INCH-POUND

MIL-B-49030A
30 November 2010
SUPERSEDING
MIL-B-49030(EL)
24 January 1974

MILITARY SPECIFICATION

BATTERIES, DRY (ALKALINE)

INACTIVE FOR NEW DESIGN
AFTER 13 SEPTEMBER 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 batteries for use with military equipment where greater performance over a wide temperature range is required. The battery is composed of electrochemical cells of the zinc-potassium hydroxide-manganese dioxide type.

1.2 Classification.

1.2.1 Part or Identifying Number (PIN): Batteries specified herein (see 3.1) are identified by a PIN that is in the following form, and as specified (see 3.1 and 6.1).

1.2.1.1 Battery type number. The battery type number identifies the basic design of the battery (see 3.1) and consists of a four-digit number (in the 3001 through 3999 series).

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.

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 a https://assist.daps.dla.mil/.

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

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.
L-P-390	-	Plastic, Molding, and Extrusion Material, Polyethylene and Co-Polymers (Low, Medium, and High Density).
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-595/34084	-	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.
MIL-B-49030/2	-	Battery, Dry, BA-3036/U
MIL-B-49030/5	-	Battery, Dry, BA-3051/U

(Copies of these documents are available online at https://assist.daps.dla.mil/quicksearch 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)

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 B164	-	Rod, Bar, and Wire, Nickel-Copper Alloy.
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/D5486M	-	Standard Specification for Pressure-Sensitive Tape for Packaging, Box Closure, and Sealing.
ASTM D5948	-	Standard Specification for Molding Compounds, Thermosetting.

(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).

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

American Welding Society (AWS)

AWS D17.2/D17.2M	-	Specification for Resistance Welding for Aerospace Applications

(Copies available online at www.aws.org or from American Welding Society, P.O. Box 440367, Miami, FL 33144-0367

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 First article. Batteries furnished under this specification shall be a product which has been tested, and passed the first article tests specified herein.

3.3 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 I. 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).

3.3.1 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.

3.3.1.1 Dissimilar metals. When dissimilar metals which would adversely affect battery performance are used in intimate contact with each other, protection against electrolysis and corrosion shall be provided.

3.4 Electrolysis leakage. There shall be no evidence of electrolyte leakage on the external surfaces of the jackiet at any time prior to or during the performance of test specified in 4.7.10, or any other tests specified herein. Electrolyte leakage shall be considered to have occurred when a drop of phenolphthalein solution placed on the battery turns pink or red.

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

3.5.1 Battery voltage.

3.5.1.1 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 4.7.8.1).

3.5.1.2 Closed-circuit voltage. The closed-circuit voltage shall be not less than the voltage specified (see 3.1 and 4.7.8.2).

3.5.2 Insulating, impregnating, potting, and sealing compounds. The insulating, impregnating, 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 (160 °F) nor crack or draw away from the sides of a container at low temperature (-40 °F) or during any temperature change between +160 °F and -40 °F sufficiently to impair electrical connections.

3.5.3 Filler or padding. Filler or padding shall be a cushioning electrically nonconducting material which maintains its insulating characteristics under adverse environmental conditions.

TABLE I. Materials and components.

Materials and components	Applicable specifications or requirements (see 4.4)	Methods of test (see 4.4.1)
Solder 1/	ASTM B644	
Soldering flux 2/	J STD-004, J STD-005 and J STD 006	
Metals	3.3.1	
Brass	ASTM B16/B16M, ASTM B36/B36M, ASTM B121/B121M, ASTM B124/B124M, ASTM B164	
Copper	ASTM-B124, ASTM B152/B152M, ASTM B187/B187M, ASTM B272	
Beryllium copper	ASTM B194, ASTM B196, ASTM B197	
Phosphor bronze	ASTM B139/B139M	
Terneplate	QQ-T-201, type II	
Nickel plating	SAE AMS QQ-N-290	
Wire	MIL-W-76	
Machine screws, studs, and nuts	FF-S-92, FF-N-836, 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	
Insulating, impregnating, potting, and sealing compounds	3.5.2	4.7.1.1.1
Filler or padding	3.5.3	4.7.1
Cell-block-container material	3.5.4, 3.6, and 3.7	4.7.2 and 4.7.3
Intercell separation	3.5.5	4.7.2 and 4.7.3
Terminals	3.5.8.1, 3.5.8.2, 3.5.8.3, 3.5.8.4, 3.5.8.5, 3.5.8.6, and 3.5.8.7	4.7.4.1.1 and 4.7.4.2.1
Jackets, metallic 3/	3.5.10.1	
Jackets, nonmetallic	3.5.10.2	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/	3.5.9	

1/ For electrical connections, type S_n40 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.

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

3.5.5 Intercell separation. A separator shall be placed between cells in series connected multicell batteries. The separator shall be an insulating material.

3.5.6 Intercell connections. Intercell connections shall be spot welded in accordance with AWS D17.2/D17.2M, class B, or soldered depending upon the applicable terminal. Connections between cell blocks and between cell block and terminal shall be so insulated or positioned as to avoid contact with other conducting material or jacket of the battery. 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.

3.5.7 Age of cells. The minimum age of cells, from the time of their fabrication to the time of their presentation for acceptance inspection 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. Batteries shall be submitted for acceptance inspection not more than 30 days prior to the shipping date.

3.5.8 Terminals. The type, dimensions, location, and mounting of terminals shall be as specified herein (see 3.1).

3.5.8.1 Stud and nut. Stud and nut terminals shall be as shown in figure 1 and except when otherwise specified (see 3.1), shall be made of brass or other approved metal. When specified, the nut shall be made of insulated material with a brass insert (see 3.1). A bronze or brass plated steel external tooth lockwasher shall be provided for each terminal.

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

3.5.8.2 Spring clip. Spring clip terminals shall be of the Fahnestock type made of spring brass or other approved metal, phosphor bronze (see 3.1), and shall be large enough to accommodate a wire having a cross-sectional area of 4,200 circular mils.

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

3.5.8.3 Wire leads. Wire-lead terminals shall be hookup wire, type MW-C18(16)U or larger of MIL-W-76.

3.5.8.3.1 Mounting. The external length of each wire lead shall be 6.5 ± .5 inches (165.1 ± 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 .500 ± .125 inch (12.70 ± 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.

3.5.8.4 Snap-on. Snap-on terminals shall consist of two parts: Stud (non-resilient member) for positive terminal and socket (resilient member) for negative terminal as shown on figure 2.

3.5.8.4.1 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 terminals.

3.5.8.4.2 Contact resistance. The contact resistance between the plug gauge and socket when tested in accordance with 4.7.4.1.1 shall not exceed .005 ohm.

3.5.8.5 Socket. Socket terminals shall be as specified in 3.1. When the following types are specified, they shall be as shown on figure 3, as applicable.

Type	Number 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, plated spring brass or other approved metal (see 3.1). 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 materials shall be of plastic. The pinhole spacing tolerances shall be ±.005 inch (0.13 mm).

3.5.8.5.1 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 be not more than .062 inch (1.57 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 .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).

3.5.8.5.2 Contact resistance. Contact resistance between each socket insert and the applicable pin of the mating-plug when tested in accordance with 4.7.4.2.1 shall not exceed .005 ohm.

3.5.8.6 Flat surface. Flat surface terminals shall be a flat plate of nickel plated steel or other approved metal, the center of which may be level, have a raised or a recessed portion, or a punched or drilled hole, as specified. 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 raised center portion of a flat plate, it may be provided with a centered outward projecting point not to exceed .200 inch (5.08 mm) (see 3.1).

3.5.8.7 Coil and flat spring. Coil and flat spring terminals shall be made of beryllium copper, spring brass, phosphor bronze, or other approved metal, and shall be as specified (see 3.1).

3.5.8.8 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. Markings shall be legible after removal of the tape or cap. The wax dip shall be applied after the application of the tape or cap.

3.5.9 Strap handle. Strap handle 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 anchorage. The strap shall withstand the test specified in 4.7.5 without breaking or separating from its anchorages.

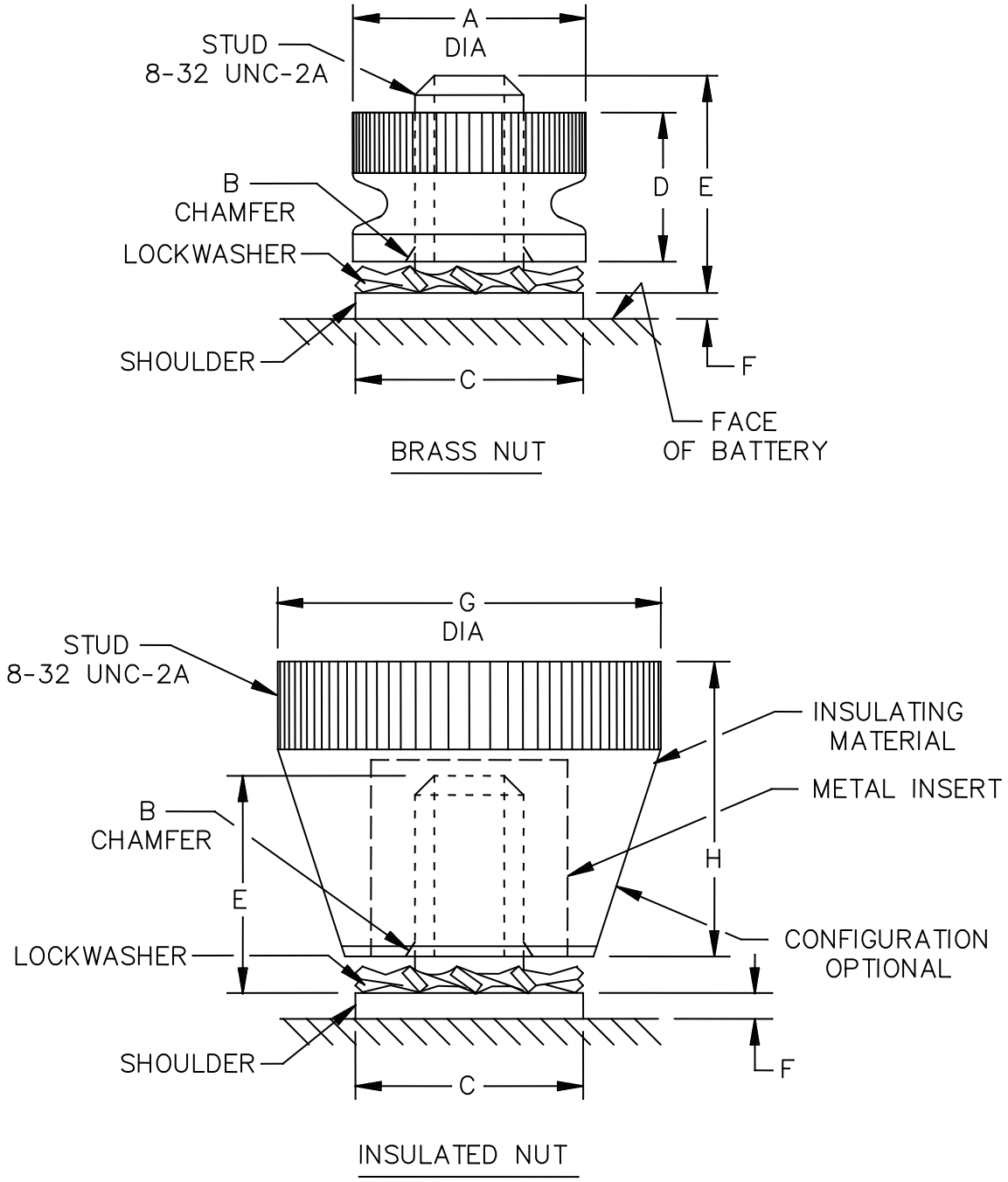


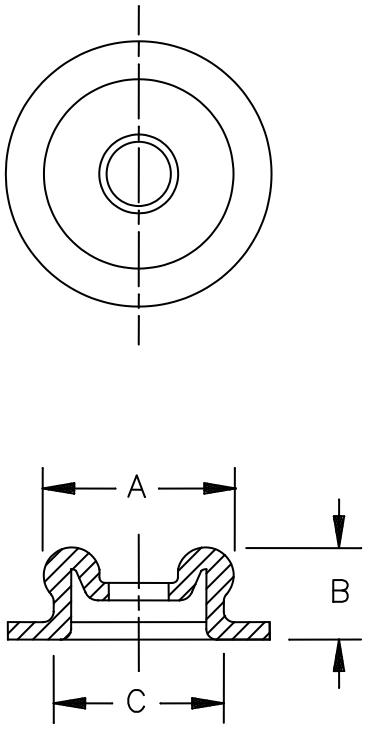
FIGURE 1. Stud and nut terminal.

Ltr	Inches		Millimeters	
	Min	Max	Min	Max
A	.313	.375	7.95	9.53
B	---	.080	---	2.03
C	.330	---	8.38	---
D	.188	.250	4.78	6.35
E	.281	.343	7.14	8.71
F	.016	.078	0.41	1.98
G	.500	.624	12.70	15.85
H	.376	.500	9.55	12.70

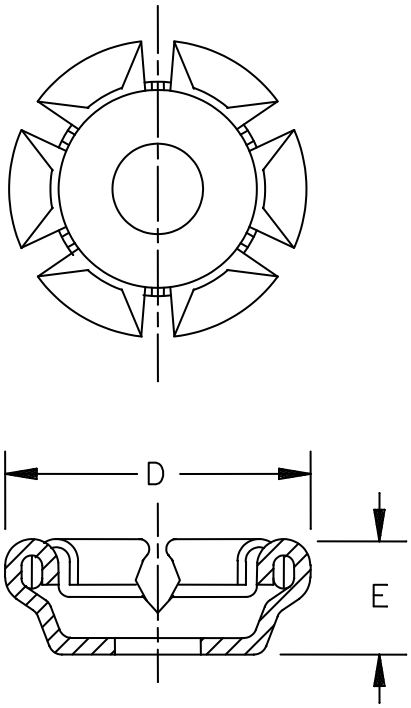
NOTES:

1. All dimensions are in inches.
2. Unless otherwise specified, tolerances are ± .031 inch.
3. Stud and nut terminal and metal insert shall be of brass or other approved metal (see 3.1).
4. Metric equivalents are given for general information only.

FIGURE 1. Stud and nut terminal - Continued.



POSITIVE TERMINAL STUD
SEE NOTE 2



NEGATIVE TERMINAL SOCKET
SEE NOTE 3

Ltr	Inches		Millimeters	
	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.

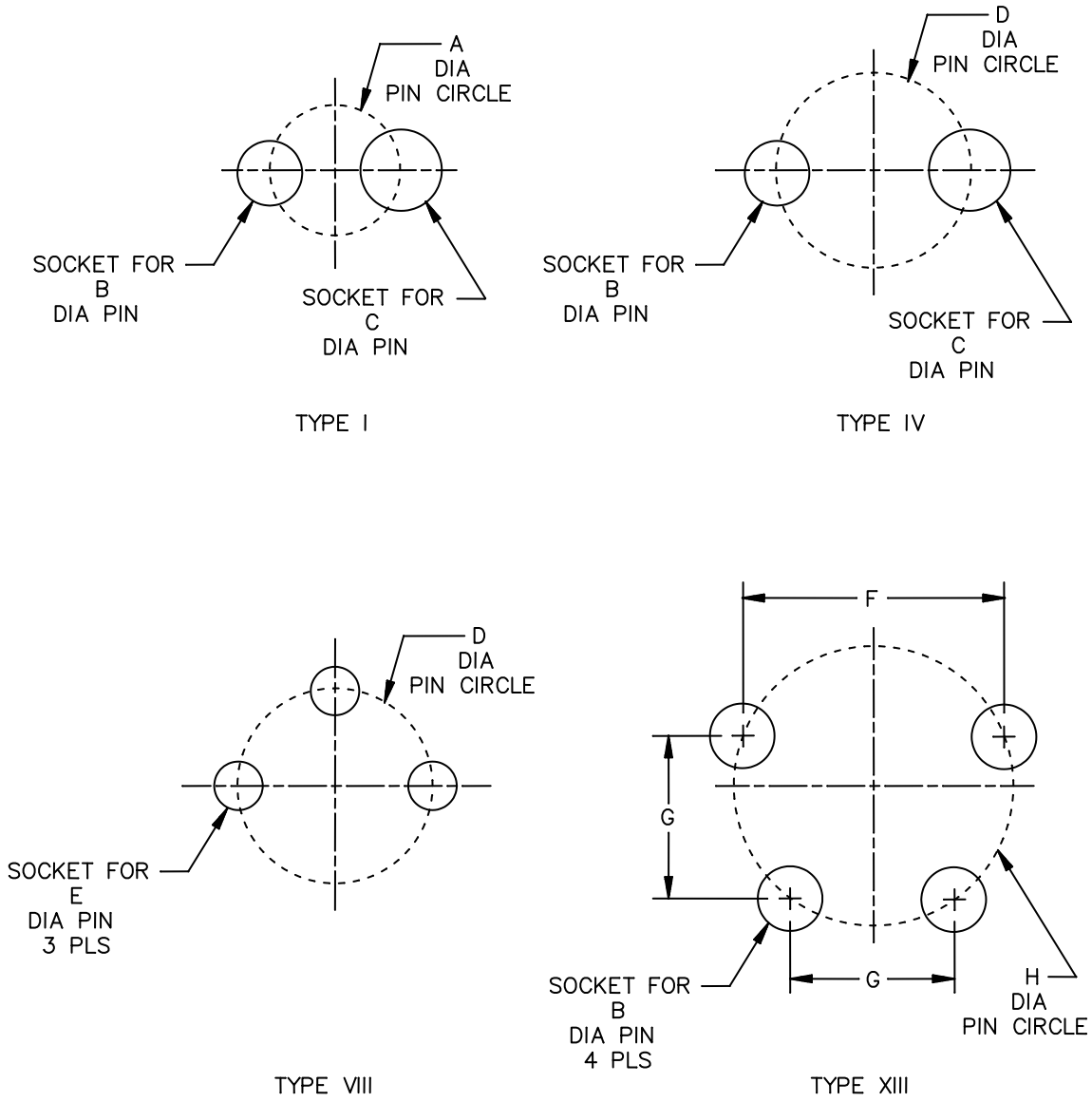


FIGURE 3. Socket terminals (top views).

Ltr	Inches		Millimeters	
	Min	Max	Min	Max
A	.245	.255	6.22	6.48
B	.123	.127	3.12	3.23
C	.154	.158	3.91	4.01
D	.370	.380	9.40	9.65
E	.091	.095	2.31	2.41
F	.495	.505	12.57	12.83
G	.307	.317	7.80	8.05
H	.531	.541	13.49	13.74

NOTES:

1. All dimensions are in inches.
2. Metric equivalents are for general information only.
3. Except as otherwise specified, tolerances are ±.005 inch.

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

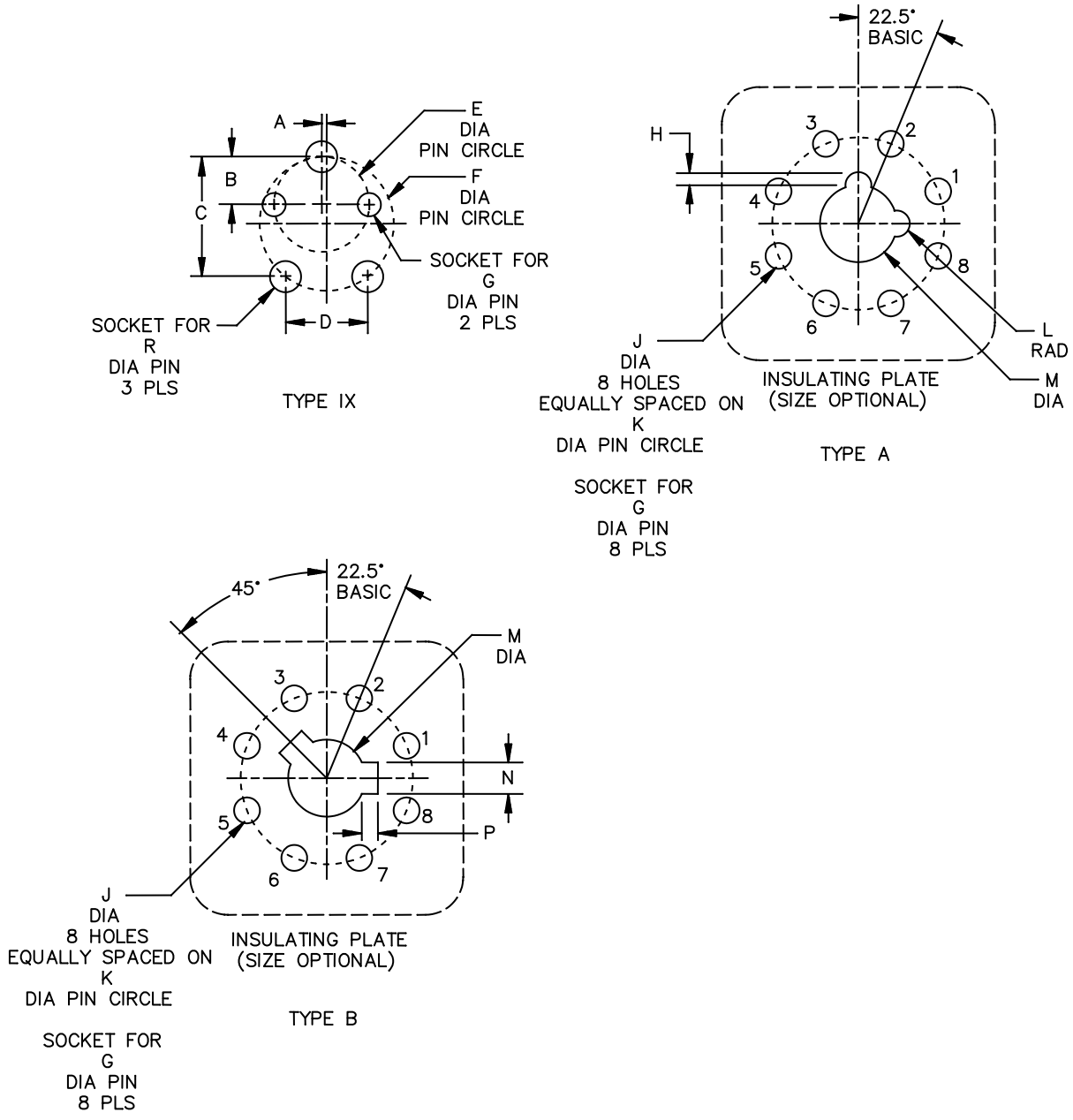


FIGURE 3. Socket terminals - Continued.

Ltr	Inches		mm	
	Min	Max	Min	Max
A	.015	.025	0.38	0.64
B	.182	.192	4.62	4.88
C	.473	.483	12.01	12.27
D	.322	.332	8.18	8.43
E	.530	.540	13.46	13.72
F	.370	.380	9.40	9.65
G	.091	.095	2.31	2.41
H	.099	.109	2.51	2.77
J	.098	.108	2.49	2.74
K	.682	.692	17.32	17.58
L	.047	.057	1.19	1.45
M	.302	.312	7.67	7.92
N	.120	.130	3.05	3.30
P	.047	.057	1.19	1.45
R	.123	.127	3.12	3.23

NOTES:

1. All dimensions are in inches.
2. Metric equivalents are for general information only.
3. Except as otherwise specified, tolerances are ±.005 inch.

FIGURE 3. Socket terminals - Continued.

3.5.10 Jackets. The jackets may consist 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 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).

3.5.10.1 Metallic jacket.

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

3.5.10.1.2 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, the contents of the jackets 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 of 4.7.6.1 shall be applicable to batteries weighing 5 pounds or more.

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

3.5.10.3 Color of jackets. The color of exposed surfaces of jackets shall match one of the following lusterless greens: 34079, 34086, 34084, 34096, 34102, 34127, and 34128 in accordance with FED-STD-595.

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

3.5.11.1 Sealing compound. When sealing compound is used for closures in batteries, the outer edge of the sealing compound shall be approximately level with the top of the container or the top of the jacket. 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).

3.5.11.2 Metal or plastic covers. Metal or plastic covers for tops of cells or batteries may be used in lieu of sealing compound provided such covers and accessory parts are not adversely affected by leakage, corrosion, or deformation during any of 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.

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

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

3.8 Capacity. When the battery is tested for capacity as specified in 4.7.9, the discharge time period to termination of test as required in 4.7.9.5 shall be not less than the minimum time specified (see 3.1).

3.9 Electrical insulation continuity. The dc resistance between each terminal and the outer metal jacket of the battery, shall be not less than 1 megohm, when tested as specified in 4.7.11.

3.10 Insulation resistance. The insulation resistance between any two terminals not electrically connected, and between all ungrounded terminals and the container of the battery, shall be not less than five megohms, when tested as specified in 4.7.12.

3.11 Vibration. After the batteries have been tested as specified in 4.7.13, they shall meet the visual and mechanical, dimensional, closed circuit voltage , and terminal requirements (see 3.1, 3.5, 3.5.1.2, and 3.5.8).

3.12 Mechanical shock. After the batteries have been tested as specified in 4.7.14, they shall meet the visual and mechanical, dimensional, closed circuit voltage, and terminal requirements (see 3.1, 3.5, 3.5.1.2, and 3.5.8).

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. Battery 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 a label positioned as specified in 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, DRY
PIN designation
(Contract number) . . .
(Code) . . .
Manufacturer's name
(Trade name may also be used)
Manufacturer's plant

EXAMPLE:

BATTERY, DRY
BA-3232/U
DAAB05-71-C-1234
0371
John Doe Company
JODOCO
Batteryville, NJ

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 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 3 working days of a month, or the first 3 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, 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.

3.14 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.

3.15 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 6.3).

3.16 Workmanship. Batteries shall be processed in such a manner as to be uniform in quality and shall be free from defects that will affect their life, serviceability, or appearance.

4. VERIFICATION

4.1 Instrument accuracy.

4.1.1 Voltmeters and ammeters. All voltmeters and ammeters used in testing the batteries shall be accurate within 1 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. The sensitivity of voltmeters shall be not less than 1,000 ohms per volt.

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

	Percent
Up to and including the 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.

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

4.2 Classification of inspection. The examination and testing of batteries shall be 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. Except as otherwise specified herein, all examinations and tests shall be performed at a temperature of 80 °F ±20 °F (26.7 °C ±11.1 °C), ambient atmospheric pressure, and relative humidity.

4.4 Materials and component inspection. Materials and components inspection shall consist of verification by certification from the source that the materials and components used in fabricating 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 I.

4.4.1 Samples of materials and components. For those items listed in table I for which the specification requirement does not reference a subsidiary specification; eight samples of materials or 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, first article inspection shall be performed by the contractor as specified in 4.5.1 through 4.5.1.2.

4.5.1 Sample batteries. The contractor at no additional cost to the Government shall make 36 batteries constituting a first article inspection lot. (46 batteries when Electrolyte Leakage Test is applicable.)

4.5.1.1 Inspection routine. First article inspection shall consist of group I, group II, group III, group IV, and group V in accordance with table II. Group V shall consist of one sample battery, untested, to remain at the suppliers plant to be available as a standard for comparative purposes.

4.5.1.2 Failure. If one or more sample batteries fail to meet any of the first article examinations and tests, the supplier shall immediately make the remedial changes. The supplier at no additional cost to the Government shall be required to submit additional first article sample for reinspection. A description of the corrective action taken or to be taken shall be included in the first article inspection report. Official approval to begin production shall be given upon successful completion of first article inspection.

4.5.2 Start of production. Any production prior to materials and components inspection and approval of the first article samples shall be at the supplier's risk (see 4.4 and 4.5).

TABLE II. First article inspection.

Group	Number of batteries	Examination and test	Requirement paragraph	Test method paragraph
I	10	Visual-mechanical (external) Battery voltage Dimensions and weight Vibration Mechanical shock Electrical insulation continuity 1/ Insulation resistance Capacity discharge I	3.5 3.5.1 3.5.1.1 and 3.5.1.2 3.5 3.11 3.12 3.9 3.10 3.8	4.7.1 4.7.8, 4.7.8.1 and 4.7.8.2 4.7.7 and 4.7.7.1 4.7.13 4.7.14 4.7.11 4.7.12 4.7.9.1.1, 4.7.9.2 through 4.7.9.5
II	15	(10) Electrolyte leakage 1/ (2) Visual-mechanical (internal)	3.4 3.5	4.7.10 4.7.1
III	10	Visual-mechanical (external) Battery voltage Capacity discharge HT	3.5 3.5.1, 3.5.1.1 and 3.5.1.2 3.8	4.7.1 4.7.8, 4.7.8.1 and 4.7.8.2 4.7.9.1.2, 4.7.9.2 through 4.7.9.5
IV	10	Visual-mechanical (external) Battery voltage Capacity discharge LT	3.5 3.5.1, 3.5.1.1 and 3.5.1.2 3.8	4.7.1 4.7.8, 4.7.8.1 and 4.7.8.2 4.7.9.1.3, 4.7.9.2 through 4.7.9.5
V	1	Untested-referenced sample	---	4.5.1.1

1/ When applicable.

4.6 Conformance inspection.

4.6.1 Inspection of product for delivery. The contractor shall perform the inspection specified in 4.4 and 4.6.1.2 through 4.6.1.4. 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 inspection shall be made available by the contractor.

4.6.1.1 Definition of lot. A lot shall be defined as the quantity of batteries of any one type, of any one contract, submitted at one time to conformance inspection.

4.6.1.1.1 Shipment lot. The shipment for (Ns) is the quantity of batteries (exclusive of the number of batteries required as samples) of any one type, of 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 of all batteries (exclusive of the number of batteries required as samples) 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 the inspection and tests specified in table III.

TABLE III. Group A inspection.

Examination and test	Requirement paragraph	Test method paragraph
Visual -mechanical (external)	3.7	4.7.1
Battery voltage	3.5.1, 3.5.1.1, and 3.5.1.2	4.7.8, 4.7.8.1 and 4.7.8.2
Electrical insulation continuity 1/	3.11	4.7.11

1/ When applicable.

4.6.1.2.1 Sampling plan. Group A inspection shall be on an inspection lot basis. Sample size shall be selected in accordance with table IV, based on the inspection lot. If there are one or more failures, the inspection lot shall be considered to have failed.

TABLE IV. Group A, zero defect sampling plan.

Lot size	Sample size
2 to 8	100 percent
9 to 15	13
16 to 25	13
26 to 50	13
51 to 90	.13
91 to 150	.13
151 to 280	20
281 to 500	29
501 to 1,200	34
1201 to 3,200	42
3201 to 10,000	50

4.6.1.3 Group B_1 inspection. Group B_1 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.see 4.6.1.2).

4.6.1.3.1 Sampling plan. Group B_1 inspection shall be on an inspection lot basis. Sample size shall be selected as indicated in table V. If there are one or more failures, the inspection lot shall be considered to have failed.

TABLE V. Group B_1 inspection.

Examination and test	Requirement paragraph	Test method paragraph	Sample size
Dimensions and weight	3.5	4.7.7 and 4.7.7.1	13
Insulation resistance 1/	3.10	4.7.12	13
Vibration	3.11	4.7.13	5
Mechanical shock	3.12	4.7.14	5
Battery voltage	3.5.1, 3.5.1.1, and 3.5.1.2	4.7.8, 4.7.8.1, and 4.7.8.2	5
Visual-mechanical (external)	3.5	4.7.1	5
Electrolyte leakage 1/ 2/	3.4	4.7.10	13

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

4.6.1.4 Group B_2 inspection. This inspection, including sampling, shall consist of the examinations and tests specified in table VI in the order shown. Group B_2 inspection shall be performed on separate samples for each sub-group and shall normally be performed on inspection lots that have passed group A inspection and on samples selected from units that have been subjected to and met the group A inspection (see 4.6.1.1).

4.6.1.4.1 Sampling plan. Group B_2 inspection shall be on an inspection lot basis. Samples shall be selected as indicated in table VI. If there are one or more failures, the inspection lot shall be considered to have failed.

TABLE VI. Group B_2 inspection.

Examination and test	Requirement paragraph	Test method paragraph	Sample size
Subgroup I:			
HT	3.8	4.7.9 and 4.7.9.1.2	13
Subgroup II			
LT	3.8	4.7.9 and 4.7.9.1.3	13

4.6.1.5 Group C inspection. Group C inspection shall be performed at the Government inspection facility (see 6.1.e) on sample batteries subjected to the examination and tests specified in table VII. Shipment of the lot represented by the sample batteries shall not be held up pending the results of group C inspection.

4.6.1.5.1 Sampling plan. A sample of n_S batteries shall be selected at random from production for each shipment lot in amounts determined from the following formula, 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 is 2n.)

4.6.1.5.1.1 Smaller-than-shipment (sub-shipment lots). At the supplier's option, selection of sample batteries (see 4.6.1.5.1) may be made on a smaller-than shipment (sub-shipment) lot basis. In such cases, 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.

4.6.1.5.1.2 Allocation of sample batteries for group C inspection. The number of batteries n_s , selected from a shipment lot (see 4.6.1.5.1) 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 taken at random and assigned to the capacity tests. The first battery shall be assigned to the T test, and the second to the D test. This shall be repeated until all the batteries have been assigned. 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 shall be adjusted so that this result is achieved.

TABLE VII. Group C inspection.

Examination and tests	Requirement paragraph	Test method paragraph
Capacity T	3.8	4.7.9.1.4, 4.7.9.2 through 4.7.9.5
Capacity D	3.8	4.7.9.1.5, 4.7.9.2 through 4.7.9.5

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 test
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 4.6.1.5.3 shall not apply to contract-lot sizes of less than 111.

4.6.1.5.2 Determination of compliance.

a. The entire contract lot shall be considered as complying when the T test results show compliance.

(1). 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 specified in 3.1 for the T test shall be compared with the applicable 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 that test. When the number is greater than the acceptance number, the contract lot does not comply.

(2). If, for any reason, upon the completion of the T test, there are fewer than n valid capacity values available for the evaluation of contract lot quality, the missing values shall be set equal to the applicable requirement.

4.6.1.5.3 Noncompliance.

4.6.1.5.3.1 Capacity T. If the capacity T test results do not show compliance with the requirements as defined in 4.6.1.5.2a(1), the entire contract lot shall be considered as not complying with the requirements of this specification and an adjustment shall be made.

4.6.1.5.3.2 Capacity D. If the number of failures on samples subjected to capacity D test exceeds the applicable acceptance number for the contract lot size n permitted by table VIII, the contract lot is considered as not complying.

4.6.1.5.4 Shipment. When the inspection lot passes group A, B_1 , and B_2 inspection, as applicable, all sample batteries selected as specified in 4.6.1.5.1 shall be shipped to the Government inspection facility (see 6.2.e) at no additional cost to the Government.

4.6.1.5.5 Marking. Sample batteries allocated to tests specified in 4.6.1.5 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 and less, the above marking shall be placed on the outside of each unit package.

4.7 Methods of examination and tests.

4.7.1 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.

4.7.1.1 Potting. The manufacturer shall determine the minimum weight of an adequately potted battery, and shall not present for acceptance any batteries failing to meet this minimum weight requirement. This shall be done by determining the minimum weight of a battery filled with a sufficient quantity of potting material to withstand the vibration and mechanical-shock tests specified (see 3.1).

TABLE IX. Visual and mechanical examination.

Requirement	Reference paragraph
External	
Design and construction 1/	3.5
Terminals	3.5.8
Jackets	3.5.10
Closure	3.5.11
Strap handle (when applicable)	3.5.9
Internal	
Dissimilar metals	3.3.1.1
Filler or padding	3.5.3
Cell-block container	3.5.4
Intercell separation	3.5.5
Intercell connections	3.5.6
Age of cells	3.5.7
Metallic jackets	3.5.10.1
Insulating, impregnating, potting, and sealing compounds	3.5.2

1/ With exception of dimensions and weight, shall be performed in group B_1 inspection (see 4.6.1.3).

4.7.1.1.1 Flowing or shrinking. Potting and sealing compounds, when used, shall be placed in a container, approximately 3 inches (76 mm) wide by 6 inches (152 mm) long by .75 inch (19 mm) high to within .25 inch (6.35 mm) of the top. The temperature of the compound within the container shall be raised to 160 °F ±5 °F (71.1 °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 -40 °F ±5 °F (-40 °C ±2.8 °C). The flow, cracking, or shrinking of the compound from the sides of the container shall be noted and the batteries shall be examined to determine that there is no impairment of electrical contact. If flow is noted at 160 °F ±5 °F (77.1 °C ± 2.8 °C), five batteries of type involved shall be exposed to 160 °F ±5 °F (77.1 °C ± 2.8 °C) storage for 24 hours with terminals resting in lowest possible position. At the end of this exposure period, batteries shall be examined to determine that there is no impairment of electrical contact (see 3.5.2).

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 (50.80 mm) high with an internal diameter of 1.5 inches (38.1 mm) shall be clamped over the material. The tube shall then be filled to a depth of 1 inch (25.4 mm) with a solution of approximately 31 percent KOH by weight or the specified electrolyte to be used in the 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 proper range in the circuit. The test shall continue for a period of 72 hours, but may be terminated if failure occurs sooner.

4.7.3 Dielectric strength. Applicable specimens of material and components shall be conditioned for 48 hours at 160 °F ±2 °F (71.1 °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 contact surface is 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. The specimens of material shall be subjected to a potential of 1,000 volts root mean square, alternating current, at commercial frequency, for a period of 1 minute. The transformer used shall be rated not less than .5 kilovolt-ampere and shall be capable of delivering up to 10,000 volts root mean square, 60-cycle alternating current, to the electrodes. The applied voltage shall be increased, starting at zero voltage, at an approximate rate of 500 volts per second.

4.7.4 Terminals.

4.7.4.1 Snap-on terminals.

4.7.4.1.1 Contact resistance. Contact resistance between the stud and socket shall be measured during engagement numbers 1, 5, 6, and 10 when a current of 5 amperes is flowing through the point of contact (see 3.5.8.5.2).

4.7.4.2 Socket terminals.

4.7.4.2.1 Contact resistance. Contact resistance between each socket insert and the applicable pin of the mating-plug shall be measured after insertions number 1, 10, 11, and 20 while a current of 5 amperes is flowing through the point of contact (see 3.5.8.5.2).

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 160 °F ± 5 °F (71.1 °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 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 at inspection conditions specified in 4.3 for at least 1 minute. This test shall be repeated again after conditioning the battery or the mockup at a temperature of -40 °F ±5 °F (-40 °C ±2.8 °C) for 6 hours. Condition of the strap handle as a whole and of the strap at its anchorages shall be observed.

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 be observed (see 3.5.10.1.2).

4.7.7 Dimensions and weight. Batteries shall be examined by gauging or measuring and by weighing to determine conformance.

4.7.7.1 Dimensions. All dimensions shall include any coating which may be used, and shall remain within the specified tolerances throughout the required tests. When box gauges are used, batteries loaded with the following weights shall pass freely through the applicable gauge openings:

a. Batteries weighing less than 5 pounds: Loading weight of 5 pounds.

b. Batteries weighing 5 pounds or more: Loading weight equal to the weight of the battery.

The inside dimensions of the box gauge shall be the specified maximum outside dimensions of the battery.

4.7.8 Battery voltage.

4.7.8.1 Open-circuit voltage. A direct current voltmeter of proper range and sensitivity shall be used to measure the open-circuit voltage.

4.7.8.2 Closed-circuit voltage. A direct current voltmeter of proper range and sensitivity shall be used to measure the closed circuit voltage utilizing resistance specified (see 3.1).

4.7.9 Capacity.

4.7.9.1 Capacity tests. Sample batteries selected for capacity tests specified in the individual battery specification sheet (see 3.1) shall be stored and discharged, as applicable, in accordance with 4.7.9.1.1 through 4.7.9.5.

4.7.9.1.1 Capacity test I. Discharge at 70 °F (21.1 °C) without previous storage specified in 4.7.9.3.

4.7.9.1.2 Capacity test HT. Discharge at 70 °F (21.1 °C) after one week (7 days) storage at 160 °F (71.1 °C).

4.7.9.1.3 Capacity test LT. Discharge at 0 °F (-17.78 °C) after storage at 0 °F (-17.78 °C) for a minimum of sixteen (16) hours.

4.7.9.1.4 Capacity test T. Discharge at 70 °F (21.1 °C) after 13 weeks storage at 113 °F (45 °CF)

4.7.9.1.5 Capacity test D. Discharge at 70 °F (21.1 °C) after (52 weeks) storage at 70 °F (21.1 °C).

4.7.9.2 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: 1) The extreme conditions specified in table IX do not exist for more than five percent (cumulative) of the specified storage or discharge periods, and 2) that at no time are the extreme conditions exceeded.

4.7.9.3 Storage. Sample batteries (packaged per contract) shall be stored at applicable storage conditions for the specified period (see 3.1). The storage period shall be considered to have started from the date the batteries are actually placed in storage. At the conclusion of the storage period, the outside of the battery container shall be examined for corrosion (see 3.5.10).

4.7.9.4 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. Prior to initiation of discharge, LT samples shall be stored at 0 °F (-17.78 °C) for a minimum of sixteen (16) hours.

4.7.9.5 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.

4.7.10 Electrolyte leakage. Sample batteries shall be discharged as specified in 3.1 and then stored for 13 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 3.4).

4.7.11 Electrical insulation continuity. Only metal jacketed single cell batteries shall be subjected to electrical insulation continuity. The electrical insulation continuity shall be measured by the application of appropriate instrumentation (Ohm-meter) between each terminal and the outer metal jacket of the battery. One contact of the circuit shall be applied to one of the battery terminals while the other contact of the circuit shall be applied to the metal jacket. This contact shall be applied in such a manner as to assure intimate contact with the metallic portion of the jacket. This procedure shall be repeated with the other battery terminal.

TABLE X. Ambient storage and discharge conditions.

Kind of storage or discharge	Normal conditions		Extreme conditions	
	Temperature	Relative humidity	Temperature	Relative humidity
T storage	113 °F +2 °F, -8 °F (45 °C +1.1 °C, -4.4 °C)	50 ± 20	88 °F (31.1 °C) through 105 °F (40.6 °C) and 115 °F (46.1 °C) through 118 °F (47.8 °C)	10 through 30 and 70 through 90
D storage	70 °F ±5 °F (21.1 °C ±2.8 °C)	50 ± 20	60 °F (15.7 °C) through 65 °F (18.3 °C) and 75 °F (23.9 °C) through 80 °F (26.7 °C)	10 through 30 and 70 through 90
HT storage	160 °F +3 °F, -7 °F) (71.1 °F, +1.7 °C, -3.9 °C)	NA	140 °F (60 °C) through 153 °F (67.2 °C) and 163 °F (22.8 °C) through 165 °F (73.9 °C)	NA
70 °F discharges	70 °F ±2 °F (21.1 °C ±1.1 °C)	50 ± 20	65 °F (18.3 °C) through 68 °F (20.0 °C) and 72 °F (22.2 °C) through 80 °F (26.7 °C)	10 through 30 and 70 through 90
LT storage and discharge	0 °F ±2 °F (-17.7 °C ± 1.1 °C)	NA	-5 °F (-20.6 °C) through -2 °F (-18.9 °C) and +2 °F (-16.7 °C) through +5 °F (-15 °C)	NA

4.7.12 Insulation resistance. Except as otherwise specified (see 3.1), insulation-resistance test shall be performed. Batteries shall be stored for a period of 48 hours at 70 °F ±5 ° (21.1 °C ±2.8 °C) and a relative humidity of 50 percent ± 15 percent. After storage and while at these conditions, the insulation resistance shall be measured by applying a direct-current potential of 500 volts ± 20 volts between any two terminals not electrically connected and between all ungrounded terminals and the container of the battery. The insulation resistance of batteries having a nonmetallic container shall be measured by the use of a 1 inch-square copper plate making physical contact with the container. The plate shall be placed with the broad surface against any area of any surface of the jacket other than that on which the battery terminals are located (see 3.10).

4.7.13 Vibration. Except as otherwise specified, vibration test shall be performed. Each battery shall be rigidly clamped to the platform of a vibration machine in a manner approximating as closely as practicable the manner in which the batteries are clamped when in use (see 3.1). A sample harmonic motion shall be applied having an amplitude of .03 inch (0.76 mm) (.06 inch (1.54 mm) total maximum excursion). The frequency shall be varied at the rate of 1 cycle per second per minute between the limits of 10 and 55 cycles per second. The entire range of frequencies and return shall be traversed in 95 minutes ± 5 minutes for each mounting position (direction of vibration), of the battery. The batteries shall be vibrated in three equal periods in mutually perpendicular directions, one of which 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 of the three vibration periods.

4.7.14 Mechanical shock. Except as otherwise specified, mechanical shock test shall be performed. Each battery shall be secured to the testing machine by means of a rigid mount which shall support all mounting surfaces of the battery. Each battery shall be subjected to a total of three shocks of equal magnitude. The shocks shall be applied in each of three mutually perpendicular directions. Each shock shall be supplied in a direction normal to a face of the battery. The faces of the battery are identified by their position in relation to the front face (the face which bears the label). For each shock, the battery shall be accelerated in such a manner that during the first 3 milliseconds the minimum average acceleration is 75 gravity units (G). The peak acceleration shall be between 125 G to 175 G.

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 equipment such 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 PIN designation.

e. Government inspection facility performing group C inspection.

f. Packaging requirements (see 5.1).

g. Shelf life coding as applicable (see 6.6).

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

6.3 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).

6.4 Subject term (key word) listing.

Capacity
Cell-block container
Electrolyte
Intercell

6.5 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.)

6.6 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/.

6.7 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.

6.8 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
DLA - CC

Preparing activity:
DLA - CC

(Project 6135-2010-009)

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/.