hours at 12 volts.
- Current:
  - At temperature of:
  - Approximately 75 ° F. (23.9 ° C.)..... 2.8 amperes at 24 volts for 5 hours or 5.6 amperes at 12 volts for 5 hours.
  - Approximately -40 ° F (-40 ° C) ..... 2.8 amperes at 23 volts for 3 hours or 5.6 amperes at 11.5 volts for 3 hours.
- Voltage Open Circuit .....Approximately 13 volts or 26 volts (dependent upon cable assembly used and a fully charged battery with a 24 hour rest period)

Minimum Cycle Life (charge and discharge) .....1,500 cycles

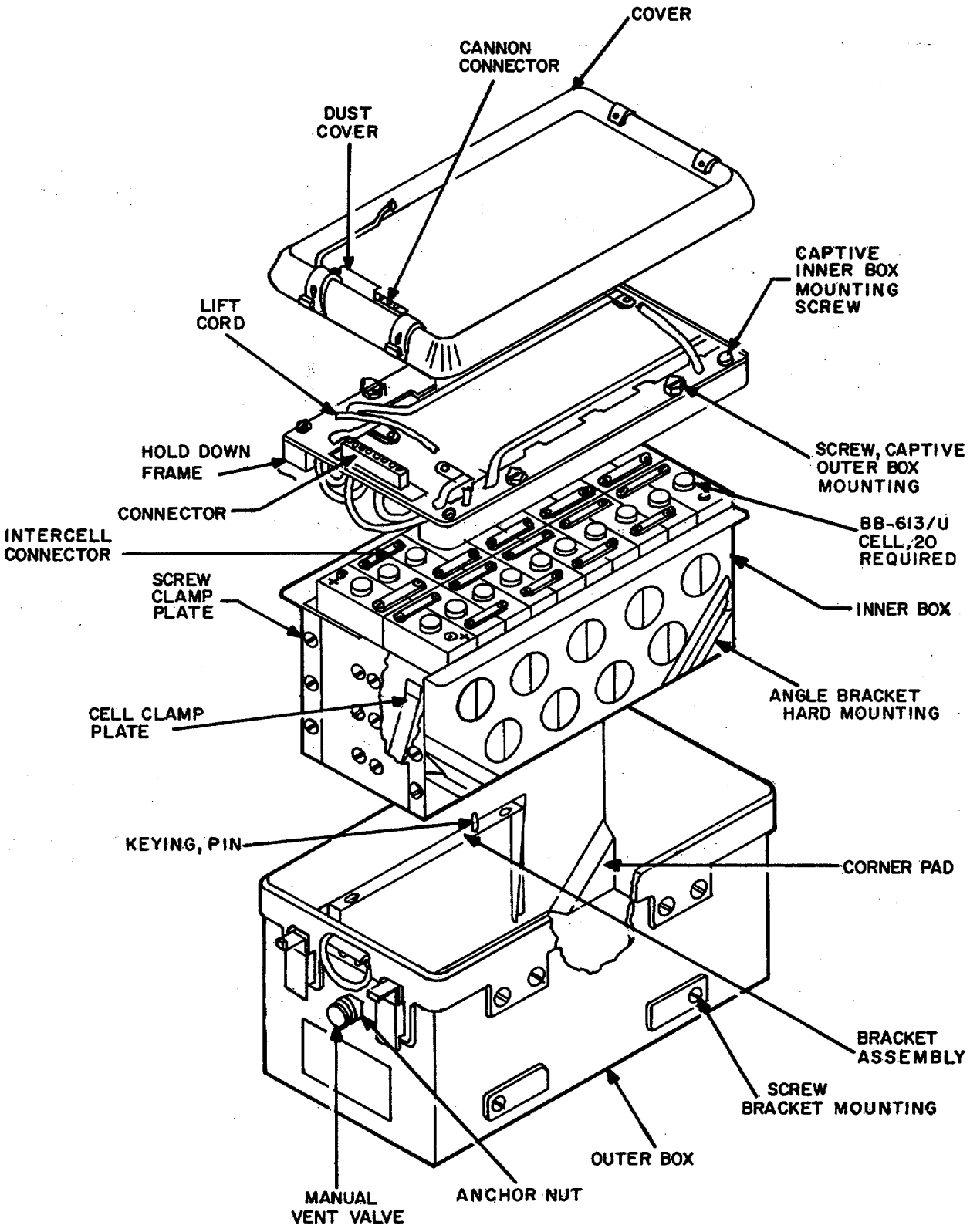


Figure 2-7. Battery, Storage BB-501/U, Exploded View

2-8. Weight and Dimensions of BB-501/U

Battery, Storage BB-50I/U (NSN 6140-00-134-0850) weighs approximately 32.5 pounds. The battery is $7\,^{3}/_{16}$ inches long, $6^{3}/_{4}$ inches wide and $^{7}/_{16}$ inches high. Refer to figure 2-7 for parts location and BB-613/U (cell) layout. The BB-613/U (cell) (NSN 6140-00-134-0849) is $5\,^{3}/_{4}$ inches high, 2¼ inches wide, and 1 inch deep and weighs $1^{1}/_{8}$ pound.

SECTION IV. BATTERY, STORAGE BB-651/U

2-9. Tabulated Data For BB-651/U (fig. 2-8)

Type ..... Nickel-cadmium.
Number of cells ..... 20 (four 5-cell monoblocks).
Type of cell ..... BB-547/U (5 cell monoblock).
Electrolyte ..... Potassium hydroxide (KOH), 31 percent (by weight) in distilled water.
Operating Range:
- Temperature ..... -40° F. (-40° C.) to 125° F. (51.7° C.).
- Atmospheric pressure..... Sea level of 10,000 feet (20.6 inches of mercury ±0.1 inch).

Storage:
- Duration ..... Unlimited, regardless of state of charge.

Temperature ..... -65° F. (-53.9° C.) to 165° F. (73.90 C.).
- Atmospheric pressure..... Sea level to 50,000 feet (3.4 inch of mercury ±0.1 inch).

Electrical Data: .....
- Rating ..... 5.5 ampere-hours.
- Current at rated load of 1.1 amperes:
  Temperatures between
  0° F. (-17.8° C.) and
  125° F. (51.70 C.) 1.1 ampere for approximately 5 hours.
- Temperatures between
  0° F. (-17.8° C.) and
  -40° F. (-40° C.) ..... 1.1amperes for approximately 3 hours.
- Voltage:
  Open circuit ..... Approximately 26 volts(battery fully charged, with a 24-hour rest period).
- At rated load of 1.1 amperes:
  Temperatures between
  75° F. (23.9° C.) and
  85° F. (29.4° C.) ..... 24 volts for approximately 5 hours.
  Temperatures between
  0° F. (-17.8° C.) and
  -40° F. (-40° C.) ..... 23 volts for approximately 3 hours.
- Intercell connector:
  Material ..... Nickel.
  Quantity ..... 18.
- Cell plate materials:
  Positive plate (charged).. Nickel oxide.
  Negative plate (caged)..... Cadmium.
  Separator material ..... Nylon cellophane sandwich.
  Monoblock case materials.... Acrylonitrile-Butadiene-Styrene (ABS).

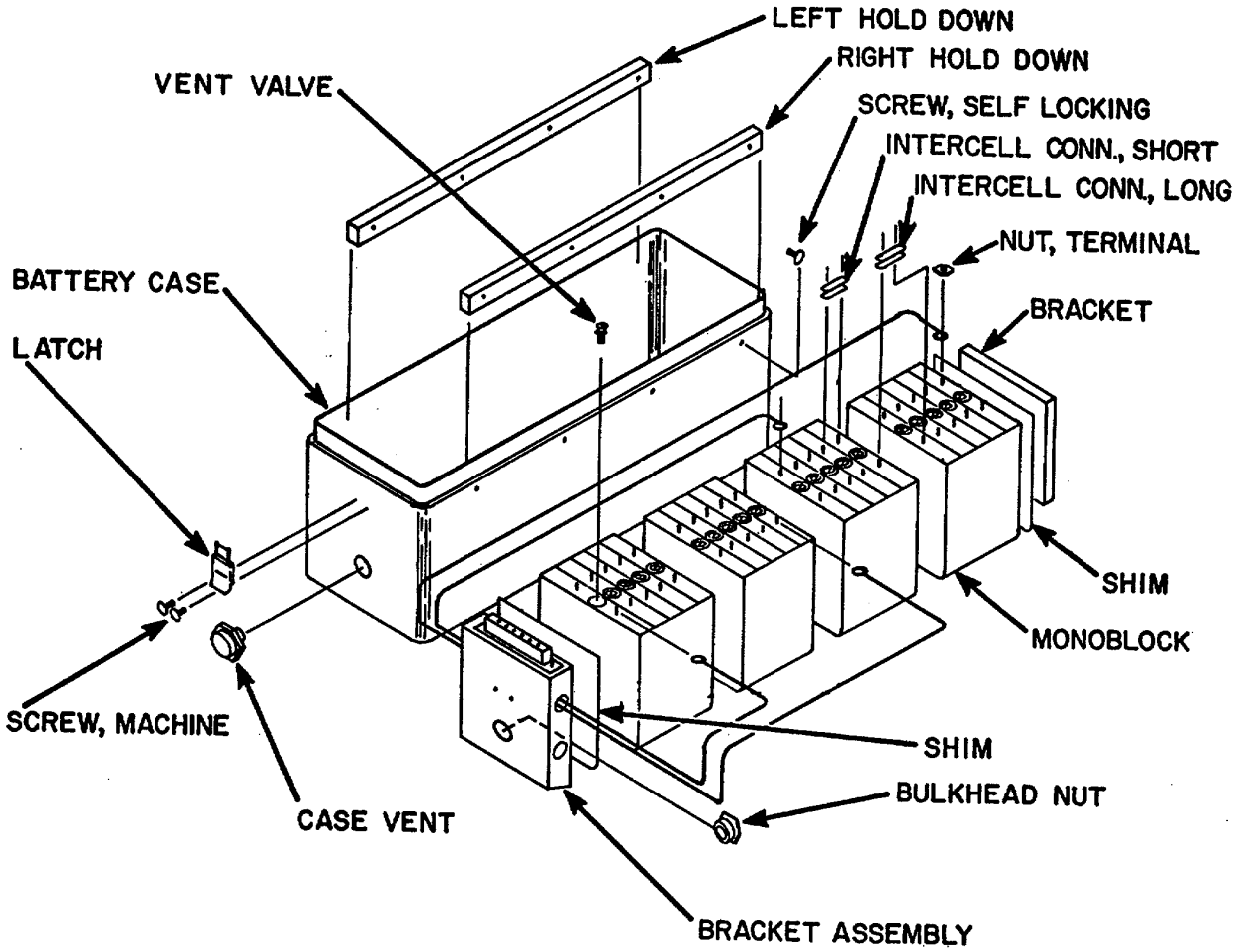


Figure 2-8. Battery, Storage BB-651/U, Exploded View

2-10. Weight and Dimensions of BB-651/U

Battery, Storage BB-651/U (NSN 6140-01-037-7344) weighs approximately 12 pounds. The battery is 4 3/4 inches high, 4 1/8 inches wide, and 13 inches deep. Refer to figure 2-8 for BB651/U parts location.

2-11. Physical Characteristics of BB-547/UMonoblock Cell

The overall dimensions of the five cell monoblock (NSN 6140-01-037-7343) are 3 11/16 inches high, 2 1/2 inches wide, and 3 9/16 inches deep. Refer to figure 2-8 for monoblock parts location and cell layout for the BB-651/U.

SECTION VI. BATTERY, STORAGE BB-672/U

2-12. Tabulated Data For BB-672/U

Type..... Nickel- cadmium(vented)
Number of cells ..... 5 BB671/U.
Type of cell..... Potassium hydroxide (KOH), 31 percent (by weight) in distilled water.

Operating range:
- Temperature..... -40 ° F. (-40° C.) to 125 ° F. (51.7 ° C.).
- Atmospheric Pressure Sea level to 10,000 feet(20.6 inches of mercury ±0.1).

Storage:
- Duation..... Unlimited, regardless of state of charge
- Temperature.....-65 ° F. (-53.9 ° C.) to 165 ° F. (73.9 ° C.).
- Atmosphere c pressure.....Sea level . to 50,000 . feet (3.4 inches of mercury ±0.1).

Electric Data:
- Rating ..... 4.7ampere-hours.
- Current at rated load (0.94 ampere):
  - Temperatures between

0° F. (17.8° C.) and...
125° F. (51.7° C.)..... 0.94 ampere for approximately 5 hours.
Temperatures between
0° F. (-17.80 C.) and
-40- F. (-400 C.).. 0.94 ampere for approximately 3 hours.

Voltage:
Open circuit ..... Approximately 6.5 volts (fully charged, with a 24-hour rest period).
Under rated load (0.94 ampere)
Temperatures between
75° F. (23.9° C.) and
850 F. (29.40 C.) .....6.0 volts for approximately 5 hours.
Temperatures between
0° F. (-17.8° C.) and
-40° F. (-40° C.).....5.75 volts for approximately 3 hours.

Intercell connector:
Material .....Nickel-Plated copper.
Number .....4.
Cell plate materials:
Positive (charged) .....Nickel oxide.
Negative (charged).....Cadmium.
Separator material .....Nylon cellophane sandwich or double felted nylon.
Cell Use Material .....Nylon.

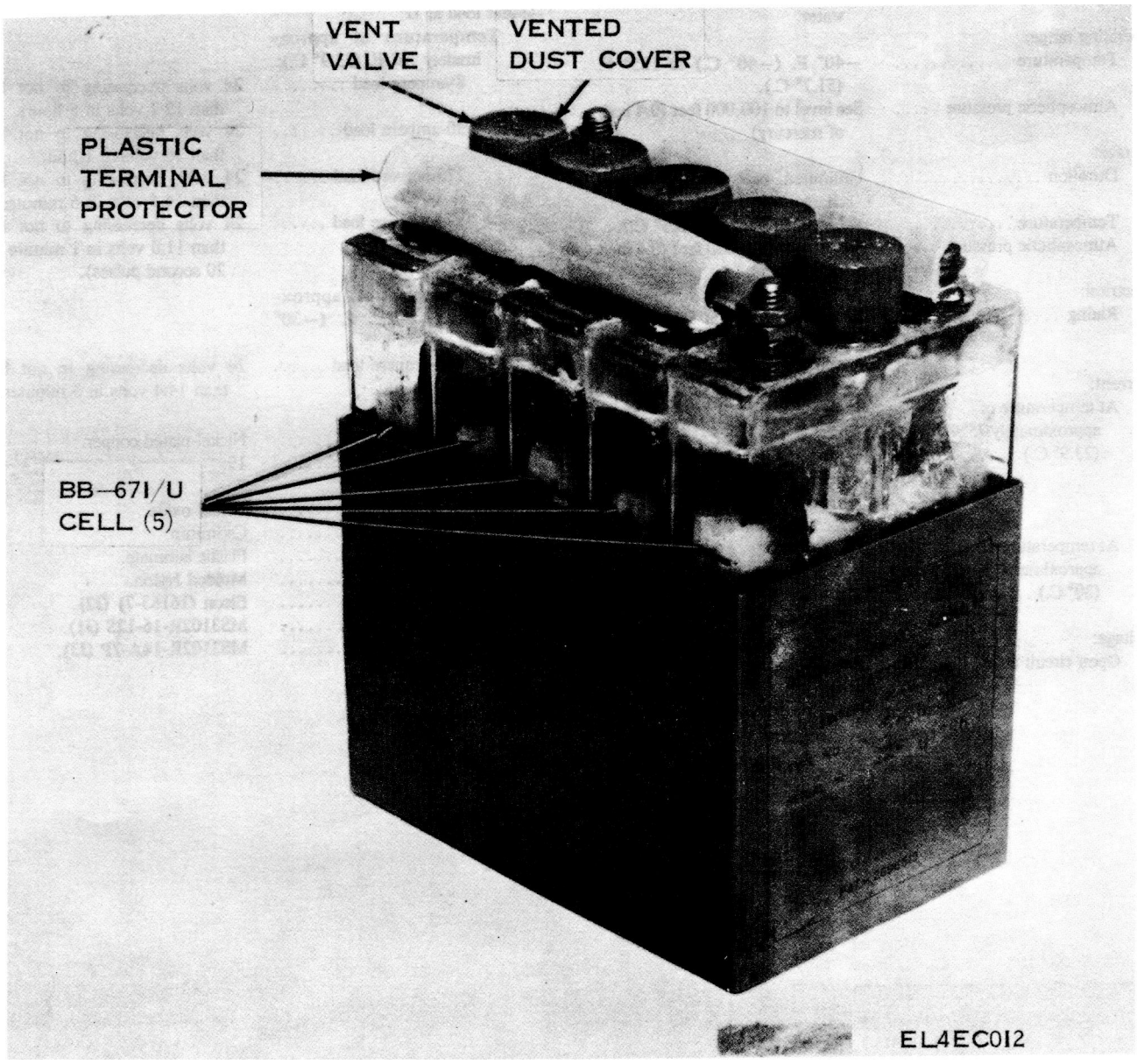


Figure 2-9. Battery, Storage BB-672/U, Cover Removed.

2-13. Weight and Dimensions

Battery, Storage BB-672/U (NSN 6140-00-777-3322) weighs approximately 2 pounds. The battery is 4 1/64 inches high, 2 13/32 inches wide, and 3 1/4 inches deep. Refer to figure 2-9 for a physical layout of the battery. No repair parts are authorized.

2-14. Physical Characteristics of BB-671/U (Cell)

The overall dimensions of Battery, Storage BB-671/U (cell) (NSN 6140-00-764-1624) are 4 1/16 inches high, 2 9/64 inches wide, 2 1/32 inch deep, and weighs approximately 6 3/10 ounces. Refer to figure 2-9 for cell layout of the BB-672/U

SECTION VII. BATTERY, STORAGE BB-693A/U

2-15 Tabulated data for BB-693A/U

Type ..... Nickel-cadmium (vented).
Number of cells ..... 19 BB-60cA/A.
Electrolyte ..... Potassium hydroxide (KOH), 31 percent (by weight) in distilled water.
Operating range:.....
  Temperature ..... -40° F. (-40° C.) to 125° F. (51.7° C.).
  Atmospheric pressure Sea level to 100,000 feet (0.4 inch of mercury).
Storage:
  Duration..... Unlimited, regardless of state of charge
  Temperature ..... -65°F. to 165° F. (73.9° C.).
less
  Atmospheric pressure ....Sea level to 100,000 feet (0.4 inch of mercury).
Electrical
  Rating..... 30 ampere hours at I hour rate, 40 ampere-hours at 5 hours rate.
Current: .....
  At temperature of.....
  approximately 75° F..
(23.90 C.) ..... 8 amperes for approximately 5 hours; 30 amperes for approximately 1 hour, 270 amperes for approximately 5 minutes.
At temperature of
  approximately -22° F.
  (30° C.)..... 270 amperes for approximately 3 minutes
Voltage:
  Open circuit at J2..... Approximately 25 volts (fully charged with 24-hour rest period).
  Open circuit at J1 .....Approximately 9 volts (fully charged with 24-hour rest period).
Under load at J2:
  Temperature of approximately 750 F. (23.9° C.):
  8-ampere load .....24 volts decreasing to not less than 19.2 volts in 5 hours.
  30-ampere load .....24 volts decreasing not less than 18 volts in 1 hour.
  270-ampere load .....24 volts decreasing to not less than 14.4 volts in 5 minutes.
  772-ampere load .....24 volts decreasing to not less than 11.0 volts in I minute (3, 20 second pulses).
Temperature of approximately -22° F. (-30° C):
  270-ampere load .....24 volts decreasing to not less than 14.4 volts in 3 minutes.
Battery terminal links:
  Material .....Nickel-plated copper.
  Number .....19.
Cell plate materials:
  Positive (charged).....Nickel oxide.
  Negative (charged) ....Cadmium.
Separator material.....Plastic laminate.
Cell case material.....Molded Nylon.
Connector type (24-vol) ....Elcon (16163-7) (12).
Connector type (8.4-volt) ..MS3102R-16-12S (11).
Connector type Near) .....M3102R-14A-7P (3).

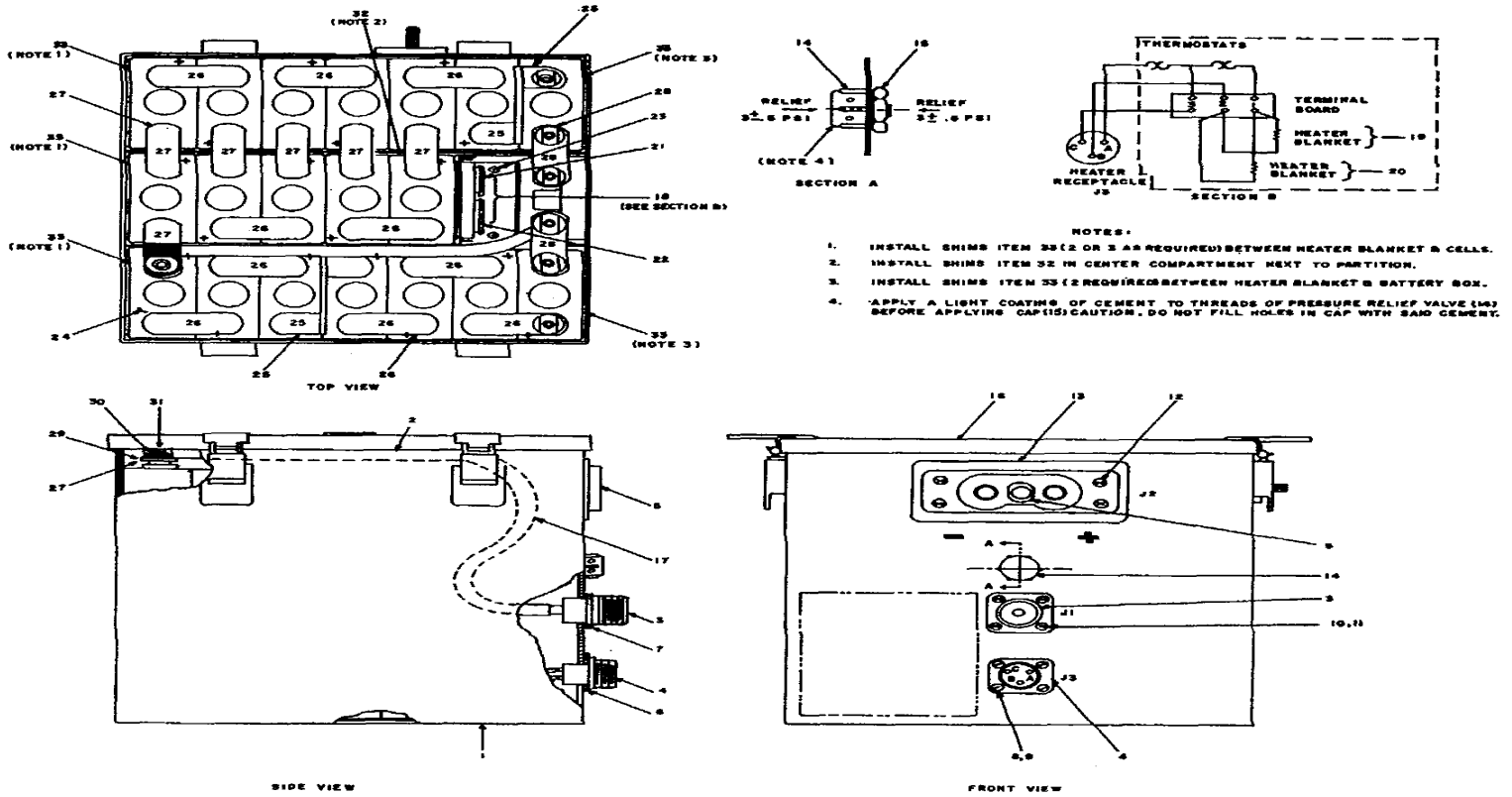


Figure 2-10. Battery, Storage BB-693A/u (Manufactured by Marathon (Sonotone) Battery Corporation), Parts Location.

1. BB-693A/U (Marathon)
2. Case Assembly
3. Connector receptacle J1
4. Connector receptacle J3
5. Connector receptacle J2
6. O-ring
7. O-ring
8. Phillip's-head screw
9. Lockwasher
10. Phillip's-head screw
11. Lockwasher
12. Phillip's-head screw
13. Rectangular ring 1A1
14. Pressure relief valve
15. Threaded cap
16. Lined Cover
17. Cable assembly
18. Thermostat assembly
19. Heater Unit
20. Heater Unit
21. Thermostat
22. Thermostat
23. Phillip's-head screw
24. Battery terminal link
25. Battery terminal link
26. Battery terminal link
27. Battery terminal link
28. Battery terminal link
29. Bellville spring
30. Double D washer
31. Hexagonal head screw
32. shim
33. Shim
34. Manual Vent valves.

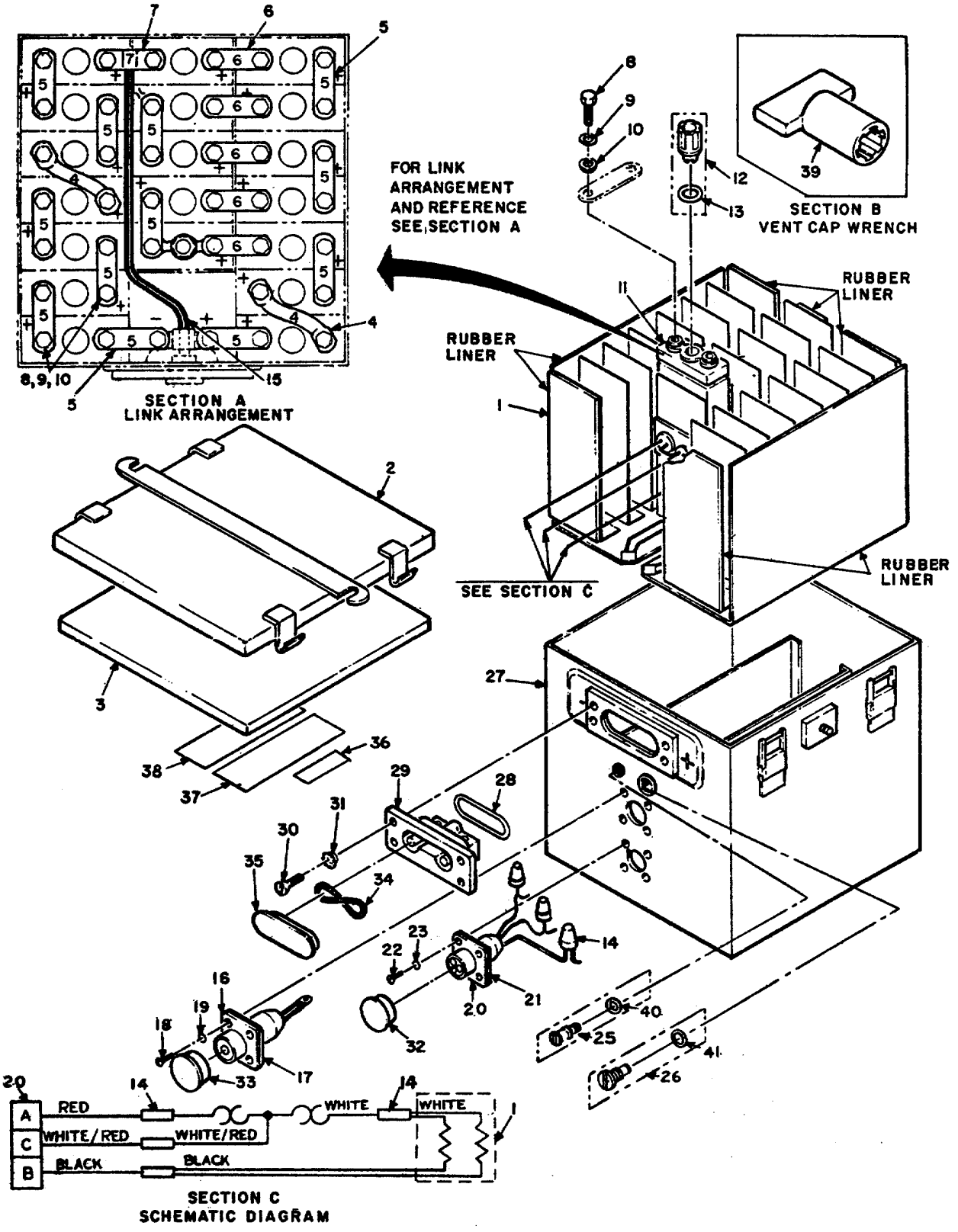


Figure 2-11. Battery, Storage BB-693a/u (Manufactured by General Electric), Parts Location.

1. Heater Assembly
2. cover assembly
3. cover gasket
4. Battery terminal link
5. Battery terminal link
6. Battery terminal link
7. Battery terminal link
8. Hexaganol head screw
9. Flat washer
10. Belleville washer
11. Cell
12. Vent cap assembly (p/o cell (11))
13. O-ring (p/o vent cap assembly (12))
14. Splice
15. Cable assembly
16. Connector assembly
17. Connector gasket
18. Binder head screw
19. Rolled washer
20. Connector receptacle J3
21. Connector gasket
22. Binder head screw
23. Rolled washer
24. Thermostat assembly
25. Valve assembly
26. Valve assembly
27. Case assembly
28. O-ring
29. Connector receptacle, electrical J2
30. Oval head screw
31. Countersunk tooth lockwasher
32. Protective cap
33. Protective cap
34. Srpring
35. Dust cap
36. Warning nameplate
37. Instruction nameplate
39. Instruction nameplate
40. O-ring (p/o valve assembly(25))
41. O-ring (p/o valve assembly(26))
42. Manual Vent Valve (2)

Figure 2-11. - Continued

2-16. Weight and Dimensions of BB-693A/U and BB-693/U

Battery, Storage BB-693A/U (NSN 6140-01-072-3123) which contains polypropylene separated cells and Battery BB-693/U (NSN 6140-00-862-2979) weigh approximately 83 pounds. The battery is 101/4 inches high, 12 inches wide, and 1P/4 inches deep. Refer to figure 2-10 for parts location for the BB-693A/U manufactured by Marathon (Sonotone) Battery Corporation and figure Marathon (Sonotone) Battery Corporation and figure 2-11 for parts location for the BB-693A/U manufactured by General Electric.

Battery	*Cell Designation*
BE-693A/U (NSN 6140-01-072-3123)	BB-600A/A
BB-693/U (NSN 6140-00-862-2979)	18191-14 43B034ACOSG5

2-17. Characteristics of Cells in BB-693A/U and BB-693/U

The cells used in the BB-693 are 913/32 inches high, 39/64 inches wide, and 125A4 inches deep. Each cell weighs ap- proximately 31/2 pounds. However, there are differences between the cells. Cells from different manufacturers or which have different stock numbers must never be mixed in the same battery. The table below lists the various cells and stock numbers used in the BB-693A/U and BB-693/U.

Manufacturer	*Cell NSN*	*Comments*
Marathon	6140-00-8814887	Preferred Type
General Electric	6140401-051-9844	Preferred Type
SAFT	N/A	
Marathon	6140-00-408-4936	Use to Exhaustion
General Electric	614040-408-4937	

The cells used in the BB-693A/U are the longer lasting polypropylene separator BB-600A/A; which is also used in the BB-433A/U aircraft battery. Only these cells have been designed to meet the BB-693A/U requirements as well as those of aircraft. The older BB-600/A cell with cellophane separator may not meet the BB-693A/U requirements. All 19 cellophane separator cells in a BB-693/U battery can be replaced with 19 polypropylene separator BB-600A/A cells. The battery should then be redesigned as a BB-693A/U battery case from either Marathon or General Electric. However, all 19 cells in the battery must have the same stock number and manufacturer. Refer to figure 2-10 for the cell layout for a Marathon built battery or figure 2-11 for the cell layout for one built by General Electric.

SECTION IX. BATTERY, STORAGE BB-634/U (6TNC)

2-18. Tabulated Data for BB-634/U (6TNC)

Type ..... Nickel cadmium (vented).
Number of cells ..... 10.
Electrolyte ..... Potassium hydroxide (KOM), 31 percent (by weight) in distilled water.
Operating range:.....
  Temperature ..... -40 F. (-40° C.) to 125° F. (51.7° C.).
Atmospheric pressure ..... Sea level to 10,000 feet (20.6 inches of mercury O0.1).
Storage:
  Duration ..... Unlimited, regardless of state of charge.
Temperature ..... -650 F. (53.90 C.) to 1650 F. (73.90 C.).
Atmospheric pressure ..... Sea level to 50,000 feet (3.4 inches of mercury +/-0.1).
Electrical data.
  Rating ..... 70 ampere-hours.

Current at rated load (14 am-Temperatures between 700 pere):

Temperatures between 0° F. (-17.8° C.) and 125° F. (51.7° C.) 14 ampere for approximately 5 hours.

Temperatures between 0° F. (-17.80 C.) and -40'F (-40° C) 14 ampere for approximately 3 hours.

Voltage:

Open circuit ..... Approximately 13 volts (fully charged, with a 24-hour rest period).

Under rated load (14 ampere):

F. (21.10 C.) and 850 F. (29.40 C.) .....12 volts for approximately 5 hours.

Temperatures between 0° F. (-17.8° C.) and -40° F. (-40° C.) .....11.5 volts for approximately 3 hours.

Intercell connector (molded in place):

Material .....Nickel-Plated copper.

Number .....9.

Cell plate materials:

Positive (charged).....Nickel oxide.

Negative (charged) ....Cadmium.

Separator material ....Nylon cellophane sandwich.

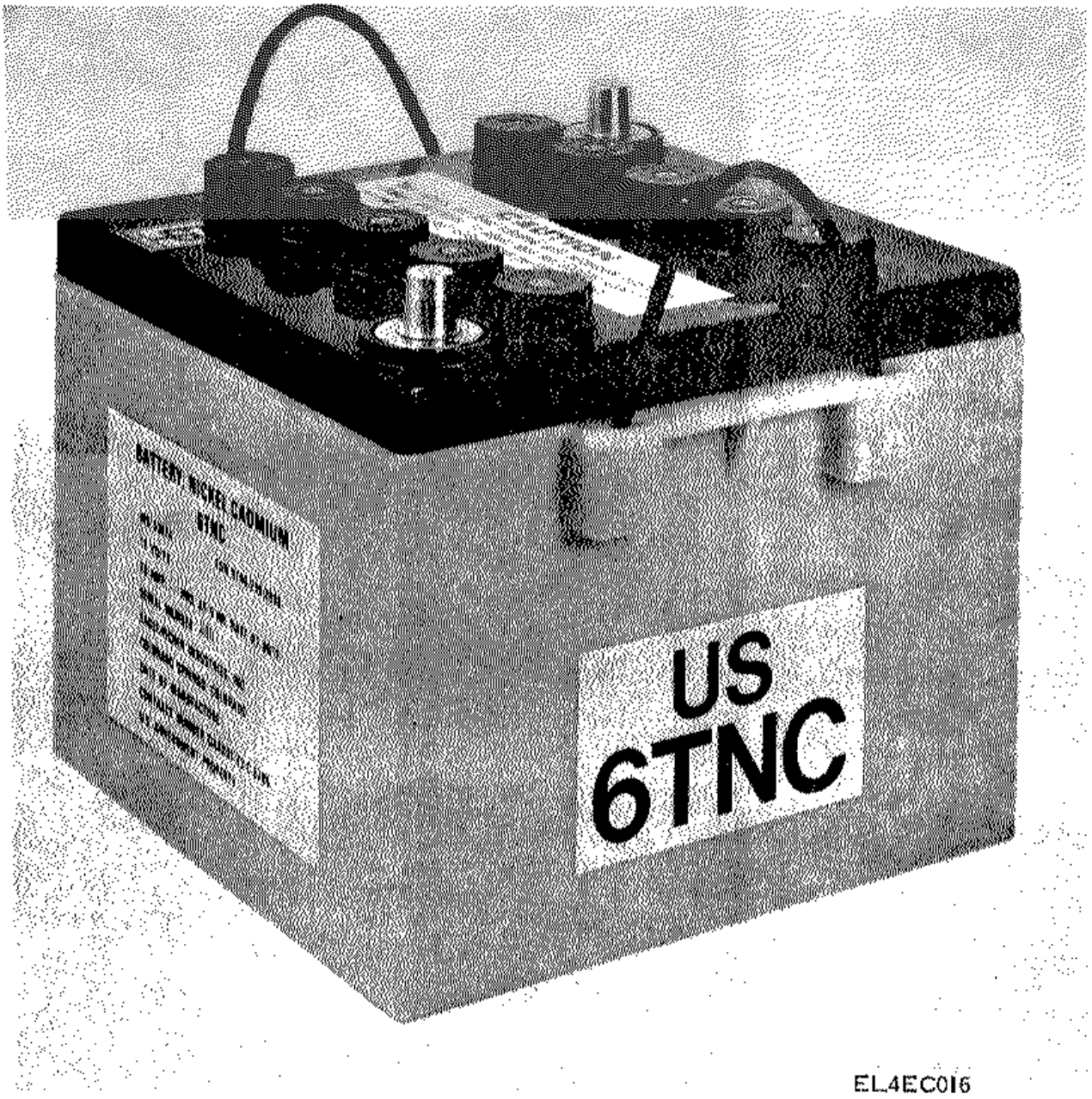


Figure 2-12. Battery, Storage BB-634/U (6TNC)

2-19. Dimensions of BB-634/U (6TNC)

The overall dimensions of the BB-634/U (6TNC) (NSN 6140-00-900-8537) are 9 inches high, 101/2 inches wide, and 11¼4 inches deep. Refer to figure 2-12 for an overall view of the battery. No repair parts are authorized for this equipment.

CHAPTER 3
INSTALLATION

3-1. Unpacking

a. When packed for domestic shipment, the batteries are packed several to a larger wooden case (fig. 3-1) (each enclosed in a separate container).

b.

CAUTION

Do not attempt to pry off the wooden cover. Remove the nails for the cover and lift off. The batteries may be damaged by the prying tool.

(1) Remove carton from wooden packing case, when applicable.
(2) Slit the gummed tape of the cardboard carton.
(3) Remove the battery from the cardboard carton. If the battery fits tightly in the carton, hold the carton down when lifting the battery.

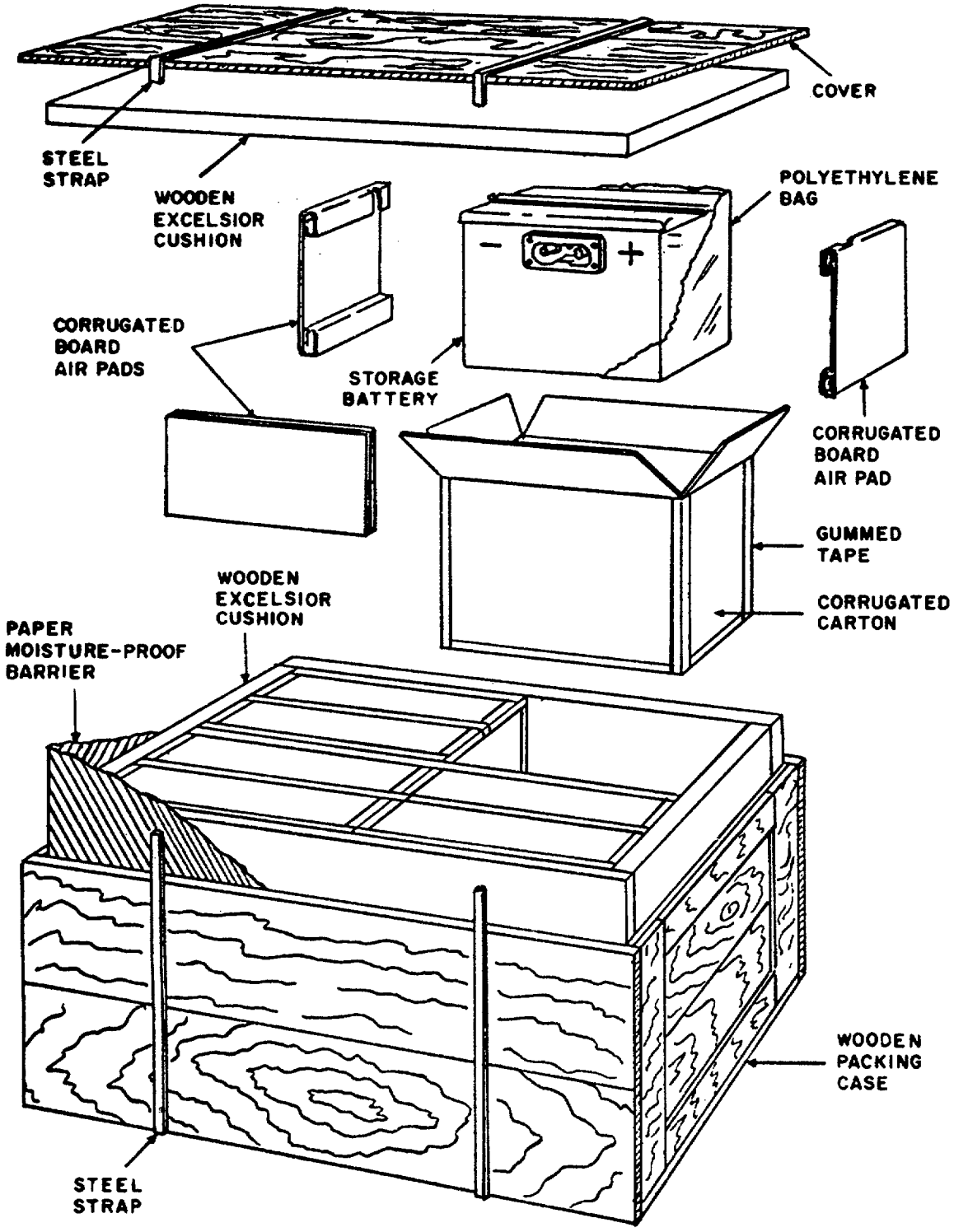


Figure 3-1. Typical Nickel-Cadmium Battery Packaging (Multiple)

3-2. Checking Unpacked Equipment

a. Inspect the equipment for damages incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6 (para 1-3b).

b. Check to see that the equipment is complete as listed on the packing slip. Report all discrepancies in accordance with procedures given in TM 38-750. Shortages of a minor assembly or pan that does not affect proper functioning of the equipment should not prevent use of the equipment.

NOTE

New batteries are prepared for service by direct support, general support, or depot maintenance personnel only.

c. Prepare the new battery for service as given in paragraph 5-5.

3-3. Battery Service Record-Format

a. Record Format. When placing a battery in service for the first time, prepare and use the format, in duplicate, similar to that shown in DD Form 314 (Preventive Main- tenance Schedule and Record (Card)) of TM 38-750 to provide a record of each individual battery. This record will serve as a verification of maintenance accomplished.

b. Recording Procedure.

(1) Affix one copy of the record to the battery immediately after formation of the battery at direct support.

(2) File the duplicate copy of the record at the direct support shop that accomplished the formation of the battery.

(3) Entries are to be made on the copy mounted on the battery by organizational Shop personnel as necessary.

(4) Make entries on the direct support file copy every time the battery is in direct support shop for service.

(5) Make cross entries (direct support personnel), as necessary, to update on each file copy of the battery record. When records are filled, start a new copy. Direct support personnel should remove old record from battery and affix current record to battery. Direct support personnel should retain all duplicate copies in their file.

3-4. Installation of Nonaircraft Nickel-Cadmium Battery

NOTE

Place into service only new batteries that have been prepared for service by higher category of maintenance personnel.

Installation of the particular nonaircraft nickel-cadmium battery will differ from ground system to ground system. For installation procedures of each different nonaircraft nickel-cadmium battery, refer to the manual covering the ground system. In addition, observe the following:

a. *Securing Battery in Position*. When installing the battery in its position to power a ground system, see that all electrical connections are made secure. Leads to the battery should be of sufficient size to carry the maximum current. The battery should be secured by holddowns.

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 some means of ventilation from this confined area to avoid accidental ignition of the hydrogen. Always charge with cover removed.

3-5. Emergency Procedures

Alkaline or nickel-cadmium batteries may experience an overheated condition resulting from internal shorting or thermal runaway. The overheated battery presents a hazardous condition to equipment, vehicle, and personnel. When an overheated battery is detected, turn off charging source, disconnect battery and wait for battery to cool. Emergency personnel should open the battery compartment, check for the following conditions and then take the action indicated.

a. If flame is present, use the available extinguishing agent.

b. If no flame is present, but smoke, fumes or electrolyte is being emitted from the battery or vent tubes, use water fog to lower the battery temperature.

c. If no flame or fire is present, and smoke, hydrogen/oxygen gas or electrolyte is not being emitted from the battery or vent tubes, ventilate the battery compartment.

WARNING

C02 is an acceptable fire extinguishing agent once a fire has developed. In no case should C02 be directed into a battery compartment to effect cooling or displace explosive gases. The static electricity generated by the discharge of the extinguisher could explode the hydrogen/oxygen gases trapped in the battery compartment.

d. Following the visual check and the action indicated above; emergency personnel should disconnect and remove the battery. Additional cooling may be accomplished with water fog.

CHAPTER 4
ORGANIZATIONAL MAINTENANCE

4-1. Scope of Organizational Maintenance

The maintenance duties assigned to the operator's of end item which are powered by nonaircraft nickel-cadmium batteries, and organizational maintenance personnel for nonaircraft nickel-cadmium batteries are listed below, together with a reference to table or paragraphs covering the specific maintenance functions. Test equipment, tools, and supplies required for the performance of organizational maintenance are listed in paragraph 4-2.

a. Operator daily preventive maintenance checks and services (at the equipment site) are limited to making sure that the battery case, cover and the top of the cells are kept clean and free of potassium carbonate deposits Sara 4-7) and, during operation of the end item of equipment, being alert for any indications which signal battery malfunction.

b. Organizational weekly preventive maintenance checks and services for the BB-693A/U only (see para 4-5).

c. Organizational quarterly maintenance is limited to removal of the battery from the equipment and returning it to higher category of maintenance for reconditioning. The battery must be returned to higher category maintenance for reconditioning if is has been through 100 cycles (discharged through normal operation (or for any other reason intentional or accidental) and recharged) prior to 2 the scheduled quarterly maintenance date. Do not allow the battery to remain in operation longer than the 120-day period or 100 cycles since its storage capacity will be greatly impaired and the duration of equipment operation severely limited.

d. Visual inspection (para 4-6).

e. Touchup painting (para 4-8).

f Electrolyte level check (para 4-9).

g. Electrical leakage test (para 4-10).

h Terminal screw torque (para 4-11).

i. Organizational repair (para 4-12).

4-2. Test Equipment, Tools, and Supplies

The following test equipment, tools, and supplies are required for organizational maintenance.

a. Test Equipment. Multimeter AN/USM-223.

b. Tools. Tool Kit, Battery Service TK-90/G.

c. Supplies. Lint-free cloth (item 1, app E).

4-3. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of nickel-cadmium batteries to prevent occurrence of trouble, reduction of downtime, and insurance that the equipment is serviceable.

a. Systematic Care. Procedures given in paragraphs 4-6 through 4-11 cover routine systematic care and cleaning essential to the proper upkeep of the equipment.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and services instructions. contained in paragraph 4-la and 4-1c, and paragraph 4-5 outline functions to be performed at specific intervals. These checks and services are to maintain nickel-cadmium batteries in a combat-serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operator and maintenance personnel in maintaining combat serviceability, the maintenance guidance indicates what to check, how to check, and the normal indications. The procedure information, where applicable, lists the paragraphs or manuals that contain detailed repair or replacement procedures. If the defect cannot be remedied by performing the corrective actions listed, a higher category of maintenance or repair is required. Records and reports of these checks and services must be made in accordance with requirements given in

4-4. Organizational Preventive Maintenance Checks and Services

Organizational preventive maintenance checks and services of the nickel-cadmium batteries are required daily, and in addition to daily, quarterly (or every 100 discharge-charge cycles) *whichever shall occur first.*

a. Paragraph 4-la specifies checks and services that must be accomplished daily.

b. Paragraph 4-5 specifies checks and services that must be accomplished weekly for the BB-693/U only.

c. Paragraph 4-1c specifies additional checks and services that must be performed quarterly (or every 100 discharge-charge cycles) *whichever shall occur first.*

4-5. Weekly Preventive Maintenance Checks and Services for BB-693A/U ONLY

Perform the following preventive maintenance checks and services for the BB-693A/U only on a weekly basis. Performance of this procedure does not exempt the battery from the required quarterly (or 100 discharge-charge cycle) maintenance.

NOTE

Weekly Preventive Maintenance Checks and Services for BB-693A/U is only required if battery power has been used during the previous week.

a. With the BB-693A/U mounted in the vehicle, use the APU or vehicle generator system to charge the battery and monitor charging current until the charging current remains steady for one hour. Set charging voltage using 1% meter to the following values at the ambient temperatures given:

(1) Above 800 F.-28V.

(2) Between 32-F.-80F.-28.5V.

(3) Below 320 F.-29V.

b. Allow the battery to rest (stand) for not less than

one-half hour or more than 2 hours. Remove the filler caps and check the electrolyte level following the instructions contained in paragraph 4-9. If the electrolyte level requires adjustment refer to higher category of maintenance.

c. Perform the electrical leakage test following the instructions contained in paragraph 4-10. If the leakage current indication is less than 30 milliamperes (ma), the battery passes the electrical leakage test. If the indication is more than 30 ma, remove the battery from the vehicle and clean it as specified in paragraph 4-7. Repeat the electrical leakage test. If the battery still fails to pass the test, refer the problem to higher category of maintenance.

d. A battery which passes the electrical leakage test after cleaning, should be placed on charge until the charging current is 5 amperes or less.

4-6. Visual Inspection

Many causes of battery failure may be detected by visual inspection. Because the battery cannot be disassembled by organizational maintenance personnel, visual inspection is limited to observing the assembled battery. Visual inspection is accomplished as follows:

a. Damage. Release the snap fasteners, remove the cover, and check the battery as indicated in (1) through (7) below.

(1) Battery case or cover scratched or dented.
(2) Battery case liners or cover gasket loose or damaged.
(3) Cell terminal or terminal screws bent or broken.
(4) Cell cases cracked.
(5) Filler cap warped or cracked.
(6) Connector bent or broken.

NOTE

If electrolyte appears on tops of cells, check setting of charging voltage, paragraph 4-5a, and perform leakage test, paragraph 4-Sc. Proceed as directed in paragraph 4-7.

(7) Tops of cell cases and caps for presence of electrolyte.

b. Improper Installation. Check the battery for improper installation as indicated in (1) and (2) below.

(1) Filler cap improperly seated.
(2) Loose terminal screws, battery terminal links, or connector.

c. Loose Connections. Check for loose connections as listed below.

(1) Battery terminal links between cells.
(2) Battery terminal links between cells and receptacle.

d. Electrolyte Leakage. If electrolyte leakage is present in the battery and is not the result of an improperly installed filler cap or spillage, a cell case is probably cracked check for cracked cell cases (tops). In any case of electrolyte leakage, higher maintenance category repair is required.

e. Corrosion or Deposits. Corrosion or white potassium carbonate deposits are caused by gassing and bubbling of 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.

4-7. Cleaning

CAUTION

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

Potassium carbonate deposits in the dry state are nonconductive and when in contact with nickel- or nickel-plated material is noncorrosive. When moisture is added to the powder, which occurs with drastic humidity changes, an electrical leakage path is established. Also, if the potassium carbonate comes 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 lint-free cloth (use item 1, app E).

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

(1) Secure the fillercaps on the 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.

WARNING

To be usable for cleaning, the compressed air source must limit the nozzle pressure to no more than 29 pounds per square inch gauge (PSIG). Goggles must be worn at all times while cleaning with compressed air.

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

e. Clean the fillercaps as follows:

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

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

(3) Use the fiflercap wrench to replace each fillercap to each cell, and tighten by turning the fillercap one-fourth 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, e above. Use a clean, dry, lint-free cloth and very carefully remove any foreign matter which has accumulated in the fillercap seat. Make certain that none of the foreign matter falls into the cell.

(2) Cut the lugs off a fillercap which is going to be thrown away. Remove the fillercap from the cell (e above). Place a clean, dry, lint-free cloth over the base of the fillercap without lugs. Place it over the fillercap seat to be cleaned and turn the fillercap and cloth with a fillercap wrench.

4-8. Touchup Painting Instructions

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

b. Refer to TB 43-0118 for instructions on painting and preserving Electronics Command equipment. When touchup painting, a perfect match with the original paint surface may not be possible because of a change in the is original pigment as a result of oxidation and differences in manufacture. The prevention of corrosion and deterioration is the most important consideration in touchup paint- ing; 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, but not for neglect, unskillful manner, or in 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 pre- vented 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 8010-00-514-1861) (item 2, app E) to the smooth finish. When dry, apply one or two thin coats of olive drab, semi-gloss paint (NSN 8010-00-598-5936) (item 3, app E) to protect the battery box from further corrosion.

4-9. Electrolyte Level Check

Electrolyte level check should be performed only after the battery has been fully charged and allowed to rest a minimum of 30 minutes but not more than 2 hours. If the battery has been at rest beyond the maximum limit, it must be fully recharged and allowed to rest before at-tempting to check the electrolyte level. This is necessary because the apparent electrolyte level drops with time after charge.

a. Remove the battery case cover.

b. Remove the battery fillercaps.

c. If the electrolyte level can be seen above the cell plates by looking into the cell fillercap openings, replace battery fillercaps and battery case cover. If electrolyte can- not be inspected visually, proceed to d below.

d. If the electrolyte level cannot be checked visually because of the battery location, proceed as follows:

(1) Insert a clean 1/s-inch diameter, 6-inch long piece of plastic tubing or ordinary drinking straw (NSN 7350-00-290-2887 or NSN 7530-00-271-1683) into the cell and lower it until the tubing or straw touches the baffle or the tops of the plates. Cover the opposite end of the tubing or straw with the index finger to create a partial vacuum.

(2) Raise the tubing or straw to the cell fillercap seat. While observing the end that was inserted into the cell, remove the finger from the other end to release the vacuum and any electrolyte that may be trapped in the tubing or straw.

(3) If any electrolyte drips from the tubing or straw, replace the battery fillercap and go to the next cell and perform the procedure described in (1) and (2) above.

e. If electrolyte is not found in all cells of the battery while performing the visual procedure in c above or the tubing check in d above, remove the battery from service, install a replacement battery, and evacuate the battery to direct support maintenance. NEVER will organizational maintenance personnel add to or remove distilled water or electrolyte from the battery.

4-10. Electrical Leakage Test

a. Disconnect the battery for the equipment it powers at the battery receptacle.

b. Set the AN/USM-223 function switch to DC MA position.

c. Plug the black test lead into the COM jack.

d. Plug the red test lead into the 10A jack.

e. Place the red test probe of the AN/USM-223 to the positive terminal of the battery. If the battery case is metal, place the block test probe of the AN/USM-223 to a clean, paint-free surface of the battery case such as the latches. If the battery case is not metal, place the black test probe on internal metal support raises, latches, etc. or on a paint-free metal surface on which the battery case is mounted.

f. If the meter pointer indicates more than 2.5 amperes, record the meter indication and proceed to l below.

g. If the meter pointer indicates less than 2.5 amperes, remove the test probes from the battery and the battery case or metal surface. Move the red test probe from the AN/USM-223 1OA jack to the V- f -A jack place the range switch in the 2500 position.

h. Reconnect the AN/USM-223 test probe as described in e above.

i. If the meter pointer does not move close to midscale, turn the range switch one range at a time, until a midscale indication is obtained.

j. Record the meter indication.

k. Repeat the procedures described in d through j above with the black test probe of the AN/USM-223 connected to the negative terminal of the battery and the red test probe to a paint-free surface as described in e above.

l. If any of the milliampere (ma) indications recorded in j above is greater than the ampere-hour rating of the battery being tested, remove the battery from service and send it to direct support maintenance for repair on a direct exchange basis. Remove the battery from service if the leakage current is more than 5.5 ma when testing a 5.5 ampere-hour battery or more than 30 ma when testing a 30 ampere-hour battery, etc.

4-11. Terminal Screw Torque

WARNING

Be extremely careful when tightening the ter- minal screws. Bodily injury and equipment damage may result if the torque wrench accidentally causes a short circuit.

The terminal screws are tightened with the aid of the torque wrench and a socket or screwdriver adapter (p/o TK-90/G).

NOTE

For batteries that have Allen-head terminal screws, an Allen-head adapter is needed for the torque wrench.

a. Place the socket, screwdriver adapter, or Allen-head adapter on the torque wrench.

b. Insert the torque wrench into the loose terminal screw.

c. Rotate the torque wrench clockwise until the given number, in inch pounds as listed below, is indicated on the torque wrench.

Screw or stud diameter	*Inch-pounds to tighten*
8-32 (screw)	Between 20 and 25
10-32 (screw)	Between 35 and 50
10-32 (stud)	Between 15 and 20
5/16-24 (stud)	Between 20 and 25

d. Carefully remove the torque wrench.

4-12. Organizational Repair

Organizational repair of nonaircraft nickel-cadmium batteries is limited to replacement of fillercaps, tightening ter- minal screws, replacement of 0-ring seals, replacement of connector dust caps, and replacement of the pressure relief valve on the BB-693/U. Instructions for each of these functions are given below:

WARNING

The storage battery is charged and will cause bodily injury and equipment damage if the cell terminals or connectors terminals are short circuited. Be extremely careful when repairing the storage battery.

a. *Removal and Replacement of Fillercaps.*

WARNING

Electrolyte on the filercap will cause serious burns if allowed to come in contact with the flesh.

To remove the fillercap use the vent cap wrench. Place the vent cap wrench over the fillercap and turn counter-clockwise one-quarter turn until loose and remove the fillercap from the cell. To replace the fillercap turn the vent cap wrench one-quarter turn clockwise until the filtercap is tight. Remove the vent cap wrench.

b. Tightening Terminal Screws. Tighten loose terminal screws by following the directions given in paragraph 4-11.

c. *Removal and Replacement of O-Ring Seals.*

(1) Remove the fillercap by following the directions given in a above.

(2) Carefully wash the fillercap to remove any trace of electrolyte before replacing the O-ring seal.

(3) Grasp the fillercap firmly with one hand.

(4) With the other hand, remove the 0-ring seal on the bayonet end of the fillercap.

(5) Replace with a new 0-ring seal by holding one side of the new seal in place and stretching the other side over the tangs, sliding the 0-ring seal against the shoulder of the fillercap. Make certain the 0-ring seal is seated firmly.

(6) Place the fillercap on the cell by following the instructions given in a above.

d. Removal and Replacement of Connector Dust Cap (BB-422 Only).

(1) Remove the screw that holds the connector dust cap keeper chain to the battery box.

(2) Unscrew the connector dust cap from the battery connector.

(3) Place the new connector dust cap of the battery connector. Hand tighten the connector dust cap.

(4) Secure the connector dust cap by inserting the screw through the connector dust cap keeper chain and secure it to the battery box.

e. Removal and Replacement of Pressure Relief Valve (BB-6931U Only). Remove the BB-693/U pressure relief valve by unscrewing it from the battery case. Screw a replacement pressure relief valve into the same location.

CHAPTER 5
DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE

5-1. General Instructions

The direct support and general support maintenance procedures given in this chapter supplement those described for organizational maintenance (chap. 4) and consist of the following.

a. Preparing a new battery for service (para 5-5).
b. Adjusting electrolyte level (para 5-6).
c. Periodic service procedures (quarterly or every 100 discharge-charge cycles) (para 5-7).
d. Troubleshooting (para 5-8).
e. Disassembly (para 5-9).
f Reconditioning battery components (para 5-10).
g. Vent valve test (para 5-1 1).
h. New cell procedure (Para 5-12).
i. Filler vent valve test (ma 5-13).

5-2. Test Equipment, Tools, Additional Equipment and Supplies

Test equipment and tools authorized for the direct support and general support maintenance levels are listed in the maintenance allocation chart, (app D). Expendable supplies and materials are listed in appendix E.

CAUTION

Maintenance personnel must wear a face shield (item 4, app E) or goggles (item 5) and an apron (item 6), while handling, servicing or making repairs to a battery.

5-3. Battery-Charger Equipment

The following battery charger equipment and cables are available for servicing nonaicraft nickel-cadmium batteries.

a. Charger, Battery PP-1659/G.
b. Generator set, gasoline engine (NSN 6115-00-475 0029), 3 kilowatts, 28 volts dc, MIL-G-52428 (used for battery charging where 115-volt or 230-volt ac power is not available).
c. Charger, Battery PP-1451/G.
d. Power Supply PP-1 104C/G with relay, reverse current cutoff (NSN 5945-00-824-5575).
e. Charger, Battery PP-6267 (for charging Battery, Storage BB-429/U).
f. Generator Set, Gasoline Engine PU-532/PPS-4 (for operating Radar Set AN/PPS-4 and charging Battery, Storage BB-422/U).
g. Cable Assembly Set MX-4765/PPS-4 (for operating Radar Set AN/PPS-4 and charging Battery, Storage BB-422/U).
h. Cable Assembly, Power Electrical CX-11935/U, (BB-501/U, BB-651/U only).
i. Charger/Analyzers such as the AN/(JSM 432, RF-80GT (Christie Electric) or AN/GSM-261 may be used if available.

NOTE

Check Charger/Analyzer literature to determined the particular battery to be charged can be operated on the specific charger.

5-4. Battery Rest Period After Charging

a. After the nonaircraft nickel-cadmium battery has been fully charged, it should be allowed to rest for a minimum of 30 minutes to a maximum of 2 hours before checking the electrolyte level. If the 2-hour maximum time is exceeded before the level of the electrolyte is checked, the battery must be brought back up to the full charge state and allowed to rest again before performing the 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. At this progresses, electrolyte solution is absorbed into the battery plates in place of the gases. It the battery has rested longer than the maximum period of time, absorption could bring the electrolyte level to the point that inspection would indicate than more 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 while installed in the equipment for service.

5-5. Preparing New Battery for Service

A new battery is a battery that has never been placed in use or a battery taken out of storage for use. Perform the procedures given in a through g below 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 liquid has spilled into the battery case or shipping container. This condition may be a sign of a damaged cell.

(2) *Electrical Connections*. Check all electrical connections for tightness. Test all screws on terminals to ensure tightness. Refer to paragraph 4-11 for correct ter- minal screw torque. Check any wing for proper connec- tion. Poor electrical contact may 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 is charged. When a battery has been discharged or allowed to stand unused over a period of time, the electrolyte becomes ab- sorbed into the plates. The batteries are shipped dis- charged and, therefore, the electrolyte level may seem low. Charging the battery should cause this level to rise to the proper mark, which is just above the tops (approximately one-fourth inch) of the plates. Do not charge cells of different capacities together. Adjust if necessary in accordance with instructions in paragraph 5-6.

b. Clean Battery. Clean the battery by following the instructions contained in paragraph 4-7.

c. Check Polarity Position of Cells. Check the polarity position of each cell or group of cells to be sure that they are connected properly. The polarity of each cell is indicated by a plus (+) sign molded into the cell cover adja- cent to the appropriate cell post. For the cell layout for a specific battery, refer to the cell layout of that specific battery (chap. 2).

d. Tighten Terminal Screws. Tighten terminal screws as described in paragraph 4-1 1.

e. Clean Fillercaps. Clean the fillercaps by following the instructions contained in paragraph 4-7e.

NOTE

Refer to paragraph 2-3, TM 11-6140-203-15-1 for detailed information concerning the electro-chemical action when charging a nickel-cadmium battery.

WARNING

Explosive gases may be released during charging. Check to be sure 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 may cause an explosion. Do not disconnect the charging cable from the battery until the battery charger has been turned off. Explosions or serious burns may result.

f. Charging. Charge the battery using the constant- voltage method or the constant-current charging method as given in (1) or (2) below. At the end of charge, before
the current has been shut off, the individual cell voltages should be checked for uniformity. Cell voltages should be within 0.1 volts of each other. Low cell voltage (under 1.2 volts) may indicate a shorted cell, while high voltage (over 1.9 volts) indicate either a dry cell or bad connec- tion.

(1) Constant-Voltage Method. Table 5-1 provides the constant-voltage charging rate required for temperature, number of cells, and time to accomplish the charge cycle. For example, for a temperature of 800 F and a battery containing 19 cells, charge for 2 hours at 30 volts. Periodically monitor the constant-voltage charging rate by placing the test prods of a voltmeter across the battery terminals and adjust the output of the battery charger, as necessary).

(2) Constant-Current Method. Table 5-2 provides the constant-current charging value required for the specific ampere-hour rating of a battery and the amount of time it normally takes to accomplish the charge cycle. For example, for a fully discharged battery, charge a 34-ampere-hour battery at 21.3 amperes for 2 hours, 10.6 amperes for 4 hours, or 6.8 amperes for 7 hours. If the battery does not meet the minimum end-of-charge voltage, check individual cells for low voltage .If no low cells are present then charge must be continued until the minimum voltages are reached. A new battery may re- quire 20-30% more charge than normal on its very first charge

.

Table 5-1.Constant-Voltage Charging Rate

Ambient temperature (degrees Fahrenheit)	2-hour charge (constant voltage) Number of cells						4-hour charge (constant voltage) Number of cells						8-hour charge (constant voltage) Number of cells					
	1	5	10	19	20	24	1	5	10	19	20	24	1	5	10	19	20	24
−40	1.68	8.4	16.8	32.0	33.7	40.4	1.68	8.4	16.8	32.0	33.7	40.4	1.68	8.4	16.8	32.0	33.7	40.4
−20	1.68	8.4	16.8	32.0	33.7	40.4	1.63	8.2	16.3	31.0	32.6	39.2	1.58	7.9	15.8	30.0	31.6	37.9
0	1.68	8.4	16.8	32.0	33.7	40.4	1.63	8.2	16.3	31.0	32.6	39.2	1.53	7.6	15.3	29.0	30.5	36.6
32	1.63	8.2	16.3	31.0	32.6	39.2	1.58	7.9	15.8	30.0	31.6	37.9	1.53	7.6	15.3	29.0	30.5	36.6
50	1.63	8.2	16.3	31.0	32.6	39.2	1.58	7.9	15.8	30.0	31.6	37.9	1.53	7.6	15.3	29.0	30.5	36.6
80	1.58	7.9	15.8	30.0	31.6	37.9	1.53	7.6	15.3	29.0	30.5	36.6	1.47	7.4	14.7	28.0	29.5	35.4
100	1.53	7.6	15.3	29.0	30.5	36.6	1.47	7.4	14.7	28.0	29.5	35.4	1.47	7.4	14.7	28.0	29.5	35.4
120	1.47	7.4	14.7	28.0	29.5	35.4	1.42	7.1	14.2	27.0	28.4	34.1	1.42	7.1	14.2	27.0	28.4	34.1

Table 5-2. Constant-Current Charging Rate and End-of-Charge Voltage

Ampere-hour rating of nickel-cadmium battery	Constant current charging rate for— 2 hours	4 hours	7 hours
4.0	2.5	1.25	0.8
5.5	3.1	1.6	1.1
7.0	4.4	2.2	1.4
9.0	5.7	2.8	1.8
11.0	6.9	3.5	2.2
13.0	8.2	4.1	2.6
14.0	8.7	4.4	2.8
22.0	13.7	6.9	4.2
34.0	21.3	10.6	6.8
35.0	21.9	10.9	7.0

Table 5-2. Constant-Current Charging Rate and End-of-Charge Voltage-Continued

Ampere-hour rating of nickel-cadmium battery	Constant current charging rate for— 2 hours	4 hours	7 hours
40.0	25.0	14.0	8.0
70.0	43.8	21.9	14.0

b.

Number of Cells	Minimum End of Charge	Voltages	(50-90°F)
1	1.55 V	1.52	1.5
19	29.5	28.9	28.5
20	31.0	30.4	30.0

g. Performance Test. Performance testing for a new battery, before placing it into service, consists of discharge capacity and electrical leakage tests. A battery which passes both of these tests is considered to be serviceable.

(1) Discharge Capacity Test.

(a) After charging (*f* above), allow the battery to rest (para 5-4) and check the electrolyte level (para 5-5).

(b) Refer to table 5-3 for the discharge time, current rate, and variable resistor value for the battery to be tested.

(c) Connect the switch (item 7, app E), variable resistor (item 8) and test equipment as shown in figure 5-1. Two multimeters (AN/USM-223) are required. Charger/Analyzers as indicated in 5-3i, may be used in place of resistors. Check Charger/Analyzer literature to determine if the particular battery to be tested can be operated on the specific Charger/Analyzer.

(d) Begin the discharge capacity test

(e) When the battery has been discharged for the specific time, at the rate indicated in table 5-3, measure the closed circuit battery terminal voltage and then as quickly as possible, the individual cell voltage.

(f) The battery terminal voltage should be as specified in table 5-3. If any cell is less than 1 volt, stop discharging and mark the cell(s) which measure less than 1 volt for replacement.

(g) If batteries are discharged at a higher rate then specified in table 5-3, refer to section 2 for applicable capacity at the specific rate.

(h) If all cells are 1 volt or greater, stop discharging and recharge the battery (f above). Allow the battery to rest and adjust the electrolyte level (para 5-6). Proceed to 2 below.

Table 5-3. 2 hour Discharge Capacity Test

Battery type	Ampere-hour rating	0- to 7.5-ohm variable resistor (FSN 5905-195-4496) adjusted to value given below (ohms)	Average discharge current for 2-hours (amperes)	Minimum closed circuit terminal voltage at end of 2-hour discharge (volts)
BB-422/U	14	3.7	6.25	19
BB-429/U	14	1.0	6.25	5
BB-651/U	5.5	9.6 (Use two load resistors in series)	2.5	20
BB-501/U	14.0	3.9	6.25	20
BB-672/U	4.7	2.7	2.2	5
		Capacity Tests over 2 Hours		
BB-693A/U	34	2.2	10.0 (3-hour discharge)	19
6TNC	70	1.1	10.9 (6-hour discharge)	10

(2) *Electrical Leakage Test.* **Perform the electrical leakage test as specified in paragraph 4-10.**

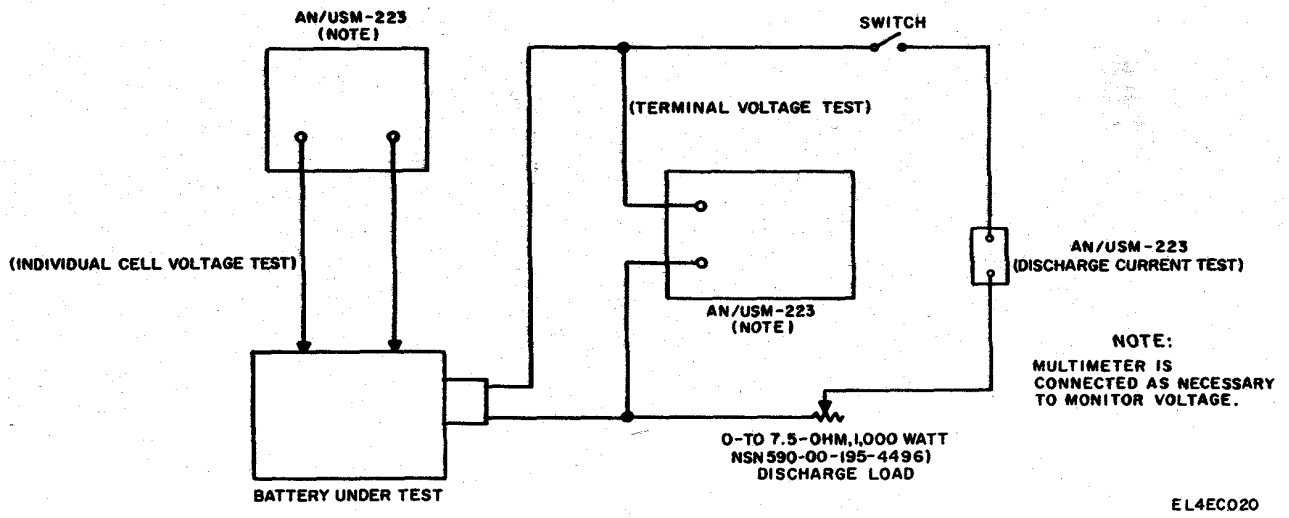


Figure 5-1. Capacity test Connection Diagram

5-6. Adjusting Electrolyte Level.

CAUTION

For batteries requiring electrolyte adjustment, be sure to perform the charging procedures given in paragraph -5-f These procedures must be followed to prevent overfilling cells that have marginal headspace. Overfilling will cause spillage of

electrolyte resulting in damage to the battery. Do not adjust electrolyte level after a battery has 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 level in the charged condition will cause the cells to heat up, resulting in their destruction.

NOTE

An inherent characteristic of nickel-cadmium 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 at a low state of charge or in a discharged condition. When the battery is recharged, the electrolyte level rises and reaches its maximum height at full charge. Ideally the electrolyte level should be checked on a fully charged battery that has been at rest for 30 minutes. The correct level of electrolyte is 1/4 inch above the top of the plates of a fully charged cell that has been at rest for the time specified in paragraph 5-4. The procedure for checking the electrolyte level is exactly the opposite of that for lead-acid batteries in which the electrolyte level is adjusted by adding water before placing the battery on charge, or whenever the electrolyte level is low.

The maximum electrolyte level for a nickel cadmium battery is one-fourth inch above the top of the places. Perform the following procedures for electrolyte adjustments:

a. Before using the syringe, if necessary, modify it as follows:

(1) Use a sharp pin that has been heated with a flame from a match to pierce the stem of the syringe one-fourth inch from the bottom of the stem (A, fig. 5-2).

(2) Let the pin remain in the stem for 2 or 3 minutes and then withdraw the pin slowly from the stem.

b. Remove the fillercaps with the nylon wrench.

CAUTION

Do not spill electrolyte on the battery. Spilled electrolyte may cause corrosion of connectors and short-circuiting between cells, resulting in damage to the battery.

c. Use the stem-pierced syringe, filled with distilled water item 9, app E), insert the syringe into the cell until it rests on the top of the plates (B, fig. 5-2). Slowly squeeze the contents of the bulb until the bulb is empty or the electrolyte is just below the mouth of the cell. Avoid overfilling.

d. Release the bulb to withdraw all liquid that is one- fourth inch above the top of the plates. if no liquid is withdrawn, repeat c above.

e. Repeat c and d above for all cells.

f. Replace the fillercaps after the electrolyte level of all cells has been adjusted.

g. Thoroughly wash out the syringe.

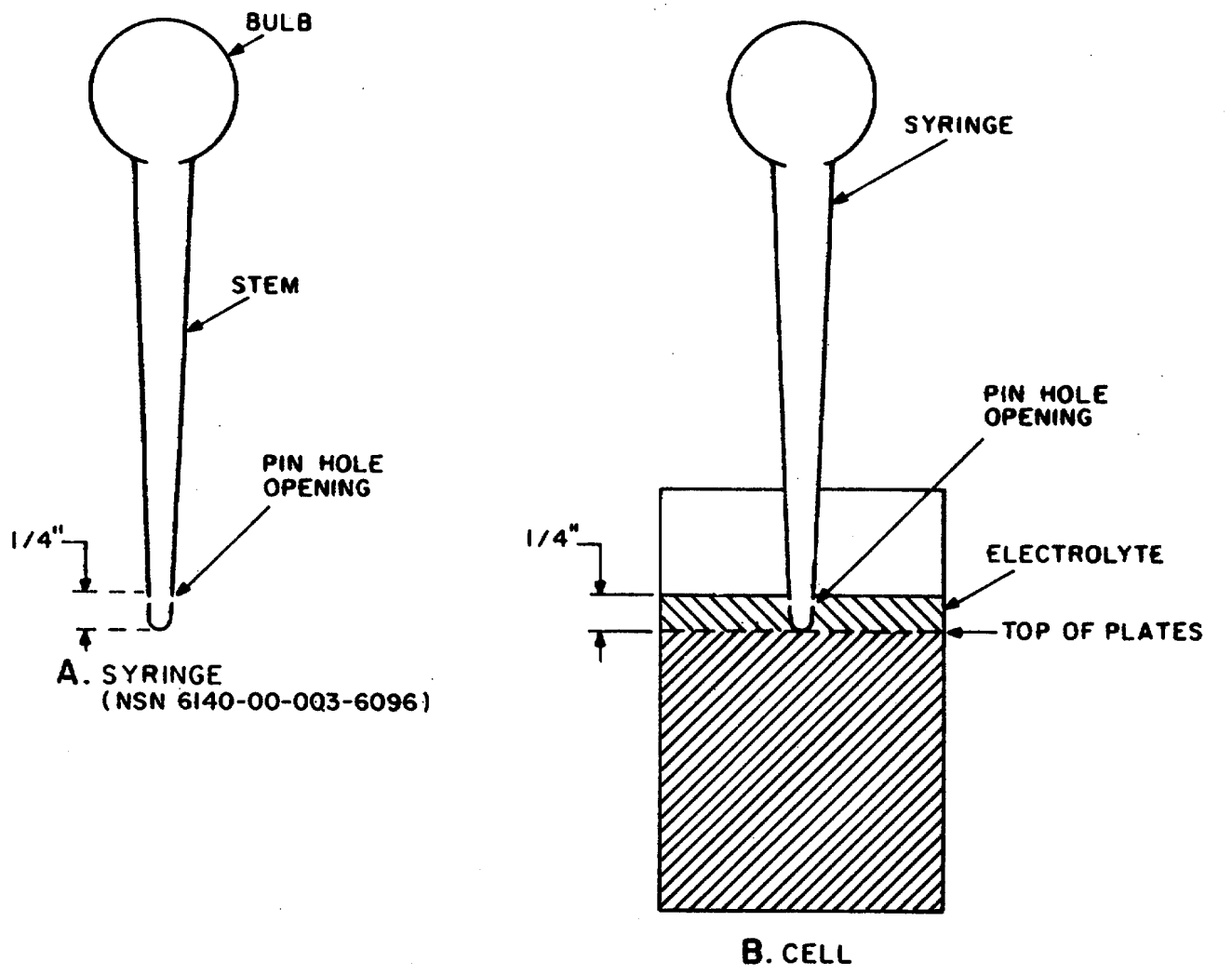


Figure 5-2. Electrolyte Level Adjustment

5-7. Periodic Service Procedures

For batteries returned to direct support or general support for quarterly or every 100 discharge-charge cycles mainte- nance service, proceed as follows:

a. Perform the procedures given in paragraph 5-5a through e.

NOTE

Refer to TM 11-6140-203-15-1 for information concerning the temporary loss of capacity of a nickel-cadmium battery and the discharge method recommended to restore the rated capacity to the nickel-cadmium battery.

b. The following discharge fixtures are available for completely discharging all the cells in the indicated battery:

(1) Battery, Storage BB-422/U, use fixture, NSN 6110-00-179-8273.

(2) Battery, Storage BB693A/U, use fixture NSN 6110-00-014-6225.

c. Discharge the battery using the proper load fixture and the instructions contained in (4) below. If a load fixture is not available then proceed as described in (1), (2), and (3) below.

(1) Connect the 0- to 7.5-ohm, 1.000-wan variable resistor (item 8, app E), two Multimeters AN/USM-223, knife switch (item 7), and nickel cadmium battery to be discharged as shown in figure 5-3. (Be sure that the knife switch is in the open position.)

(2) Close and open the knife switch as necessary while adjusting the 0- to 7.5-ohm variable resistor for a resistance value high enough to permit the discharge cur- rent to flow at approximately the 2-hour rate of the battery. Monitor the terminal voltage of each cell during dis- charge using the AN/USM-223. When the terminal voltage of a cell reaches 0 volts, place a shorting device

(spring metal strip) across the positive and negative terminals of that cell. DO NOT USE ANY OTHER METHOD TO DETERMINE WHEN A SHORTING DEVICE SHOULD BE PLACED ACROSS THE CELL TERMNALS.

NOTE

For the BB-634/U (6TNC) the individual cell terminals are not accessible. Therefore, dis- charge at the 6-hour rate until the total battery voltage reaches 10.0 volts.

(3) Disconnect the equipment from the battery.

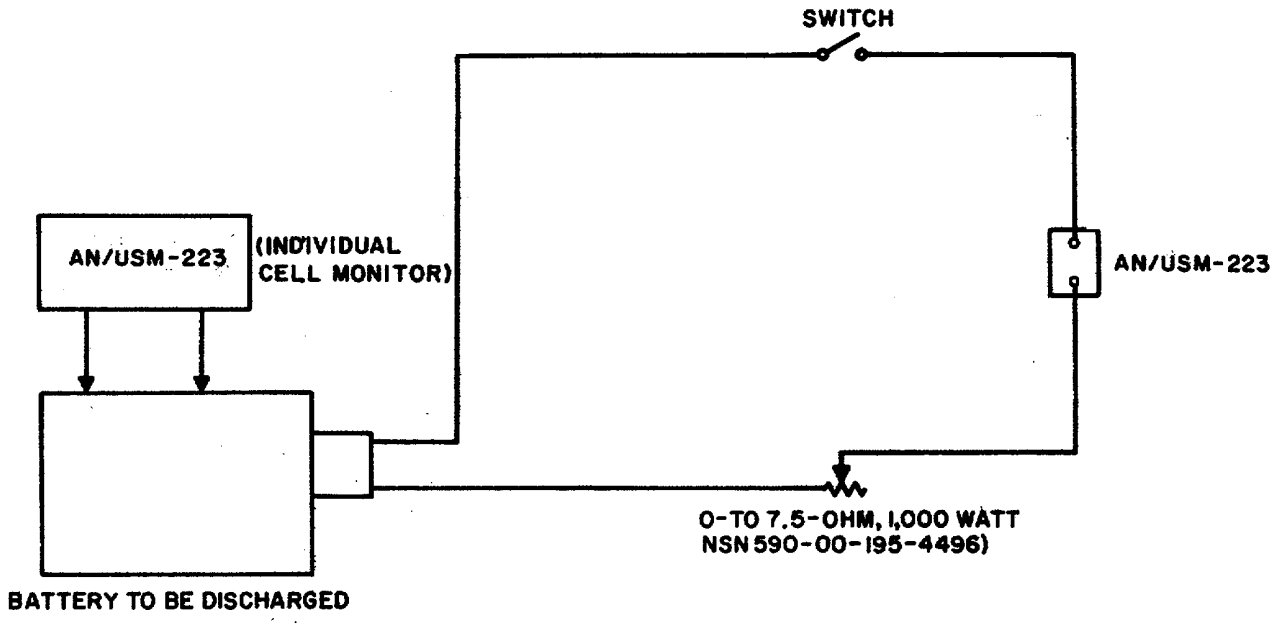


Figure 5-3. Discharging Connection Diagram.

(4) Discharge a battery which has a discharge fixture as follows:

(a) Position the appropriate discharge fixture (5-4 for BB-422/U) over an uncovered battery. Push down firmly on the discharge fixture unto it uniformly covers the battery case.

(b) Clamp the battery case catches on the strikes of the discharge fixture bottom plate.

(c) Leave the discharge fixture on the battery for 16 to 18 hours. After 16 to 18 hours of discharge, remove the discharge fixture

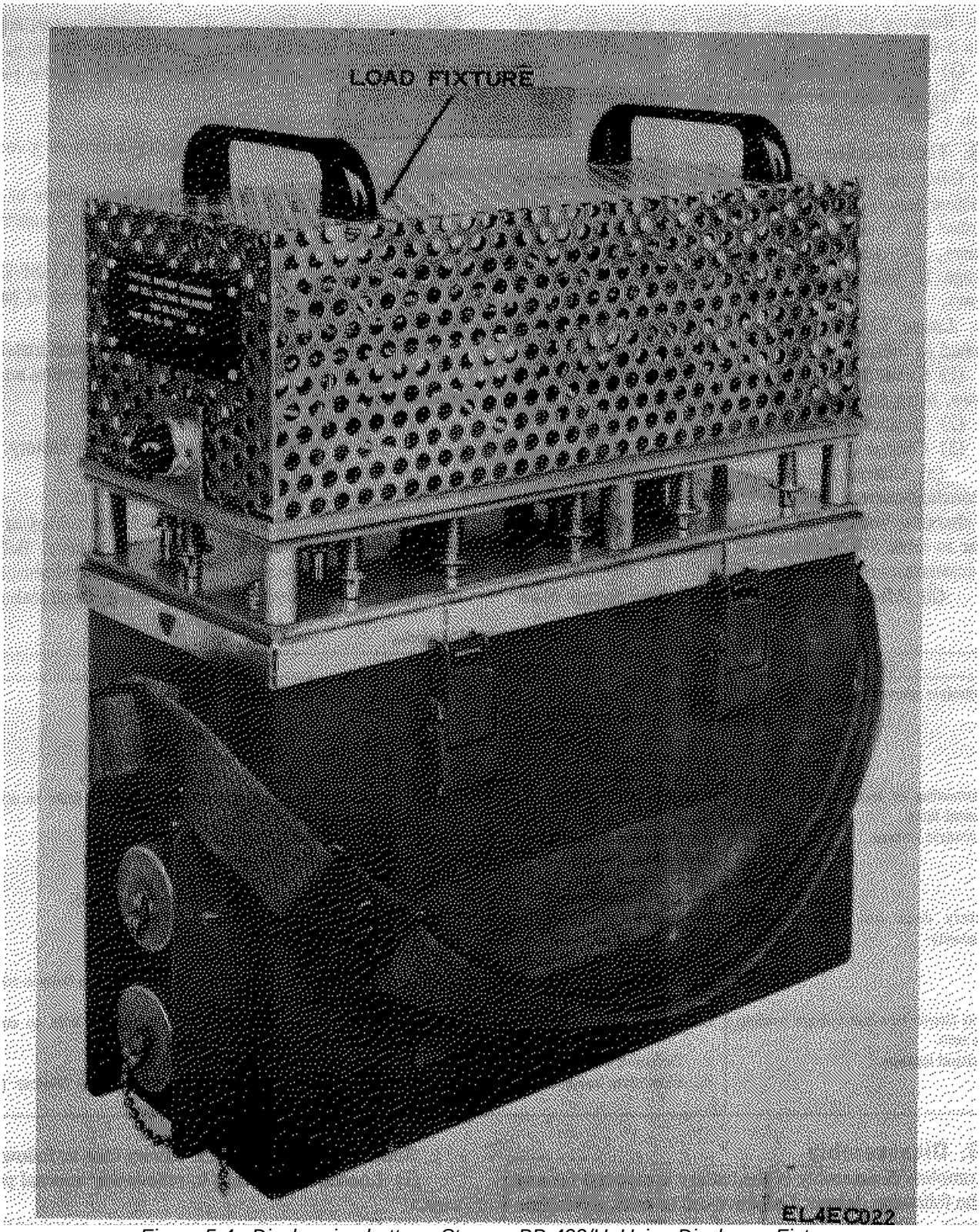


Figure 5-4. Discharging battery, Storage BB-422/U, Using Discharge Fixture

c. After discharge (b above), charge the battery as follows:

(1) Charge the battery, using constant-potential or constant-current method. Refer to table 5-1 to determine the charging voltage for the constant-potential method. Refer to table 5-2 to determine the charging current for the constant-current method.

(2) After charging the battery, allow it to rest (para

5-4). Remove the fillercaps. Adjust the electrolyte level (para 5-6).

(3) Replace the fillercaps.

d. Test the performance of the battery as given in paragraph 5-5g.

5-8. Troubleshooting

The following procedures will aid in troubleshooting a defective battery. Visually inspect the battery to determine whether the trouble is caused by loose connections (a below), corroded connections (b below), electrical leakage (c below), or an incorrectly Installed cell (d below).

a. Loose Connections. If connections are loose, proceed as follows:

(1) Clean the battery (para 4-7) and tighten terminal screws, using the proper torque valves (para 4-11).

(2) Discharge the storage battery (para 5-7c).

(3) Charge the battery as follows:

(a) Charge the battery, using constant-potential or constant-current method. Use table 5-1 to determine the charging voltage for the constant-potential method. Refer to table 5-2 to determine the charging current for the constant-current method.

(b) After charging, allow the battery to rest (para 5-4). Remove the fillercaps. Using distilled water, adjust the electrolyte level by bringing the electrolyte level to not more than one-fourth inch above the top of the plates (para 5-6).

(c) Replace the fillercaps.

(4) Test the performance of the battery as given in paragraph 5-5g.

b. Corroded Connections. if the cell terminals or the connector terminals are corroded, completely disassemble and clean the battery as given in paragraph 5-9.

c. Electrical Leakage Test. Using the AN/USM-223, perform the electrical leakage test as described in paragraph 4-10.

d. Reverse Polarity Position. If a cell has been installed in reverse polarity as determined when performing an individual cell voltage test, proceed as follows:

(1) Discharge the battery (para 5-7c).

(2) Remove and reinstall the cell in the battery.

(3) Charge the battery (para 5-5s.6

(4) Capacity test the battery (para 5-5-g).

e. Troubleshooting Table. Table 5-5 is provided to aid in isolating troubles that occur in the battery. Before following the procedures outlined in the troubleshooting table, perform the procedures given in a through d above.

Table 5-5. Troubleshooting

Condition	Probable trouble	Corrective action
Electrolyte spewage during charge.	*a.* High charge current or high ambient temperature during charge.	*a.* Reduce charging current.
	b. Excessive electrolyte.	*b.* Withdraw excessive electrolyte.
	c. Defective cell or cells.	*c.* Replace defective cells as necessary.
	d. Cell installed in reverse polarity.	*d.* Reinstall cell correctly.
Overheating or burn marks on terminal links.	Loose Terminal links.	Clean links and terminals, then tighten links to correct torque (para 4-11) as necessary.
Electrolyte leakage.	*a.* Defective cell or cells.	*a.* Replace defective cells as necessary.
	b. Defective O-ring.	*b.* Replace defective O-ring (para 4-12*c*).
	c. Defective vent valve.	*c.* Replace defective vent valve.
	d. Defective fillercap.	*d.* Replace defective fillercap (para 4-12*a*).
Battery does not provide rated capacity.	*a.* Battery not fully charged.	*a.* Charge battery (para 5-5*f*).
	b. Defective cell or cells.	*b.* Replace defective cells as necessary.
	c. Cell installed in reverse polarity.	*c.* Reinstall cell correctly.
	d. Loose terminal links.	*d.* Clean links and terminals, then tighten links to correct torque (para 4-11).
Open circuit terminal voltage reading is zero.	Loose or missing terminal links.	Clean links and terminals, then tighten links to correct torque (para 4-11) as necessary.
Electrical leakage.	*a.* Defective cell or cells.	*a.* Replace defective cells as necessary.
	b. Electrolyte leakage.	*b.* Replace defective O-ring, vent valve, fillercap (para 4-12).

5-9. Disassembly

A complete disassembly of the battery is required for any of the following defects: Defective cell or cells, electrolyte leakage, electrical leakage, cell installed in reverse polarity, or defective battery case. Disassemble the battery, as given in a through e below:

a. Discharge the battery as given in paragraph 5-7c

b. After completely discharging the battery, remove all terminal links by removing their screws and associated washers

c. Remove all cells from the battery case as follows:

(1) Loosen all fillercaps to relieve any internal pressure.

(2) Fabricate a cell puller by using two terminal links bent at right angles and appropriate nonconductive heavy cord or flat web material as shown in figure 5-5.

NOTE

Do not use wire or other conductive material. Use the cell terminal screws and washers to secure the cell puller to the cell terminals and

carefully work each cell out of the battery case starting with the cell that is approximately in the center position.

NOTE

If a cell puller cannot be fabricated as shown in figure 5-5, screw a stud of the appropriate size into each cell terminal. Grasp these studs with pliers and lift the cell straight up.

d. Remove liners from the battery case and inspect the interior of the case for peeling or chipping of paint or corrosion. Return defective cases to the depot for repair.

e. Remove the battery terminal connector or receptacle as follows:

(1) Remove screws and washers that hold the connector or receptacle to the battery case.
(2) Remove the battery terminal connector or receptacle.

CAUTION

Be careful when removing the gaskets from the battery case. Do not allow the scraper to gouge the battery case.

(3) For connectors or receptacles having damaged gaskets, remove the gaskets by scraping or peeling the gasket from the battery case. For batteries having liners or cover gaskets, remove liners and cover gaskets by scraping or peeling.

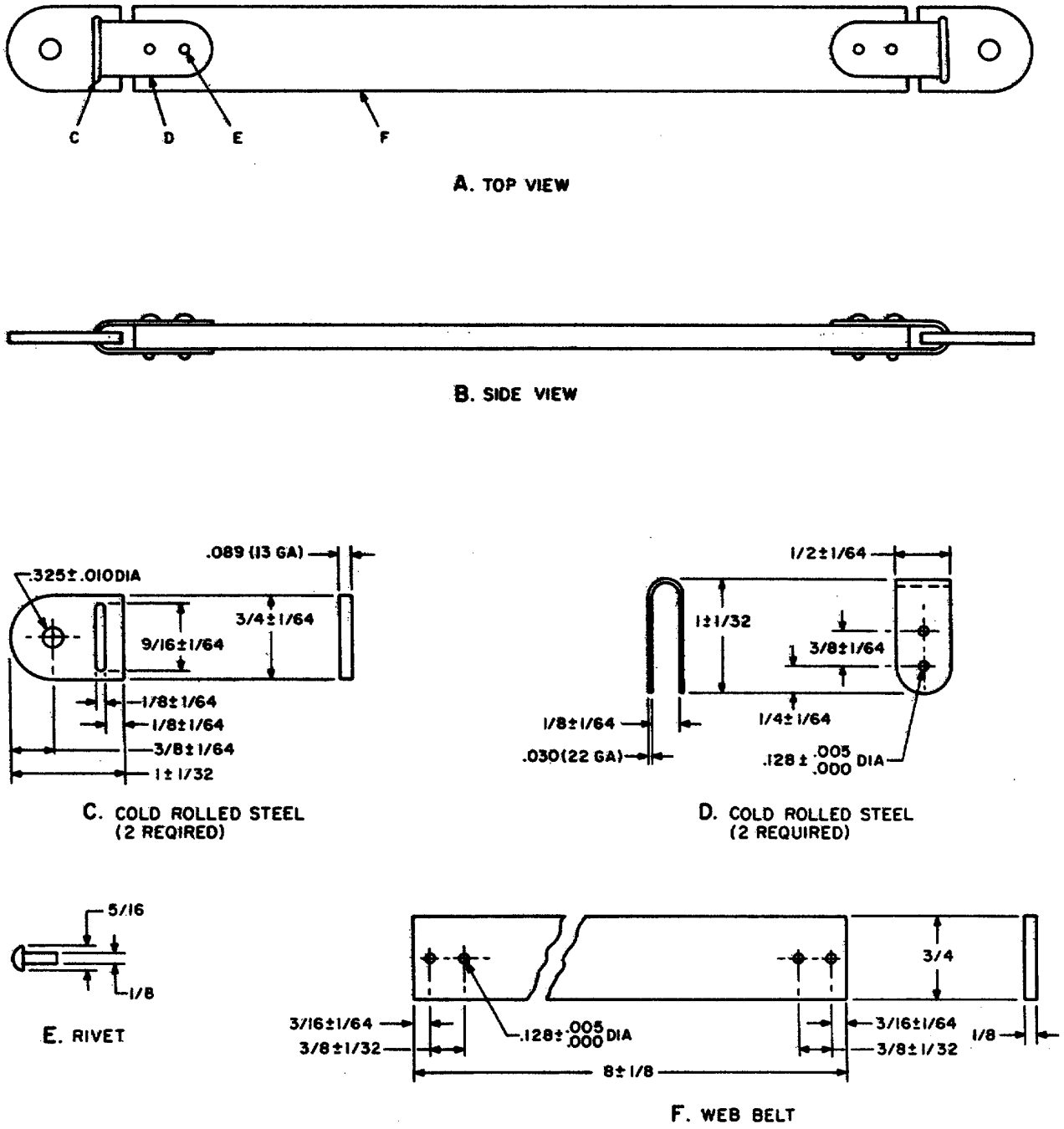


Figure 5-5. Cell Puller.

5-10. Reconditioning Battery Components

After the battery is disassembled (para 5-9), proceed as follows:

a. Individual Cell Inspection.

(1) Remove, clean (para 4-7), and replace fillercaps on all cells. Be sure fillercaps are on tight.

CAUTION

Do not allow tapwater to enter cell; the electrolyte will be diluted or contaminated and will require replacement.

(2) Wash each cell with tapwater. Remove potassium carbonate deposits by brushing with the nylon brush. Rewash the cell with tapwater.

WARNING

To be used for cleaning, the compressed air source must limit the nozzle pressure to no more than 29 pounds per square inch gauge (PSIG). Goggles must be worn at all times while cleaning with compressed air.

(3) Air hose until dry.

(4) Lightly buff each cell terminal with fine sandpaper or emery cloth.

(5) Examine each cell for cracks, distorted case, discoloration, and electrolyte contamination. If a cell has a crack or distorted case, the cell is beyond repair and should not be used. If the exterior of a cell is discolored with burn spots or contains electrolyte contamination (contamination is evident if foreign substances are in electrolyte), the cell is unserviceable and should be dis- carded. For cells that visually appear to be free of cracks, discoloration, distortion, and electrolyte contamination, proceed as follows to test the cell for electrolyte leakage:

(a) Invert cell for 2 minutes.

(b) After the cell has been inverted for 2 minutes, lay cell on each of its sides either on a blotter or a paper towel for 30 seconds per side. Any wetting of the blotter or the paper towel is cause to consider the cell repairable, if the leakage is from the cell terminal only. This repair can be accomplished by the depot. Coordinate the shipment of these defective cells with Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-MMG-B, Fort Monmouth, NJ 07703.

b. Installing Cover Gasket.

(1) Check to be sure 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 10, app E) 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 areas of both cover and cover gasket mating.

(6) Firmly press (by hand) the cover gasket in place on the cover.

(7) Allow at least 2 hours for the cement to dry before installing the cover on the battery.

c. Installing Battery Terminal Connector or Receptacle.

Check to be sure that the terminal connector or receptacle is clean and dry. (2) Install the terminal connector or receptacle, using screws, washers, and gaskets as required.

d. Installing Battery Case Liner.

NOTE

If necessary to replace any liner, use polyamnide plastic sheet (item 11, app E).

(1) Check to see that the battery case is clean and dry.

(2) Cut the battery case liner or insulator (polyamide plastic sheet, (NSN 9330-00-877-2872)) to the same size as the one removed and install the replacement battery case liner in the battery case.

e. Installing Cells in Battery Case.

NOTE

Each battery must be constructed of cells made by the same manufacturer and carry the same stock number. DO NOT mix cells made by different manufacturers or different stock numbers from the same manufacturer, to retrofit a battery. Use cells with or as close to the same date code or length of service as possible.

(1) Replace liners. Using appropriate cell layout diagram shown in chapter 2 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 polyamide plastic sheets (item 11, app E), shim cells as necessary for a tight fit.

(2) Replace all terminal hardware in the following sequence:

(a) Intercell connectors.

(b) Belleville washer.

(c) Flatwasher.

(a) Stud (finger tight).

NOTE

Torque hardware before applying corrosion pre- ventive compound. Be sure all cell terminals and intercell connectors are clean and smooth before assembling.

(3) Torque all connections as specified in paragraph 4-11. After reassembly, coat all hardware with corrosion preventive compound item 12 app E).

f. Charging. Charge the battery, using constant-potential or constant-current method (para 5-f). Allow the battery to rest (Para 5-4). Remove the fillercaps. Use dis- tilled water to adjust the electrolyte level to one-fourth inch above the top of the plates Sara 5-6).

g. Testing. Perform the procedures given in paragraph 5-Sg to test the battery.

5-11. Vent Valve (metal) Test

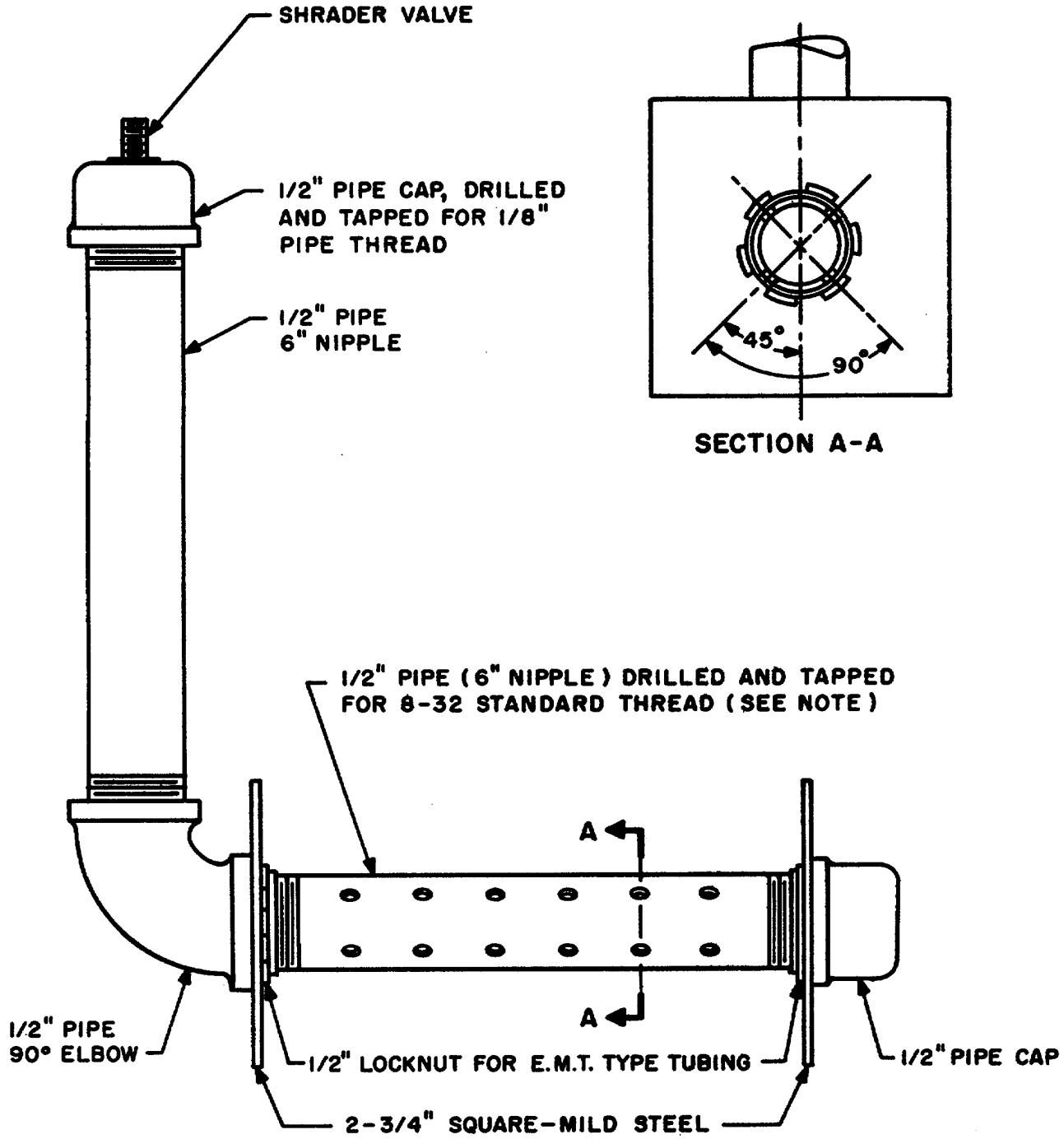
a. Fabricate the metal vent valve tester as shown in figure 5-6.

b. Install 24 metal vent valves to be tested into the 24 holes. Tighten each metal vent valve sufficiently to prevent leakage when air pressure is applied.

c. Connect air pressure pump with a 0- to 25-pound per square inch (psi) gauge to the Shrader valve mounted on the metal vent valve tester

d. Submerge the metal vent valves into a tank of water. Slowly apply air pressure until 2 psi is reached. Observe for leakage. If any metal vent valves leak with the 2 psi of air pressure applied, the metal vent valve is defective and

should be discarded. Continue slowly increasing the applied air pressure until 10 psi of air pressure is reached. Observe for leakage. Metal vent valves that do not leak with 10 psi of air pressure applied are defective and should be discarded.



NOTE:
HOLES DRILLED AT 90° TO FACILLIATE INSTALLATION OF VENT VALUVES BY PLACING VENT VAULVE TESTER ON EITHER SIDE. EACH SIDE ACCOMIDATES 12 VENT VALVES.

Figure 5-6. Fabrication Diagram for Metal Vent Valve Tester

5-12. Individual New Cells

When individual new cells are being prepared for use, be careful when charging. Do not charge individual cells unless the plastic cell case is externally supported because gas pressure, while charging the unprotected cell, may cause the cell case to crack. When assembling cells to make up a battery, be sure that all cells were constructed by the same manufacturer and have the same NSN. To avoid an unbalance in the battery, do not mix cells made by different manufacturers or having different NSN's to retrofit a battery.

5-13. Fillercap Vent Valve Test

a. Fabricate the fillercap vent valve tester as shown in figure 5-7. (Use a test cell that has been flushed clean and is empty of electrolyte.)

b. Before testing, wash the fillercap thoroughly in detergent and water.

CAUTION

To be used for cleaning, the compressed air source must limit the nozzle pressure to no more than 29 pounds per square inch gauge PSIG). Goggles must be worn at all times while cleaning with compressed air.

c. After washing, rinse the fillercap with clean water and dry with an air blower.

d. Place the fillercap to be tested on the test cell.

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

f. if the fillercap vent valve does not open between 2 psi and 10 psi, discard the filercap. If the filercap vent -valve does open between 2 psi and 10 psi, remove the 0- ring from the fillercap, replace with a new 0-ring, and return the fillercap to stock for reissue.

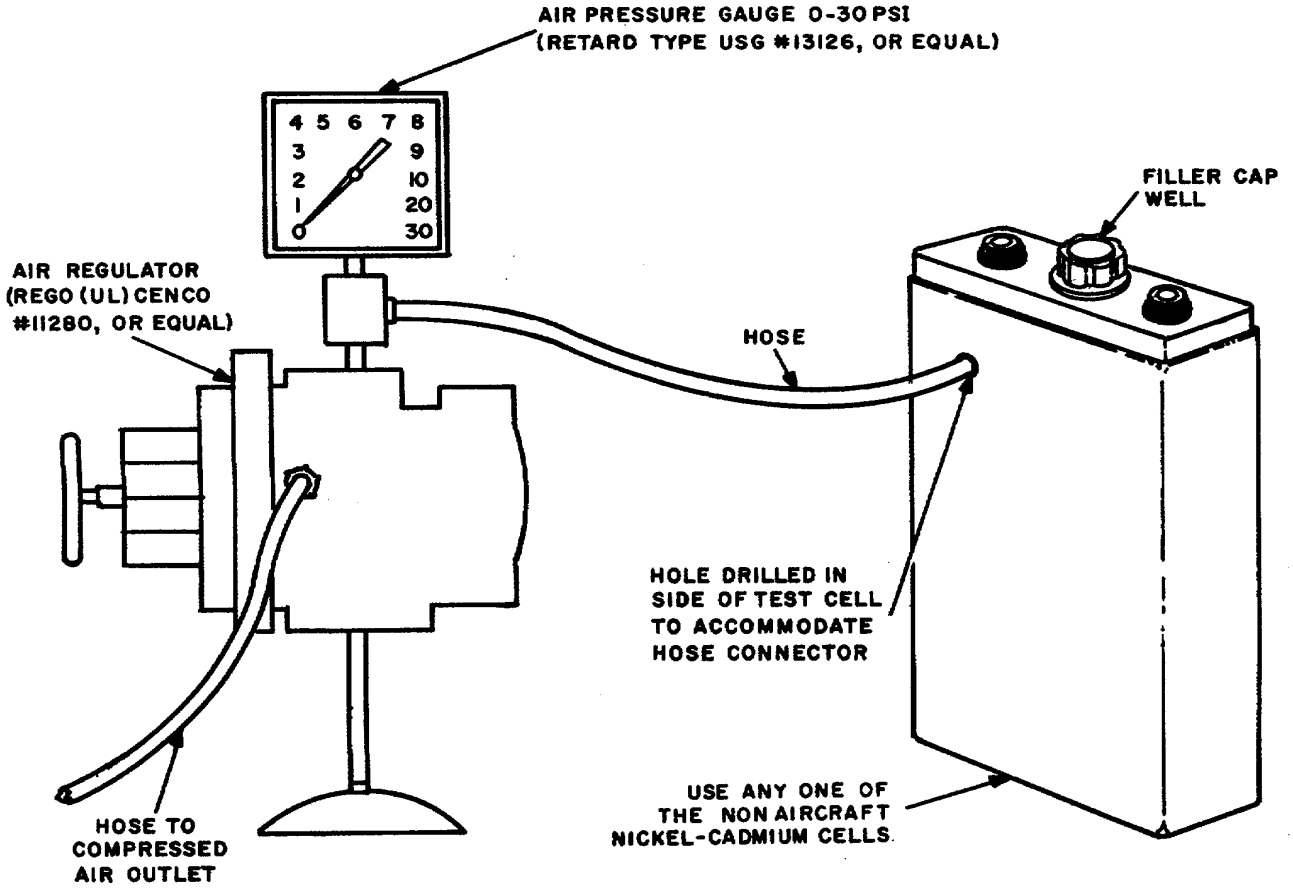


Figure 5-7. Fabrication Diagram for Fillercap Vent Valve Tester

5-14. Battery Blanket Electrical Test

The battery blanket electrical test consists of measuring for a low resistance, through the heating element, at the battery blanket terminal board. An infinite or very high

resistance indicates that the battery blanket is defective and should be replaced. As a guide the following specifications are provided:

a. General Electric Battery Blanket

(1) Resistance. 4. 4- to 4. 8-ohms.

(2) Power Consumption. 175 watts plus or minus 9 watts at 29 volts dc.

b. Marathon (Sonotone) Battery Blanket

(1) Resistance. Center heater element, 3. 5- to 3. 6-ohms; outer heater element 8. 0- to 8. 1-ohms.

(2) Power Consumption. Center heater element, 107 watts at 29 volts dc; outer heater element, 253 watts at 29 volts dc. Testing of the heater blankets through the connector (J3) can only be done if the battery has been cooled below the temperature at which the control thermostats close.

APPENDIX A
REFERENCES

The following publications are available to maintenance personnel of nonaircraft nickel-cadmium batteries:

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	US Army Index of Modification Work Orders.
SB 11-573	Painting and Preservation Supplies Available for Field Use for Electronics Command Equipment.
TB 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.
TM 11-6130-236-12	Operator and Organizational Maintenance Manual; Charger, Battery PP- 1451/G (NSN 6130-00-985-8157).
TM 11-6130-238-14	Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Charger, Battery PP-1659/G, and PP-1659A/G (NSN 6130-00-985-8185).
TM 11-6130-246-12	Operator's and Organizational Maintenance Manual: Power Supply PP-1104C/G (NSN 6130-00-542-6385) (With Instructions for Use as Battery Charger).
TM 11-6140-203-15-1	Operator, Organizational, Direct Support, General Support, and Depot Maintenance Manual: Aircraft and Nonaircraft Nickel-Cadmium Batteries (General).
TM 11-6140-203-14-2	Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Aircraft Nickel-Cadmium Batteries.
TM 11-6140-203-20P-3	Organizational Maintenance Repair Parts and Special Tools Lists for Nonaircraft Nickel-Cadmium Batteries BB-422/U (NSN 6140-00-789-2118), BB-651/UIH6(V) (NSN 6140-00-935-5265), BB-429/U (NSN 6140-00-996-3746), BB-501/U (NSN 6140-00-134-0850), BB-693/U (NSN 6140-00-862-2979), and BB-651/U (NSN 6140-00-037-7344).
TM 11-6140-203-34P-3	Direct Support and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools) for Nonaircraft Nickel-Cadmium Batteries BB-422/U (NSN 6140-00-789-2118), BB-651/UIH6(V) (NSN 6140-00-935-5265), BB-429/U (NSN 6140-00-996-3746), BB-501/U (NSN 6140-00-134-0850), BB-693/U (NSN 6140-00-862-2979), and BB-651/U (NSN 6140-00-037-7344).
TM 11-6625-654-14	Operator's, Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Repair Parts and Special Tools) for Multimeter AN/USM-223.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 750-244-2	Procedures for Destruction of Electronics Material to Prevent Enemy Use Electronics Command).

APPENDIX D
MAINTENANCE ALLOCATION

SECTION I. INTRODUCTION

D-1. General

This appendix provides a summary of the maintenance operations for Nonaircraft Nickel-Cadmium Batteries. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

D-2. Maintenance Function

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. Test. To verify serviceability and to detect incipient failure 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 clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air sup- plies.

d. Adjust. To maintain, within prescribed limits, by brining into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. 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 measuring and diagnostic equipments 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, module (component or assembly) in a manner to allow the proper functioning of the 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 (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) 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/operational condition as prescribed by maintenance standards (. e. , DMWR) in appropriate technical publications. 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 materiel 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 equipments/components.

D-3. Column Entries

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, sub-assemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 species, by the listing of a "work time" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "work time" figures will be shown for each category. The number of task- hours specified by the "work time" figure represents the average time required to restore an item (assembly, sub- assembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshoot- ing time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C Operator/Crew
O Organizational

F Direct Support
H General Support
D Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

D-4. Tool and Test Equipment Requirements (Sec Ill)

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

D-5. Remarks (Sec IV)

a. Reference Code. This code refers to the appropriate item in section HI, column 6.

b. Remarks This column provides the required explanatory information necessary to clarify items appearing in section II

SECTION II MAINTENANCE ALLOCATION CHART FOR

BATTERIES, STORAGE - BB-422/U, BB-429/U, BB-501/U, BB-693/U, BB-651/U BB-2HNC, BB-672/U, BB-6TNC

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
00	BATTERY, STORAGE BB-422/U	Inspect		.2				4	
		Inspect			.7			4	
		Test			.8			1-4	
		Service		.2				4,5,6, 8-12	
		Adjust		.4				3	
		Adjust			.2			4	
		Repair		.5				4	A
		Repair			.5			4	
		Overhaul				2.0		1-11, 15-18	
		Rebuild					5.0	1-18	
01	BATTERY, STORAGE (CELL) BB-431/U	Inspect			.1			4	
		Test			.5			4	
		Service			.1			3,4	
		Replace			1.1			4	
		Replace		.5				4	A
		Repair			.6			4	

SECTION II MAINTENANCE ALLOCATION CHART FOR

BATTERIES, STORAGE - BB-422/U, BB-429/U, BB-501/U, BB-693/U, BB-651/U BB-2HNC, BB-672/U, BB-6TNC

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
00	BATTERY, STORAGE BB-651/UlH 6(V) and BB-651/U	Inspect		.2				4	
		Inspect			.7			4	
		Test			.8			1-4'	
		Service		.2				4,5,6, 8-12	
		Adjust		.4				3	
		Adjust			.2			4	
		Repair		.5				4	
		Repair			.5			4	
		Overhaul				2.0		1-11,15-18	
		Rebuild					5.0	1-18	
01	BATTERY, STORAGE (CELL) BB-436/U	Inspect			.1			4	
		Test			.5			4	
		Service			.1			3,4	
		Replace			1.1			4	
		Replace		.5				4	A
		Repair			.6			4	

SECTION II MAINTENANCE ALLOCATION CHART FOR

BATTERIES, STORAGE - BB-422/U, BB-429/U, BB-501/U, BB-693/U, BB-651/U BB-2HNC, BB-672/U, BB-6TNC

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
00	BATTERY, STORAGE BB-429/U	Inspect		.2				4	
		Inspect			.7			4	
		Test			.8			1-4	
		Service		.2				4,5,6, 8-12	
		Adjust		.4				3	
		Adjust			.2			4	
		Repair		.5				4	
		Repair			.5			4	
		Overhaul				2.0		1-11, 15-18	
		Rebuild					5.0	1-18	
01	BATTERY, STORAGE (CELL) BB418/U	Inspect			.1			4	
		Test			.5			4	
		Service			.1			3,4	
		Replace			1.1			4	
		Replace		.5				4	A
		Repair			.6			4	

SECTION II MAINTENANCE ALLOCATION CHART FOR

BATTERIES, STORAGE - BB-422/U, BB-429/U, BB-501/U, BB-693/U, BB-651/U BB-2HNC, BB-672/U, BB-6TNC

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
00	BATTERY, STORAGE BB-501/U	Inspect		.2				4	
		Inspect			.7			4	
		Test			.8			1-4	
		Service		.2				4,5,6, 8-12	
		Adjust		.4				3	
		Adjust			.2			4	
		Repair		.5				4	
		Repair			.5			4	
		Overhaul				2.0		1-11 15-18	
		Rebuild					5.0	1-18	
01	BATTERY, STORAGE (CEI) BB-613/U	Inspect			.1			4	
		Test			.5			4	
		Service			.1			3,4	
		Replace			1.1			4	
		Replace		.5				4	A
		Repair			.6			4	

SECTION II MAINTENANCE ALLOCATION CHART FOR

BATTERIES, STORAGE - BB-422/U, BB-429/U, BB-501/U, BB-693/U, BB-651/U BB-2HNC, BB-672/U, BB-6TNC

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
00	BATTERY, STORAGE BB5693/U	Inspect		.2				4	
		Inspect			.7			4	
		Test			.8			1-4	
		Service		.2				4,5,6, 8-12	
		Adjust		.4				3	
		Adjust			.2			4	
		Repair		.5				4	
		Repair			.5			4	
		Overhaul				2.0		1-11, 15-18	
		Rebuild					5.0	1-18	
01	BATTERY, STORAGE (CELL) 18191-14 or 43B034AC05G5	Inspect			.1			4	
		Test			.5			4	
		Service			.1			3,4	
		Replace			1.1			4	
		Replace		.5				4	A
		Repair			.6			4	

SECTION II MAINTENANCE ALLOCATION CHART FOR

BATTERIES, STORAGE - BB-422/U, BB-429/U, BB-501/U, BB-693/U, BB-651/U BB-2HNC, BB-672/U, BB-6TNC

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
00	BATTERY,STORAGE:BB-672U,BB-2-Hmc,BB-6TNC	Inspect		.2				4	
		Inspect			.7			4	
		Test			.8			1-4	
		Service		.2				4,5,6, 8-12	
		Replace		.1				4	

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR

BATTERIES, STORAGE - BB-422/U, BB-429/U, BB-501/U, BB-693/U, BB-651/U BB-2HNC, BB-672/U, BB-6TNC

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER
1	F,H,D	FIXTURE, BATTERY DISCHARGE AND CELL VOLTAGE BALANCING FOR BB-422/u BATTERY. (SEE NOTE 1:)	6110-00-179-8273
2	F,N,D	BATTERY DISCHARGE PLATE AE-IDP-1582 FOR BB-651/uIN-6(V) BATTYERY. (SEE NOTE 1.)	5830-O0-637-0937
3	O,F,H,D	MULTIMETER AN/uJSM-223.	
4	O,F,H,D	TOOL KIT, BATTERY SERVICE TE-90/G.	5180-00—542-5812
5	F	CABLE ASSEMBLY SET, ELECTRICAL NX4765/PPS4. (FOR USE IN OPERATING RADAR AN/PPs-4 AND CHARGING BATTERY STORAGE BB-422/U). (SPECIAL PURPOSE SEE NOTE 1.)	6115-00-957-3709
6	F,H,D	CABLE ASSEMBLY, POWER ELECTRICAL CX-11935/u (FOR CONNECTING BATTERY ASSEMBLY THAT HAS A SIX PIN RECEPTACLE TO THE BATTERY CHARGER). (GENERAL PURPOSE SEE NOTE 1.)	5995-00-404-7535
7	F,H,D	CHARGER, BATTER PP-1451/G. (GENERAL PURPOSE SEE NOTE 1.) (IF THE PP-i451/G IS NOT Available, USE (AS AN ALTERNATE CHARGER) THE PP-1659/U OR PP-1104(*)/G LISTED BELOW).	6130-00-985-8157
8	F,H,D	CHARGER, BATTERY PP-1659/u. (GENERAL PURPOSE SEE NOTE 1.)	6130-00-985-8185
9	F,H,D	CHRGER, BATTERY MODEL AEM-PSF1582 (FOR CHARGING BATTERY BB-651/uIH-6(V)). (SPECIAL PURPOSE SEE NOTE 1.)	5835-00637-0938
10	F,H,D	CHARGER BATTERY PP-6267/u (FOR CHARGING BATTER!, STORAGE BB-429/u). (SPECIAL PURPOSE SEE NOTE 1.)	5130-00-179-8333
11	F	GENERATOR SET, GASOLINE ENGINE PU-532/PPS-4 (FOR OPERATING RADAR SET AN/PPS-4 AND CHARGING BATTERY STORAGE BB-422/u). (SPECIAL PURPOSE).	5115-00-889-1212
12	F	GENERATOR SET, GASOLINE ENGINE 3KW, 28V DC MIL-G-52428 (USED WHERE AC POWER IS NOT AVAILABLE).	6115-00-475-0029
13	F,H,D	POWER SUPPLY PP-1104c/G GENERAL PURPOSE 12 & 24V GENERAL PURPOSE CHARGER. (SEE NOTE 2.)	5130-00-542-6385
14	F,H,D	RELAY, REVERSE CURRENT CUTOFF. (SEE NOTE 2).	5945-00-824--5575
15	F,H,D	EALANCING UNIT, STORAGE BATTERY (USED TO DEEP DISCHARGE B-693/U).	6110-00-1680585
16	F,H,D	MULTIMETER 300M-A AND ADAPTER KIT	6625-oo-68-o585
17	F,H,D	POWER SUPPLY PP-6224/u (USED TO CHARGE BB-693/u).	6130-00-133-5879
18	F,H,D	CABLE ASSEMBLY, POWER ELECTRICAL (USED TO CONNECT PP-6224a/u TO BB-693/u FOR CHARCIING OF BB-693/u).	6150-00-214-8343
		NOTES: 1. Use appropriate and available, discharge fixtures, chargers, charging cables and analyzers when servicing batteries. 2. Reverse current relay must be connected to the output of Dower Supply PP-1104C/G to prevent battery from discharging through the power supply in event of power failure.	

SECTION IV. REMARKS

REFERENCE CODE	REMARKS
A	REPAIR BY REPLACEMENT OF FILLERCAP O-RING SEAL AND CONNECTOR DUST CAP.

APPENDIX E
EXPENDABLE SUPPLIES AND MATERIALS LIST

SECTION I. INTRODUCTION

E-1. Scope

This appendix lists expendable supplies and materials you will need to operate and maintain Nonaircraft Nickel-Cadmium Batteries. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

E-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 material (e. g. , "Use cleaning compound, item 5, app. D").

b. *Column 2-Level* This column identifies the lowest level of maintenance that requires the listed item.

C Operator/Crew
O Organizational Maintenance

F Direct Support Maintenance
H General Support 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*. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

e. *Column 5-Unit of Measure (UIM)*. Indicates 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.

(Next printed page is E-3)

SECTION II EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION PART NO. AND FSCM	(5) U/M
1	0	8305-00-267-3015	CLOTH, CHEESECLOTH, LINTLESS, CCCC440 (81348).	YD
2	0	80O1-00-514-1861	PAINT-TOUCHUP, PRIMER COATING, ZINC CHRO74ATE YEL. , 30 MINUTES DRYING TIME:USE METAL, RIGID PLASTIC, AND GLASS, FED SPEC TT-P-00600, 16 OUNCE CAN,1319 (87187).	CAN
3	0	8010-00-598-5936	PAINT-TOUCHVP, ENAMEL, SEIIGWSS, 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 PRESSURZED 12 OUNCE CAN, TTE485 (81348).	CAN
4	0	4240-00-439-3450	FACESHIELD, INDUSTRIAL, 8 IN. LG, FED-L-F-0036, STYLE B, SIZE 3, L LF 36 (81348).	EA
5	0	4240-00-203-0317	GOELIES, INDUSTRIAL, CHEMICAL TYPE GGG-G-521, TYPE II, (81348).	PR
6	0	8415-00-715-0450	APRON, IMPERMEABLE, BATTERY WORKERS MILA-A 41801 (81349).	EA
7	F	5930-00-224-4938	SWITCH, KNIFE, DPST, 60 AMP, 25OV, 1143J (05684).	EA
8	F	5905-00-195-4496	RESISTOR, VARIABLE, 0- TO 7. 5-OHM, 1000 WATTS (FOR BUILDING BATTERY LOADS).	EA
9	F	6810-00-682-6867	DISTILLED OR DEIONIZED WATER, 243 (24774).	GAL
10	F	8014-00-664-4318	ADHESVE, RUBBER BASE, GENERAL PURPOSE, EC2141 (76381).	PT
11	F	9330-00-877-2872	POLYAMIDE PLASTIC SHEET, L-P-410 (81348).	EA
12	F	8030-00-903-0931	CORRSION PREVENTATIVE COMPOUND, NOX RUST No. 366 (02847).	PT
13	F	6810-00-543-4041	ELECTROLYTE (KOH), APPROXIMATELY 31 PERCENT BY WEIOHT PREMIXED SOLUTION IN 500 CC POLYETHYLENE BOTTLE, 1. 305 ±0. 005 SPECIFIC GRAVITY AT 80° F.	B+1

INDEX

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By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-28, Operator maintenance requirements for Direction and Warning Systems, Alarm and DA Form 12-36A, Requirements for Aircraft and Nonaircraft Nickel Cadmium Batteries**.**

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL.

SOMETHING WRONG WITH PUBLICATION

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE

BE EXACT PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.

IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT.

PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER	SIGN HERE

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PREVIOUS EDITIONS ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

'VEIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

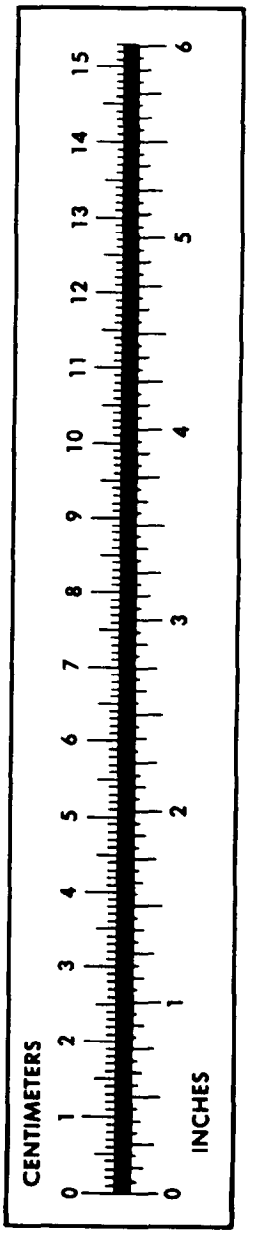
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
lometers per Liter	Miles per Gallon	2.354
meters per Hour	Miles per Hour	0.621



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