INCH-POUND
MIL-B-18F
12 November 2010
SUPERSEDING
MIL-B-18E
21 January 1983

MILITARY SPECIFICATION

BATTERIES, NON-RECHARGEABLE, DRY

INACTIVE FOR NEW DESIGN AFTER 11 JUNE 1999

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 electro-chemical 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 6.2):

BA- 1232/U

BA-: Component (see 1.2.1.1)
1232/U: Battery type number (see 1.2.1.2)

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

Comments, suggestions or questions on this document should be addressed to DLA Land and Maritime, ATTN: VAT, Post Office Box 3990, Columbus, OH 43218-3990, or emailed to CircuitProtect@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.daps.dla.mil/

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL SPECIFICATIONS

L-P-390	-	Plastic, Molding, and Extrusion Material, Polyethylene and Co-Polymers (Low, Medium, and High Density.)
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-T-201	-	Terneplate, for Roofing and Roofing Products.

FEDERAL STANDARDS

FED-STD-595/34079	-	Army Forest Green Colors Used in Government Procurement.
FED-STD-595/34086	-	Army Forest Green Camo Colors Used in Government Procurement.
FED-STD-595/34087	-	Green Colors Used in Government Procurement.
FED-STD-595/34096	-	Green Colors Used in Government Procurement.
FED-STD-595/34102	-	Dark Green Colors Used in Government Procurement.
FED-STD-595/34127	-	Light Green Camo Colors Used in Government Procurement.
FED-STD-595/34128	-	Green Colors Used in Government Procurement.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-W-76	-	Wire and Cable, Hookup, Electrical, Insulated, General Specification for.
MIL-W-530	-	Webbing, Textile, Cotton, General Purpose, Natural or in Colors.
MIL-DTL-1222	-	Studs, Bolts, Screws and Nuts for Application Where a High Degree of Reliability is Required, General Specification for.

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

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-202	-	Electronic and Electrical Component Parts

(Copies of these documents are available online at https://assist.daps.dla.mil/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI NCSL Z540-3	-	Laboratories Calibration, and Measuring and Test Equipment.
ISO-10012-1	-	Equipment, Quality Assurance Requirements for Measuring – Part 1: Metrological Confirmation System for, Measuring Equipment.
J STD -004	-	Soldering Fluxes, Requirements for.
J STD-005	-	Soldering Pastes, Requirements for.
J STD-006	-	Electronic Grade Solder Alloys and Fluxed and Non-fluxed Solid Solders for Electronic Soldering Applications for, Requirements for.

(Copies available online at www.ansi.org or from American National Standards Institute, 25 West 43rd Street, 4th floor, New York, NY 10036.)

AMERICAN SOCIETY OF TEST MATERIALS (ASTM International)

ASTM B16/B16M	-	Rod, ,Brass, Free Cutting, Bar and Shapes for use in Screw Machines.
ASTM B36/B36M	-	Plate, Brass, Sheet Strips, and Rolled Bar.
ASTM B121/B121M	-	Plate, Leaded Brass, Sheet, Strip, and Rolled Bar.
ASTM B124/B124M	-	Copper and Copper Alloy Forging Rod, Bar, and Shapes.
ASTM B139/B139M	-	Rod, Phosphor Bronze, Bar, and Shapes.
ASTM B152/B152M	-	Copper Sheet, Strip, Plate and Rolled Bars.
ASTM B187/B187M	-	Copper, Bus Bar, Rod, and Shapes and General Purpose Rod, Bar, and Shapes.
ASTM B194	-	Copper, Beryllium Alloy Plate, Sheet, Strip and Rolled Bar.
ASTM B196/B196M	-	Rod and Bar, Copper Beryllium Alloy.
ASTM B197/B197M	-	Wire, Alloy Copper-Beryllium.
ASTM B272	-	Copper Flat Products with Finished (Roll or Drawn) Edges (Flat Wire and Strips).
ASTM B644	-	Copper Alloy Addition Agents.
ASTM-D709	-	Materials, Laminated Thermosetting.
ASTM D5486/5486M	-	Standard Specification for Pressure-Sensitive Tape for Packaging, Box Closure, and Sealing.
ASTM D5948	-	Standard Specification for Molding Compounds, Thermo setting.

(Copies available online at www.astm.org or from ASTM International, 100 Barr Harbor Drive, P. O. Box C700, West Conshohocken, PA 19428-2959.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE International)

SAE AMS QQ-N-290	-	Nickel Plating (Electrodeposited).
SAE AMS QQ-P-416	-	Plating, Cadmium (Electrodeposited).

(Copies available online at www.sae.org or from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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 the 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.
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.
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 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.4 Pure tin. The use of pure tin, as an underplate or final finish, is prohibited both internally and externally. Tin content of (product) and solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum of 3 percent lead, by mass (see 6.5).

3.5 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).

3.6 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 shall be required. 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).

3.6.1 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.

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

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

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

3.7.2 Battery voltage.

3.7.2.1 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 3.6)	Test methods (see 4.4)
Solder 1/	ASTM B644	
Soldering flux 2/	J STD-004, J STD-005 and J STD 006	
Metals	3.6.1	
Brass	ASTM B36/B36M, ASTM-B121/B121M, ASTM B16/B16M, and ASTM B124/B124M	
Copper	ASTM B133, ASTM B152/B152M, ASTM B187/B187M, and ASTM B272	
Beryllium copper	ASTM B194, ASTM B196, and ASTM B197/B197M	
Phosphor bronze	ASTM B139/B139M	
Terne plate	QQ-T-201, type II	
Cadmium plating	SAE AMS QQ-P-416	
Nickel plating	SAE AMS QQ-N-290	
Wire	MIL-W-76	
Machine screws, studs, and nuts	FF-N-836, FF-S-92, and MIL-DTL-1222	
Plastic, laminated,	ASTM D709, type PBE	
Plastic, molded	ASTM D5948, type MFE	
Plastic, polyethylene	L-P-390, type I	
Webbing, cotton	MIL-W-530	
Tape	ASTM D5486/D5486M	
Potting and sealing compounds	3.7.3	4.7.1.1
Fillers or padding	3.7.4	4.7.1
Cell-block-container material	3.7.5, 3.8, and 3.9	4.7.2 and 4.7.3
Intercell separation – Leclanche type	3.7.6.1, 3.8, and 3.9	4.7.2 and 4.7.3
Intercell separation – Mercury type	3.7.6.2	
Terminals	3.7.9.1, 3.7.9.2, 3.7.9.3, 3.7.9.4, 3.7.9.5, 3.7.9.6, and 3.7.9.7	4.7.4
Jackets, metallic 3/	3.7.11.1.1, 3.7.11.1.2, and 3.8	4.7.2 and 4.7.6.1
Jackets, nonmetallic	3.7.11.2, 3.8, and 3.9	4.7.2 and 4.7.3
Terminal mounting plates	3.8 and 3.9	4.7.2 and 4.7.3
Strap handle 4/	3.7.10	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.

3.7.2.2 Closed-circuit voltage. The closed-circuit voltage shall be not less than the voltage specified (see 3.1 and 4.7.7.1).

3.7.3 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, 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.

3.7.4 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.

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

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

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

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

3.7.7 Intercell connection. Intercell connection 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 .094 inch (2.39 mm) from the lug, nor shall it extend more than .094 inch (2.39 mm) beyond the lug.

3.7.8 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.

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

3.7.9.1 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.

3.7.9.1.1 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.

3.7.9.2 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.

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

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

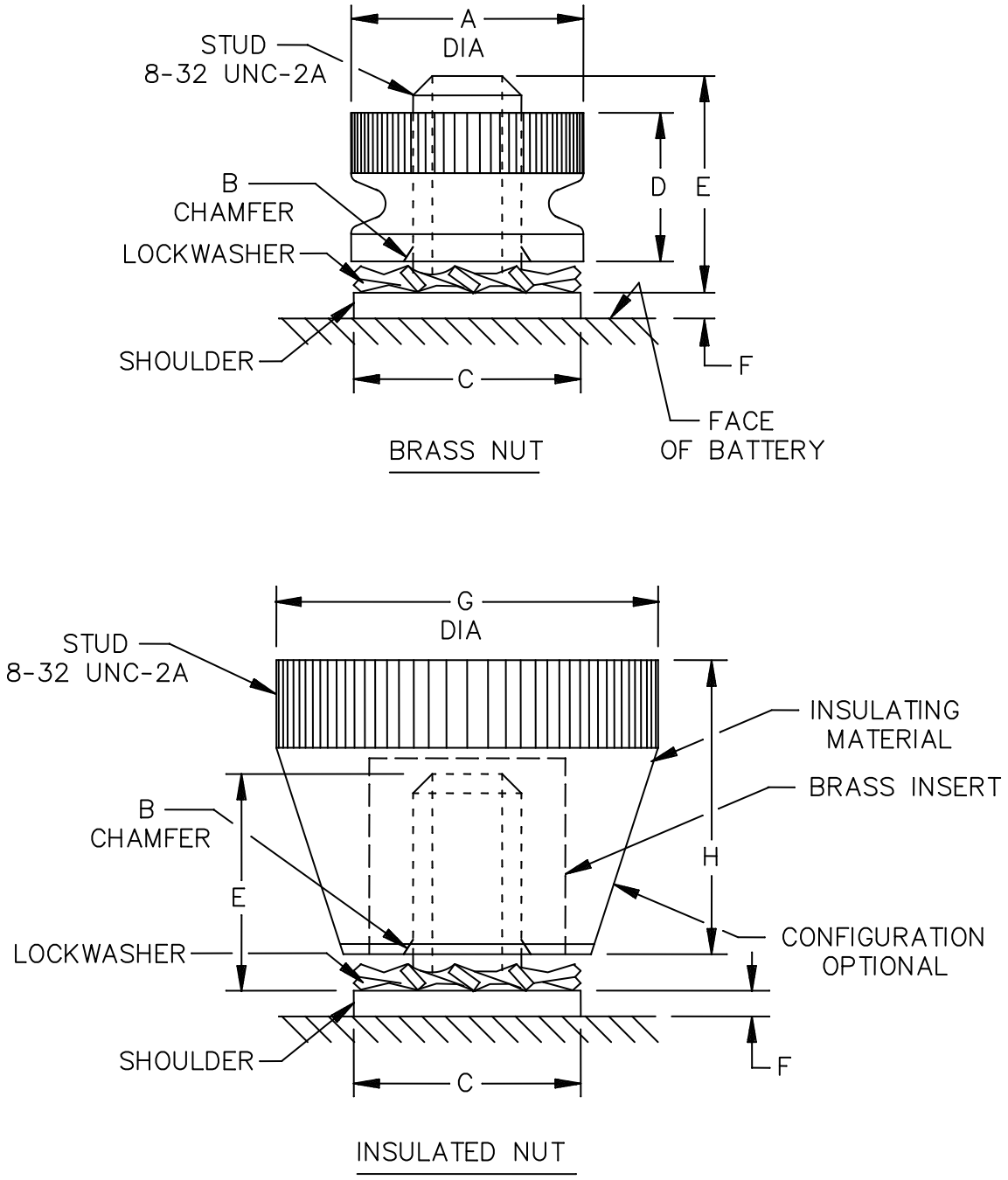


FIGURE 1. Stud and nut terminal.

Ltr	Inches		mm	
	Min	Max	Min	Max
A	.312	.374	7.92	9.50
B	---	.080	---	2.03
C	.330	---	8.38	---
D	.187	.249	4.75	6.32
E	.281	.343	7.14	8.71
F	.016	.078	0.41	1.98
G	.500	.624	12.70	15.85
H	.375	.499	9.53	12.67

NOTES:

1. All dimensions are in inches.
2. Metric equivalents are for general information only.
2. Unless otherwise specified, tolerances are ±.031 inch.

FIGURE 1. Stud and nut terminal - Continued.

3.7.9.3.1 Mounting. The external length of each wire lead shall be 6.5 inches (165.1 mm) ±.5 inches (12.7 mm). 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 .5 inch (12.6 mm) ±.125 inch (3.18 mm). 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.

3.7.9.4 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 on figure 2.

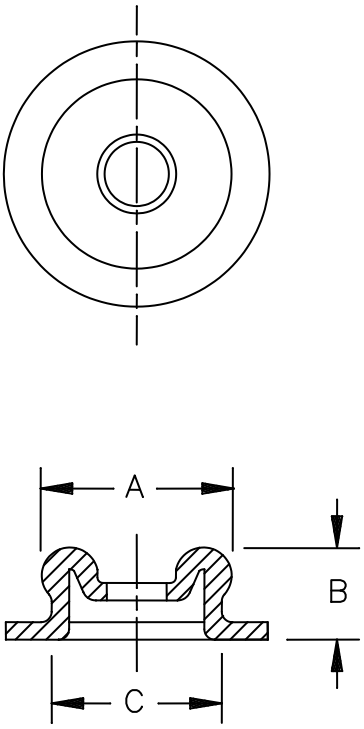
3.7.9.4.1 Mounting. Each member shall be securely mounted. Mating member engagements and disengagements shall be made without dislocating the terminals or distorting the battery beyond the specified limits during or after any tests performed on the battery (see 3.1). Each member shall be mounted so that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

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

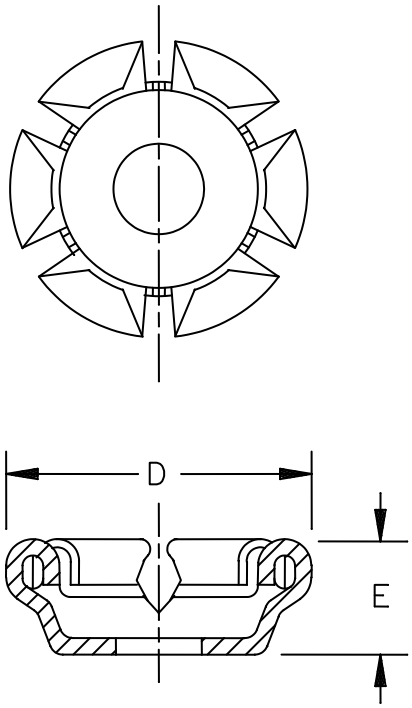
3.7.9.5 Socket. Socket terminals shall be as specified (see 3.1). When the following types of socket terminals are specified, they shall be as shown on figure 3, as applicable:

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 shall 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 ±.005 inch (0.127 mm). When used, socket domes shall be made of sheet zinc .018 inch (0.0007 mm) thick (No. 9 gauge), or mechanical equivalent (see 3.1).



POSITIVE TERMINAL STUD
SEE NOTE 2



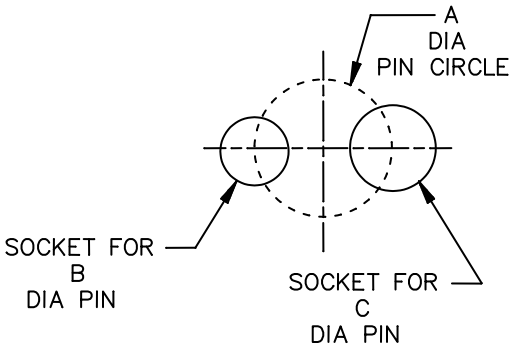
NEGATIVE TERMINAL SOCKET
SEE NOTE 3

Ltr	Inches		mm	
	Min	Max	Min	Max
A	.282	.284	7.16	7.21
B	.140	.146	3.56	3.71
C	.260	.265	6.60	6.73
D	---	.425	---	10.80
E	---	.150	---	3.81

NOTES:

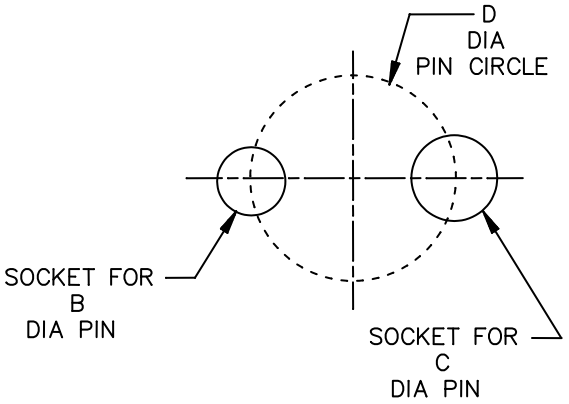
1. All dimensions are in inches.
2. Metric equivalents are for general information only.
3. Stud shall be of plated soft brass not less than .015 inch (0.38 mm) in thickness.
4. Socket shall be plated spring brass.

FIGURE 2. Snap-on terminals.



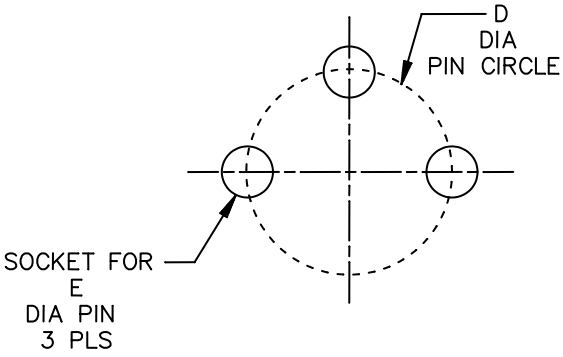
INSERTION FORCE 12 POUNDS MAX
WITHDRAWAL FORCE 12 POUNDS MAX
3 POUNDS MIN

TYPE I



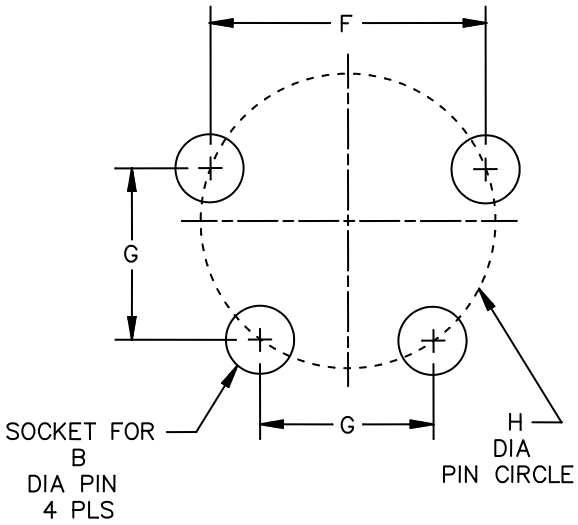
INSERTION FORCE 12 POUNDS MAX
WITHDRAWAL FORCE 12 POUNDS MAX
3 POUNDS MIN

TYPE IV



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

TYPE VIII



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

TYPE XIII

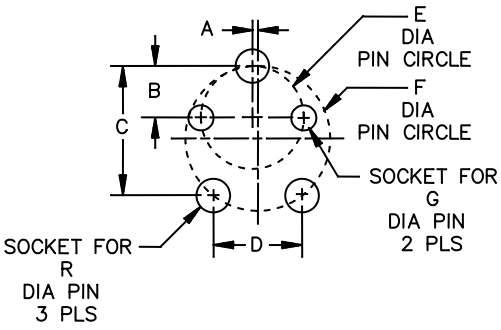
FIGURE 3. Socket terminals (top view).

Ltr	Inches		mm	
	Min	Max	Min	Max
A	.247	.253	6.27	6.43
B	.123	.127	3.12	3.23
C	.154	.158	3.91	4.01
D	.372	.378	9.45	9.60
E	.091	.095	2.31	2.41
F	.477	.503	12.12	12.78
G	.309	.315	7.85	8.00
H	.533	.539	13.54	13.69

NOTES:

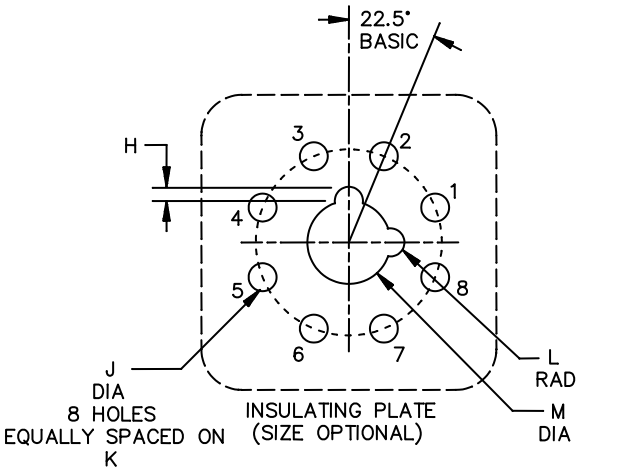
1. All dimensions are in inches.
2. Metric equivalents are for general information only.
3. Tolerances are ±.003, except as otherwise specified.

FIGURE 3. Socket terminals (top view) - Continued.



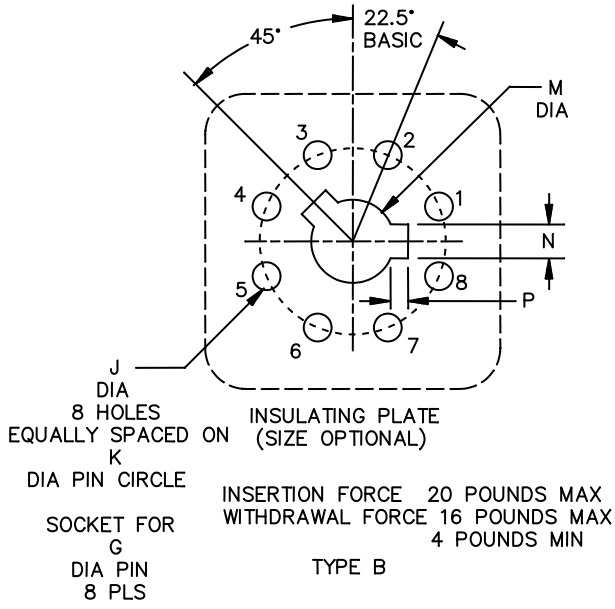
INSERTION FORCE 12 POUNDS MAX
WITHDRAWAL FORCE 12 POUNDS MAX
4 POUNDS MIN

TYPE IX



INSERTION FORCE 20 POUNDS MAX
WITHDRAWAL FORCE 16 POUNDS MAX
4 POUNDS MIN

TYPE A



INSERTION FORCE 20 POUNDS MAX
WITHDRAWAL FORCE 16 POUNDS MAX
4 POUNDS MIN

TYPE B

FIGURE 3. Socket terminals - Continued.

Ltr	Inches		mm	
	Min	Max	Min	Max
A	.017	.023	0.43	0.58
B	.184	.190	4.67	4.82
C	.475	.481	12.07	12.22
D	.324	.330	8.23	8.38
E	.372	.378	9.45	9.60
F	.532	.538	13.51	13.67
G	.091	.095	2.31	2.41
H	.101	.107	2.57	2.72
J	.100	.106	2.54	2.69
K	.684	.690	17.37	17.53
L	.049	.055	1.24	1.40
M	.304	.310	7.72	7.87
N	.122	.128	3.10	3.25
P	.049	.055	1.24	1.40
R	.123	.127	3.12	3.23

NOTES:

1. All dimensions are in inches.
2. Metric equivalents are for general information only.
3. Tolerances are ±.003 inch, except as otherwise specified.

FIGURE 3. Socket terminals - Continued.

3.7.9.5.1 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 .125 inch (3.18 mm) 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 .094 inch (2.39 mm) 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).

3.7.9.5.2 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.

3.7.9.6 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 (see 3.4), or nickel. The cap and the raised center portion of a flat plat may be provided with a centered, outward projecting point, which does not exceed .020 inch (.05 mm)

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

3.7.9.8 Protection of terminals. When flash-dip micro-crystalline 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.

3.7.10 Strap handles. Strap handles shall be of webbing, using natural or synthetic fiber, or of plastic material. The width of the strap shall be .438 inch (11.13 mm) 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.

3.7.11 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 a 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).

3.7.11.1 Metallic jacket.

3.7.11.1.1 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.

3.7.11.1.2 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.

3.7.11.2 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.

3.7.11.3 Jacket integrity (JI). 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.

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

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

3.7.12.1 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).

3.7.12.2 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 shall 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.

3.7.13 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).

3.8 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.

3.9 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.

3.10 Vibration. After the multicell batteries have been tested as specified in 4.7.8, they shall meet the visual and mechanical requirements (see 3.7.1 through 3.7.2.2 and 3.7.9 through 3.7.9.7). There shall be no voltage fluctuations during the test.

3.11 Mechanical shock. After the multicell batteries have been tested as specified in 4.7.9, they shall meet the visual and mechanical requirements (see 3.7.1 through 3.7.2.2 and 3.7.9 through 3.7.9.7.)

3.12 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.

3.13 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.

3.14 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 shall be considered to have occurred when moisture appears on a piece of absorbent paper rubbed on the surface of the jacket.

3.15 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.

3.15.1 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, NJ, USA

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

3.15.1.1 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 2009 shall bear the code "0309".

A battery manufactured in November 2009 shall bear the code "1109".

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.

3.15.2 Terminal markings. On batteries having socket-type terminals, all markings such as polarity, voltage, and the unit of battery (A, B, or C) 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.

3.16 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 shall affect their life, serviceability, or appearance.

4. VERIFICATION

4.1 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 ISO 10012-1 and ANSI Z540.3.

4.1.1 Instrument accuracy.

4.1.1.1 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 not be less than 1,000 ohm per volt. Unless otherwise specified (see 3.1), for all open-circuit voltage measurements, the sensitivity of voltmeters shall be100 ohms ±10 ohms per volt.

4.1.1.2 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.

4.1.1.3 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. Conformance inspection (see 4.6).

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 required as proof of conformance to applicable 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. Unless otherwise specified in the contract or purchase order, after award of contract 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 shall 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	Examination and tests	Requirement paragraph	Method of test paragraph
I	15	Visual and mechanical examination (external)	3.7 and 3.7.1	4.7.1
		Battery voltage	3.7.2 through 3.7.2.2	4.7.7 through 4.7.7.1
		Dimensions and weight	3.7 and 3.7.1	4.7.1
		Vibration 1/	3.10	4.7.8
		Mechanical shock 1/	3.11	4.7.9
		Insulation resistance 1/	3.12	4.7.10
		Capacity	3.13	4.7.11 through 4.7.11.4
II	10	Electrolyte leakage 1/	3.14	4.7.12
	3	Jacket integrity	3.7.11.3	4.7.6.2
	2	Visual and mechanical examination (internal)	3.7	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 and 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 shall 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 Conformance inspection.

4.6.1 Inspection of product for delivery. Inspection of product for delivery shall consist of materials and components inspection and group A and group 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 shall 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 requirements. 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) Battery voltage	3.7 3.7.2 through 3.7.2.2	4.7.1 4.7.7 through 4.7.7.1

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. Group B inspection shall be on an inspection lot basis. Samples shall be selected in accordance with table VI, based on the inspection lot. If there are one or more failures, the inspection lot shall be considered to have failed.

TABLE V. Group B inspection.

Examination or tests	Requirement paragraph	Method of test paragraph	Sample size
Dimensions and weight	3.7 and 3.7.1	4.7.1	A
Insulation resistance	3.12	4.7.10	A
Vibration 1/	3.10	4.7.8	B
Mechanical shock 1/	3.11	4.7.9	C
Battery voltage	3.7.2 through 3.7.2.2	4.7.7 through 4.7.7.1	A
Jacket integrity 1/ 2/	3.7.11.3	4.7.6.2	B
Electrolyte leakage	3.14	4.7.12	D

1/ When applicable.
2/ Batteries shall be selected at random during the first ten (10) days of the monthly production lot.

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

TABLE VI. Group B inspection sampling plan.

Lot size	Sample size A	Sample size B	Sample size C	Sample size D
2 to 8	All	5	5	13
9 to 15	13	5	5	13
16 to 25	13	5	5	13
26 to 50	13	5	5	13
51 to 90	13	7	5	13
91 to 150	13	11	5	13
151 to 280	20	13	5	13
281 to 500	29	16	5	13
501 to 1,200	34	19	20	13
1,201 to 3,200	42	23	20	50
3,201 to 10,000	50	29	20	50

TABLE VII. Group C inspection.

Tests	Requirement paragraph	Method of test paragraph
Capacity T	3.13	4.7.11 through 4.7.11.4
Capacity D	3.13	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.

$$n_S = \frac{N_S}{N} (2n)$$

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 VIII).
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 VIII (Total number of batteries selected in 2n).

TABLE VIII. 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 n_s 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. 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 VIII. 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 VIII, the contract lot is not in compliance.

4.6.1.4.4 Shipment. When the inspection lot passes group A and group B inspections, all sample batteries selected as specified in 4.6.1.4.1 for group C inspections, shall be shipped to the Government inspection facility (see 6.2e) 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.

4.7 Visual and mechanical examination. Batteries shall be examined to determine compliance with all applicable requirements and characteristics listed in table IX. 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 IX. Visual and mechanical examination.

Requirement	Reference paragraph
External	
Design and construction (excluding dimensions and weight)	3.7
Terminals	3.7.9, 3.7.9.1.1, 3.7.9.2.1, 3.7.9.3.1, 3.7.9.4.1, 3.7.9.5.1, and 3.7.9.8
Jackets	3.7.11 through 3.7.11.2 and 3.7.11.4
Closure	3.7.12 through 3.7.12.2
Internal	
Dissimilar metals	3.6.1.1
Filler or padding	3.7.4
Cell-block container	3.7.5
Intercell separations	3.7.6
Intercell connections	3.7.7
Age of cells	3.7.8
Metallic jacket	3.7.11.1.1 and 3.7.11.1.2
Potting	3.7.13

4.7.1 Potting. The contractor shall determine the minimum weight of an adequately potted battery for each production lot, and shall not present any batteries for 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 shall 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 3.7.13).

4.7.1.1 Flow or shrinking. Potting and sealing compounds, when used, shall be placed in a container, approximately 3 inches (76.2 mm) wide by 6 inches (152.4 mm) long by .75 inch (19.05 mm) high to within .25 inch (6.35 mm) of the top. The temperature of the compound within the container shall be raised to 130 °F ±5 °F (54.4 °C ±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 °F ±5 °F (-17.8 °C ±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 °F ±5 °F(54.4 °C ±2.8 °C) storage for 24 hours with the terminals resting in the lowest possible position. At the en d of this exposure period, the batteries shall be examined to determine that there is no impairment of electrical contact (see 3.7.12.1). At the contractor's option, batteries assigned to JI testing may be used (see 3.7.3).

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 (50.8 mm) high with an internal diameter of 1.5 inches (38.10 mm), shall be clamped over the material. The tube shall then be filled to a depth of 1 inch (25.4 mm) 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 .5 inch (12.7 mm). 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 °F ±2 °F (65.6 °C ±1.1 °C) and a relative humidity of 50 ±15 percent; then for 1 hour at 70 °F ±5 °F (21.1 °C ±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 shall make contact with both sides of the specimen being tested. Each electrode shall have a diameter of 2 inches (50.8 mm) with the edge rounded to a radius of .25 inch (6.35 mm), so that the center surface of a circle 1.5 inches (38.10 mm) in diameter. The specimen shall extend at least .5 inch (12.7 mm) 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 insulations or damage.

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

4.7.4 Contact resistance of terminals (see 3.7.9.4.2 and 3.7.9.5.2). 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 °F ±5 °F (54.4 °C ±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 °F ±5 °F (-40 °C ±2.8 °C). The strap handle shall be examined for evidence of breakage or separation from its anchorage (see 3.7.10).

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 3.7.11.1.2).

4.7.6.2 Jacket integrity (JI). All multicell batteries and paper-jacketed, single-cell batteries shall be immersed to with .25 inch (6.35 mm) of the top of the jacket in water maintained at a temperature of 113 °F ±5 °F (45 °C ±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 3.7.11.3).

4.7.7 Battery voltage (see 3.7.2).

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 3.7.2.2).

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 .03 inch (0.76 mm) (.06 inch (1.52 mm) 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 Hz 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 3.10).

4.7.9 Mechanical shock (see 3.11). 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 3.7.1 through 3.7.2.2 and 3.7.9 through 3.7.9.7).

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°F ±5 °F (21.1 °C ±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 (25.4 mm) 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 3.12).

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 3.13).

4.7.11.1 Ambient storage and discharge conditions. The ambient conditions specified in table X shall prevail during storage and discharge periods. Normal conditions shall be maintained insofar as possible. Deviations from normal conditions are permitted, provided that:

a. The extreme conditions specified in table X do not exist for more than five percent (cumulative) of the specified storage or discharge periods (see 3.1)

b. That at no time are the extreme conditions exceeded which shall adversely affect the battery.

4.7.11.2 Storage. At the Government inspection facility (see 6.2e), 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 3.7.11.1); non-metallic jackets shall be examined for their condition (see 3.7.11.3).

TABLE X. Ambient storage and discharge conditions.

Kind of storage or discharge	Normal conditions (temperature)	Extreme conditions (temperature)
D storage	70 °F ±5 °F (21.1 °C ±2.8 °C)	60 °F (15.6 °C) through 65 °F (18.3 °C); and 75 °F (23.9 °C) through 80 °F (26.7 °C)
T storage	113 °F, +2 °F/-8 °F (45 °C, +1.1 °C/ 4.4 °C)	88 °F (31.1 °C) through 105 °F (40.6 °C); and 115 °F (46.1 °C) through 118 °F (47.8 °C)
All discharges	70 °F ±2 °F (21.1 °C ±1.1 °C)	65 °F (18.3 °C) through 68 °F (20 °C); and 72 °F (22.2 °C) through 80 °F (26.7 °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 X.

4.7.11.4 Discharge. Following stabilization, the batteries shall be discharged at the ambient discharge conditions specified in table X. 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 3.14).

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 3.14).

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

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 mulicell batteries in such wide-ranging equipment as flashlights, test equipment, radio sets, and other portable communication and electronic equipment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of the specification.

b. Title, number, and date of the applicable specification sheet.

c. The specific issue of individual documents referenced (see 2.2).

d. Complete battery type designation.

e. Government inspection facility performing group C inspection.

f. Packaging requirements (see 5.1).

g. Shelf life coding as applicable (see 6.8).

h. Whether or not First Article is required; if so, whether or not a waiver may be requested.

i. Whether certification of conformity is required (see 3.6).

6.3 International standardization agreements. Certain provisions of this specification are the subject of international standardization agreements. 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.

6.4 Environmental. Environmental pollution preventing measures are contained in the packaging material specifications referenced herein. Refer to material specifications or preparing activity for recommended disposability methods.

6.5 Tin whisker growth. The use of alloys with tin content greater than 97 percent, by mass, may exhibit tin whisker growth problems after manufacture. Tin whiskers may occur anytime from a day to years after manufacture and can develop under typical operating conditions, on products that use such materials. Conformal coatings applied over top of a whisker-prone surface will not prevent the formation of tin whiskers. Alloys of 3 percent lead, by mass, have shown to inhibit the growth of tin whiskers. For additional information on this matter, refer to ASTM-B545 (Standard Specification for Electrodeposited Coatings of Tin).

6.6 Subject term (key word) listing.

Leclanche type batteries
Mercury type batteries
Multicell
SLD
SLT
Terne plate

6.7 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmentally Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals and additional information is available on their website at http://www.epa.gov/osw/hazard/wastemin/priority.htm. Included in the list of 31 priority chemicals are cadmium, lead, and mercury. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see section 3).

6.8 Shelf-life. This specification covers items where shelf life is a consideration. Specific shelf-life requirements should be specified in the contract or purchase order. The shelf-life codes are contained in the Federal Logistics Information System Total Item Record. Additive information for shelf-life management may be obtain from *DoD 4140.27-M Shelf-life Management Manual*, or the designated shelf-life Points of Contact (POC). The POC should be contacted in the following order: (1) the Inventory Control Points and (2) the DoD Service and Agency administrators for the DoD Shelf-Life Program. Appropriate POCs for the DoD Shelf-Life Program can be contacted through the DoD Shelf-Life Management website: https://www.shelflife.hq.dla.mil/.

6.9 Changes from previous issue. The margins of this specification are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
Army - CR
Navy - SH
Air Force - 99
DLA - CC

Review activities:
Army - AR, AV
Navy - AS, MC, OS, YD
Air Force - 11

Preparing activity:
DLA - CC

(Project number 6135-2010-002)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.daps.dla.mil/.