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SUPERSEDING
MIL-B-49430A(ER)
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MILITARY SPECIFICATION
BATTERIES, NON-RECHARGEABLE, LITHIUM SULFUR DIOXIDE

This specification is approved for use within Laboratory Command, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers non-rechargeable batteries of the non-reserve type composed of electrochemical cells utilizing a lithium sulfur dioxide system (see 6.1).

1.2 Classification.

1.2.1 Type designation. The type designation of lithium sulfur dioxide non-rechargeable batteries shall be in the following form (see 3.1).

BA-	5590	/U
Component (1.2.1.1)	Battery Type number (1.2.1.2)	Installation indicator (1.2.1.3)

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

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

AMSC N/A FSC 6135

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1.2.1.2 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 5001 through 5999 series.

1.2.1.3 Installation Indicator. The installation indicator identifies equipment the battery is used in; i.e. /PRC-25 or if "universal", i.e. /U indicates use in various equipment.

2. APPLICABLE DOCUMENTS

2.1 Government Documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this specification to the extent specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

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

MILITARY

MIL-W-76	Wire and Cable, Hook-up, Electrical Insulated.
MIL-P-116	Preservation-Packaging, Methods of
MIL-I-631	Insulation, Electrical, Synthetic-Resin Composition, Non-rigid
MIL-W-6858	Welding, Resistance, Aluminum, Magnesium, Non-hardening Steels or Alloys, Heat resisting Alloys, and Titanium Alloys, Spot and Seam.
MIL-F-14072	Finishes for Ground Electronic Equipment.
MIL-F-14256	Flux, Soldering, Liquid (Rosin Base).

(see supplement 1 for list of associated specifications).

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STANDARDS

FEDERAL

FED-STD-595	Colors.

MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-454	Standard General Requirements for Electronics Equipment.
MIL-STD-970	Standards and Specifications, Order of Preference for the Selection of
MIL-STD-1360	Fuses, Fuseholders and Associated Hardware, Selection and Use of.
MIL-STD-45662	Calibration System Requirements.

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

PUBLICATIONS

AG00000066	Special Packaging Instructions
DOT-E-7052	Transportation Exemption for Lithium Batteries

(Copies of special packaging instructions may be obtained from Commander, U.S. Army CECOM, ATTN: AMSEL-IM-T, Fort Monmouth, NJ 07703-5016.)

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

2.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein except for specification sheets, the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

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3. REQUIREMENTS

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

3.2 Selection of specification and standards. Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-970 and shall be approved by the procuring activity.

3.3 First article. When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.6 and 6.3).

3.4 Materials. Materials listed in Table I, when used, shall be in accordance with the applicable specification (see 4.4 and 6.2).

3.4.1 Metals. All metals which do not enter into the basic electrochemical reaction of the cell shall resist, or be treated to resist, corrosion in accordance with MIL-F-14072.

3.4.1.1 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 in accordance with MIL-F-14072.

3.4.2 Insulating compounds - flow or shrinking. When tested as specified in 4.8.14 the insulating, impregnating, potting and sealing compounds shall not flow at high temperature, nor crack or draw away from the sides of a container at low temperature. Any compound used shall be non-flammable and non-toxic. Potting shall not inhibit cell vent operations (see 4.8.10).

3.4.2.1 Electrical connection wires and tabs. All electrical connecting wires and tabs for the cells and the battery shall be covered by an insulation with the following characteristics:

Softening temperature: 150°C (302°F) minimum
Lengthwise shrinkage: 3% maximum
Thickness: 0.008 inches minimum

The material shall be non-flammable and non-toxic.

3.5 Design and construction. Batteries shall be of the design, construction, physical dimensions, weight, and polarity as specified in 3.1.

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3.5.1 Intercell connections. Intercell connections shall be spot welded in accordance with MIL-W-6858, Class B. All electrical connections and leads, either circular, flat, or any other configuration, shall be completely insulated. The cell side on which both positive and negative terminals are present should also be completely covered with an insulating material. An insulating sleeve should be wrapped tightly along the length or longitudinal part of the cell. The sleeve shall extend a minimum of 3/16 inch over the top and bottom parts of the cell. Any other metallic or electrically conducting components within the battery shall be insulated. The heat sensing portion of the thermal fuse shall not be insulated. However, the electrical connecting wires to the thermal fuse shall be insulated. The insulating compounds and materials shall meet the requirements as stated in 3.4.2 and 3.4.2.1 as appropriate. The insulated electrical wire shall not be bared more than 3/32 inch from any solder or weld (see table II and 4.8.18).

3.5.2 Age of cells and batteries. The manufacturer shall certify that the age of the cells and batteries are as follows (see 6.2):

a. 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.

b. Maximum age of cells, from the time of their fabrication to the time of their shipping date, shall be 180 days.

c. Batteries shall be submitted for Government testing within 30 days of manufacture (see 4.5).

3.5.3 Terminals (insulation resistance). Terminals shall be as specified on the applicable specification sheet (see 3.1) and insulation resistance shall be not less than 5 megohms when tested as specified in 4.8.8.

3.5.3.1 Cell positive terminal coating. The positive terminal of each cell shall be coated with a non-conducting compound which is impervious to moisture. The compound shall meet the requirements specified in 3.4.2 and 4.8.14.

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3.5.4 Safety features. Each cell of the battery shall contain a feature so that any potentially explosive condition caused by sustained external or internal shorting shall cause the safety feature to activate and thus preclude an explosion. This feature shall operate between 200° and 300°F. In addition to this safety precaution each complete battery shall be fused, when necessary, with a nonreplaceable slow blow fuse. If a battery type is composed of more than one leg, each individual leg shall be fused separately, when necessary, with a nonreplaceable, slow blow fuse. The physical location of the slow blow fuses shall be optional. Fuses shall be selected from MIL-STD-1360. Batteries shall not be constructed using parallel arrangements of cells unless protected by diodes (see 4.8.10).

3.5.5 High temperature switch. A high temperature switch or thermal fuse shall be as specified on the applicable specification sheet (see 3.1). When tested as specified in 4.8.16, the switch shall remain closed below 180°F and open at 190± 5°F.

3.5.5.1 High temperature switch location. The high temperature switch or thermal fuse shall be located as close as possible to the geometric center of the battery or as indicated below. For a two or three cell in-line arrangement, the high temperature switch or thermal fuse shall be located between any two adjacent cells. For a cluster arrangement of three or more cells, the high temperature switch or thermal fuse shall be located within the cluster.

3.5.5.2 Diode. Diode(s) shall be inserted in the battery as specified in the applicable specification sheet to prevent significant reverse current (see 3.1). The diode shall conform to requirement 30 of MIL-STD-454 and have the following characteristics:

Forward current, I_F = 3 amperes
Forward voltage drop, V_F = 0.55±0.1 volts
Reverse current, I_R = 2 milliamperes
Reverse voltage, V_R = 40 volts

When the battery is tested to assure that the diode is functioning correctly the charging current shall not exceed 2.0 milliampers maximu (see 4.8.10.3).

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3.5.5.3 Complete Discharge Device. The complete discharge device shall consist of a normally open switch and a resistor connected across each battery leg in series with the switch. A single switch action shall activate all complete discharge devices. This requirement shall not apply to any single cell battery. Switch access in battery surface shall be through a rectangular hole measuring 1/2" plus 0, minus 1/8" by 3/16" plus 0, minus 1/16". The effective hole size shall be provided if the battery's surface is curved. The top center of the switch plunger shall be located at center of slot plus or minus 1/16". The hole shall be covered by a removable label that can be made of either paper, paper products, or plastic. The top surface of switch shall be 3/16" plus 0, minus 3/32" below the outer surface of the battery where the slot is located. The switch action shall move at least 1/8" down and not more than 3/8". The switch shall not be in the surface of the battery that contains the electrical connector. The resistor to be used in the complete discharge device shall be within the range specified and shall conform to requirement 33 of MIL-STD-454. Each resistor shall be tested to verify its value. None of the battery's fuses, diodes or thermal switches shall prevent the discharge of any cell upon activation of the complete discharge device. The contractor shall certify the value of the resistor selected and the operation of the discharge circuitry (see 4.8.20 and 6.2).

3.5.6 Jackets. (see 4.8.1) The jackets must be a 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. Non-metallic jackets, cardboard or plastic, shall not support combustion nor emit toxic vapors when subjected to flame. The seams of the jacket shall not be open prior to or after being subjected to any test to which the battery is subjected (see 4.8).

3.5.6.1 Jacket integrity (paperboard). Paperboard jackets shall not fall apart and the seams shall remain intact when tested as specified in 4.8.11.2.

3.5.6.2 Color of jackets. The color of exposed surfaces of jackets shall match one of the following lusterless greens 34079, 34086, 34087, 34096, 34102, 34127, and 34128 per FED-STD-595 (see 6.2).

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3.5.7 Connectors. Connectors shall be as specified on the applicable specification sheet. Location of the connectors shall be verified as specified in 4.8.15. Only sockets which are electrically connected shall require pins.

3.5.7.1 Socket strength (when specified). After the batteries have been tested as specified in 4.8.10.1, they shall meet the open-circuit voltage jacket integrity, and visual and mechanical requirements (see 3.6.1 and 3.5).

3.5.8 Manufacturing processes traceability. The contractor shall maintain records on all manufacturing processes employed for the preparation, fabrication and/or refining of cell and battery components. These records shall be available to the Government upon request. The records shall be so maintained that any cell lot and battery fabricated from the cell lot can be identified with respect to material used, cell manufacture date, component supplier, and other process data (see 6.2). Each cell must be marked so that the date of manufacture can be identified by the Government.

3.5.8.1 Time order production. Cell lots shall be assembled into batteries consecutively unless the lot does not pass the in process inspection (see 3.8 and 3.8.1). Battery lots shall be packaged and shipped as produced consecutively (see 6.2).

3.6 Battery voltages.

3.6.1 Battery open circuit voltage. The open-circuit voltage shall not exceed the maximum voltage specified (see 3.1 and 4.8.2.1).

3.6.2 Battery closed-circuit voltage. The closed-circuit voltage shall be not less than the minimum voltage specified (see 3.1 and 4.8.2.2).

3.6.3 Cell closed-circuit voltage. When cells are tested as specified in 4.8.12, the voltage shall not fall below 2.00 volts.

3.6.4 Cell Series String Voltage. When any cells are connected in series prior to assembly into a battery where they will be connected in parallel, they must be subjected to a loaded voltage test to insure proper electrical contact among the cells. (See 4.8.12.1).

3.7 Capacity. When the battery is tested for capacity as specified in 4.8.9 the time required to reach its specified minimum voltage shall be not less than the battery discharge time requirement specified (see 3.1).

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3.7.1 Initial voltage delay. When the battery is tested for capacity, the time required at the beginning of discharge for the battery or its legs to meet the specified minimum battery voltage after the load is applied shall be not more than the time specified (see 3.1 and 4.8.9.1.1).

3.8 Sulfur dioxide gas leakage - (cell test). The cell batch used in a battery shall demonstrate a four week leakage rate not to exceed 0.005 percent of the total sulfur dioxide in the cell when tested in accordance with 4.8.13.

3.8.1 Cell discharge Any cell whose capacity deviates from the average capacity of its associated cell lot by more than ±9 percent, or which delivers less than the minimum capacity service requirement, shall be considered as failed. There shall be no leaking, venting, fire, or explosion (see 3.1 and 4.8.13.1).

3.9 Vibration. After the batteries have been tested as specified in 4.8.6 they shall meet the visual and mechanical and battery voltage requirements (see 3.5 and 3.6.2).There shall be no voltage fluctuations during the test.

3.10 Mechanical shock. After the batteries have been tested as specified in 4.8.5 they shall meet the visual and mechanical and battery voltage requirements (see 3.5 and 3.6.2).

3.11 Drop test. Following the battery drop test, the socket shall remain within the limits specified on the individual specification sheet (see 3.1). After the batteries have been tested at each temperature as specified in 4.8.3 they shall meet the visual, mechanical, and battery voltage requirements. No cells shall be visible before or after the tests with a multi cell battery (see 3.5 and 3.6.2).

3.12 Altitude. After the batteries have been tested as specified in 4.8.7 they shall meet the visual , mechanical, and battery open circuit voltage requirements (see 3.5 and 3.6.1).

3.13 Stoichiometric mole ratio. Each cell shall have a stoichiometric mole ratio of lithium to sulfur dioxide of 0.90 to 1.05 inclusive. A method of maintaining anode continuity and electrical contact between all reactive lithium metal and the cells negative terminal throughout any specified discharge shall be incorporated into the anode design. The contractor shall certify that this ratio and anode continuity and electrical continuity are being maintained throughout cell production (see 6.2).

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

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3.14.1 Labels. Each battery shall have a label 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, NON-RECHARGEABLE, LITHIUM SULFUR DIOXIDE
Type Designation
(Contract Number)---
(Code) --- (See Note and 3.14.1.1)
Serial Number (See 3.14.1.2)
Manufacturer's name
(Trade name may also be used)
Manufacturer's plant

DO NOT CHARGE, SHORT CIRCUIT, INCINERATE, OR MUTILATE THIS BATTERY OTHERWISE BATTERY MAY VENT OR RUPTURE RELEASING TOXIC MATERIALS

EXAMPLE:

BATTERY, NON-RECHARGEABLE, LITHIUM SULFUR DIOXIDE
BA-5590/U
DAAB05-83-C-1234
0383B

Serial number 1-2-3
James E. Doe Company
JODOCO
Batteryville, N.J.

DO NOT CHARGE, SHORT CIRCUIT, INCINERATE OR MUTILATE THIS BATTERY OTHERWISE BATTERY MAY VENT OR RUPTURE RELEASING TOXIC MATERIALS

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

3.14.1.1 Code. The Code shown shall indicate the month, year and week of manufacture of the battery by means of a four-digit number followed by a single letter in which the first two digits shall indicate the number of the month. The last two digits shall indicate the year. Months earlier than the tenth month shall be a single digit preceded by "O". "A" shall be used for the first week of the month, "B" for the second week of the month etc. Sunday shall be considered the first day of a week.

EXAMPLES:

A battery manufactured during the second week of March 1983 will bear the code "0383B".

A battery manufactured during the third week of November 1983 will bear the code "1183C".

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3.14.1.2 Serial Number. Each battery produced and furnished under a particular contract shall be given a specific serial number. These serial numbers shall be assigned consecutively beginning with one and continuing therefore for the entire contract lot of batteries. Serialization of batteries shall be accomplished immediately upon completion of fabrication and prior to sampling for inspection. Serial numbers of batteries are not required on shipping containers or packaging.

3.14.2 Terminal marking. On batteries having socket-type terminals, all markings require to indicate polarity, voltage, and the voltage leg of the battery (A, B, C, etc.) shall appear on the face of the battery bearing the socket. On other type terminals, the terminal markings may appear on the surface with the terminal or the side of the battery, or both. Markings shall indicate clearly the terminals to which they refer.

3.14.3 Complete discharge device label. The label shall be a removable 1 inch (width) x 2 inch (length) two-panel label made of waterproof transparent material with lusterless black lettering. The label shall be centered as closely as possible over the switch access opening. The format shall be as follows:

ATTENTION
Before Disposal
Remove this Label and
Push Switch

The word ATTENTION in the top panel shall be in bold lettering and shall fill the available area of the top panel.

3.14.4 Complete discharge device card. The maximum card dimension shall be 3" x 5". The printing shall be clearly legible and read as follows:

ATTENTION

THIS BATTERY HAS A DISCHARGE SWITCH. AFTER THE BATTERY IS USED AND THIS SWITCH IS PUSHED THE BATTERY MAY BE DISPOSED AS NORMAL TRASH. BEFORE DISPOSAL REMOVE CAUTION LABEL, PUSH SWITCH. IF BATTERY IS NOT FULLY DISCHARGED WAIT FIVE DAYS THEN DISCARD BATTERY.

The card shall be packaged in the plastic bag containing the battery and the card shall be placed lettering side out over the face containing the connector. The word ATTENTION shall be in bold lettering.

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3.15 Cell water content. Water content of the sulfur dioxide electrolyte solution in a cell shall not exceed 1000 parts per million by weight when tested by the Karl Fisher electrolyte titration method. The contractor shall certify that this limit is not exceeded throughout production (see 6.2 and 4.8.19).

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, interchangeability, or appearance.

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4. QUALITY ASSURANCE PROVISIONS

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

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities shall be of sufficient accuracy, quality and quantity to permit performance of the required examinations and tests. Unless otherwise specified herein, all examinations and tests shall be performed under ambient temperature, humidity, and atmospheric pressure conditions. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662.

4.1.2.1 Instrument accuracy.

4.1.2.1.1 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 10,000 ohms per volt.

4.1.2.1.2 Resistor tolerance. During 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

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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.

4.1.2.1.3 Power supplies. Power supplies used for discharges specified herein shall be accurate within ±1 percent.

4.1.2.1.4 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 inspection (see 4.4).

b. In-process inspection (see 4.5).

c. First article inspection (see 4.6).

d. Quality conformance inspection before packaging. (see 4.7)

e. Packaging inspection (see 4.7.2).

4.3 Inspection conditions. Except as otherwise specified herein, all examinations and tests shall be performed at a temperature of 80±20°F.

4.4 Materials inspection. Materials inspection shall consist of verification by certification from the source that the materials used in fabricating the cells and 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. (see Table I).

TABLE I - Materials inspection.

Material	Requirement Paragraph	Applicable Specification
Metal and Finishes Solder (Sn 40) Solder Flux (type RMA)	3.4.1	MIL-F-14072 QQ-S-571 MIL-F-14256

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TABLE II - In process inspection.

Inspection	Requirement Paragraph	Test Method Paragraph	Cell	Battery Component	Sampling Plan
Cell Closed-circuit voltage	3.6.3	4.8.12	X		100 percent of cell lot
Sulfur dioxide gas leakage	3.8	4.8.13	X		30 cells per cell lot
Cell discharge	3.8.1	4.8.13.1	X		4.8.13.1
Stoichio-metric mole ratio	3.13	4.8.17	X		NA
Cell water content	3.15	4.8.19	X		NA
Insulating compounds flow and shrinking	3.4.2	4.8.14		X	Once per battery lot
Intercell connections	3.5.1	4.8.18		X	4.8.18.1
High temperature switch	3.5.5	4.8.16		X	4.8.16.1
Cell Series StringVolt-age	3.6.4	4.8.12.1		X	100 Percent of Cell Strings
Complete Discharge Device	3.5.5.3	4.8.20		X	100 Percent of resistors

4.5 In-process Inspection.

4.5.1 Cells. Each inspection lot shall be inspected in accordance with Table II including the cells made for the first article inspection.

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4.5.2 Cell lot. A cell lot shall be defined as the quantity of cells, not exceeding 15,000 cells, manufactured during one month, or the cells produced on one date of any one type and produced a any one place of manufacture on any one contract by any one production method.

4.5.2.1 Sampling plan. A cell sample lot shall consist of 30 cells per cell lot selected at random.

4.5.3 Battery components. In-process inspection on battery components (3.4.2, 3.5.1, 3.5.5.3 and 3.6.4) shall be tested in accordance with Table II.

4.6 First article inspection. First article inspection shall be performed by the contractor, after award of contract and prior to production, at a location acceptable to the Government. First article inspection shall be performed on sample units which have been produced with equipment and procedures normally used in production. First article approval is valid only on the contract under which it is granted, unless extended by the Government to other contracts.

4.6.1 Sampling plan. The number of batteries constituting an inspection lot shall be in accordance with Table III.

4.6.2 Inspection routine. First article inspection shall consist of all the examinations and tests in accordance with Table III. One sample battery, untested, is to remain at the contractor's plant and is to be available as a standard for comparative purposes.

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TABLE III First-article inspection.

Group	No.of Batteries	Examination and Test	Requirement Paragraph	Method of Test Paragraph
I	20[1/]	Visual & Mechanical examination	3.5, 3.14	4.8.1
		Battery voltage	3.6.1	4.8.2.1
		Diode Test	3.5.5.2	4.8.10.3
		Drop test	3.11	4.8.3
		Dimension & weight	3.5	4.8.4
		Mechanical shock	3.10	4.8.5
		Vibration	3.9	4.8.6
		Altitude	3.12	4.8.7
		Insulation resistance terminals	3.5.3	4.8.8
IA	10	"I" Test @ 70°F	3.7	4.8.9.1.2
IB	5	"L" Test @-20°F	3.7	4.8.9.1.3
		Complete discharge device	3.5.5.3	4.8.10.2
IC	5	"H" Test @130°F	3.7	4.8.9.1.4
		Complete discharge device	3.5.5.3	4.8.10.2
II	25[1/]	Visual-mechanical	3.5, 3.14	4.8.1
		Battery voltage	3.6.1	4.8.2.1
IIA	10	"HT" Test @ 130°F after 4 weeks storage @ 160°F	3.7	4.8.9.1.6
IIB	10	"LT" Test @-20°F after 4 weeks storage @160°F	3.7	4.8.9.1.5
IIC	5	"ILR" Test @ 80°F	3.7	4.8.9.1.9
III	10[1/]or15[2/]	Battery voltage	3.6.1,3.6.2	4.8.2.1, 4.8.2.2
IIIA	10	Safety feature	3.5.4	4.8.10
IIIB	5[2/]	Socket Strength (as required)	3.5.7.1	4.8.10.1
		Jacket integrity (paperboard)	3.5.6.2.1	4.8.11.2
		Visual mechanical	3.5, 3.14	4.8.1
IV	1	Untested-reference sample	---	4.6.2

1/ The number of batteries shall be subjected to each examination and test listed for the group or as noted for the destructive tests.

2/ Five additional batteries are required when socket strength and/or jacket integrity testing is applicable.

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4.6.2.1 First article data. The first article test plan and test report(s) shall be as specified in the contract or purchase order (see 6.2).

4.6.2.2 Failure. If one or more sample batteries fail to meet any of the first article requirements and tests, the contractor shall immediately make the remedial changes. The contractor is required to submit additional first article samples for reinspection. A description of the corrective action taken or to be taken shall be included in the first article inspection reports.

4.7 Quality conformance inspection before packaging.

4.7.1 Inspection of product for delivery. Inspection of product for delivery shall consist of Groups A, B and C inspection. Test equipment for government verification inspection shall be made available by the contractor, if required.

4.7.1.1 Group A inspection. Each battery on contract or purchase order shall be 100 percent inspected for conformance to the inspections in the order specified in Table IV. Discrete lots shall be formed from batteries that pass this inspection.

TABLE IV - Group A inspection.

Examination and Test	Requirement Paragraph	Method or Test Para.
Visual & mechanical	3.5,3.14 and table VI	4.8.1
Battery voltage	3.6.1 and 3.6.2	4.8.2
Diode Test	3.5.5.2	4.8.10.3

4.7.1.2 Group B inspection. Group B inspection shall consist of the tests specified in Table V in the order shown. Special procedures for small-sample inspection of MIL-STD-105 shall apply. Group B inspection shall be performed on sample units from lots which have been subjected to and passed group A inspection.

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TABLE V - Group B inspection.

Examination and test	Requirement paragraph	Method or test Paragraph	AQL	Inspection Level
Subgroup 1				
Dimensions & Weight	3.5	4.8.1	0.65%	S-1
Insulation resistance	3.5.3	4.8.8	0.65%	S-1
Safety feature	3.5.4	4.8.10	0.65%	S-1
Subgroup 2 1/				
Jacket integrity	3.5.6.2.1	4.8.11.2	2.5%	S-1
Visual & mechanical	3.5	4.8.1	2.5%	S-1

1/ Performed only for paperboard jacketed batteries

TABLE VI - Classification of visual and mechanical examination defects.

Categories	Defects
101	Improper assembly causing parts to be inoperative or unsafe in service.
102	Deformed or damaged parts which are inoperative or malfunction in service.
103	Cell aging requirement not met.
104	Contact surfaces obstructed by insulation material so that electrical use is affected.
105	Torn non-metallic jackets - any tear or rip with dimension greater than 1/2 inch.
106	Improper jacket closure.

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TABLE VI - Classification of visual and mechanical examination defects
Continued

107	Insulating parts or materials missing, damaged, or improperly located so as to affect electrical performance.
108	Location, polarity and marking or terminals not as specified.
109	Labeling and marking wrong, missing or illegible so that utilization is affected.
110	External and internal threads missing, wrong size or so damaged to prevent proper use.
111	Electrolyte leaking caused by missing or defective sealing or closure.
112	Welded or soldered connections improperly made so as to adversely affect battery performance.
113	Improper assembly which could reduce efficiency of operation but not render battery inoperative or unsafe in service.
114	Deformed or damaged parts which do not adversely affect electrical performance.
115	Burrs or imperfections which do not interfere with proper use in operation, assembly or disassembly, or cause unsafe condition in service.
116	Improper marking which doesn't hamper utilization or identification or the battery.

4.7.1.3 Group C inspection. Group C inspection shall consist of (a) HT capacity test and (b) LT capacity test. Each capacity test shall be preceded by both the mechanical shock and vibration tests described in paragraphs 4.8.5 and 4.8.6 respectively.

4.7.1.3.1 Sampling plan. Samples shall be selected in accordance with General Inspection Level I from Table I of MIL-STD-105. Fifty percent (50%) shall be used for the HT capacity test and fifty percent (50%) shall be used for the LT capacity test.

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4.7.1.3.2 Group C failures. An AQL of 6.5 shall be used for failures (a), (b) and (c). No failures shall be allowed for (d).

a. Insufficient service.

b. Excessive initial voltage delay.

c. Battery exceeds dimensional tolerances after discharge.

d. Battery vents, leakers, burns or ruptures.

4.7.1.4 Group D inspection Group D inspection shall be performed at the Government inspection facility on sample batteries in accordance with Table VII. Shipment of the lot represented by the sample batteries shall not be held up pending the results of group D inspection.

TABLE VII - Group D inspection

Storage and Capacity Test	Requirement Paragraph	Method or Test Paragraph
Subgroup I (Adjustment Purposes see 4.7.1.5.3.1)		
Capacity T	3.7	4.8.9.1.7
Capacity LT	3.7	4.8.9.1.5
Capacity ILR	3.7	4.8.9.1.9
Subgroup II (see 4.7.1.5.3.2)		
Capacity D	3.7	4.8.9.1.8

4.7.1.4.1 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 both T and LT capacity test when the sample for the final shipment of the contract lot has been drawn.

$$n_s = a + N_s\frac{(2n)}{N}$$

where:

a = 10 batteries, 5 for ILR capacity test and 5 for D capacity test

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 LT, in accordance with Table VIII (total number of T and LT samples selected is 2n)

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4.7.1.4.1.1 Allocation of sample batteries for Group D inspection. The number of batteries n_s, selected from a shipment lot shall be assigned at random at the Government test facility so that 5 batteries will be scheduled for both the ILR and D capacity tests, and the remainder split approximately in half for the T and LT tests. Such assignment shall result in the allocation of exactly n batteries to both T and LT 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.

TABLE VIII Sample size and allowable failures for both T and LT capacity tests.

Contract lot size "N"	Sample size "n" for T and LT tests from contract lot	1/ Acceptance No. for T and LT 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 4.7.1.4.2 shall not apply to contract lot sizes of less than 111.

4.7.1.4.2 Compliance. The entire contract lot shall be considered as complying when the T and LT tests show compliance as specified in Table VIII and the number of ILR failures for the contract lot does not exceed twenty (20) percent of the number of samples subjected to ILR testing.

4.7.1.4.3 Noncompliance.

4.7.1.4.3.1 Subgroup I. If the capacity test results do not show compliance with the requirements as defined in 4.7.1.4.2, the entire contract lot shall be considered as not complying with requirements of this specification.

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4.7.1.4.3.2 Subgroup II. If the number of failures found during capacity test D exceeds twenty (20) percent of the number of samples subjected to this test, the contract lot is considered in noncompliance.

4.7.2 Packaging inspection. Packaging inspection requirements specified herein are classified as follows:

a. First Article Inspection of Packaging.

b. Quality Conformance Inspection of Packaging.

4.7.2.1 First Article Inspection of Packaging. Unless otherwise specified in the contract, First Article Inspection of Packaging shall be in accordance with the Unit Pack Design Validation Requirements of MIL-P-116.

4.7.2.2 Quality Conformance Inspection of Packaging.

4.7.2.2.1 Materials inspection. All materials to be used in packaging shall be inspected in accordance with the applicable material specification.

4.7.2.2.2 Preservation inspection. Inspection of preservation and interior markings shall be in accordance with group A and B Quality Conformance Inspection Requirements of MIL-P-116. Lot formation and sampling procedures shall be as specified therein.

4.7.2.2.3 Packing inspection. Inspection of packing and the marking for shipment and storage consist of the examinations specified in Table IX, "Packing Inspection Provisions." Lot formation shall consist of all packs made of the same materials during an identifiable period and submitted at one time for acceptance. Sampling procedures shall be in accordance with MIL-STD-105, using a single sampling plan and Acceptable Quality level of 4.0 percent defective.

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TABLE IX - PACKING INSPECTION PROVISIONS.

NO.	CHARACTERISTIC	METHOD OF INSPECTION
101	Intermediate container not as specified	Visual
102	Improper closure of intermediate container	Visual
103	Shipping containers not in accordance with specification	Visual
104	Excessive cube	Visual
105	Improper blocking and bracing	Visual
106	Closure not in accordance with specification	Visual
107	Weight and size exceed container limitations	Weight & Measure
108	Strapping not in accordance with specification, incorrectly applied,omitted	Visual
109	Marking omitted, incorrect, or illegible	Visual

4.8 Test Methods and examination.

4.8.1 Visual and mechanical examination. Batteries and cells shall be examined to determine compliance with all applicable requirements and characteristics as specified herein (see 3.5, 3.14 and Table IV).

4.8.2 Battery Voltage.

4.8.2.1 Open-circuit voltage. A direct current voltmeter of appropriate range and sensitivity shall be used to measure the open-circuit voltage (see 3.6.1).

4.8.2.2 Closed-circuit voltage. A direct current voltmeter of proper range and sensitivity shall be used to measure the closed circuit voltage utilizing the load specified (see 3.6.2).

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4.8.3 Drop test. Each battery shall be dropped once, for each temperature, from a height of 30 ± 2 inches onto a hard surface consisting of concrete. The smallest side of the battery perpendicular to and nearest the socket shall be parallel to the concrete surface upon release but need not be parallel on impact. The drop test shall be performed at 160°F and -20°F. The batteries shall be stabilized a minimum of 4 hours at each test temperature and dropped within 10 minutes after removal from the temperature chamber (see 3.11).

4.8.4 Dimensions and weight. Batteries shall be examined by gauging or measuring and by weighing to determine conformance (see 3.5).

4.8.4.1 Dimensions. All dimensions shall include any coating which may be used, and shall remain within the specified tolerances throughout the required tests. Both minimum and maximum dimensions shall be determined. 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 dimensions of the box gauge shall be the specified maximum outside dimensions of the battery.

4.8.5 Mechanical shock. Each battery shall be secured to the testing machine by means of a rigid mount which will 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 applied in a direction normal to a face of the battery. The faces of the battery are identified by their position in relation to the face which bears the electrical connector. 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 to 175 G, exact value shall be recorded (see 3.10). Open-Circuit voltage shall be measured following the tests. (see 3.6.1).

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4.8.6 Vibration. 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 simple harmonic motion shall be applied having an amplitude of 0.03 inch (0.06 - inch total maximum excursion). The frequency shall be varied at the rate of 1 hertz per minute between the limits of 10 and 55 cycles per second. 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 equal periods in mutually perpendicular directions, one of which shall be perpendicular to the face which bears the electrical connector of the battery. Open-circuit voltage shall be observed for 30 seconds during the last quarter of each of the three vibration periods (see 3.6.1 and 3.9).

4.8.7 Altitude. Batteries shall be placed in an altitude chamber, in which the pressure is maintained at a value corresponding to an altitude of 50,000 feet and the temperature is kept at 75±5°F, for a period of six (6) hours (see 3.12). Open circuit voltage only shall be observed after the test. (see 3.6.1)

4.8.8 Insulation resistance (terminals). Insulation-resistance test shall be performed, except as otherwise specified (see 3.1). Batteries shall be stored for a period of 48 hours at +70±5°F and a relative humidity of 50 ± 15 percent. After storage and while at these conditions, the insulation resistance shall be measured by applying a direct-current potential of 500 ± 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 non-metallic 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 areas of any surface of the jacket other than that on which the battery terminals are located (see 3.5.3).

4.8.9 Capacity (see 3.7).

4.8.9.1 Capacity Tests. Sample batteries selected for capacity tests specified in the individual specification sheet (3.1) shall be stored and discharged in air as applicable, in accordance with 4.8.9.1.1. through 4.8.9.2.1. All batteries shall be discharged to zero volts, except those subjected to the ILR test. The time required to reach the specified minimum voltage shall be used to determine the battery capacity. A continous temperature recording shall demonstrate the accuracy of the discharge temperature.

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4.8.9.1.1 Initial voltage delay. At the start of the capacity discharge test, each battery shall be monitored with an oscillographic device or equivalent to determine the time in milliseconds required for battery closed circuit voltage to rise to the minimum voltage after the specified loads are applied as specified in the individual specification sheets. No loads shall be applied at any time during storage or prior to the discharge test following such storage (see 3.7.1).

4.8.9.1.2 Capacity test I. Discharge at +70±5°F without previous storage. After the battery reaches zero volts, force discharge the battery into voltage reversal for the specified time.

4.8.9.1.3 Capacity test L. Discharge at -20±3°F after storage at -20±3°F for a minimum of sixteen (16) hours.

4.8.9.1.4 Capacity test H. Discharge at +130±3°F after storage at +130±3°F for a minimum of sixteen (16) hours.

4.8.9.1.5 Capacity test LT. Discharge at -20±3°F after four(4) weeks storage at 160°F followed by a minimum of sixteen (16) hours at -20±3°F. No load shall be applied during the storage at +160°F and -20°F or prior to discharge test.

4.8.9.1.6 Capacity test HT. Discharge at +130±3°F after four (4) weeks storage at +160°F and a minimum of sixteen (16) hours at +130±3°F. No load shall be applied during the storage at 160°F and 130°F or prior to discharge test.

4.8.9.1.7 Capacity test T.. Discharge at +70±5°F after thirteen (13) weeks storage at +130°F.

4.8.9.1.8 Capacity test D. Discharge at +70±5°F after fifty-two (52) weeks storage at +70°F.

4.8.9.1.9 Capacity test ILR. Discharge at +80±20°F to the specified minimum voltage without previous storage.

4.8.9.2 Storage conditions. The storage conditions specified in Table X shall prevail during storage periods specified. Normal conditions shall be maintained. A continous temperature recording device shall demonstrate the accuracy of the storage temperature. No loads shall be applied at any time during storage prior to the discharge test following storage. Deviations from normal conditions are permitted provided that (1) the extreme conditions specified in Table X do not exist for more than ten percent (cumulative of the specified storage periods) and (2) that at no time are the extreme conditions exceeded. Batteries must be oriented in storage to have at least 50 percent of the cell seals at the bottom of the batteries (see 3.1).

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Table X - Storage test conditions.

Kind of storage	Normal conditions temperature	Extreme conditions temperature
T Storage	+130+3°F -4°F	108°F thru 126°F and 133°F thru 135°F
D Storage	+70±5°F	60°F thru 65°F and 75°F thru 80°F
HT and LT Storage	+160+3°F	140°F thru 153°F and 163°F thru 165°F

4.8.9.2.1 Discharge. Following stabilization the batteries shall be discharged at the ambient discharge conditions as specified. There shall be at least a two (2) inch separation between all batteries that are being discharged. All batteries subjected to capacity testings shall be discharged as specified in individual specification sheets. Certification of that temperature shall be made at five equal time intervals over the test period. A battery shall be considered to have failed a discharge test when any one of the following conditions occurs:

a. The battery voltage or the voltage of any one leg falls below the specified minimum voltage prior to exceeding the capacity or fails to reach minimum voltage in the required time.

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

c. Any evidence of cell leakage, venting, rupture or fire is observed within twenty-four hours after the completion of the test. Any fuse or safety device operates before the test is completed.

d. Insufficient service.

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4.8.10 Safety feature. Each sample battery shall be subjected to a direct short. i.e., less than 0.1 ohm, until the circuit is broken by the safety feature. The maximum current and time required to activate the safety feature shall be determined and recorded. Following the direct shorting, all batteries shall be placed at +195°F for two hours. At the end of two hours the batteries must be checked to see that no cell has vented. If any cell has vented, the battery has failed this test. If no cell has vented, the ambient temperature shall be raised to a maximum of 300°F. Batteries shall be maintained at an ambient of +300°F for two hours. Any cell that vented at or below 300°F must be checked to insure that the venting occurred only through the designed vent. Venting through any portion of the cell other than the designed vent is a failure. Batteries containing cells which exploded, burned or did not vent are failures (see 3.5.4). Distortion of labeling or dimensions is permitted.

4.8.10.1 Socket strength test. Before conducting the jacket integrity and visual mechanical examinations specified in Table III, the five batteries shall be subjected to the following:

Using a 0.250"±0.050" diameter rod, apply a force to the center of the socket and deflect it downward a distance of 0.250"+0.0625,-0" below the top surface of the battery.

4.8.10.2 Complete discharge device. Location and operability shall be verified. Ability to discharge an end voltage discharged battery after activation of complete discharge device shall be certified and verified during first article inspection. (see 3.5.5.3 and 6.2). The device shall be activated on the five batteries submitted to the group IB test and also the five batteries submitted to the group IC test. The device must apply the specified load to the battery or its section when the switch is activated (see 3.5.5.3 and 6.2).

4.8.10.3 Diode breakdown test. A DC power supply capable of delivering at least 2.50 ma. shall be used. The voltage to be used shall be 40 volts, +10%, -10%, plus the voltage obtained by multiplying the number of cells by 3.05. It shall be electrically connected with low impedance contacts to the connector terminals of series-connected cell string of the battery to force reverse current flow (charging) through the cell string (i.e. positive to positive and negative to negative). This voltage shall be applied for a minimum of 1.0 second. This test shall be conducted immediately following the battery closed-circuit voltage test. The amount of current flowing shall not exceed the amount specified. (see 3.5.5.2).

4.8.11 Jackets.

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4.8.11.1 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 3.5.6).

4.8.11.2. Jacket integrity (paperboard). Batteries shall be immersed to within 1/4 inch of the top of the jacket in water maintained at a temperature of +113±5°F for a period of 48 hours. The condition of the jacket and its seams shall be observed (see 3.5.6.2.1). This test is only to be conducted on paperboard jackets.

4.8.12 Cell lot test. Closed-circuit voltage test. All the cells in a cell lot shall be pulse tested for five (5) seconds at 1.5C amperes. Cell test capacity, C, shall be defined as the capacity in ampere-hours to 2.0 volts at the 24 hour rate. Any cell whose voltage falls below 2.0 volts during the 5 second pulse period shall be rejected for further cell lot testing (see 3.6.3).

4.8.12.1 Cell Series String Test. Upon assembly into a cell String each cell shall be pulse tested for five (5) seconds at 1.5C amperes. Cell test capacity, C, shall be defined as the capacity in amp-hours to 2.0 volts at the 24 hour rate. Any cell string whose voltage fall below 2.0 volts times the number of cells in series during the 5 second pulse period shall be rejected (see 3.6.4). The String may be retested upon repair.

4.8.13 Sulfur dioxide gas leakage test. At no time shall there be potting substances or cell jackets applied to the cells designed for this test. Each of the thirty (30) cells shall be weighed prior to and after filling with the electrolyte sulfur dioxide mixture. Each cell shall be weighed to the nearest tenth of a milligram and the weight recorded. The amount of sulfur dioxide shall be determined for each cell based on the percentage of sulfur dioxide used. The cells shall then be stored for one week (7 days) at +160°F. At the end of one week, the cells shall be removed from the temperature cabinet, placed in a desiccator, and cooled at room temperature for at least two hours. Each cell shall be weighed to the nearest tenth of a milligram. All cells shall be placed in the temperature cabinet and stored for three weeks (21 days) at +160°F. At the completion of this three week storage period, the cells shall be removed, placed in a desiccator and cooled for at least two hours at room temperature. Each cell shall be weighed to the nearest tenth of a milligram. The weight loss between day 7 and day 28 shall be recorded (see 3.8). The weight loss shall not exceed 0.005 per cent of the total sulfur dioxide weight. The solvent and the electrolyte salt weights shall not be used in this computation. If there are one or more failures the cell lot is rejected.

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4.8.13.1 Cell discharge test. Following the sulfur dioxide leakage test, the same thirty (30) cells used in the sulfur dioxide test shall be discharged at 70±5°F through the load and to end voltage in accordance with the individual specification sheet. There shall be at least a two (2) inch separation between all cells that are being discharged. Following capacity determination, the discharge shall continue to zero volts and into voltage reversal for the number of hours specified (see 3.1 and 3.8.1).

a. If all thirty (30) cell samples meet the requirements of 3.8.1 the cell lot may be used for fabrication of batteries.

b. If there are two (2) or more failures (delay, capacity, or venting) during the capacity testing of the thirty (30) cell sample the cell lot shall be rejected. If only one (1) failure occurs, another thirty (30) cell sample shall be selected from the same lot and this same test shall be repeated. If no failures occur during retesting, the cell lot shall be considered acceptable. If one (1) or more cells fail during retesting , the cell lot shall be rejected and a new lot of cells shall be submitted for cell lot inspection.

4.8.14 Flow or shrinking (insulating compounds) (see 3.4.2). Compounds shall be placed in a container, approximately 3 inches wide by 6 inches long by 3/4 inch high, to within 1/4 inch of the top. The temperature of the compound within the container shall be raised to +200±5°F and the container shall be held in an inverted position for 24 hours. Then the temperature of the compound shall be lowered to -40±5°F.

4.8.14.1 Quality conformance inspection of insulating material for electrical conducting wire. Quality conformance inspection shall be in accordance with MIL-I-631 (see 6.2).

4.8.15 Connector location. Connector location shall be verified by use of a mating connector mounted on a gauge.

4.8.16 High temperature switch test. This test shall be performed on switches or thermal fuses prior to installation in batteries. Test sample shall be placed in a temperature chamber at +175±5°F for a minimum of two hours. Each sample shall then be checked to verify that the switch or thermal fuse is closed. The temperature shall be raised to +190±5°F. After 45 minutes, each sample shall be checked to verify that the switch or thermal fuse is open. (see 3.5.5)

4.8.16.1 Sample size. The number of high temperature switches or thermal fuses tested per inspection battery lot shall equal the same number of batteries subjected to the "T" capacity test per inspection battery lot.

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4.8.16.2 Failure rate. The failure rate shall be the same as for the "T" capacity test in Table VIII.

4.8.17 Stoichiometric mole ratio. Stoichiometric mole ratio for lithium to sulfur dioxide shall be certified for first article inspection in the first article test report and for each inspection battery lot in the quality conformance test report. (see 3.13 and 6.2).

4.8.18 Intercell connections. Intercell connections shall be visually examined for conformance to 3.5.1.

4.8.18.1 Sample size. The number of batteries examined per inspection battery lot shall equal the same number of batteries subjected to the "T" capacity test per inspection battery lot.

4.8.18.2 Failure rate. The failure rate shall be the same as for the "T" capacity test in Table VIII.

4.8.19 Cell water content. Cell water content shall be certified for first article inspection in the first article test report and for each inspection battery lot in the quality conformance test report. (see 3.15 and 6.2).

4.8.20 Complete discharge device Resistor. Each battery shall have the value of the resistor to be used in the complete discharge device measured by applying a voltage and reading the resulting current prior to installation in the battery. (see 3.5.5.3).

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with Special Packaging Instruction AG00000066.

6. NOTES

6.1 Intended use. The primary batteries included are of the non-reserve type composed of electrochemical cells utilizing a lithium sulfur dioxide system. The lithium cell batteries are capable of storage and use under wide temperature ranges.

6.1.1 Indirect shipments. The packaging, packing and marking specified in Section 5 apply only to direct purchases by or direct shipment to the Government and are not intended to apply to contracts or orders between the supplier and prime contractor.

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6.2 Ordering data. Procurement documents should specify the following:

a. Title, number and date of this specification.

b. Applicable specification sheet (see Supplement 1).

c. Complete type designation (see 1.2.1).

d. Requirement for first article test plan and test report (see 4.6.2.1).

e. Requirement for maintaining manufacturing processes (see 3.5.8).

f. Requirement for certification of materials and processes (see 3.4,3.13)

g. Requirement for certification of stoichiometric mole ratio (see 3.13 and 4.8.17).

h. Requirement for certification of age of cells (see 3.5.2).

i. Requirement for contractor to state color jackets (see 3.5.6.2).

j. If rough handling tests are not required.

k. Requirement for certification of cell water content (see 3.15).

l. Requirement for certification of insulating material for electrically conducting wires (see 3.4.2.1 and 4.8.14.1).

m. Requirement for certification of operation of complete discharge device for production lots (see 3.5.5.3 and 4.8.10.2).

n. Level A or level B preservation and packing (see section 5).

o. When first article packaging inspection reports require Acquisition Activity approval prior to production unit packaging.

p. Requirement for certification of method of maintaining anode continuity.

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q. Requirement for certification of non-flammable and non-toxic materials.

r. Requirement for certification of high temperature switch operation (see 3.5.5 and 4.8.16).

6.3 First article. When a first article inspection is required, the item(s) should be a first article sample. The first article should consist of 86 or 91 unit(s). The contracting officer shall include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract."

6.4 Definitions.

6.4.1 Non-flammable and non-toxic materials. Non-flammable and non-toxic materials are those materials which will not support combustion, produce smoke, or be capable of emitting toxic fumes when subjected to the environmental conditions specified for the battery.

6.4.2 Inspection Battery Lot. A lot shall be defined as the quantity of batteries of any one type produced at any one place of manufacture on any one contract during a one month or less period, submitted at one time to quality conformance inspection.

6.4.3 Shipment lot. The shipment lot 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.

6.4.4 Contract lot. The contract lot 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.

6.5 International standardization agreement. Provisions of this specification are the subject of international standardization agreements. When amendment, revision, or cancellation of this specification is proposed, the departmental custodians will inform their respective Departmental Standardization Offices so that appropriate action may be taken respecting the international agreement concerned.

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6.6 Level B preservation. When level B preservation is specified, this level of protection will only be used under known favorable conditions during transportation, storage, and handling.

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

6.8 Subject term (key word listing).

Battery
Lithium
Non-rechargeable
Sulfur Dioxide

6.9 Changes from previous issue. Asterisks (or vertical lines) are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians
Army-ER

Preparing Activity
Army-ER
(Project 6135-A209)

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-B-49430B(ER)	Batteries, Non-Rechargeable, Lithium Sulfur Dioxide

3a. NAME OF SUBMITTING ORGANIZATION

b. ADDRESS *(Street, City, State, ZIP Code)*

4. TYPE OF ORGANIZATION *(Mark one)*

- ☐ VENDOR
- ☐ USER
- ☐ MANUFACTURER
- ☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*