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SC - 5263 (Sp)

DEVELOPMENT SPECIFICATION
FOR THE
XMC-1092

DOC. DATE: MAY 2, 1958

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DATED 9-11-96

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38/64A E. I. Bruce, 1461
39/64A Paul Syroid, 1613
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41/64A E. A. Turner, 7422
42/64A R. C. Smelich, 2553-3
43,44/64A R. K. Smeltzer, 7221-3
45-64/64A Sandia Corporation Document Files

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SC-5263 (Sp)
Document Change #1
Insertion Page 2a
July 7, 1958

Listing of Pages Effective with Document Change #1

The following is a list of the page numbers and respective issue dates which are effective with Document Change #1 of this specification.

An issue date is not shown on any page of original issue.

Page No.	Issue Date
1	Original
2	Original
2a	7-7-58
3	7-7-58
4	Original
5	Original
6	Original
7	7-7-58
8	7-7-58
9	7-7-58
10	Original
11	7-7-58
12	7-7-58
13	7-7-58
14	Original

Changes from previous issue are flagged with an asterisk in the left margin on each page.

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SC-5263 (Sp)

DEVELOPMENT SPECIFICATION
FOR THE
* XMC-1092

1 PURPOSE AND CLASSIFICATION

*1.1 Purpose. -- This specification defines the requirements for development of a general purpose, dual voltage, low power thermal battery, capable of rapid activation.

2 APPLICABLE SPECIFICATIONS, OTHER PUBLICATIONS, AND DRAWINGS

2.1 Applicable Specifications. -- The following specifications of the issue and amendment designated (amendment number is given in parentheses after the specification designation) form a part of this specification to the extent indicated in the text and on the applicable Sandia Corporation drawings:

Federal Specifications		Custodian
QQ-Z-325	Zinc Plating (Electrodeposited)	Fed
QQ-P-416a	Plating, Cadmium (Electroplated)	Fed
QQ-S-571b	Solder, Soft (Tin, Tin-Lead, Lead-Silver)	Fed
Fed-Std-595	Colors: (for) Ready-Mixed Paints	Fed
Military Specifications		
MIL-C-490A	Cleaning and Preparation of Ferrous and Zinc Coated Surfaces for Organic Protective Coatings	Sh, MC, Or, Y
MIL-S-4456(USAF)	Shock, Variable Duration, Method and Apparatus for	USAF
MIL-F-4995(USAF)	Flux, Soldering	USAF
MIL-S-5002(2)	Surface Treatments (Except Priming and Painting) for Metal and Metal Parts in Aircraft	A
MIL-E-5272A	Environmental Testing, Aeronautical and Associated Equipment (General Specification for)	USAF, A, Or
MIL-S-6872A	Soldering Process, General Specification for	USAF, A, MC, Or
MIL-P-6889A(4)	Primer; Zinc Chromate, for Aircraft Use	A
MIL-B-7883(1)	Brazing of Steels, Copper, Copper Alloys, and Nickel Alloys	USAF,A,Or

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Procuring Agency Specifications		Custodian
400178	Electroplating, Gold	SC
400179	Electroplating, Silver	SC

2.2 Other Publications. -- The latest issues of the following publications form a part of this specification to the extent indicated in the text.

Publication	Custodian
USAF Specification Bulletin No. 23 - Material and Process Specifications	USAF
*ANA Bulletin No. 143d - Specifications and Standards; Use of	USAF

*Related bulletins ANA343d and ANA343i

2.3 Ordering Information. -- Copies of the specifications and publications listed above may be obtained from the custodians listed below. When ordering, give both title and number of the specification or publication and reference the prime contract number of the procuring agency.

Custodian Symbol	Name of Custodian	Address of Custodian
USAF	Air Force	Commanding General Wright Air Development Center Attn: WCXP Wright-Patterson Air Force Base Dayton, Ohio
A	Bureau of Aeronautics	Chief, Bureau of Aeronautics Technical Data Division Department of the Navy Washington 25, D. C.
Fed	Federal	General Service Administration Regional Office Building 7th and D Streets, S. W. Washington 25, D. C.
Sh	Bureau of Ships	Chief, Bureau of Ships Attn: Code 357 Department of the Navy Washington 25, D. C.
SC	Sandia Corporation	Sandia Corporation Publications Division Sandia Base Albuquerque, New Mexico

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Custodian Symbol	Name of Custodian	Address of Custodian
Or	Bureau of Ordnance	Chief, Bureau of Ordnance Attn: Chief Engineer (Rec) Department of the Navy Washington 25, D. C.
Y	Bureau of Yards and Docks	Chief, Bureau of Yards and Docks Attn: Code C-330 Department of the Navy Washington 25, D. C.

3 REQUIREMENTS

3.1 Precedence

3.1.1 Precedence of this Specification and Related Documents. -- Whenever their requirements are in conflict, this specification and related documents shall take precedence in the following order:

a. The contract
b. This specification
c. Procuring agency drawings
d. Applicable specifications and standards

3.1.2 Precedence of Standard Materials, Parts and Processes. -- Any material or process not covered herein shall conform with a specification listed in USAF Specification Bulletin No. 23. If the specifications listed in Bulletin No. 23 are not applicable, the material or process shall be selected in accordance with the order of precedence established by ANA Bulletin No. 143. Any standard part not covered herein shall be chosen to comply with specifications and standards selected in the order of precedence set forth in ANA Bulletin No. 143.

3.1.3 Precedence of Requirements of Military Organizations. -- When referenced government publications stipulate different requirements for several military organizations, the requirements of those organizations shall take precedence in the following order: U. S. Air Force, Bureau of Aeronautics, Bureau of Ordnance, U. S. Army Ordnance Department, Bureau of Ships, U. S. Army Signal Corps.

3.1.4 Requirements for Tests or Services. -- Whenever referenced government publications stipulate services to be performed by an agency other than Sandia Corporation, the assistance of Sandia Corporation in securing such service may be obtained.

3.2 Certification and Substitution

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3.3.4.1 Mechanical Strength. -- No assembly of soldered joints shall depend solely on soft solder for mechanical strength. Joints shall be mechanically secure before soldering, except when mechanically secure connection of small parts is impracticable.

3.3.4.2 Soft Solder. -- Soft solder shall be in accordance with QQ-S-571b, Composition Sn60 or Sn50. Compositions are indicated in the order of preference.

3.3.4.3 Solder Flux. -- Only rosin or rosin and alcohol, in accordance with MIL-F-4995, shall be used as a flux for soft soldering or for cleaning soldering irons.

3.3.5 Brazing. -- Brazing shall be in accordance with MIL-B-7883.

3.3.6 Welding. -- All welding shall be performed by qualified welders, skilled in the performance of the particular type of welding procedure on which they are employed. All welds shall be free of slag and foreign materials; weld metal shall be properly fused to base metal, all welds shall be cleaned. Automatic welding procedure shall be used where practical. Welding shall be such that it will meet the requirements of 3.5 under the conditions of 3.6. The supplier shall be responsible for the quality of the welding of his organization and for the welding of his subcontractors.

3.4 General Design

3.4.1 Battery Case. -- The battery shall be hermetically sealed in a metal can. The can shall be able to withstand, without gas leakage, any internal pressure developed within the battery. After activation, the battery shall not exceed the original dimensional tolerance by more than 2 per cent.

*3.4.2 Battery Terminals. -- Terminals shall be of compression type with glass-to-metal seals. The following terminals shall be placed in the battery header:

Three terminals for two squibs (one common terminal)
Two terminals for a monitoring circuit
One terminal for a +28-volt connection
One terminal for a +15-volt connection
One terminal for a common negative connection

No terminals shall be common with the can or header. A drawing showing header terminal arrangement and header dimensions will be furnished at a later date.

*3.4.3 Size, Shape, and Weight. -- The configuration of the can shall be that of a cylinder with a maximum diameter of two inches and a maximum length of 4-1/4 inches including terminals. Weight shall be kept at a minimum.

3.4.4 Safety. -- The battery shall be designed to provide maximum safety for maintenance and operating personnel.

3.5 Performance Requirements

MICROBEX CORRECTION GUIDE (M-9)

CORRECTION

The preceding document has been re-photographed to assure legibility and its image appears immediately hereafter.

BP 25010

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3.2.1 Certification. -- The supplier shall certify in writing to the Sandia Corporation that the materials, processes, and/or parts used in the assembly conform to the applicable specifications. Samples certified to be representative of the materials used in the battery and that are suitable for testing in accordance with the applicable specifications shall be furnished the Sandia Corporation upon request.

3.2.2 Substitution. -- No substitution for parts, materials, processes, or designs, called out herein and on applicable drawings, shall be made without the prior written approval of the Sandia Corporation. Requests for approval of substitutions shall provide evidence that the substitution is equal or superior to the specified item. The procuring agency may require samples from which the suitability of the substitution can be determined.

3.2.3 Additional Protection of Base Metals. -- Gold, nickel, chromium, rhodium, corrosion-resistant steel (12 per cent or more chromium), copper (normally), tin, lead-tin alloys, or sufficiently thick platings of these metals are satisfactory without additional protection or treatment other than buffing or cleaning.

3.3 Workmanship. -- Processing of materials or parts used in the battery shall be performed or supervised by workers skilled in the particular process. Processes which are used that are not covered herein shall conform with recognized practices associated with the highest quality of workmanship and product of the particular trade.

3.3.1 Forming of Parts. -- All methods of forming parts shall be such as to ensure the quality of performance required in 3.5 under the conditions of 3.6.

3.3.2 Finishes. -- External parts and parts not involved in the electrochemical reaction of the battery shall be resistant to corrosion; ie, there shall be no destructive corrosion of such parts after test in accordance with 4.3.5. Destructive corrosion shall be construed as being any type of corrosion which in any way interferes with mechanical and electrical performance. Bright finishes shall not be used on external surfaces. When cleaning operations on metal surfaces are not specified in detail, they shall be in accordance with commercial practices which will not cause subsequent destructive corrosion or affect activation of the battery.

3.3.3 Cleanup. -- The battery case shall be thoroughly cleaned of metal chips and other foreign material before final assembly. Burrs and unnecessary sharp edges shall be removed from all parts.

3.3.4 Soldering. -- Solder joints shall be such that both a positive electrical and a strong mechanical connection is assured. Soft soldering shall be done in accordance with MIL-S-6872, with the exception of the solder and flux limitations specified in 3.3.4.2 and 3.3.4.3.

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3.3.4.1 Mechanical Strength. -- No assembly of soldered joints shall depend solely on soft solder for mechanical strength. Joints shall be mechanically secure before soldering, except when mechanically secure connection of small parts is impracticable.

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3.4.4 Safety. -- The battery shall be designed to provide maximum safety for maintenance and operating personnel.

3.5 Performance Requirements

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*3.5.1 Voltage. -- The battery shall be a dual voltage battery consisting of a group of series connected cells for development of a nominal potential of 15 volts and a second electrically independent group of cells which shall develop a nominal 28 volts. The 15-volt section shall not fall below 12 volts after rise to nominal potential. The 28-volt section shall not exceed 32 volts at any time nor fall below 24 volts under steady load. A voltage of 20 volts or more shall be maintained on application of surge loads.

3.5.2 Activation. -- The battery shall be activated electrically by a 30,000 erg squib. Two squibs shall be used in each battery to ensure reliability. Both squibs shall be located adjacent to the negative end of the cell stack. In addition, the battery shall be mechanically activated by a percussion primer located in the bottom of the battery.

*3.5.3 Rise Time. -- The maximum time interval between activation of the primer or squib until the voltage at the 28-volt section terminals reaches 24 volts shall not be greater than 1.75 seconds under a 24-ohm load. The time interval for the 15-volt section to reach 12 volts under open circuit conditions shall not exceed 0.5 second.

*3.5.4 Load Requirements

*3.5.4.1 15-volt Section. The 15-volt section shall be capable of supplying a minimum of 5 amperes for 20 milliseconds during the application of each of the two .08-ohm loads.

*3.5.4.2 28-volt Section. -- The 28-volt section shall be capable of supplying a continuous current of 1 ampere at a voltage of not less than 24 volts for 100 seconds. In addition, the following pulses are required:

a. One 2-ohm surge for 10 milliseconds and one 4-ohm surge for 50 milliseconds at 4 seconds before the end of life.

b. One 2-ohm surge for 10 milliseconds and one 4-ohm surge for 50 milliseconds at the end of life.

*3.5.5 Activated Life. -- Activated life is defined as the total elapsed time between the moment of initiation of activation and the time at which, under steady load, the 28-volt section falls to 24 volts; or the 15-volt section, with open circuit, falls to 12 volts. The activated life shall not be less than 100 seconds for the 28-volt section nor less than 15 seconds for the 15-volt section.

3.6 Environmental Conditions. -- The assembly shall be designed to function as specified in 3.5 under the conditions defined in 3.6.1 after subjection to the conditions defined in 3.6.2.

3.6.1 Operating Environment

3.6.1.1 Temperature and Humidity

a. Temperatures from -65° to +85° F with relative humidities of 30 to 100 per cent (including condensation and frost conditions).

b. Temperatures between +85° and 160° F with relative humidities decreasing linearly from 30 per cent at 85° F to 5 per cent at 160° F.

c. Thermal shock caused by sudden variations between these temperature extremes is also required.

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3.6.1.2 Pressure

a. Any pressure from 30 to 2 inches mercury absolute at temperatures between -65° and 160°F for 20 hours.

b. Any pressure change between 2 and 29 inches mercury absolute occurring in one minute.

*3.6.1.3 Vibration. -- Vibrations in any direction at any temperature between -65° and 160°F in accordance with the following table:

Frequency range (cps)	Constant acceleration or double amplitude
10 - 23	1.0g
23 - 73.7	0.036 inch
73.7 - 500	20g

*3.6.1.4 Shock. -- The longitudinal (two directions) and transverse shock requirements are as follows:

	Longitudinal	Transverse
Rise Time	1 msec	2 msec
Peak value	2000g	2000g
Decay to plateau	10 msec	5 msec
Plateau value	500g	500g
Duration of plateau	40 msec	10 msec

3.6.1.5 Linear Acceleration. -- Accelerations up to 75g applied in any direction for five seconds while activated.

3.6.1.6 Explosive Atmosphere. -- Fumes of gasoline or other vapors in explosive proportions at any pressure or temperature listed in 3.6.1.

3.6.1.7 Spin. -- Spin in any direction with the unit mounted anywhere within a 4-inch radius of the center of spin as follows:

2 rps with the battery activated

3.6.2 Nonoperating Environment

3.6.2.1 Rain. -- Rainfall of approximately 4 inches per hour for a two-hour period.

3.6.2.2 Marine Atmosphere. -- Exposure and storage conditions generally encountered on a wharf or dock adjacent to a large body of salt water for six months.

3.6.2.4 Fungus. -- Tropical atmospheres containing fungus spores.

3.6.3 Storage Conditions. -- The assembly will be subjected to the following storage conditions. These conditions are included as information to be considered in the design. The tests in Section 4 will be considered adequate for this requirement.

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a. Storage for five years at temperatures ranging from +20° to +90°F and at relative humidities of less than 40 per cent.

b. Storage for six months at temperatures ranging from -80° to +160°F. Moisture conditions may consist of relative humidities ranging from 30 to 100 per cent and/or condensation between -80° and +85°F and relative humidities decreasing linearly from 30 per cent at +85°F to approximately 5 per cent at 160°F.

4 TESTS

4.1 General. -- The assembly shall be subjected to and shall meet the requirements of the tests specified below.

4.1.1 Test Facilities. -- Test equipment shall have accuracies commensurate with specified tolerances (normally 10 per cent of tolerance spread). Test chambers shall have a volume of at least twice that of the equipment being tested therein and shall be arranged so that a minimum of radiant heat or circulating air impinges directly on the equipment. Unless otherwise specified, tests shall be performed at room atmospheric conditions.

4.1.2 Tolerances on Environmental Conditions. -- Unless otherwise specified, environmental test conditions shall be held within the following limits:

Barometric pressure: ±0.2 inch of mercury

Temperature: ±5°F

Relative Humidity: ±5 percentage points

Vibration tolerance:

Acceleration or amplitude: ±10 per cent (shall approximate a sine wave)

Frequency: ±2 per cent

4.1.3 Stabilization. -- An acceptable method of temperature stabilization measurement is to locate a temperature indicating device at a point in the assembly which, in the design engineer's judgment, has the greatest heat lag. When the temperature of this point is within 2°F of the test chamber air temperature, the temperature of the assembly may be considered stable.

4.1.4 Test Records. -- Records shall be made of all specified measurements.

4.2 Basic Tests

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*4.2.1 Function. -- The battery shall be activated by means of a pulse of electrical current passing through one of the squibs or by striking the percussion primer. A square wave pulse of 580 milliamperes of 2 milliseconds duration passing through one of the squibs or a force of 20 inch-ounces applied to a primer firing pin with a .02 radius point shall activate the battery 100 per cent of the time. The battery shall be capable of supplying current to the following loads:

Time after activation (seconds)	15-volt section Load (ohms) (Note 1)	Duration of load	Minimum voltage
0.5 to 15	0.08	20 milliseconds	0.5
0.5 to 15	0.08	20 milliseconds	0.5
	28-volt section (Note 2)		
In circuit at activation	24 ohms	100 seconds	24
50	2 ohms	10 milliseconds	20
96	2 ohms	10 milliseconds	20
96	4 ohms	50 milliseconds	20
100	4 ohms	50 milliseconds	20

Note 1: Loads specified shall not be applied simultaneously.

Note 2: Pulse loads are in addition to the steady 24-ohm load.

*4.2.2 Insulation Resistance. -- When voltage of 500 ±50 volts DC is applied continuously for at least six seconds between the battery case and each power terminal, then between the case and the three squib terminals connected in parallel, and finally, between the case and both monitor terminals connected in parallel, the leakage current shall not exceed 2.5 milliamperes. Terminals not being tested shall be grounded to the case. This test shall be performed in an atmosphere where the relative humidity does not exceed 30 per cent.

4.3 Environmental Tests

4.3.1 High Temperature Test. -- The assembly shall be placed in a suitable chamber. The chamber temperature shall be raised to 160°F at a maximum relative humidity of 5 per cent. The temperature of the assembly shall be stabilized and maintained at this level for 50 hours. While at this temperature, it shall meet the requirements of 4.2.1.

4.3.2 Temperature Shock. -- The assembly shall be tested in accordance with MIL-E-5272A, Section 4.3.1, except that the high temperature shall be 160°F and the low temperature shall be -65°F. Upon completion of this test and within a period of one hour, the assembly shall meet the requirements of 4.2.1.

4.3.3 Humidity Test

4.3.3.1 Humidity Cycle. -- The assembly shall be placed in a suitable humidity chamber and subjected to ten humidity cycles with no lapse of time between cycles. While the assembly is in the chamber, the humidity shall be maintained at 90 to 98 per cent relative humidity throughout the following cycle:

a. The temperature shall be raised to 149°F within four hours and maintained at this point for eight hours.

b. The temperature shall then be reduced to 86°F within four hours and maintained at this point for 21 hours.

c. The temperature shall be reduced to 68°F within one hour and maintained at this point for four hours.

d. The temperature shall then be raised to 86°F within one hour and maintained at this point for five hours. Between the 43rd and 48th hours, the last cycle of the assembly shall meet the requirements of 4.2.1.

4.3.2 Vibration. -- The assembly shall be mounted in such a manner as to simulate service installation. The temperature of the assembly shall be stabilized before beginning tests. At the conclusion of these tests, visual inspection of the assembly shall reveal no damage which might ultimately result in malfunction, and the battery shall meet the requirements of 4.2.1.

4.3.2.1 Resonance

*4.3.2.1.1 Survey. -- Resonant conditions (frequency, amplitude, axis, temperature) shall be determined by vibrating the assembly along each of three mutually perpendicular axes at room temperature, at -65°F and 160°F, through a range of frequencies from 3 to 500 to 3 cps varied slowly at the following double amplitudes or accelerations.

Frequency range (cps)	Constant acceleration or double amplitude
10 - 23	1.0g
23 - 73.7	0.036 inch
73.7 - 500	20.0g

4.3.2.1.2 Vibration at Resonance. -- The assembly shall be vibrated at each resonant condition observed in 4.3.2.1.1. The period of vibration shall be 60 minutes for resonances occurring at room temperature and 15 minutes for resonances occurring at -65°F or 160°F. If more than one resonant frequency was encountered at the same temperature along one axis, the period of vibration as specified above for this temperature may be divided among the different frequencies or used to cover the frequency which caused the most severe resonance. The method considered most likely to produce failure should be selected.

4.3.2.2 Cycling. -- The assembly shall be vibrated through a frequency range of 10 to 500 to 10 cps in 15-minute cycles at an applied double amplitude of 0.036 inch in the frequency range of 10 to 73.7 cps and an applied constant acceleration of 20g in the 73.7 - 500 cps range, Vibration shall be applied along each of three mutually perpendicular axes for one hour at room temperature, 15 minutes at -65°F and 15 minutes at +160°F.

4.3.3 Acceleration and Shock. -- The assembly shall be mounted in such a manner as to simulate service mounting.

4.3.3.1 Linear Acceleration. -- The assembly shall be subjected to a constant acceleration of 75g for at least five seconds applied in both directions along each of three mutually perpendicular axes. The assembly shall meet the requirements of 4.2.1 after this test.

*4.3.3.1.1 Shock. -- The assembly shall be subjected to a 100g shock of 100 milliseconds duration applied in each direction along three mutually perpendicular axes, except that one shock 2000g for 15 milliseconds shall be applied along the longitudinal axis in a direction away from the terminals. Upon completion of the test, the assembly shall meet the requirements of 4.2.1.

4.3.4 Rain test. -- The assembly shall be tested in accordance with MIL-E-5272A, Section 4.10.1. At the end of the test period, it shall meet the requirements of 4.2.1.

4.3.5 Salt Spray. -- The assembly shall be tested in accordance with MIL-E-5272A, Section 4.6.1, for 50 hours. At the end of the test period, after removal of salt deposit and drying, it shall meet the requirements of 4.2.1.

4.3.6 Explosion-proof Test. -- The assembly shall be tested in accordance with MIL-E-5272A, Section 4.13.1 (operate in accordance with 4.2.1).

4.3.7 Radiation. -- The assembly shall be exposed to neutron radiation consisting of 1.5×10^{18} integrated dose per square centimeter.

The assembly shall meet the requirements of 4.2.1 after radiation exposure.

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5 PREPARATION FOR DELIVERY

5.1 Packaging. -- The battery shall be packaged to prevent damage in shipment by common carrier and ensure delivery in such a condition as to conform with all the requirements of this specification.

5.2 Marking. -- Each package shall be marked 'FRAGILE-HANDLE WITH CARE.'

6 NOTES

None.

Notice: When government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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SC-5263 (Sp)

DEVELOPMENT SPECIFICATION
FOR THE
XMC-584

1 PURPOSE AND CLASSIFICATION

1.1 Purpose. -- This specification defines the requirements for developments for a general purpose, 28-volt, low power thermal battery, capable of rapid activation.

2 APPLICABLE SPECIFICATIONS, OTHER PUBLICATIONS, AND DRAWINGS

2.1 Applicable Specifications. -- The following specifications of the issue and amendment designated (amendment number is given in parentheses after the specification designation) form a part of this specification to the extent indicated in the text and on the applicable Sandia Corporation drawings:

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Fed-Std-595	Colors: (for) Ready-Mixed Paints	Fed
	Military Specifications	
MIL-C-490A	Cleaning and Preparation of Ferrous and Zinc Coated Surfaces for Organic Protective Coatings	Sh, MC, Or, Y
MIL-S-4456(USAF)	Shock, Variable Duration, Method and Apparatus for	USAF
MIL-F-4995(USAF)	Flux, Soldering	USAF
MIL-S-5002(2)	Surface Treatments (Except Priming and Painting) for Metal and Metal Parts in Aircraft	A
MIL-E-5272A	Environmental Testing, Aeronautical and Associated Equipment (General Specification for)	USAF, A, Or
MIL-S-6872A	Soldering Process, General Specification for	USAF,A,MC,Or
MIL-P-6889A(4)	Primer; Zinc Chromate, for Aircraft Use	A
MIL-B-7883(1)	Brazing of Steels, Copper, Copper Alloys, and Nickel Alloys	USAF,A, Or

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400178	Electroplating, Gold	SC
400179	Electroplating, Silver	SC

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*ANA Bulletin No. 143d - Specifications and Standards; Use of	USAF

*Related bulletins ANA343d and ANA343i

2.3 Ordering Information. -- Copies of the specifications and publications listed above may be obtained from the custodians listed below. When ordering, give both title and number of the specification or publication and reference the prime contract number of the procuring agency.

Custodian Symbol	Name of Custodian	Address of Custodian
USAF	Air Force	Commanding General Wright Air Development Center Attn: WCXP Wright-Patterson Air Force Base Dayton, Ohio
A	Bureau of Aeronautics	Chief, Bureau of Aeronautics Technical Data Division Department of the Navy Washington 25, D. C.
Fed	Federal	General Service Administration Regional Office Building 7th and D Streets, S. W. Washington 25, D. C.
Sh	Bureau of Ships	Chief, Bureau of Ships Attn: Code 357 Department of the Navy Washington 25, D. C.
SC	Sandia Corporation	Sandia Corporation Publications Division Sandia Base Albuquerque, New Mexico

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3.3.4.1 Mechanical Strength. -- No assembly of soldered joints shall depend solely on soft solder for mechanical strength. Joints shall be mechanically secure before soldering, except when mechanically secure connection of small parts is impracticable.

3.3.4.2 Soft Solder. -- Soft solder shall be in accordance with QQ-S-571b, Composition Sn60 or Sn50. Compositions are indicated in the order of preference.

3.3.4.3 Solder Flux. -- Only rosin or rosin and alcohol, in accordance with MIL-F-4995, shall be used as a flux for soft soldering or for cleaning soldering irons.

3.3.5 Brazing. -- Brazing shall be in accordance with MIL-B-7883.

3.3.6 Welding. -- All welding shall be performed by qualified welders, skilled in the performance of the particular type of welding procedure on which they are employed. All welds shall be free of slag and foreign materials; weld metal shall be properly fused to base metal, all welds shall be cleaned. Automatic welding procedure shall be used where practical. Welding shall be such that it will meet the requirements of 3.5 under the conditions of 3.6. The supplier shall be responsible for the quality of the welding of his organization and for the welding of his subcontractors.

3.4 General Design

3.4.1 Battery Case -- The battery shall be hermetically sealed in a metal can. The can shall be able to withstand, without gas leakage, any internal pressure developed within the battery. After activation, the battery shall not exceed the original dimensional tolerance by more than 2 per cent.

3.4.2 Battery Terminals -- Terminals shall be of the compression type, glass-to-metal seals. Four squib terminals and the positive and negative terminals shall be placed at the top of the battery (header). No terminals shall be common with the can or header. A header drawing showing terminal arrangement and dimensions shall be furnished at a later date.

3.4.3 Size, Shape and Weight -- The configuration of the can shall be that of a cylinder of 1.75 inches in diameter and 2.75 inches in height. A drawing will be furnished at a later date. Weight shall be kept at a minimum.

3.4.4 Safety -- The battery shall be designed to provide maximum safety for maintenance and operating personnel.

3.5 Performance Requirements

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3.5.1 Voltage -- The nominal voltage shall be 28. The maximum open circuit voltage shall not be more than 32. The voltage on surge shall not fall below 15 volts. (This does not apply if the load is applied during battery rise.)

3.5.2 Activation. -- The battery shall be activated electrically by a 30,000 erg squib. Two squibs shall be used in each battery to ensure reliability. Both squibs shall be located adjacent to the negative end of the cell stack. In addition, the battery shall be mechanically activated by a percussion primer located in the bottom of the battery.

3.5.3 Rise Time -- The maximum time interval between activation of the primer or match until the voltage at the battery terminals reaches 24 volts shall not be greater than 0.50 second with a 24-ohm load on the battery. With a 1.2-ohm load on the battery at activation, this time interval to a voltage of 5 volts shall not exceed 0.75 second.

3.5.4 Load Requirements. -- The battery shall be capable of delivering a continuous current of one ampere after the rise time interval until the end of battery life.

3.5.5 Activated Life -- Activated life is defined as the total elapsed time between the moment of initiation of activation and the time at which, under steady load, the voltage falls to 24 volts. The activated life shall not be less than 90 seconds.

3.6 Environmental Conditions. -- The assembly shall be designed to function as specified in 3.5 under the conditions defined in 3.6.1 after subjection to the conditions defined in 3.6.2.

3.6.1 Operating Environment

3.6.1.1 Temperature and Humidity

a. Temperatures from -65° to +85°F with relative humidities of 30 to 100 per cent (including condensation and frost conditions).

b. Temperatures between +85° and 160°F with relative humidities decreasing linearly from 30 per cent at 85°F to 5 per cent at 160°F.

c. Thermal shock caused by sudden variations between these temperature extremes is also required.

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3.6.1.2 Pressure

a. Any pressure from 30 to 2 inches mercury absolute at temperatures between -65° and 160°F for 20 hours.

b. Any pressure change between 2 and 29 inches mercury absolute occurring in one minute.

3.6.1.3 Vibration. -- Vibrations in any direction at any temperature between -65° and 160°F in accordance with the following table:

Frequency range (cps)	Constant acceleration or double amplitude
3 - 4.5	1.0 inch
4.5 - 23	1.0g
23 - 73.7	0.036 inch
73.7 - 500	20g

3.6.1.4 Shock. -- Shock loads up to 2000g for 15 milliseconds duration, applied along the longitudinal axis while in the unactivated condition. Shock loads of 200g of 50 milliseconds duration in any direction while activated.

3.6.1.5 Linear Acceleration. -- Accelerations up to 75g applied in any direction for five seconds while activated.

3.6.1.6 Explosive Atmosphere. -- Fumes of gasoline or other vapors in explosive proportions at any pressure or temperature listed in 3.6.1.

3.6.1.7 Spin. -- Spin in any direction with the unit mounted anywhere within a 4-inch radius of the center of spin as follows:

2 rps with the battery activated

3.6.2 Nonoperating Environment

3.6.2.1 Rain. -- Rainfall of approximately 4 inches per hour for a two-hour period.

3.6.2.2 Marine Atmosphere. -- Exposure and storage conditions generally encountered on a wharf or dock adjacent to a large body of salt water for six months.

3.6.2.4 Fungus. -- Tropical atmospheres containing fungus spores.

3.6.3 Storage Conditions. -- The assembly will be subjected to the following storage conditions. These conditions are included as information to be considered in the design. The tests in Section 4 will be considered adequate for this requirement.

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a. Storage for five years at temperatures ranging from +20° to +90°F and at relative humidities of less than 40 per cent.

b. Storage for six months at temperatures ranging from -80° to +160°F. Moisture conditions may consist of relative humidities ranging from 30 to 100 per cent and/or condensation between -80° and +85°F and relative humidities decreasing linearly from 30 per cent at +85°F to approximately 5 per cent at 160°F.

4 TESTS

4.1 General. -- The assembly shall be subjected to and shall meet the requirements of the tests specified below.

4.1.1 Test Facilities. -- Test equipment shall have accuracies commensurate with specified tolerances (normally 10 per cent of tolerance spread). Test chambers shall have a volume of at least twice that of the equipment being tested therein and shall be arranged so that a minimum of radiant heat or circulating air impinges directly on the equipment. Unless otherwise specified, tests shall be performed at room atmospheric conditions.

4.1.2 Tolerances on Environmental Conditions. -- Unless otherwise specified, environmental test conditions shall be held within the following limits:

Barometric pressure: ±0.2 inch of mercury

Temperature: ±5°F

Relative Humidity: ±5 percentage points

Vibration tolerance:

Acceleration or amplitude: ±10 per cent (shall approximate a sine wave)

Frequency: ±2 per cent

4.1.3 Stabilization. -- An acceptable method of temperature stabilization measurement is to locate a temperature indicating device at a point in the assembly which, in the design engineer's judgment, has the greatest heat lag. When the temperature of this point is within 2°F of the test chamber air temperature, the temperature of the assembly may be considered stable.

4.1.4 Test Records. -- Records shall be made of all specified measurements.

4.2 Basic Tests

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4.2.1 Function. -- The battery shall be activated by means of a pulse of electrical current passed through one of the squibs. A square wave pulse of 580 milliamperes of 2 milliseconds duration shall activate the battery 100 per cent of the time. The battery shall be capable of supplying current to the following load:

Time after activation (seconds)	Load (ohms)	Duration of load	Minimum voltage
0.50	24	90.0 seconds	24
12	4	20 milliseconds	20

NOTE: Loads are paralleled.

4.2.2 Insulation Resistance. -- A voltage of 500 ±50 volts DC shall be applied continuously for at least six seconds between the battery case and each power terminal, then between the case and both terminals of each squib connected in parallel. During high potential testing, the terminals not being tested shall be grounded to the case. Leakage current shall not exceed 2.5 milliamperes. The test shall be performed in an atmosphere whose relative humidity does not exceed 30 per cent.

4.3 Environmental Tests

4.3.1 High Temperature Test. -- The assembly shall be placed in a suitable chamber. The chamber temperature shall be raised to 160°F at a maximum relative humidity of 5 per cent. The temperature of the assembly shall be stabilized and maintained at this level for 50 hours. While at this temperature, it shall meet the requirements of 4.2.1.

4.3.2 Temperature Shock. -- The assembly shall be tested in accordance with MIL-E-5272A, Section 4.3.1, except that the high temperature shall be 160°F and the low temperature shall be -65°F. Upon completion of this test and within a period of one hour, the assembly shall meet the requirements of 4.2.1.

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4.3.3 Humidity Test

4.3.3.1 Humidity Cycle. — The assembly shall be placed in a suitable humidity chamber and subjected to ten humidity cycles with no lapse of time between cycles. While the assembly is in the chamber, the humidity shall be maintained at 90 to 98 per cent relative humidity throughout the following cycle:

a. The temperature shall be raised to 149°F within four hours and maintained at this point for eight hours.

b. The temperature shall then be reduced to 86°F within four hours and maintained at this point for 21 hours.

c. The temperature shall be reduced to 68°F within one hour and maintained at this point for four hours.

d. The temperature shall then be raised to 86°F within one hour and maintained at this point for five hours. Between the 43rd and 48th hours, the last cycle of the assembly shall meet the requirements of 4.2.1.

4.3.2 Vibration. — The assembly shall be mounted in such a manner as to simulate service installation. The temperature of the assembly shall be stabilized before beginning tests. At the conclusion of these tests, visual inspection of the assembly shall reveal no damage which might ultimately result in malfunction, and the battery shall meet the requirements of 4.2.1.

4.3.2.1 Resonance

4.3.2.1.1 Survey. -- Resonant conditions (frequency, amplitude, axis, temperature) shall be determined by vibrating the assembly along each of three mutually perpendicular axes at room temperature, at -65°F and 160°F, through a range of frequencies from 3 to 500 to 3 cps varied slowly at the following double amplitudes or accelerations.

Frequency range (cps)	Constant acceleration or double amplitude
3 - 4.5	1.0 inch
4.5 - 23	1.0g
23 - 73.7	0.036 inch
73.7 - 500	20.0g

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4.3.2.1.2 Vibration at Resonance. -- The assembly shall be vibrated at each resonant condition observed in 4.3.2.1.1. The period of vibration shall be 60 minutes for resonances occurring at room temperature and 15 minutes for resonances occurring at -65°F or 160°F. If more than one resonant frequency was encountered at the same temperature along one axis, the period of vibration as specified above for this temperature may be divided among the different frequencies or used to cover the frequency which caused the most severe resonance. The method considered most likely to produce failure should be selected.

4.3.2.2 Cycling. -- The assembly shall be vibrated through a frequency range of 10 to 500 to 10 cps in 15-minute cycles at an applied double amplitude of 0.036 inch in the frequency range of 10 to 73.7 cps and an applied constant acceleration of 20g in the 73.7 - 500 cps range. Vibration shall be applied along each of three mutually perpendicular axes for one hour at room temperature, 15 minutes at -65°F and 15 minutes at +160°F.

4.3.3 Acceleration and Shock. -- The assembly shall be mounted in such a manner as to simulate service mounting.

4.3.3.1 Linear Acceleration. -- The assembly shall be subjected to a constant acceleration of 75g for at least five seconds applied in both directions along each of three mutually perpendicular axes. The assembly shall meet the requirements of 4.2.1 after this test.

4.3.3.1.1 Shock. -- The assembly shall be subjected to a 200g shock of 50 milliseconds duration applied in each direction along three mutually perpendicular axes, except that one shock 2000g for 15 milliseconds shall be applied along the longitudinal axis in a direction away from the terminals. Upon completion of the test, the assembly shall meet the requirements of 4.2.1.

4.3.4 Rain test. -- The assembly shall be tested in accordance with MIL-E-5272A, Section 4.10.1. At the end of the test period, it shall meet the requirements of 4.2.1.

4.3.5 Salt Spray. -- The assembly shall be tested in accordance with MIL-E-5272A, Section 4.6.1, for 50 hours. At the end of the test period, after removal of salt deposit and drying, it shall meet the requirements of 4.2.1.

4.3.6 Explosion-proof Test. -- The assembly shall be tested in accordance with MIL-E-5272A, Section 4.13.1 (operate in accordance with 4.2.1).

4.3.7 Radiation. -- The assembly shall be exposed to neutron radiation consisting of 1.5×10^{18} integrated dose per square centimeter.

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5 PREPARATION FOR DELIVERY

5.1 Packaging. -- The battery shall be packaged to prevent damage in shipment by common carrier and ensure delivery in such a condition as to conform with all the requirements of this specification.

5.2 Marking. -- Each package shall be marked 'FRAGILE-HANDLE WITH CARE.'

6 NOTES

None.

Notice: When government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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