MIL-B-18E
21 January 1983

SUPERSEDING
MIL-B-18D
29 October 1963

MILITARY SPECIFICATION

# BATTERIES, NON-RECHARGEABLE, DRY

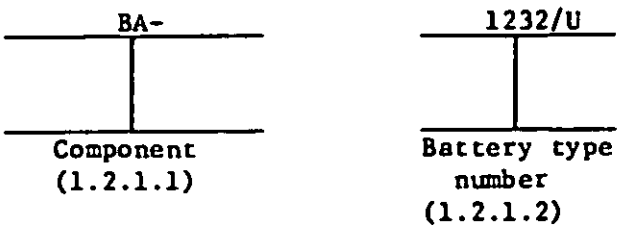
This specification is approved for use by all Departments and Agencies of the Department of Defense.

## 1. SCOPE

1.1 Scope. This specification covers non-rechargeable, dry batteries for use with military equipment. The batteries are composed of electrochemical cells which are either of the Leclanche or mercury type.

1.2 Classification.

1.2.1 Type designation. The type designation of non-rechargeable, dry batteries shall be in the following form (see 3.1 and 6.1):




1.2.1.1 Component. Non-rechargeable, dry batteries are identified by the two-letter symbol "BA" followed by a hyphen.

1.2.1.2 Battery type number. The battery type number identifies the basic design of the battery (see 3.1) and the kind of cell with which it is assembled, as shown in table I.

TABLE I. Battery type numbers.

| Type number | Kind of cell |
|---|---|
| 1 to 999, incl. ---- | Leclanche |
| 1,000 to 1,999, incl. ---- | Mercury |

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, U.S. Army Electronics Command, ATTN: DELET-R-S, Fort Monmouth, NJ 07703 by using the self addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

## 2. APPLICABLE DOCUMENTS

### 2.1 Government documents.

2.1.1 Specifications and standards. Unless otherwise specified, the following specifications and standards, of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

| | |
|---|---|
| L-P-390 | - Plastic, Molding and Extrusion Material, Polyethylene and Copolymers (Low, Medium, and High Density). |
| L-P-513 | - Plastic Sheet and Insulation Sheet, Electrical (Laminated, Thermosetting, Paper Base, Phenolic Resin). |
| FF-N-836 | - Nut, Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding and Single Ball Seat. |
| FF-S-92 | - Screws, Machine, Slotted, Cross-Recessed or Hexagon Head. |
| QQ-B-613 | - Brass, Leaded and Nonleaded; Flat Products (Plate, Bar, Sheet and Strip). |
| QQ-B-626 | - Brass, Leaded and Nonleaded; Rod, Shaped, Forgings and Flat Products with Finished Edges (Bar and Strip). |
| QQ-B-750 | - Bronze, Phosphor, Bar, Plate, Rod, Sheet, Strip; Flat Wire and Structural and Special Shaped Sections. |
| QQ-C-502 | - Copper Rods and Shapes; and Flat Products with Finished Edges (Flat Wire, Strips and Bars). |
| QQ-C-530 | - Copper-Beryllium Alloy Bar, Rod, and Wire (Copper Alloy Numbers 172 and 173). |
| QQ-C-533 | - Copper-Beryllium Alloy Strip (Copper Alloy Numbers 170 and 172). |
| QQ-C-576 | - Copper Flat Products with Slit, Slit and Edge-rolled, Sheared, Sawed, or Machined Edges (Plate, Bar, Sheet, and Strip). |
| QQ-N-290 | - Nickel Plating (Electrodeposited). |
| QQ-P-416 | - Plating, Cadmium (Electrodeposited). |

QQ-S-571 - Solder, Tin Alloy, Lead-Tin Alloy and Lead Alloy.

QQ-T-201 - Terneplate, for Roofing and Roofing Products.

PPP-T-60 - Tape, Packaging, Waterproof.

MILITARY

MIL-M-14 - Molding Plastics and Molded Plastic Parts, Thermosetting.

MIL-W-76 - Wire and Cable, Hookup, Electrical, Insulated.

MIL-P-116 - Preservation, Methods of

MIL-W-530 - Webbing, Textile, Cotton, General Purpose, Natural or in Colors.

MIL-S-1222 - Studs, Continuous Thread (Bolt Studs); Nuts, Plain, Hexagon; and Steel Bars, Round - High Temperature.

MIL-F-14256 - Flux, Soldering, Liquid (Rosin Base).
MIL-B-55521 - Battery, Dry Packaging and Packing OF.

STANDARDS

FEDERAL

FED-STD-595-Colors.

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.

MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.

MIL-STD-45662 - Calibration System Requirements.

(See Supplement 1 for list of associated specification sheets.)

(Copies of specifications, specification sheets, standards, drawings, and publications, required by contractors in connection with specific acquisition functions, should be obtained from the contracting activity or as directed by the contracting officer.)

2.1.2 Order of precedence. In the event of a conflict between the text of this specification and the reference cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between requirements of this specification and the specification sheet, the latter shall govern.

3.2 Abbreviations. The abbreviations used herein are defined as follows:

| | | |
|---|---|---|
| D | - | Delayed capacity. |
| EL | - | Electrolyte leakage. |
| JI | - | Jacket integrity test. (formerly WOJ). |
| n | - | Number of batteries subjected to each capacity test in 4.6.1.4. |
| SLD | - | Minimum capacity value specified in 3.1 for the D test. |
| SLT | - | Minimum capacity value specified in 3.1 for the T test. |
| T | - | Capacity after high-temperature storage. |
| WOJ | - | Waterproofing of jackets. (Where specified in 3.1, use Jacket integrity (JI) above.) |
| $X_D$ | - | Number of batteries in the sample with capacity values below SLD. |
| $X_T$ | - | Number of batteries in the sample with capacity values below SLT. |

3.3 First article inspection. Batteries furnished under this specification shall be a product which has been tested and passed the first article inspection specified herein (See 4.5).

3.4 Materials and components. When a definite material or component is specified, it shall be in accordance with the applicable specification or requirement listed in table II. When deemed necessary by the Government, certification from the source of the material or component will be requried. In the absence of certification from the source, a certificate of analysis or certified inspection data shall be required (see 4.4 and 4.4.1).

3.4.1 Metals. All metals, which do not enter into the basic electrochemical reaction of the cell, shall resist or be treated to resist corrosion when subjected to any test or storage conditions specified herein.

3.4.1.1 Dissimilar metals. When dissimilar metals are used in intimate contact with each other, protection against electrolysis and corrosion shall be provided.

3.5 Design and construction. Batteries shall be of the design, construction, physical dimensions, weight, and polarity specified (see 3.1).

3.5.1 Dimensions. All dimensions shall include any coating which may be used, and shall remain within the specified tolerances throughout the required tests.

3.5.2 Battery voltage.

3.5.2.1 Open-circuit voltage. Unless otherwise specified, the open-circuit voltage shall not exceed the specified nominal voltage by more than 15 percent. (See 3.1 and 4.7.7.1.)

TABLE II. Materials and components.

| Materials or components | Applicable specifications or requirements (See 3.4) | Test methods (See 4.4) |
|---|---|---|
| Solder 1/ | QQ-S-571 | |
| Soldering flux 2/ | MIL-F-14256 | |
| Metals | 3.4.1 | |
| Brass | QQ-B-613 or QQ-B-626 | |
| Copper | QQ-C-502 or QQ-C-576 | |
| Beryllium copper | QQ-C-530 or QQ-C-533 | |
| Phosphor bronze | QQ-B-750 | |
| Terne plate | QQ-T-201, type II | |
| Cadmium plating | QQ-P-416 | |
| Nickel plating | QQ-N-290 | |
| Wire | MIL-W-76 | |
| Machine screws, studs, and nuts | FF-N-836, FF-S-92, or MIL-S-1222 | |
| Plastic, laminated | L-P-513, type PBE | |
| Plastic, molded | MIL-M-14, type MFE | |
| Plastic, polyethylene | L-P-390, type I | |
| Webbing, cotton | MIL-W-530 | |
| Tape | PPP-T-60 | |
| Potting and sealing compounds | 3.5.3 | 4.7.1.1.1 |
| Filler or padding | 3.5.4 | 4.7.1 |
| Cell-block-container material | 3.5.5, 3.6, and 3.7 | 4.7.2 and 4.7.3 |
| Intercell separation - Leclanche type | 3.5.6.1, 3.6, and 3.7 | 4.7.2 and 4.7.3 |
| Intercell separation - Mercury type | 3.5.6.2 | |
| Terminals | 3.5.9.1, 3.5.9.2, 3.5.9.3, 3.5.9.4, 3.5.9.5, 3.5.9.6, and 3.5.9.7 | 4.7.4 |
| Jackets, metallic 3/ | 3.5.11.1.1, 3.5.11.1.2, and 3.6 | 4.7.2 and 4.7.6.1 |
| Jackets, nonmetallic | 3.5.11.2, 3.6, and 3.7 | 4.7.2 and 4.7.3 |
| Terminal mounting plate | 3.6 and 3.7 | 4.7.2 and 4.7.3 |
| Strap handle 4/ | 3.5.10 | 4.7.5 |

1/ For electrical connections, type Sn 40 or higher tin content shall be used.

2/ If other fluxes are used, they shall not affect the performance of the battery or reduce its shelf life.

3/ Test method 4.7.2 is applicable only for metallic jackets of material other than terneplate.

4/ Applicable to batteries with metallic jackets only.

3.5.2.2 Closed-circuit voltage. The closed-circuit voltage shall be not less than the voltage specified. (See 3.1 and 4.7.7.2.)

3.5.3 Potting and sealing compounds. Potting and sealing compounds shall exclude moisture from insulating material without impairing its electrical characteristics. When tested as specified in 4.7.1.1.1, the potting and sealing compounds shall not flow at high temperature, nor crack or draw away from the sides of a container at low temperature sufficiently to impair electrical connections.

3.5.4 Filler or padding. Filler or padding shall be cushioning, electrically-nonconducting material which maintains its insulating characteristics under adverse environmental conditions. If adverse environmental conditions affect this material, then it shall be isolated from the electrical components by an insulating material that maintains its electrical characteristics, or the filler or padding may be impregnated with microcrystalline wax.

3.5.5 Cell-block container. The cell-block container shall be an insulating material surrounding a group or a stack of individual cells.

3.5.6 Intercell separation. A separator shall be placed between cells in series-connected multicell batteries.

3.5.6.1 Leclanche type batteries. For Leclanche type batteries, the separator shall be an insulating material.

3.5.6.2 Mercury type batteries. For mercury type batteries, the separator may be an absorbent material.

3.5.7 Intercell connections. Intercell connections between cell blocks and between cell block and terminal shall be so insulated or positioned as to avoid contact with other conducting material. When insulated wire is soldered to terminal lugs, it shall not be bared more than 3/32 inch from the lug, nor shall it extend more than 3/32 inch beyond the lug.

3.5.8 Age of cells. The minimum age of cells, from the time of their fabrication to the time of their presentation for inspection of product for delivery as batteries, shall be 5 days. The maximum age of cells, from the time of their fabrication to the time of their shipping date, shall be 90 days. Non-rechargeable batteries shall be submitted for inspection of product for delivery not more than 30 days prior to the shipping date.

3.5.9 Terminals. The type, dimensions, location, and mounting of terminals shall be as specified herein and in 3.1.

3.5.9.1 Stud and nut. Stud and nut terminals shall be as shown in figure 1 and shall be made of brass or of insulated material with a brass insert, as specified (see 3.1). A bronze or brass-plated steel, external-tooth, lockwasher shall be provided for each terminal.

3.5.9.1.1 Mounting. It shall be possible to screw the terminal nut down by hand to make a firm seat with the shoulder of the terminal stud, without turning of the stud.

3.5.9.2 Spring clip. Spring-clip terminals shall be of the Fahnestock type, made of spring brass or phosphor bronze, and shall be large enough to accommodate a wire having a cross-sectional area of 4,200 circular mils.

3.5.9.2.1 Mounting. Each spring clip shall be mounted in such a manner that the entire surface of the clip will be located above the surface adjacent to the clip.

3.5.9.3 Wire leads. Wire-lead terminals shall be hookup wire, type MW-C18(16)U or larger, as specified in MIL-W-76.

3.5.9.3.1 Mounting. The external length of each wire lead shall be 6½ ± ½ inches. The wire leads shall be color coded as follows:

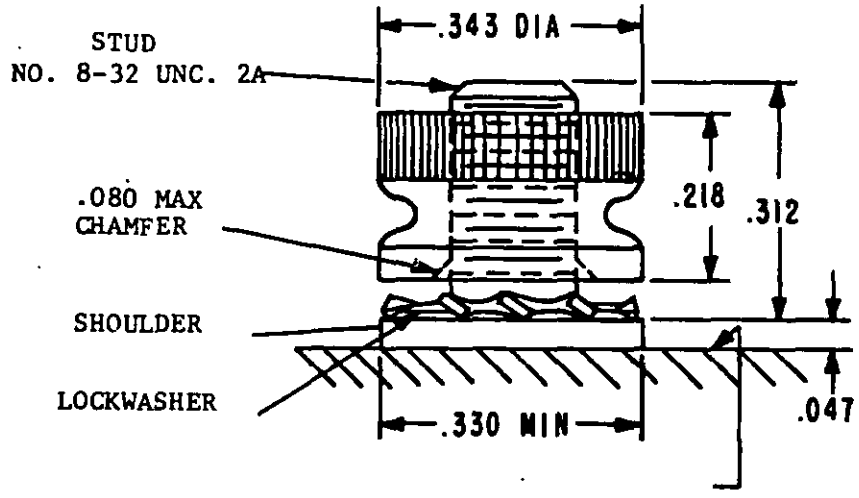
Positive - red
Negative - black
Intermediate - as specified (see 3.1).

The free end of each wire shall be bared for a distance of ½ ± 1/8 inch. The strands of each lead, so bared, shall be twisted together and soldered, and then covered with an adherent insulating waterproof material, or an equivalent method shall be used to prevent short circuits during storage and handling.

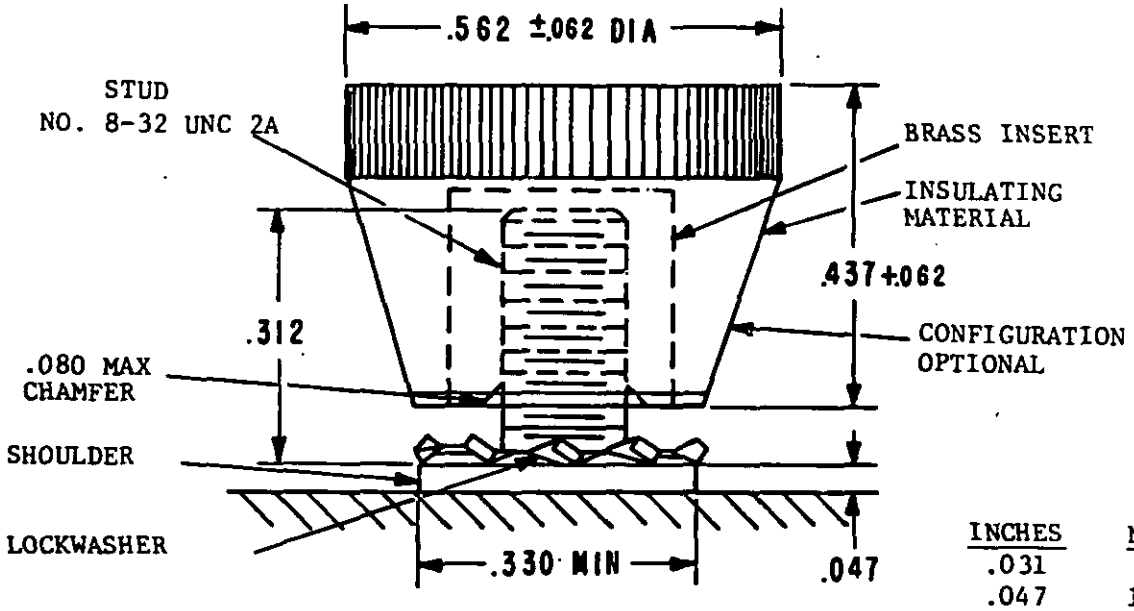
3.5.9.4 Snap-on. Snap-on terminals shall consist of two parts: stud (nonresilient member) for the positive terminal, and socket (resilient member) for the negative terminal, as shown in figure 2.

3.5.9.4.1 Mounting. Each member shall be securely mounted. Mating member engagements and disengagements shall be made without dislocating the terminals or distorting the battery beyond the specified limits during or after any tests performed on the battery (see 3.1). Each member shall be mounted so that the battery jacket does not interfere with the proper mating of the terminals.

3.5.9.4.2 Contact resistance. The contact resistance between the stud and socket, when tested in accordance with 4.7.4, shall not exceed 0.005 ohm.




BRASS NUT

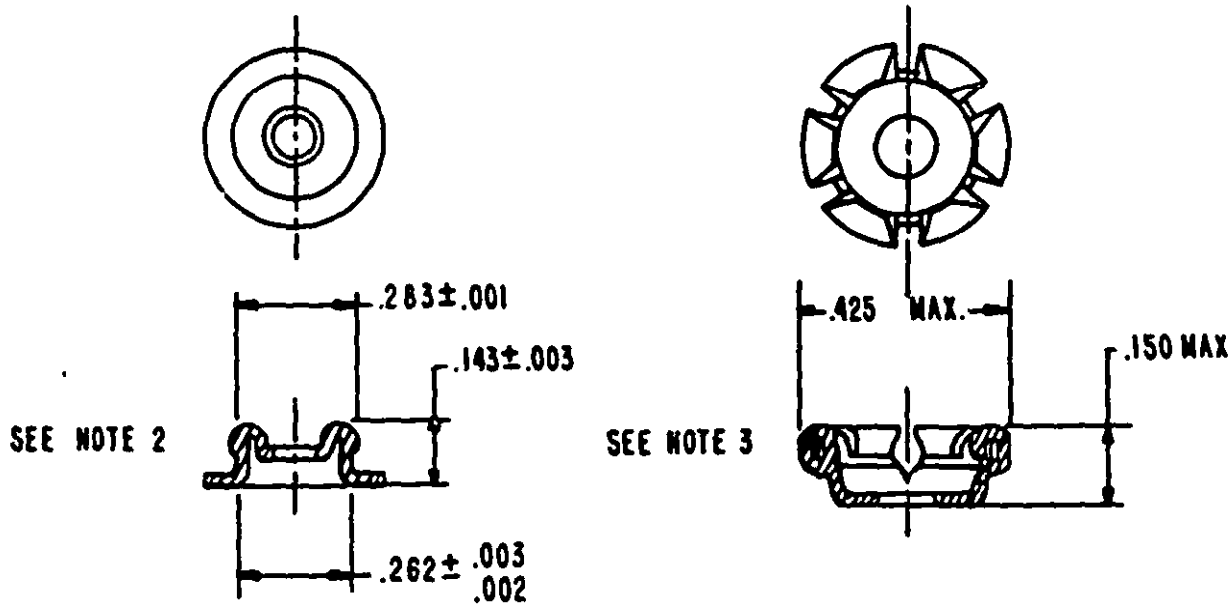



INSULATED NUT

| INCHES | MM |
|---|---|
| .031 | .79 |
| .047 | 1.19 |
| .062 | 1.57 |
| .080 | 2.03 |
| .218 | 5.54 |
| .312 | 7.92 |
| .330 | 8.38 |
| .343 | 8.71 |
| .437 | 11.10 |
| .562 | 14.27 |

1 - ALL DIMENSIONS IN INCHES.
2 - UNLESS OTHERWISE SPECIFIED TOLERANCES ARE ± .031.

Figure 1. Stud and nut terminal.




STUD, POSITIVE TERMINAL

SOCKET, NEGATIVE TERMINAL

NOTES:

1. ALL DIMENSIONS IN INCHES
2. STUD SHALL BE OF PLATED SOFT BRASS NOT LESS THAN 0.015 IN THICKNESS
3. SOCKET SHALL BE PLATED SPRING BRASS

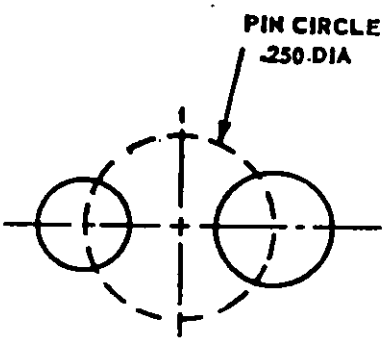
| INCHES | MM |
|---|---|
| .001 | .03 |
| .002 | .05 |
| .003 | .08 |
| .143 | 3.63 |
| .150 | 3.81 |
| .262 | 6.65 |
| .283 | 7.19 |
| .425 | 10.80 |

Figure 2. Snap-on terminals.

3.5.9.5 Socket. Socket terminals shall be as specified (see 3.1). When the following types of socket terminals are specified, they shall be as shown in figure 3, as applicable:

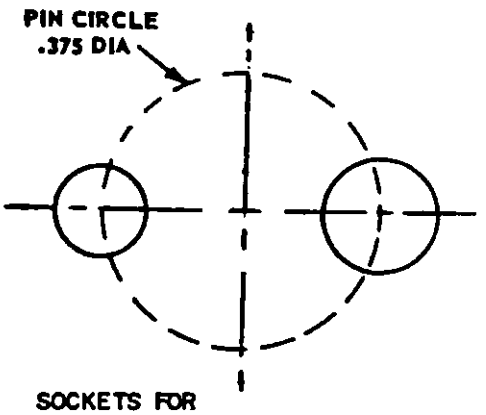
| Type | No. of holes |
|---|---|
| I | 2 |
| IV | 2 |
| VIII | 3 |
| XIII | 4 |
| IX | 5 |
| A | 8 |
| B | 8 |

Contact components of socket terminals shall be made of phosphor bronze, beryllium copper, or plated spring brass. Sockets shall be so designed and constructed that there will not be contact of any of the pins of the mating plug to any socket terminal other than those for which such pins are intended without using undue force. Insulating material shall be of plastic. The pinhole-spacing tolerances shall be ± 0.005 inch. When used, socket domes shall be made of sheet zinc 0.018-inch thick (No. 9 gage), or mechanical equivalent. (See 3.1.)



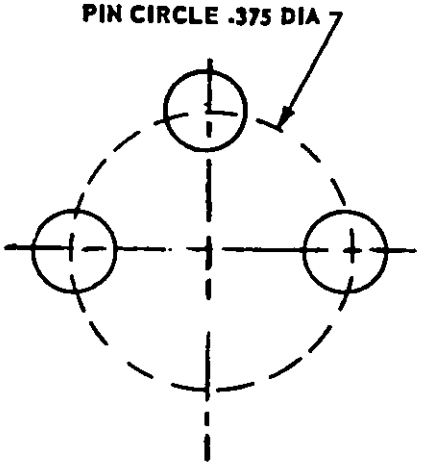

SOCKETS FOR
1 PIN 1/8 DIA (0.125 ± 0.002)
1 PIN 5/32 DIA (0.156 ± 0.002)
INSERTION FORCE 12 POUNDS MAX
WITHDRAWAL FORCE 12 POUNDS MAX
3 POUNDS MIN

TYPE I




SOCKETS FOR
1 PIN 1/8 DIA (0.125 ± .002)
1 PIN 5/32 DIA (0.156 ± .002)
INSERTION FORCE 12 POUNDS MAX
WITHDRAWAL FORCE 12 POUNDS MAX
3 POUNDS MIN

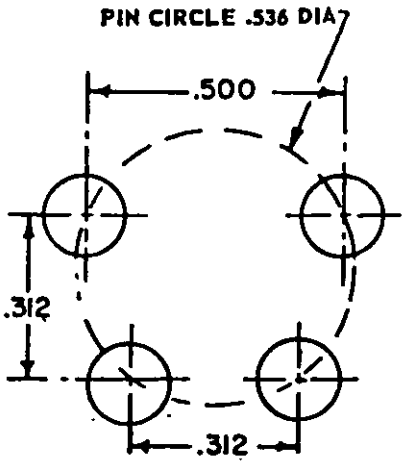
TYPE IV




INSERTION FORCE 12 POUNDS MAX
WITHDRAWAL FORCE 12 POUNDS MAX
4 POUNDS MIN

SOCKETS FOR
3 PINS 3/32 DIA (0.093 ± .002)

TYPE VIII

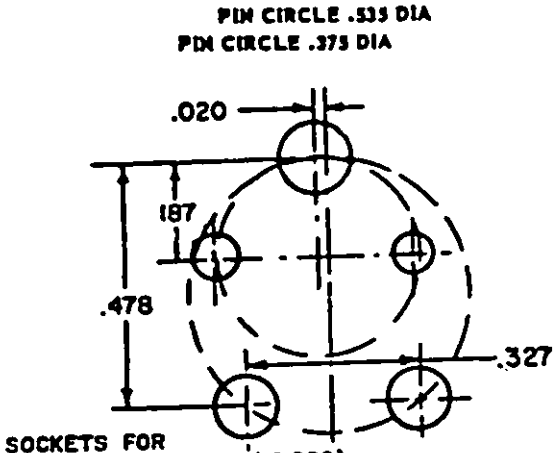



INSERTION FORCE 12 POUNDS MAX
WITHDRAWAL FORCE 12 POUNDS MAX
4 POUNDS MIN

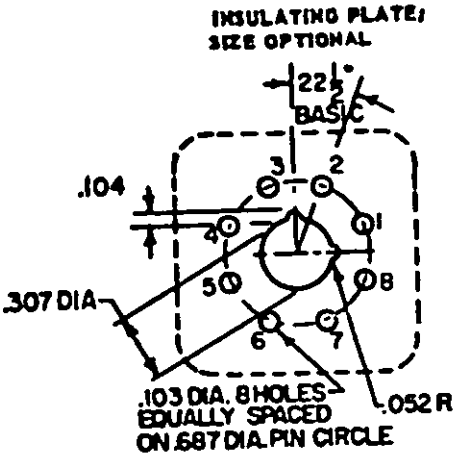
SOCKETS FOR
4 PINS 1/8 DIA (0.125 ± .002)

TYPE XIII

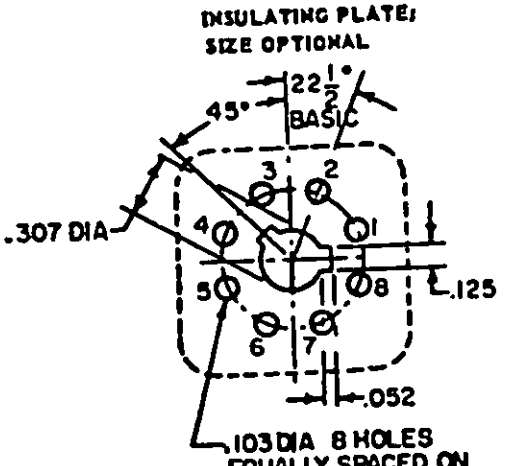
FIGURE 3. *Socket terminals (top views).*




TYPE IX




TYPE A.




TYPE B

1. ALL DIMENSIONS IN INCHES
2. TOLERANCES ARE ± .015 ON FRACTIONS AND ±.005 ON DECIMALS EXCEPT AS OTHERWISE SPECIFIED.

| INCHES | MM | INCHES | MM |
|---|---|---|---|
| .002 | .05 | .187 | 4.75 |
| .005 | .13 | .250 | 6.35 |
| .015 | .38 | .307 | 7.80 |
| .020 | .51 | .312 | 7.92 |
| .052 | 1.32 | .327 | 8.31 |
| .093 | 2.36 | .375 | 9.53 |
| .103 | 2.62 | .478 | 12.14 |
| .104 | 2.64 | .500 | 12.70 |
| .125 | 3.18 | .536 | 13.61 |
| .156 | 3.96 | .687 | 17.45 |

FIGURE 3— Socket terminals - continued

3.5.9.5.1 Mounting. The socket shall be so supported and mounted, that the top surface of the socket shall not protrude above the adjacent surface of the jacket and shall not be more than 1/8 inch below the surface of the jacket or socket dome, when used; initially, during, and after subsequent insertions of the mating plug. The socket pin-circle center shall be located as specified, and the jacket opening shall be positioned so that its center is within a 3/32-inch diameter circle, whose center coincides with the socket pin-circle center; initially, during, and after insertions of the mating plug. The angular orientation of the socket shall be within 5° of the battery centerlines or other lines of orientation, as specified. Socket well-depth, when measured from the top surface of the jacket or socket dome, shall be as specified. (See 3.1).

3.5.9.5.2 Contact resistance. Contact resistance between each socket insert and the applicable pin of the mating plug, when tested in accordance with 4.7.4, shall not exceed 0.005 ohm.

3.5.9.6 Flat surface. Flat-surface terminals shall be a flat plate of brass, or other metal, when specified (see 3.1), the center of which may be level, have a raised or a recessed portion, or a punched or drilled hole, as specified (see 3.1). When one terminal is the bottom of the can housing the battery, it shall be smooth and not injured as a result of cleaning or polishing. When the positive terminal is the carbon rod of a cell, it shall have a tight-fitting cap of brass, or other metal when specified (see 3.1). The cap shall be coated with solder, tin, cadmium, or nickel. The cap and the raised center portion of a flat plate may be provided with a centered, outward projecting point, which does not exceed 0.020 inch.

3.5.9.7 Coil and flat spring. Coil and flat-spring terminals shall be made of the beryllium copper, spring brass, or phosphor bronze, and shall be as specified (see 3.1).

3.5.9.8 Protection of terminals. When flash-dip microcrystalline wax, or equal, is used to waterproof the jacket, the terminals shall be covered with a removable tape or cap. Marking shall be legible after removal of the tape or cap. The wax dip shall be applied after the application of the tape or cap.

3.5.10 Strap handles. Strap handles shall be of webbing, using natural or synthetic fiber, or of plastic material. The width of the strap shall be 7/16-inch minimum. The effective length of the strap shall be at least one inch longer than the distance between its anchorages. The strap shall withstand the test specified in 4.7.5, without breaking or separating from its anchorages.

3.5.11 Jackets. The jackets may be fabricated of either metallic or nonmetallic material. The contents of multicell batteries shall fit snugly enough in the jackets to minimize movement of the cells. Jackets covering one or more cylindrical cells stacked end on end, and having an open top and open bottom, shall be so attached to the cells as to prevent them from slipping out when held or shaken vertically. The bottom opening of the jacket shall be of the size specified (see 3.1).

3.5.11.1 Metallic jacket.

3.5.11.1.1 Prior to battery fabrication. The inside of the jacket, when other than terne plate, shall be coated or lined with an electrolyte-corrosion-resistant material.

3.5.11.1.2 As a fabricated battery. The outside of the battery shall have a coating to protect the jacket from corrosion during or at the conclusion of any of the tests specified herein. Unless otherwise specified (see 3.1), the contents within the jacket shall be completely insulated from the metal. The jacket shall not become permanently distorted, nor open at any of its seams after being subjected to the test specified in 4.7.6.1. The test specified in 4.7.6.1 shall apply only to batteries weighing five pounds or more.

3.5.11.2 Nonmetallic jacket. When coating a nonmetallic jacket with wax, microcrystalline wax, or equal, shall be used. All excess wax shall be removed from the external surfaces of the jacket.

3.5.11.3 Jacket integrity (JI) (formerly specified as WOJ). When tested as specified in 4.7.6.2, metallic jackets shall show no evidence of water penetration and nonmetallic jackets shall not fall apart and the seams shall remain intact. The JI requirements shall not apply to single-cell non-rechargeable dry batteries with metallic or plastic jackets.

3.5.11.4 Color of jackets. The color of exposed surfaces of jackets shall match one of the following lusterless greens: 34079, 34086, 34087, 34096, 34102, 34127, and 34128 in accordance with FED-STD-595.

3.5.12 Closure. The closure is defined as the seal of the cell or battery.

3.5.12.1 Sealing compound. When sealing compound is used for closures in batteries containing cells whose seals are exposed, the outer edge of the sealing compounds of such cells shall be approximately level with the top of the jacket, and the inner edge of the sealing compound shall be approximately level with the lower edge of the cap on the carbon element. On multicell batteries, the exposed sealing compound shall be

approximately level with the edge of the jacket and shall not obstruct the contact surfaces of the terminals. (See 4.7.1.1.1.)

3.5.12.2 Metal or plastic covers. Metal or plastic covers for tops of cells or batteries may be used in lieu of sealing compound, provided that such covers and accessory parts are not adversely affected by leakage, corrosion, or deformation during the tests specified herein. Construction shall be such that it will be impossible for one cell to be short-circuited by coming in contact with another cell of the same type when placed end to end.

3.5.13 Potting. When potting is specified (see 3.1), voids within the battery, except the socket well, shall be adequately filled with microcrystalline wax, asphalt, wood blocks, or wax-impregnated chipboard, or equivalent material. (See 4.7.1.1.)

3.6 Electrolyte penetration. When applicable materials are tested as specified in 4.7.2, the milliammeter deflection shall be less than 0.225 milliampere during the entire test period.

3.7 Dielectric withstanding voltage. When applicable materials are tested as specified in 4.7.3, there shall be no voltage breakdown during the entire test period.

3.8 Vibration. After the multicell batteries have been tested as specified in 4.7.8, they shall meet the visual and mechanical requirements. (see 3.5.1 through 3.5.2.2 and 3.5.9 through 3.5.9.7). There shall be no voltage fluctuations during the test.

3.9 Mechanical shock. After the multicell batteries have been tested as specified in 4.7.9, they shall meet the visual and mechanical requirements (see 3.5.1 through 3.5.2.2 and 3.5.9 through 3.5.9.7).

3.10 Insulation resistance. The insulation resistance between any two terminals not electrically connected, and between all ungrounded terminals and the jacket of the battery, shall be not less than five megohms, when tested as specified in 4.7.10.

3.11 Capacity. When batteries are tested for delayed capacity (D) and capacity after high-temperature store (T), as specified in 4.7.11, the time required to terminate the discharge, as specified in 4.7.11.4, shall be not less than the minimum time specified for SLD or SLT.

3.12 Electrolyte leakage. There shall be no evidence of electrolyte leakage on the external surfaces of the battery at any time prior to or during the performance of the test specified in 4.7.12. Electrolyte leakage will be considered to have occurred when moisture appears on a piece of absorbent paper rubbed on the surface of the jacket.

3.13 Labeling and marking. All labeling and marking shall be clear and legible throughout all of the tests specified herein. Labeling and marking shall be black. Metallic and plastic jackets may have the labeling and marking embossed or die-depressed, in which case it may be the same color as the background.

3.13.1 Labels. Each battery shall have the label positioned as specified (see 3.1). If there is insufficient space to show all required information on one face of the battery, it shall be continued on another face. There shall be no information on the label other than the following:

BATTERY, NON-RECHARGEABLE, DRY

Type designation

NATO type designation

(Order number)----

(Code)----

Manufacturer's name

(Trade name may also be used)

Manufacturer's plant

Example:

BATTERY, NON-RECHARGEABLE, DRY

BA-23

NBA-023

1958-PP-61

0361

JOHN DOE COMPANY

JODOCO

Batteryville, N. J., U.S.A.

Note: The code may be placed on the bottom of single-cell batteries.

3.13.1.1 Code. The code shown, shall indicate the month and year of manufacture of the battery by means of a four-digit number, in which the first two digits shall indicate the number of the month and the last two digits shall indicate the year. Months, earlier than the tenth month, shall be a single digit preceded by "0".

Examples:

A battery manufactured in March 1982 will bear the code "0382."

A battery manufactured in November 1982 will bear the code "1182."

When a battery is completed during the last three working days of a month, or the first three working days of the subsequent month, the manufacturer is permitted to use either month as the date to be coded.

3.13.2 Terminal markings. On batteries having socket-type terminals, all markings such as polarity, voltage, and the unit of battery (A,B,C,etc.) shall appear on the face of the battery bearing the socket. On other type terminals, the terminal markings may appear on the top or the side of the battery, or both. Markings shall indicate clearly the terminals to which they refer.

3.14 Workmanship. Batteries shall be processed in such a manner as to be free from cracked or displaced parts, sharp edges, burrs, and other defects, which will affect their life, serviceability, or appearance.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration

system, to control the accuracy of the measuring and test equipment, shall be in accordance with MIL-STD-45662.

4.1.1.1 Instrument accuracy.

4.1.1.1.1 Voltmeters and ammeters. All voltmeters and ammeters, used in testing the batteries, shall be accurate within one percent of the full-scale value. The voltmeter and ammeter ranges shall be such that all readings are taken on the upper half of the scale. For all closed-circuit voltage measurements, the sensitivity of voltmeters shall be not less than 1,000 ohms per volt. For all open-circuit voltage measurements, the sensitivity of voltmeters shall be 100 ohms ± 10 ohms per volt, unless otherwise specified (see 3.1).

4.1.1.1.2 Resistor tolerances. In all tests involving discharge through a resistance, such resistance shall be accurate within the following percentages:

| | Percent |
|---|---|
| Up to and including 25,000 ohms - - - | 0.5 |
| From above 25,000 ohms to and including 1 megohm - - - - - - - - - | 1.0 |
| Above 1 megohm - - - - - - - - - - - - | 5.0 |

In determining the resistance used as a test load, the resistance of all continuously operating voltmeters shall be considered as part of the specified load.

4.1.1.1.3 Timing. Timing equipment shall be accurate within 0.5 percent.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Materials and components inspection (see 4.4).
b. First article inspection (see 4.5).
c. Quality conformance inspection (see 4.6).
   (1) Inspection of product for delivery (see 4.6.1).
   (2) Inspection of packaging (see 4.6.2).

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in "GENERAL REQUIREMENTS" of MIL-STD-202.

4.4 Materials and components inspections. Materials and components inspection shall consist of verification by certification from the source that the materials and components, used in fabrication of the batteries, are in accordance with applicable requirements prior to such fabrication. In the absence of certification from the source, a certificate of analysis or certified inspection data shall be requried as proof of conformance to ap-

plicable requirements. Materials and components involved are listed in table II.

4.4.1 Samples of materials and components. For those items listed in Table II, for which the specification does not reference a subsidiary specification, eight sample specimens of materials and components, treated and processed as they would be in the finished batteries, shall be inspected.

4.5 First article inspection. After award of contract, unless otherwise specified in the contract or purchase order, first article inspection shall be performed by the contractor as specified in 4.5.1 through 4.5.5.

4.5.1 Sample batteries. The contractor, at no additional cost to the Government, shall fabricate 21 batteries (if multicell), or 31 batteries (if single cell) which will constitute the first article inspection lot.

4.5.2 Inspection routine. First article inspection shall consist of the examinations and tests specified in table III, and shall be performed in the order shown. One untested sample battery, as shown in Group III, shall remain at the contractor's manufacturing plant and shall be available to the Government as a reference standard for comparative purposes.

TABLE III. First article inspection.

| Group | Number of batteries | Examinations and tests | Requirement paragraph | Method of test paragraph |
|---|---|---|---|---|
| I | 15 | Visual and mechanical examination (external) | 3.5 and 3.5.1 | 4.7.1 |
| | | Battery voltage | 3.5.2 through 3.5.2.2 | 4.7.7 through 4.7.7.2 |
| | | Dimensions and weight | 3.5 and 3.5.1 | 4.7.1 |
| | | Vibration 1/ | 3.8 | 4.7.8 |
| | | Mechanical shock 1/ | 3.9 | 4.7.9 |
| | | Insulation resistance 1/ | 3.10 | 4.7.10 |
| | | Capacity | 3.11 | 4.7.11 through 4.7.11.4 |
| II | 10 | Electrolyte leakage 1/ | 3.12 | 4.7.12 |
| | 3 | Jacket integrity | 3.5.11.3 | 4.7.6.2 |
| | 2 | Visual and mechanical examination (internal) | 3.5 | 4.7.1 |
| III | 1 | Untested reference - sample | 4.5.2 | ---- |

1/ When applicable.

4.5.3 Failures. Failure of any battery to comply with any of the examinations or tests, shall be cause for failure of first article inspection.

4.5.4 Noncompliance. If a sample fails first article inspection, the contractor shall take corrective action on the materials or processes, or both, as warranted, to eliminate the cause of failure. The contractor, at no additional cost to the Government, shall be required to fabricate an additional first article inspection lot and subject them to reinspection. A description of the corrective action taken shall be included in the first article inspection test report. Government approval to begin production will be given only upon the successful completion of first article inspection.

4.5.5 Start of production. Any production of batteries by the contractor, prior to materials and components inspection (see 4.4) and approval of first article inspection, shall be at his own risk.

4.6 Quality conformance inspection.

4.6.1 Inspection of product for delivery. Inspection of product for delivery shall consist of materials and components inspection and groups A and B inspections. (See 4.4 and 4.6.1.2 through 4.6.1.3.) This does not relieve the contractor of his responsibility for performing any additional inspection, which is necessary to control the quality of the product and to assure compliance with all specification requirements. The Government will review and evaluate the contractor's inspection procedures and examine the contractor's inspection records. In addition, the Government, at its discretion, may perform all or any part of the specified inspection to verify the contractor's compliance with specified requriements. (See 6.3) Test equipment for Government verification shall be made available by the contractor.

4.6.1.1 Lot definitions.

4.6.1.1.1 Shipment lot. A shipment lot (Ns) is the quantity of batteries (exclusive of the number of batteries required as test sample units) of any one type, any one code, and produced at any one place of manufacture, on any one contract.

4.6.1.1.2 Contract lot. The contract lot (N) is the total quantity of all batteries (exclusive of the number of batteries required as test sample units) of any one type, delivered in one or more shipment lots, under the terms of any one contract.

4.6.1.2 Group A inspection. Group A inspection shall consist of 100 percent inspection of all batteries in a shipment lot in accordance with the examination and test in table IV. If, during this 100 percent inspection, more than 4 percent of the batteries are discarded, the entire lot shall be rejected.

TABLE IV. Group A inspection.

| Examination or test | Requirement paragraph | Method of test paragraph |
|---|---|---|
| Visual and mechanical (external) | 3.5 | 4.7.1 |
| Battery voltage | 3.5.2 through 3.5.2.2 | 4.7.7 through 4.7.7.2 |

4.6.1.3 Group B inspection. Group B inspection shall consist of the examinations and tests specified in table V in the order shown, and shall be made on sample units from inspection lots which have passed group A inspection.

4.6.1.3.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105, for small-sample inspection. The acceptable quality levels (AQL) and inspection levels shall be as specified in table V.

TABLE V. Group B inspection.

| Examinations or tests | Requirement paragraph | Method of test paragraph | AQL % | Inspection level |
|---|---|---|---|---|
| Dimensions and weight | 3.5 and 3.5.1 | 4.7.1 | 1.0 | |
| Insulation resistance | 3.10 | 4.7.10 | 1.0 | |
| Vibration 1/ | 3.8 | 4.7.8 | 2.5 | |
| Mechanical shock 1/ | 3.9 | 4.7.9 | 2.5 | S-3 |
| Battery voltage | 3.5.2 through 3.5.2.2 | 4.7.7 through 4.7.7.2 | 1.0 | |
| Jacket integrity 1/ 2/ | 3.5.11.3 | 4.7.6.2 | 2.5 | |
| Electrolyte leakage | 3.12 | 4.7.12 | 1.5 | S-4 |

1/ When applicable.
2/ Batteries shall be selected at random during the first 1/3 of the monthly production lot.

4.6.1.4 Group C inspection. Group C inspection shall consist of the tests specified in table VI in the order shown. The tests shall be performed at the applicable Government inspection facility (see 6.2f). Shipment of the lot, represented by group C sample batteries, shall not be held up pending results of group C inspection.

TABLE VI. Group C inspection.

| Tests | Requirement paragraph | Method of test paragraph |
|---|---|---|
| Capacity T | 3.11 | 4.7.11 through 4.7.11.4 |
| Capacity D | 3.11 | 4.7.11 through 4.7.11.4 |

4.6.1.4.1 Sampling plan. A sample, consisting of $n_s$ batteries, shall be selected at random from production for each shipment lot in quantities determined from the formula below, and rounded off in the case of fractions, to an adjacent integer (up or down for each shipment lot), so that exactly n batteries have been assigned to each capacity test (T and D), when the sample for the final shipment of the contract lot has been drawn.

$$n_s = \frac{Ns}{N} (2n)$$

Where:

$n_s$ = total number of sample batteries to be taken from each shipment lot.

$N_s$ = number of batteries in the shipment lot.

N = number of batteries in the contract lot. (see table VII.)

n = number of batteries to be taken from the contract lot for each of the two capacity tests, T and D, in accordance with table VII. (Total number of batteries selected is 2n.)

TABLE VII. Sample size and acceptance number for each capacity test.

| Contract lot size "N" | Sample size "n" for each capacity test from contract lot | Acceptance number 1/ T and D tests |
|---|---|---|
| 0 to 110 | 5 2/ | -- 2/ |
| 111 to 500 | 15 | 3 |
| 501 to 800 | 25 | 5 |
| 801 to 1,300 | 35 | 7 |
| 1,301 to 3,200 | 50 | 9 |
| 3,201 to 8,000 | 75 | 13 |
| 8,001 to 22,000 | 110 | 18 |
| 22,001 to 110,000 | 150 | 24 |
| over 110,000 | 225 | 34 |

1/ When the number of capacity values, falling below the minimum requirements specified (see 3.1) for a given test, is equal to or less than the associated acceptance number, the contract lot from which the sample was drawn has met the requirements of that test.

2/ Determination of compliance, specified in 4.6.1.4.2, shall not apply to contract lot-sizes less than 111.

4.6.1.4.1.1 Smaller-than-shipment (sub-shipment) lots. At the option of the contractor, selection of sample batteries (see 4.6.1.4.1) may be made on a smaller-than shipment (sub-shipment) lot basis. In such case, the sample size for the sub-shipment lot shall bear the same ratio to the sample size for the shipment lot as the sub-shipment lot bears to the shipment lot.

4.6.1.4.1.2 Allocation of sample batteries for group C inspection. The number of batteries $n_s$, selected from a shipment lot (see 4.6.1.4.1), shall be assigned at random for group C inspection as follows:

(a) The quantity of batteries $\frac{(2n\ Ns)}{N}$ in the sample of the first shipment lot shall be selected at random and assigned to the capacity tests. The first battery shall be assigned to the T test, and the second one to the D test, etc. This sequence of assignment of sample batteries to the two capacity tests shall be resumed in each succeeding shipment lot at the same point at which it ended in the previous shipment lot.

(b) The assignment of batteries to capacity tests shall result in the allocation of exactly n batteries to each of the two capacity tests after the final shipment on the contract lot is made. If necessary, the sample size $n_s$ taken from the last shipment lot of a contract lot shall be adjusted so that this result is achieved.

4.6.1.4.2 Determination of compliance. The entire contract lot shall be considered as complying, when the T test results show compliance. To determine whether the contract lot conforms to the specified T test requirements, the number of batteries in the sample with capacity values below the minimum capacity value (SLT) specified in 3.1, shall be compared with the acceptance numbers for sample sizes n in table VII. When the number for a given test is less than or equal to the corresponding acceptance number, the contract lot complies with the requirements of the test. When the number is greater than the acceptance number, the contract lot does not comply.

4.6.1.4.2.1 Missing capacity values. If, for any reason, upon completion of the T test, there are fewer than n valid capacity values available for the evaluation of the contract lot quality, the missing values shall be set equal to the applicable requirement. If, during the performance of the contract lot inspection, fewer sample units than required are furnished on more than two occasions, the Government shall have the option to set the missing values to zero performance.

4.6.1.4.3 Noncompliance.

4.6.1.4.3.1 Capacity T. If the capacity T test results do not show compliance with the requirements, as defined in 4.6.1.4.2, the entire lot shall be considered as not being in compliance with requirements of this specification, and an adjustment shall be made.

4.6.1.4.3.2 Capacity D. If the number of failures on sample batteries, subjected to the capacity D test, capacity values below the minimum capacity value (SLD), specified in 3.1 exceeds the applicable acceptance number for the contract lot size n, allowed by table VII, the contract lot is not in compliance.

4.6.1.4.4 Shipment. When the inspection lot passes group A and B inspections, all sample batteries selected as specified in 4.6.1.4.1 for group C inspection, shall be shipped to the Government inspection facility (see 6.2f) at no additional cost to the Government.

4.6.1.4.5 Marking of test batteries. Sample batteries, allocated to tests specified in 4.6.1.4, shall be marked "(*) TEST SAMPLE." The asterisk (*) shall be replaced by "T" or "D", as applicable. The marking shall be rubber-stamped or placed on a label, securely attached to each battery. However, on batteries weighing eight ounces or less, the above marking shall be placed on the outside of each unit package.

4.6.1.4.6 Packaging of test batteries. Sample batteries, allocated as specified in 4.6.1.4, shall be separately unit-packaged as specified in 5.1. Any void spaces, in unit packages containing sample batteries, shall be filled with filler material or dummy batteries. Each unit package shall be marked "RESERVED FOR (*) TEST, DO NOT OPEN UNTIL COMPLETION OF STORAGE PERIOD." The asterisk (*) shall be replaced by "T" or "D", as applicable.

4.6.1.4.7 Packing of test batteries. The unit packages shall be packed in a shipping container in accordance with 5.1. Maximum gross weight of shipping containers, enclosing these sample batteries, shall be sixty (60) pounds.

4.6.2 Inspection of packaging. Inspection shall be in accordance with group A and group B of MIL-P-116 and, when required (see 6.2 (g)), the rough handling test of MIL-P-116. Inspection lots shall be in accordance with MIL-P-116.

4.7.1 Visual and mechanical examination. Batteries shall be examined to determine compliance with all applicable requirements and characteristics listed in table VIII. When internal examination is necessary, it shall be performed either during fabrication of the battery or by dismantling the finished battery. For dimensions and weight, batteries shall be examined for compliance with requirements, as specified (see 3.1).

TABLE VIII. Visual and mechanical examination.

| Requirement | Reference paragraph |
|---|---|
| External | |
| Design and construction (excluding dimensions and weight) | 3.5 |
| Terminals | 3.5.9, 3.5.9.1.1, 3.5.9.2.1, 3.5.9.3.1, 3.5.9.4.1, 3.5.9.5.1, and 3.5.9.8 |
| Jackets | 3.5.11 through 3.5.11.2 and 3.5.11.4 |
| Closure | 3.5.12 through 3.5.12.2 |
| Internal | |
| Dissimilar metals | 3.4.1.1 |
| Filler or padding | 3.5.4 |
| Cell-block container | 3.5.5 |
| Intercell separation | 3.5.6 |
| Intercell connections | 3.5.7 |
| Age of cells | 3.5.8 |
| Metallic jacket | 3.5.11.1.1 and 3.5.11.1.2 |
| Potting | 3.5.13 |

4.7.1.1 Potting. The contractor shall determine the minimum weight of an adequately potted battery for each production lot, and shall not present any batteries for quality conformance inspection which fail to meet this minimum weight requirement. This shall be accomplished by determining the minimum weight of a battery filled with a sufficient quantity of potting material which will enable the battery to withstand the vibration and mechanical-shock tests. The minimum weight determined for a lot shall be forwarded to the designated Government inspection facility at the time sample batteries for the lot are shipped for group C inspection (see 3.5.13).

4.7.1.1.1 Flow or shrinking. Potting and sealing compounds, when used, shall be placed in a container, approximately 3 inches wide by 6 inches long by 3/4 inch high to within 1/4 inch of the top. The temperature of the compound within the container shall be raised to 130° ± 5°F. (54.4° ± 2.8°C.) and the container shall be held in an inverted position for 24 hours. Then the temperature of the compound shall be lowered to 0° ± 5° F. (-17.8° ± 2.8°C.). Any flow, or cracking, or shrinking of the compound from the sides of the

container shall be noted. If flow is noted at the high temperature, five batteries of the type involved shall be exposed to 130° ± 5° F. (54.4° ± 2.8°C.) storage for 24 hours with the terminals resting in the lowest possible position. At the end of this exposure period, the batteries shall be examined to determine that there is no impairment of electrical contact. (See 3.5.12.1.) At the contractor's option, batteries assigned to JI testing may be used. (See 3.5.3.)

4.7.2 Electrolyte penetration. Applicable specimens of materials and components shall be placed on a metal plate, and a cylindrical plastic tube, 2 inches high with an internal diameter of 1½ inches, shall be clamped over the material. The tube shall then be filled to a depth of 1 inch with an aqueous solution of the appropriate electrolyte (zinc chloride, 50 percent by weight, for Leclanche-type batteries, and potassium hydroxide, 31 percent by weight, for mercury-type batteries). A metal electrode shall be inserted into this solution to a depth of approximately 1/2 inch. A direct-current potential of 22.5 volts shall be applied between this electrode and the metal plate, with a milliammeter of the proper range in the circuit. The test shall continue for a period of 72 hours, but may be terminated if failure occurs sooner. For small extruded plastic jackets, a comparable test shall be performed. (See 3.6.)

4.7.3 Dielectric withstanding voltage (see 3.7). Batteries shall be tested in accordance with method 301 of MIL-STD-202. The following details and exceptions shall apply:

(a) Special conditions - Applicable specimens of material and components shall be conditioned for 48 hours at 150° ± 2°F. (65.6° ± 1.1°C.) and a relative humidity of 50 ± 15 percent; then for 1 hour at 70° ± 5° F. (21.1° ± 2.8°C.) and a relative humidity of 50 ± 15 percent. Each specimen of material shall then be placed between two electrodes in such a manner that the electrodes will make contact with both sides of the specimen being tested. Each electrode shall have a diameter of 2 inches, with the edge rounded to a radius of ¼ inch, so that the contact surface is a circle 1½ inches in diameter. The specimen shall extend at least ½ inch beyond the electrode surfaces around the entire circumference of the electrode to prevent flashover at the edge of the specimen.

(b) Test voltage - 1,000 volts, rms.

(c) Duration of application of test voltage - 60 seconds.

(d) Source of test voltage - A transformer rated not less than 500 volt-amperes, capable of delivering up to 10 kilovolts, rms to the electrodes.

(e) Monitoring - Specimens shall be monitored while the test voltage is at its magnitude for evidence of breakdown of insulation or damage.

For small extruded plastic jackets, a comparable test shall be performed.

4.7.4 Contact resistance of terminals (see 3.5.9.4.2 and 3.5.9.5.2). Battery terminals shall be tested in accordance with method 307 of MIL-STD-202. The following details and exceptions shall apply:

(a) Test current - 5 amperes.

(b) Number of insertions and withdrawals - 10, complete for snap-on terminals, using a mating stud for the socket; and 20 complete for socket terminals, using a mating plug for the socket.

(c) Number of test activations on which measurements are to be made - During engagement numbers 1, 5, 6, and 10 for snap-on terminals, between the stud and socket; and during engagement numbers 1, 10, 11, and 20 for socket terminals, between applicable pins of the mating plug and the socket.

4.7.5 Strap handle strength. The sample battery, or a strap handle attached to a metal plate (mockup), shall be supported by the strap handle. The battery or the mockup shall be conditioned for 6 hours at a temperature of 130° ± 5°F. (54.4° ± 2.8°C.) and ambient relative humidity. Immediately following the conditioning, a weight shall be added gradually in such a manner that the total weight (including the total weight of the battery, if used), applied to the strap handle and its anchorages, shall be at least 80 pounds; and it shall be maintained for 1 minute. This test shall be repeated after the battery or the mockup has been conditioned for 6 hours at a temperature of -40° ± 5°F. (-40° ± 2.8°C.). The strap handle shall be examined for evidence of breakage or separation from its anchorages. (See 3.5.10.)

4.7.6 Jackets.

4.7.6.1 Metallic jackets. Metallic-jacketed batteries, weighing five pounds or more, shall be loaded by applying weights totaling 100 pounds, evenly distributed over the top of the battery, and shall remain so loaded at least one minute. The condition of the jacket shall then be observed. (See 3.5.11.1.2.)

4.7.6.2 Jacket integrity (JI). All multicell batteries and paper-jacketed, single-cell batteries shall be immersed to within ¼ inch of the top of the jacket in water maintained at a temperature of 113° ± 5°F. (45° ± 2.8°C.) for a period of 48 hours. In the case of multicell, metal-jacketed batteries the metal containers, without covers, may be subjected to this test in place of assembled batteries. In the case of nonmetallic-jacketed batteries, the jackets may be applied to dummy batteries in place of actual batteries. The jackets shall be examined for evidence of water penetration for metallic jackets and that seams are still intact and jackets are not falling apart for nonmetallic jackets, and that labels remain legible and intact. (See 3.5.11.3.)

4.7.7 Battery voltage (see 3.5.2).

4.7.7.1 Open-circuit voltage. A direct-current voltmeter of proper range and sensitivity shall be used to measure the closed-circuit voltage. (see 3.5.2.2.)

4.7.8 Vibration (applicable only to multicell batteries). Each battery shall be rigidly clamped to the platform of a vibration machine in a manner approximately as closely as practicable to the manner in which the batteries are clamped when in use. A simple harmonic motion, having an amplitude of 0.03 inch (0.06-inch maximum total excursion), shall be applied. The frequency shall be varied at the rate of 1 Hertz (Hz) per minute between the limits of 10 and 55 Hz. The entire range of frequencies and return shall be traversed in 95 ±5 minutes for each mounting position (direction of vibration) of the battery. The batteries shall be vibrated in three mutually perpendicular directions, for approximately equal periods. One of the directions of vibration shall be perpendicular to the terminal face of the battery. Open-circuit voltage shall be observed for 30 seconds during the last quarter of each vibration period. (see 3.8.)

4.7.9 Mechanical shock (see 3.9). Batteries shall be tested in accordance with method 213 of MIL-STD-202. The following details shall apply:

(a) Test-condition letter-I (100G sawtooth).

(b) Examination after test - Dimensions and visual and mechanical requirements. (see 3.5.1 through 3.5.2.2 and 3.5.9 through 3.5.9.7.)

4.7.10 Insulation resistance. Batteries shall be tested in accordance with method 302 of MIL-STD-202. The following details and exceptions shall apply:

(a) Test-condition letter - B, except that tolerance is ± 20 volts.

(b) Special preparations and conditions - Batteries shall be stored for a period of 48 hours at 70° ± 5°F. (21.1 ± 2.8°C.) and a relative humidity of 50 ±15 percent. The insulation resistance measurement shall be made at the end of this storage period and while at these storage test conditions.

(c) Points of measurement - Between any two terminals not electrically connected and between all ungrounded terminals, for all batteries; between all ungrounded terminals and the metallic jacket of the battery for those batteries having a metallic jacket. For batteries having a nonmetallic jacket, the measurements shall be made between a 1-inch square copper plate in physical contact with the jacket and all ungrounded terminals. The copper plate shall be placed with its broad surface against any area of any surface other than the one on which the battery terminals are located. (See 3.10.)

4.7.11 Capacity. Sample batteries, marked "RESERVED FOR (D or T) TEST. DO NOT OPEN UNTIL COMPLETION OF STORAGE PERIOD", shall be stored conditioned, if applicable, and discharged as specified in 4.7.11.2 through 4.7.11.4. (See 3.11.)

4.7.11.1 Ambient storage and discharge conditions. The ambient conditions specified in table IX shall prevail during storage and discharge periods. Normal conditions shall be maintained insofar as possible. Deviations from normal conditions are permitted, provided that: (1) the extreme conditions specified in table IX do not exist for more than five percent (cumulative) of the specified storage or discharge periods (see 3.1); and (2) that at no time are the extreme conditions exceeded which will adversely affect the battery.

4.7.11.2 Storage. At the Government inspection facility (see 6.2 f), the sample batteries (as received in container-barrier containers) shall be stored at applicable storage conditions for the specified period (see 3.1). For D test, the storage period shall be considered to have started from the coded month appearing on the battery label. For the T test, the storage period shall be considered to have started from the date the batteries are actually placed in controlled storage. At the conclusion of the storage period, the outside of the metallic jackets shall be examined for evidence of corrosion (see 3.5.11.1); non-metallic jackets shall be examined for their condition (see 3.5.11.3).

TABLE IX. Ambient storage and discharge conditions.

| Kind of storage or discharge | Normal conditions (temperature) | Extreme conditions (temperature) |
|---|---|---|
| D storage | $70^{\circ} \pm 5^{\circ}F$ ($21.1^{\circ} \pm 2.8^{\circ}C$) | $60^{\circ}F$ ($15.6^{\circ}C$) through $65^{\circ}F$ ($18.3^{\circ}C$); and $75^{\circ}F$ ($23.9^{\circ}C$) through $80^{\circ}F$ ($26.7^{\circ}C$) |
| T storage | $113^{\circ}{}^{+2^{\circ}}_{-8^{\circ}}F$ ($45^{\circ}{}^{+1.1^{\circ}}_{-4.4^{\circ}}C$) | $88^{\circ}F$ ($31.1^{\circ}C$) through $105^{\circ}F$ ($40.6^{\circ}C$) and $115^{\circ}F$ ($46.1^{\circ}C$) through $118^{\circ}F$ ($47.8^{\circ}C$) |
| All discharges | $70^{\circ} \pm 2^{\circ}F$ ($21.1^{\circ} \pm 1.1^{\circ}C$) | $65^{\circ}F$ ($18.3^{\circ}C$) through $68^{\circ}F$ ($20^{\circ}C$); and $72^{\circ}F$ ($22.2^{\circ}C$) through $80^{\circ}F$ ($26.7^{\circ}C$) |

4.7.11.3 Stabilization preceding discharge. Following storage and conditioning, when applicable, the batteries shall be further stored for 48 hours at ambient discharge conditions specified in table IX.

4.7.11.4 Discharge. Following stabilization, the batteries shall be discharged at the ambient discharge conditions specified in table IX. The discharge shall be terminated when any one of the following conditions occur:

(a) The battery voltage or the voltage of any one unit falls below the specified test end-voltage. (For batteries requiring discharge alternately through two resistances, the voltage shall be read during the final minute of the heavier-load period.)

(b) The battery dimensions exceed the maximum specified. (See 3.1.)

(c) Electrolyte leakage becomes apparent on the exterior surface of the battery. (See 3.12.)

(d) SLD or SLT has been reached.

4.7.12 Electrolyte leakage. Sample batteries shall be discharged as specified (see 3.1) and then stored for 15 days. Fifty percent of the batteries shall be stored in an inverted position. The storage and discharge shall be performed at inspection conditions specified in 4.3. During the 15-day storage period, each battery shall be examined daily for evidence of electrolyte leakage on the external surfaces of the jacket. (See 3.12.)

## 5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-B-55521.

## 6. NOTES

6.1 Intended use. Non-rechargeable, dry batteries conforming to this specification are intended for use in electronic and communication equipment and all other military equipments which are powered by non-rechargeable dry batteries. Included are single and multicell batteries used in such wide-ranging equipment as flashlights, test equipment, radio sets, and other portable communication and electronic equipment.

6.2 Ordering data. Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Title, number and date of the applicable specification sheet.
(c) Complete battery type designation.
(d) Date for notice of availability for shipment.
(e) Level A and level B presentation and packing.
(f) Government inspection facility performing Group C inspection.
(g) When rough handling test is required (see 4.6.2).

6.3 Award of contract. Contracts will be awarded only to contractors who guarantee to meet the requirements of this specification. No combining of performance requirements should be undertaken. Bids, that offer to guarantee higher capacities, will not receive special consideration in awarding a contract. Contracts will be awarded to the lowest bidder on a cost-per-unit-battery basis, provided that all performance requirements are guaranteed.

6.4 Verification inspection. Verification inspection by the Government will be limited to the amount deemed necessary to determine compliance with the contract, and will be limited in severity to the definitive quality assurance provisions established in this specification and the contract. The amount of verification inspection by the Government will be adjusted to make maximum utilization of the contractor's quality control system and the history of the product.

6.5 International standardization agreements. Certain provisions of this specification are the subject of international standardization agreement. When amendment, revision, or cancellation of this specification is proposed, which will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels, including departmental standardization offices, to change the agreement or make other appropriate accommodations.

6.6 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodians:

Army - ER
Navy - SH
Air Force - 99

Review activities:

Army - AR, SM
Navy - AS, OS
Air Force - 85

User activities:

Army - AV, ME, MI
Navy - YD, MC
Air Force - 11

International interest (see 6.5)

Preparing activity:

Army - ER

(Project No. 6135-0548)

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS: This form is provided to solicit beneficial comments which may improve this document and enhance its use. DoD contractors, government activities, manufacturers, vendors, or other prospective users of the document are invited to submit comments to the government. Fold on lines on reverse side, staple in corner, and send to preparing activity. Attach any pertinent data which may be of use in improving this document. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity. A response will be provided to the submitter, when name and address is provided, within 30 days indicating that the 1426 was received and when any appropriate action on it will be completed.

NOTE: This form shall not be used to submit requests for waivers, deviations or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

DOCUMENT IDENTIFIER *(Number)* AND TITLE

MIL-B-18E Batteries, Non-Rechargeable Dry

NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

☐ VENDOR ☐ USER ☐ MANUFACTURER

1. ☐ HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? ☐ IS ANY PART OF IT TOO RIGID, RESTRICTIVE, LOOSE OR AMBIGUOUS? PLEASE EXPLAIN BELOW.

A. GIVE PARAGRAPH NUMBER AND WORDING

B. RECOMMENDED WORDING CHANGE

C. REASON FOR RECOMMENDED CHANGE(S)

2. REMARKS

SUBMITTED BY *(Printed or typed name and address — Optional)*

TELEPHONE NO.

DATE

DD FORM 1 OCT 76 1426 EDITION OF 1 JAN 72 WILL BE USED UNTIL EXHAUSTED.