

22 August 1984

MILITARY SPECIFICATION

This specification is approved for use by U.S. Army Electronics Research and Development Command, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

/ U

1.2.1.1 Component. Rechargeable batteries are identified by the two-letter symbol "BE" followed by a hyphen.

FSC 6140

MIL-B-55130A(ER)

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 three digit number.

1.2.1.3 Installation indicator. The installation indicator identifies the equipment the battery is used in; i.e., /TAS, 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. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed, that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

Federal

QQ-N-290 Nickel Plating Electrodeposited

Military

MIL-M-14 Molding Plastics & Molded Plastic Parts
 Thermosetting
 MIL-P-116 Preservation, Methods of
 MIL-M-13231 Marking of Electronic Items

STANDARD

Military

MIL-STD-105 Sampling Procedures and Tables for
 Inspection by Attributes
 MIL-STD-143 Standards and Specifications, Order of,
 Precedence For the Selection of
 MIL-STD-202 Test Methods for Electronic and Electrical
 Component Parts
 MIL-STD-454 Standard General Requirements for Electronic
 Equipment
 MIL-STD-810 Environmental Test Methods
 MIL-STD-889 Dissimilar Metals
 MIL-STD-45662 Calibration System Requirements

MIL-B-55130A(ER)

2.1.2 Other Government documents, drawings and publications. The following Government documents, drawings, and publications form a part of this specification to the extent specified herein.

SPI 1G00196 Special Packaging Instruction

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

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

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN TRUCKING ASSOCIATION

National Motor Freight Classification No. A-3 and No. 14

(Application for copies should be addressed to the American Trucking Association, 1424 16th Street, N.W., Washington, DC 20013).

ASSOCIATION OF AMERICAN RAILROADS

Uniform Freight Classification No. 4
Consolidated Freight Classification Rule No. 21

(Application for copies should be addressed to the Consolidated Classification Committee, 202 Union Station, Chicago, Illinois 60607).

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 the requirements of this specification and the applicable specification sheet, the latter shall govern.

MIL-B-55130A(ER)

3.1.1 Selection of specification and standards. Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143.

3.2 First Article requirements. The battery furnished under this specification shall be a product which has been tested and has passed the first article inspection and testing specified herein. When specified in the contract or purchase order, the contractor shall furnish first article units in accordance with 4.4.

3.3 Parts, materials, and processes. Parts, materials, and processes shall be such as to enable the battery to meet its performance and other requirements, as specified herein. Rating and derating values shall conform to Requirement 18 of MIL-STD-454. When deemed necessary by the government, certification from the source of the part, material, or component shall be required (see 4.3.1). When a definite material or component is specified, it shall be in accordance with the applicable specification, drawing or requirement listed in Table I.

3.3.1 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals shall not be employed in intimate contact with each other. Dissimilar metals are defined in MIL-STD-889; and shall meet Requirement 16 of MIL-STD-454.

TABLE I. Materials and Components

Materials or components	Requirements paragraphs	Inspection Method (See 4.5.1)
Case (Battery)	3.4.1	
Metals	3.9.1	4.8.1
Pressure Release Device (Cell)	3.4.3	4.10
Nickel Plating	QQ-N-290	

MIL-B-55130A(ER)

3.4 Visual and mechanical. Batteries shall meet all the requirements of this specification after inspection in accordance with the following paragraphs.

3.4.1 Battery case. The battery case shall be capable of maintaining the specified dimensions during the life of the battery. The battery case shall have a smooth finish free from pitting, cracks, rough spots, or other deformations. The case shall be fabricated of materials having sufficient strength to withstand deformation. The case shall be made of nickel-plated steel or equal.

3.4.1.1 Protective jacket. The metal battery case shall have a protective jacket which shall meet the requirements of 3.10.1 and shall be a minimum of 0.003 inches (.0762 mm) thick. The battery plus the protective jacket shall meet the dimensional requirements of the applicable specification sheets.

3.4.1.2 Color. The color of the battery jacket shall be white or as otherwise stated on the applicable specification sheet (3.1).

3.4.2 Terminals. The size and location of the terminals shall be specified in the applicable specification sheet (see 3.1). Contact surfaces of the terminals shall not be obstructed by insulating compounds.

3.4.2.1 Terminal seal. The seals between battery terminals and battery covers shall be so constructed that the batteries shall be capable of meeting the electrolyte leakage requirements and the cycle life requirements of the applicable specification sheet.

3.4.3 Resealable vent mechanism. A resealable vent mechanism shall be incorporated into each battery. This mechanism shall be designed to release below the bursting pressure of the case and above the normal operating pressure of the battery. The mechanism is intended to function only as an emergency release to protect the battery against abnormal pressure buildup (see 4.10).

3.4.4 Labels. Each battery shall have a label as specified on applicable specification sheets (See 3.1). Markings on the labels shall be in accordance with MIL-M-13231. There shall be no information on the label other than the following:

MIL-B-55130A(ER)

3.4.4.1 Identification label. The identification label shall show the following data:

BATTERY, RECHARGEABLE BB- 1/
 NICKEL CADMIUM SEALED
 (VOLTAGE) (CAPACITY AT)
 (NSN)
 (CONTRACT NUMBER)
 (DATE CODE)
 (MANUFACTURER)
 (LOCATION)

1/ The nomenclature of the battery required shall be placed here, such as Battery, Rechargeable, BB-412/U (see 6.3).

Example

BATTERY, RECHARGEABLE BB-412/U
 NICKEL CADMIUM SEALED
 1.20V 4.0 AH AT 0.80 AMPS
 NSN 6140-00-921-3670
 DAAB07-83=C-M122
 0583
 JOES BATTERY COMPANY
 POTTERSVILLE, NEW JERSEY

3.4.4.2 Date code. The code shown shall indicate the month and year of manufacture of the battery by means of a four-digit number in which the first two digits shall indicate the number of the month and the last two digits shall indicate the year. Months earlier than the tenth month shall be a single digit preceded by "0". When a battery is completed during the last three working days of the subsequent month, the manufacturer is permitted to use either month as the coded month of manufacture.

3.4.4.3 Charging and warning label. Each battery shall be furnished with complete instructions for charging of the battery. Instructions shall be

Charge at a constant current of (Amps or mA) for (hours).
 Temperature during charge should be between 40°F (5°C) and
 100°F (38°C). WARNING: DO NOT incinerate or mutilate
 battery.

The warning statement is considered part of the charging instruction.

MIL-B-55130A(ER)

3.4.4.4 Terminal marking. Positive terminals shall be identified by +. If space is available, negative terminals should be identified by -.

3.4.5 Cleaning.

3.4.5.1 Parts. After fabrication, parts shall be cleaned in accordance with good commercial practice. Cleaning processes shall have no deleterious effect. Corrosive material shall be removed completely.

3.4.5.2 Batteries. After assembly, batteries shall be cleaned thoroughly and shall be free from particles of foreign material.

3.4.6 Electrolyte leakage. There shall be no evidence of electrolyte leakage around the terminals or cover to case seal of any battery at any time prior to or during the performance of any of the tests specified in Section 4, except the internal pressure test (see 4.5.2.3).

3.5 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, in accordance with Requirement 9 of MIL-STD-454.

3.5.1 Parts, materials, and processes. All parts, materials and processes used in the fabrication of the batteries covered by this specification shall be of the proper grade for the purpose intended and shall not adversely affect the life of the battery.

3.5.2 Commercial parts. Commercial parts having suitable properties may be used where, on the date of invitation for bids, there are no suitable standard parts.

3.5.3 Standard parts. With the exceptions in Table I, MS and AN standard parts shall be used where they suit the purpose. They shall be identified on the drawings by their part numbers.

3.5.4 Materials conforming to contractors' specifications. Materials conforming to contractor's specifications may be used provided the specifications are approved by the Government and contain provisions for adequate tests. The use of the contractors' specifications will not constitute waiver or government inspection.

3.5.5 Welding. Welds shall conform to Requirement 24 of MIL-STD-454.

MIL-B-55130A(ER)

3.6 Dimensions and weights. The dimensions and weights of batteries shall be as shown on the applicable specification sheets. Dimensions shall be gauged or measured accurately to determine conformance.

3.7 Attitude. The battery shall be designed for operation in any position and shall meet the specified capacity, voltage and electrolyte leakage requirements specified herein.

3.8 Battery condition for shipping. The battery shall be furnished in the discharged state. For the purpose of shipping only, the battery may contain up to 10% of its rated capacity and still be considered discharged.

3.9 Chemical requirements.

3.9.1 Corrosion resistance. External metal parts of the battery shall show no evidence of cracking, pitting, chipping, scaling, corrosion or other deleterious effects after being tested as specified in 4.9.1.

3.10 Electrical requirements.

3.10.1 Insulation resistance. The insulation resistance between either terminals and the jacket shall not be less than 0.1 megohm when tested in accordance to 4.11.

3.10.2 Performance. The discharge current in amperes for each discharge shall be equal to the nominal rated capacity (C-rating) in ampere-hours multiplied by the rate factor shown in the applicable specification sheet. The temperature of discharge and the minimum end voltage shall be the value listed in the applicable specification sheet. Inability to meet the specified minimum requirements shall constitute a failure. Should the battery meet the test requirements, the specified test schedule shall be resumed.

3.11 Temperature requirements.

3.11.1 Operating. The battery shall meet the temperature performance requirements of the applicable specification sheet.

3.11.2 Non-operating. The battery shall show none of the defects listed in 3.12 when subjected to temperature shock in the range of 160°F (71°C) to -70°F (-57°C).

3.12 Environmental test requirements. The battery when subjected to tests listed in Table II shall show no:

- a. Dimensional distortion beyond specified limits.
- b. Sharp current or voltage fluctuations during any discharge period.
- c. Mechanical failure of any part.
- d. Electrolyte leakage.
- e. Diminution of the rated capacity specified in the applicable specification sheets, following the performance of each test.

MIL-B-55130A(ER)

TABLE II. Environmental test

Tests	Test paragraph
Temperature Shock	4.9.1
Mechanical Shock	4.9.2
Vibration	4.9.3
Overcharge	4.8.1.1

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

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

a. Inspections covered by subsidiary documents including components and materials inspection (see 4.3).

b. First article inspection (see 4.4).

c. Quality conformance inspection (see 4.5).

(1) Quality conformance inspection of equipment before packaging (see 4.5.1).

(2) Packaging inspection (see 4.5.5).

4.3 Inspections covered by subsidiary documents. Inspections required under the applicable subsidiary documents form part of the inspections required by this specification.

4.3.1 Samples of components and materials. For those items that are not referenced by a subsidiary specification, three samples of components and materials, treated and processed as they would be in the finished battery shall be inspected.

MIL-B-55130A(ER)

4.4 First article inspection. This inspection shall be performed by the contractor unless otherwise specified in the contract. It shall consist of inspection and testing specified in Table III and shall be performed in the order indicated. If a different test is indicated on the applicable specification sheet (see 3.1) perform that test in place of the established test. Production may start after the samples successfully completed the 196th cycle of the life cycle test. For batteries with cycle requirements less than 196 cycles, all the cycles must be completed prior to start of production.

4.4.1 First article compliance report. The contractor shall submit a compliance report with any battery type that is submitted for acceptance. The report, complete in detail, shall be submitted regardless of whether the tests to determine compliance with specification requirements are conducted at the contractors facilities, government facilities or independent facilities. The contractor's report shall indicate to what degree the equipment complies with each individual electrical, mechanical, or other specification requirement. The degree of compliance shall be expressed in the report by the use of the same terms as those used in the specification to express the requirement (see 6.7).

4.4.2 Sampling plan. Unless specified, the contractor shall furnish 12 first article samples selected at random of each battery type on order.

4.4.2.1 Cycling schedule. The samples (no. 9 thru 12) shall be given the life test of 4.8.6 at the start of the first article testing, and shall meet the capacity and number of cycles specified in the applicable specification sheet (see 3.1). However, see para 4.4 for special provisions regarding the number of cycles required to start production.

MIL-B-55130A(ER)

TABLE III. First article testing

Requirement paragraph	Inspection or test	Battery numbers	Inspection paragraph
3.4	Visual and mechanical	1 thru 12	4.5.2.2
3.6	Dimension and weight	1 thru 12	4.6.6
3.10.2	Charge	1 thru 12	4.8.1
3.10.1	Insulation resistance	1 thru 12	4.11
3.10.2	Initial capacity discharge	1 thru 12	4.8.2.1
3.10.2	Cycle life	9 thru 12	4.8.6
3.10.2;3.12	Overcharge	1 thru 4	4.8.1.1
3.10.2	Charge	4 thru 8	4.8.1
3.4.6	Electrolyte leakage	1 thru 8	4.5.2.3
3.10.2	Full capacity discharge	1 thru 8	4.8.2
3.10.2	Retention of charge	2,4,6,8	4.8.5
3.11.2	Temperature shock	2,4,6,8	4.9.1
3.11.1	Low temperature discharge	1,3,5,7	4.8.4
3.11.1	High temperature performance	1,3,5,7	4.9.4
3.10.2	Charge	1,3,5,7	4.8.1
3.12	Mechanical shock ^{1/}	1,3,5,7	4.9.2
3.12	Vibration ^{2/}	1,3,5,7	4.9.3
3.10.2	Charge	1,3,5,7	4.8.1
3.4.6	Electrolyte leakage	1,3,5,7	4.5.2.3
3.10.1	Full capacity discharge	1,3,5,7	4.8.2
3.10.2	High rate discharge	1 thru 8	4.8.3
3.4.3	Internal pressure	1 thru 8	4.10

1/ No discharge

2/ Discharge as specified in applicable specification sheets.

MIL-B-55130A(ER)

4.4.3 Definition of failure. The failure of a battery is defined as follows:

a. Failure to deliver the minimum electrical performance as specified in 3.10 and the applicable specification sheet.

b. Distortion, cracking or breakage which prevent the battery and any of its components from mating with a corresponding part or maintaining its electrical leak-proof requirements.

4.4.3.1 Degree of failure. The batteries shall be considered unacceptable if any of the sample batteries numbers 1-12 fail to pass the inspections of table III as specified in the applicable specification sheet.

4.4.3.2 Rework and retest provisions. Once a failure has occurred, no rerun can be made of that test on the same or a new sample from the same group of samples unless positive action consisting of design change, modification, or rework actually related to observed failures has been applied to the group. Any subsequent rerun must start at the beginning of the test in which the failure occurred provided aforementioned action will not affect any tests prior to the test in which the failure occurred.

4.5 Quality conformance inspection.

4.5.1 Inspection of product for packaging. Inspection of product for delivery shall consist of groups A, B and C inspections. This does not relieve the contractor of his responsibility for performing any additional inspection which is necessary to control the quality of the product and to assure compliance with all specification requirements. The government will review and evaluate the contractor's inspection procedures and examine the contractor's inspection records. In addition, the government at its discretion may perform all or any part of the specified inspection, to verify the contractor's compliance with specified requirements (see 6.5). Test equipment for government verification inspection shall be made available by the contractor.

4.5.2 Group A inspection. Each unit of each inspection lot shall be subjected to and meet the requirements of Tables IV and V utilizing inspection Level II of MIL-STD-105. Discrete lots shall be formed from units that pass this inspection. Factors of lot composition not defined herein or in the contract or purchase order shall be in accordance with MIL-STD-105. Group A inspection shall be performed in any order which is satisfactory to the government.

MIL-B-55130A(ER)

4.5.2.1 Disposition of group A samples. Unless otherwise specified, group A sample batteries shall be shipped and included in the quantity on order if they meet the necessary requirements.

TABLE IV - Group A inspection

Inspection	Req para.	Test para.	General Insp. Level	AQL
Visual & Mechanical	3.4	4.5.2.2	II	1%
Electrolyte leakage	3.4.6	4.5.2.3	II	1%

4.5.2.2 Visual and mechanical. Samples shall be examined to verify that the basic materials, component materials and parts, design and construction, marking and workmanship are in accordance with all the requirements of 3.4.

4.5.2.3 Electrolyte leakage. There shall be no visual evidence of a white (potassium carbonate) powder around the terminal seals of the battery. After each environmental test, the outside of each battery shall be rolled over on all sides on dry blotter paper. No wet spots shall appear on the blotter paper.

MIL-B-55130A(ER)

TABLE V. Classification of defects for batteries
in accordance with MIL-STD-105

Category	Defects	Method of Insp
Critical 001 002	Gross leakage Zero (0) voltage	Visual Voltmeter
Major 101 102 103 104 105 106 107 108 109	Contact surfaces obstructed by insulation compounds so that electrical use is affected. Pitting blow holes, or other imperfections in cell containers causing structural weakness. Improper assembly causing parts to be inoperable and unsafe in service. Weight not within specified limits. Location and polarity of terminals not as specified. Terminal markings, identification label and operating instructions not as specified. Terminal seal missing or defective which could cause electrolyte leakage. Corrosion which could cause mechanical, operational or electrical failure. Insulators or insulation missing or damaged as to cause electrical failure.	Visual Visual Visual Scale Scale Visual Visual Visual Visual
Minor 201 202 203 204	Deformation or damage which does not affect operation or use in service. Burrs or imperfections which do not interfere with proper use in operation, assembly or disassembly or cause an unsafe condition in service. Contact surfaces of the terminals obstructed by insulation compounds, but would not cause mechanical or electrical failure in service. Insulators or insulation damaged, but would not cause mechanical or electrical failure in service.	Visual Visual Visual Visual

MIL-B-55130A(ER)

4.5.3 Group B inspection. This inspection, including sampling, shall conform to Table VI and to the special procedures for small sample inspection of MIL-STD-105. The AQL's and inspection levels shall be as indicated in Table VI. Group B inspection shall normally be performed on lots that have passed Group A inspection and on samples selected from units that have been subjected to and met the Group A inspection. Samples for subgroup II may be selected from units that have passed subgroup I inspection.

4.5.3.1 Order of inspection within group B. Group B inspection shall be performed in that order shown in Table VI.

TABLE VI. Group B inspection

<u>Subgroup I</u>	AQL	Insp level	Req	Insp para
Dimensions & Weight	2.5%	S-3	3.6	4.6.6
Capacity Discharge	2.5%	S-3	3.10.2	4.8.2
<u>Subgroup II</u>				
Low Temperature	2.5%	S-2	3.10.2	4.8.4
High Rate	2.5%	S-2	3.10.2	4.8.3
Overcharge	2.5%	S-2	3.10.2	4.8.1.1

4.5.3.2 Disposition of conforming group B sample units. Unless otherwise specified, sample units which have been subjected to and passed Group B inspection may be shipped against the quantity on order provided any damage is repaired and the sample units are resubjected to and pass Group A inspection.

4.5.4 Group C inspection. This inspection shall consist of the tests listed in Table VII. Shipment of batteries shall not be made until subgroups I and II have met the required inspections and 28 cycles of the required number of cycles of subgroup II have been successfully completed. Inspection shall be performed in the order shown.

MIL-B-55130A(ER)

TABLE VII. Group C inspection

Inspection	Requirement paragraph	Test paragraph	Subgroups		
			I	II	III
Full Capacity Discharge	3.11	4.8.2	X	X	X
Retention of Charge	3.10.2	4.8.5	X		
Internal Pressure	3.5.4	4.10	X		
Cycle Life	3.10.2	4.8.6		X	
Temperature Shock	3.12	4.9.1			X
Vibration	3.12	4.9.3			X
Electrolyte Leakage	3.4.6	4.5.2.3		X	X

4.5.4.1 Sampling plan. Samples shall be selected for each subgroup (I,II,III) in accordance with Table VIII. The first samples shall be selected at the start of the contract from the first 10 percent of batteries produced on the contract; with the exception of contract lot sizes less than 10,000 batteries (see 4.5.4.1.1). These samples shall constitute the group C requirement for the first 10 percent of batteries produced. Shipment of batteries shall be withheld until subgroup I and III have met the requirements and subgroup II batteries have successfully completed a minimum of 28 of the required number of cycles (cycling shall be continued to completion). Thereafter, samples shall be selected at random for each subgroup (I,II,III) at the intervals specified in Table VIII. Shipment of batteries shall not be withheld pending results of these group C inspections.

4.5.4.1.1 Small contract lot size. For those contracts or purchase orders whose total quantity on order is 2,001 to 10,000 (excludes all samples), group C samples shall be selected at random from the entire production on the contract or purchase order; with the exception of the cycle life test which may be selected from the first 500 units produced.

4.5.4.1.2 Disposition of sample units. Sample units which have been subjected to the group C inspections in Table VII shall not be delivered on the contract or order.

4.5.4.2 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall notify the qualifying activity and the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which are manufactured under essentially the same materials and processes, and which are considered subject to the same failure. Acceptance and

MIL B-55130A(ER)

shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken. After the corrective action has been taken group C inspection shall be repeated on additional sample units (all tests and examinations, or the test which the original sample failed, at the option of the qualifying activity). Groups A and B inspections may be reinstituted; however, final acceptance and shipment shall be withheld until the group C inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the qualifying activity.

TABLE VIII. Group C sampling

Contract lot size	Total number of samples	Subgroups			Intervals (approx. % of production)
		I	II	III	
2000 or less	NA	NA	NA	NA	see 4.5.4
2001-6000	4	4	-	-	see 4.5.4.1.1
6001-10000	8	4	4	-	see 4.5.4.1.1
10001-30000	16	4	4	2	10%
		4	2	-	40-60%
30001-50000	24	4	4	4	10%
		4	2	-	20-40%
		4	2	-	50-80%
Over 50000	40	4	4	4	10%
		4	4	-	20-30%
		4	4	4	40-60%
		4	4	-	70-90%

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

- a. First Article Inspection of Packaging
- b. Quality Conformance Inspection of Packaging

4.5.5.1 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.

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

4.5.5.3 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.

MIL-B-55130A(ER)

4.5.5.4 Packing inspection. Inspection of packing and the marking for shipment and storage shall 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.

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 specifications	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

4.6 Inspection conditions and equipment.

4.6.1 Normal temperature. Unless otherwise specified herein, all measurements and tests shall be made at $73.4 \pm 9^{\circ}\text{F}$ ($23^{\circ} \pm 5^{\circ}\text{C}$) at ambient atmospheric pressure and relative humidity with a minimum storage time of 2 hours between charge and discharge except for cycle life test.

4.6.2 Low temperature. Low temperature charged storage and discharge tests shall be conducted at the temperature indicated in the applicable specification sheets, with a minimum storage time of 16 hours between charge and discharge. Tolerances of specified temperatures shall be kept with $\pm 2^{\circ}\text{F}$ ($\pm 1.1^{\circ}\text{C}$).

MIL-B-55130A(ER)

4.6.3 High temperature. High temperature charged storage and discharge tests shall be conducted at the temperature and for the length of time indicated in the applicable specification sheet. Tolerances of specified temperatures shall be kept within $\pm 2^{\circ}\text{F}$ ($\pm 1.1^{\circ}\text{C}$).

4.6.4 Test equipment and inspection facilities. Test equipment and inspection facilities shall be of sufficient accuracy, quality, and quantity to permit performance of the required inspection. The contractor shall establish and maintain a system for the calibration of all measuring and test equipment in accordance with MIL-STD-45662.

4.6.5 Instrument accuracy.

4.6.5.1 Electrical indicating instruments. All voltmeters and ammeters shall be accurate within ± 1 percent of the full scale reading. The range shall be such that the readings are taken on the upper half of the scale. Timers shall be accurate within ± 0.5 percent. The sensitivity of voltmeters shall be at least 1000 ohms per volt.

4.6.5.2 Resistor and current tolerances. In all tests involving discharge through a resistance, such resistance shall be accurate within ± 0.5 percent. During the charging and discharging of batteries, conducted at various rates specified herein, the current shall be maintained within a tolerance of ± 3 percent of the specified value.

4.6.5.3 Timing. The timing of discharges one minute or less shall be maintained within 5 percent. All others shall be accurate within 1 percent.

4.6.6 Dimensions and weight. The battery shall be weighed and measured for conformance to the requirements of the specification sheets. A gauge or other suitable measuring device shall be used to determine dimensional conformance.

4.7 Chemical tests.

4.7.1 Corrosion resistance. Samples of all metal parts of the battery shall comply with 3.9.1 after being subjected to salt spray test in accordance with Method 101 of MIL-STD-202 for a continuous period of 100 hours.

4.8 Electrical performance tests.

4.8.1 Charging. All batteries shall be charged by the constant current method at normal temperature conditions per 4.6.1 at the rates and for the length of time specified in the applicable paragraphs and specification sheet (see 3.1).

MIL-B-55130A(ER)

4.8.1.1 Overcharge. Batteries shall be charged per 4.6.1 at the rate specified in the applicable specification sheet for the specified number of hours. Voltage readings shall be recorded and meet the requirements of 3.12.b. The battery shall then be discharged and meet the overcharge test of the applicable specification sheets and the requirements of 3.12.

4.8.2 Full capacity discharge. After being charged in accordance with 4.8.1 the battery shall be stabilized per 4.6.1. It shall then be discharged per 4.6.1 at the rate specified on the applicable specification sheet to the specified final voltage, and meet full capacity discharge test of the applicable specification sheet.

4.8.2.1 Initial full capacity discharge. For initial full capacity discharge, the battery, when subjected to the test specified in 4.8.2 shall meet the performance specified in the applicable specification sheet within any one of the first three cycles. Any cycle in which less than initial full capacity is achieved is not counted as part of cycle life requirement.

4.8.3 High rate discharge.

- a. The battery shall be charged per 4.8.1 and stored under the specified temperature and storage conditions.
- b. The battery shall then be discharged at the rate specified in the applicable specification sheet.
- c. The following shall be recorded:
 - (1) The terminal voltage, 5 seconds after the state of discharge.
 - (2) The elapsed time for the voltage to drop to the final voltage specified on the specification sheet after the start of discharge. The battery shall meet high rate discharge test of the applicable specification sheet.

4.8.4 Low temperature discharge. Charge as specified in 4.8.1. The battery shall then be stored per 4.6.2. Discharge as specified at the low ambient temperature to the specified final voltage, and meet low temperature discharge test of the applicable specification sheet.

4.8.5 Retention of charge. The battery shall be charged as specified in 4.8.1. It shall then be stored under high temperature conditions (4.6.3) for the number of days specified in the applicable specification sheet and then returned to normal ambient temperature (4.6.1). It shall then be discharged at the rate specified on the applicable specification sheet to the specified final voltage and meet retention of charge test of the applicable specification sheet.

MIL-B-55130A(ER)

4.8.6 Cycle life test. The battery shall be tested as follows (4.6.1):

- a. Cycle 1 - Charge per 4.8.1, discharge at $0.28C_5$ for 2.25 hours.
- b. Cycles 2-26 - Charge at C/5 for 3.75 hours, discharge at $0.28C_5$ for 2.25 hours.
- c. Cycle 27 - Charge per b above. Discharge per 4.8.2.
- d. Cycle 28 - Charge per 4.8.1, discharge per 4.8.2.
- e. Check for electrical leakage (4.11).
- f. Repeat cycles 1-28 until any of the following conditions occur:
 - (1) The capacity on any 28th cycle is lower than that specified on the cycle life test of the applicable specification sheet (see 3.1).
 - (2) The battery fails to pass the leakage inspection of 4.5.2.3.
 - (3) The number of satisfactory cycles completed equals that specified on the applicable specification sheet.

4.9 Environmental tests.

4.9.1 Temperature shock. With the battery in a discharged condition, it shall be subjected to temperature shock per Method 503.1, Procedure 1 of MIL-STD-810 (3.9.2), except the temperature extremes shall be 160°F (71°C) to -70°F (-57°C). The battery shall be examined for breaks, cracks, or other defects resulting from this storage. The requirements of 3.12 shall be met.

4.9.2 Mechanical shock tests (see 3.12). The batteries in a charged condition shall be rigidly attached to the test carriage by the mounting screws and shock tested at 75g for 3 millisecond pulse duration in accordance with Test Method 516.2, Procedure 1, of MIL-STD-810. If the battery is rectangular shaped: 6 shocks - one per each face. If the battery is cylindrically shaped: 3 shocks - one per each end, and one per perpendicular to the center line axis.

4.9.3 Vibration (see 3.12). With the battery fully charged, it shall be tested in accordance with Method 201 for low frequency conditions and Method 204, Test Condition C, Part 2 only for high frequency conditions of MIL-STD-202, with the following exceptions:

MIL-B-55130A(ER)

- a. The battery may be vibrated in one direction through both low and high frequencies before being changed to the next direction on the vibration table.
- b. The low frequency vibration may be varied either uniformly or logarithmically between the limits of 10 and 55 cycles/second.
- c. The length of time for low frequency vibration in one direction shall be 90-100 minutes, (270-300 minutes for the complete test).
- d. The battery shall be discharged at the rate specified on the applicable specification sheet in each direction during the low frequency vibration and the discharge continued to the specified final voltage. The capacity specified in the applicable specification sheet shall be met (see 3.1).
- e. The voltage shall be recorded on a recording voltmeter during both high and low frequency vibration, and shall meet the requirements of 3.12.

4.9.4 High temperature performance. The fully discharged battery shall be soaked at 130°F (55°C) and shall be charged for 7 hours at the 0.2 C₅ ampere rate at 130°F (55°C). The battery shall be discharged at a 0.2 C₅ ampere rate at 55°C. The battery shall meet the requirements of the applicable specification sheets.

4.10 Internal pressure test (see 3.4.3) The battery shall be submersed in a clear non-corrosive, non-conducting liquid, (e.g., mineral oil), and reverse charged at the .05 C₅ rate until bubbles appear at the site of the vent relief device. The vent relief device shall release below the bursting point of the cover-to-case seal and the case.

4.11 Insulation resistance inspection (see 3.10.1) The insulation resistance shall be measured by applying a dc potential of 500 ± 20 volts between any two terminals not electrically connected and between all ungrounded terminals and the case jacket of the battery. The insulation resistance of a battery having a non-metallic case or covered with insulation material shall be measured by the use of a 1 inch square copper plate making electrical contact with the case. The plate shall be placed with the broad surface against any area of any surface of the case other than that on which the battery terminals are located.

MIL-B-55130A(ER)

5. PREPARATION FOR DELIVERY

5.1 Packaging requirements. The requirements for packaging shall be in accordance with SPI 1G00196.

5.2 Commercial trucking and rail. The handling and shipment of batteries shall be in accordance with the National Motor Freight Classification No. A-3 and No. 14 for commercial trucking, and the Uniform Freight Classification No. 4 and Consolidated Freight Classification Rule No. 21 for commercial railroad.

6. NOTES

6.1 Intended use. Battery, rechargeable sealed, nickel-cadmium is used in electronic and communications equipment, and for other power requirements.

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number, and date of this specification and any amendment thereto.
- b. Level A or B preservation and packing (see section 5).
- c. When first article inspection rough handling tests are not required.
- d. If first article inspection (see 3.2), first article test plans and test report(s) are required (see 4.4.1).
- e. If certification of parts, materials, or components are required (see 3.3).
- f. Actions required relative to group C inspection failure (see 4.5.4.2).

6.3 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.

6.4 Definitions.

6.4.1 Fully charged batteries. Batteries shall be considered fully charged when charged in accordance with 4.8.1.

6.4.2 Discharged batteries. Batteries shall be considered discharged when a specified discharge rate was conducted until a specified final voltage was reached. For shipping purposes only, the battery may retain up to 10% of its capacity.

MIL-B-55130A(ER)

6.4.2.1 Discharge rate. The rate of discharge is defined as:

$$I = \frac{1}{t} C_5$$

where I = current in amperes
 t = hourly rate of discharge
 C_5 = rated ampere hour capacity

For example, the expression for the five hour discharge current for a 25 ampere hour battery will be $I = \frac{1}{5} (25) = 5$ amperes.

6.4.3 Final voltage. The final voltage of the battery is the specified final voltage reached at the end of discharge.

6.4.4 Cycle. A cycle is a combination of a charge and a discharge.

6.4.5 Measured performance. The data obtained in conducting a test in accordance with Section 4 of this specification, such as capacity or cycle life, shall be known as the measured performance.

6.4.6 Specified performance. The numerical performance requirement specified in a specification sheet covering parameters such as voltage, capacity, cycle life, storage life, etc., shall be known as the specified performance.

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

6.6 Definition of lot size.

6.6.1 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 inspection lots, under the terms of any one contract.

6.6.2 Inspection lot. The inspection 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.

MIL-B-55130A(ER)

6.7 Test report data. The following requirements shall apply to First Article and Quality Conformance Test Reports:

"Whenever there is a service or ampere hour requirement, the following data shall be included:

Initial Open Circuit Voltage (IOCV)

Initial Closed Circuit Voltage (ICCV)

Initial Current Drain

Closed Circuit Voltage and Current shall be recorded at regular intervals. Interval shall be Service Requirement or shorter.

The time elapsed between ICCV and end voltage (EV).

Record how low a battery is discharged. Particularly whenever near zero volts."

Date and time of day that any portion of test is initiated shall be recorded in test report including initiation of soak at test temperature.

When a requirement limit is specified, a final quantitative figure shall be recorded.

6.8 International Standardization. Certain provisions of this specification are the subject of International Standardization Agreement OSTAG 315. 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.

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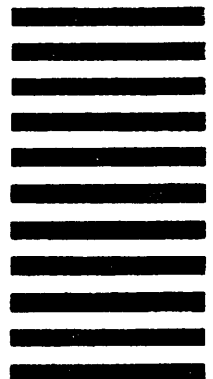
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