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MAY 24 1965 WS

DEVELOPMENT SPECIFICATION FOR A PULSE-TYPE THERMAL BATTERY

MAY 10, 1957

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW

1st Review Date: 10-14-96
Authority: ☐ ADC ☒ ADD
Name: W. Layne

2nd Review Date: 10/30/96
Authority: ADD
Name: R.T. Duff

Determination (Circle Numbers):
1. Classification Retained
2. Classification Changed to: U
3. Contains No DOE Classified Information
4. Coordinate With:
5. Contains UCNI?
6. Comments: THERMOBATTERY NOT CLASS.

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
DECLASSIFICATION STAMP

Emelda Selph 11-25-96
PERSON MARKING DOCUMENT

W C Layne 11-26-96
PERSON VERIFYING MARKING & DATE

AUTHORITY: R.T. Duff
RECORD ID: 97SW032
DATED: 10/30/96

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Document Change #4
Replacement Page 2a
October 12, 1960

Listing of Pages Effective with Document Change #4

The following is a list of the page numbers and respective issue dates which are effective with Document Change #4 of this specification.

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

Page No.	Issue Date
1	Original
2	Original
2a	October 12, 1960
3	April 7, 1959
4	April 7, 1959
5	Original
6	Original
7	April 7, 1959 — To page 7
8	October 12, 1960
8a	October 12, 1960
9	January 15, 1960
10	January 15, 1960
11	January 15, 1960
12	January 15, 1960
13	January 15, 1960

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

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Page 2a

SC-5248 (Sp)
Document Change #1
Replacement Page 3
April 7, 1959

DEVELOPMENT SPECIFICATION
FOR
A PULSE-TYPE THERMAL BATTERY

1 PURPOSE AND CLASSIFICATION

1.1 Purpose. -- This specification defines the requirements for a rapidly activating, high discharge rate, short life thermal battery which is to be used for squib activation.

1.2 Classification. -- The classification of this specification is CONFIDENTIAL DI.

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-P-416a	Plating, Cadmium (Electroplated)	Fed
QQ-S-571c	Solder, Soft (Tin, Tin-Lead, Lead-Silver)	Fed
Fed-Std-595	Colors: (for) Ready-Mixed Paints	Fed

	Military Specifications	Custodian
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-005272B (USAF)	Environmental Testing, Aeronautical and Associated Equipment (General Specification for)	USAF
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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Sandia Corporation Specifications		Custodian
400185	Electroplating, Gold	SC
400186	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 ANA 343j	

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.
O	Ordnance Corps	Office, Chief of Ordnance Department of the Army Washington 25, D.C.
Sh	Bureau of Ships	Chief, Bureau of Ships Attn: Code 357 Department of the Navy Washington 25, D.C.

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Custodian Symbol	Name of Custodian	Address of Custodian
SC	Sandia Corporation	Sandia Corporation Attn: Purchasing Agent Sandia Base Albuquerque, New Mexico
Sig	Signal Corps	Commanding Officer Signal Corps Supply Agency Attn: Technical Records Branch 225 South 18th Street Philadelphia 3, Pennsylvania
Or	Bureau of Ordnance	Chief, Bureau of Ordnance Attn: Chief Engineer (Rec) Department of the Navy Washington 25, D. C.
S	Bureau of Supplies and Accounts	Chief, Bureau of Supplies and Accounts Attn: Code S-33 Department of the Navy Washington 25, D. C.
MC	Marine Corps	Commandant, U. S. Marine Corps Code CSG Headquarters, U. S. Marine Corps 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.
Q	Quartermaster Corps	Commanding General Philadelphia Quartermaster Depot 2800 South 20th Street Philadelphia 45, Pennsylvania

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 services may be obtained.

3.2 Certification and Substitution

3.2.1 Certification. -- The contractor 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 pulse-type thermal 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.

3.3 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.

Page 7 missing

Address

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3.4.1 Battery Case. -- The battery shall be hermetically sealed in a metal can. The can must be able to withstand any internal pressure developed within the battery. After activation, the battery shall not exceed the original dimensional tolerance. The battery case shall be electrically isolated from all battery terminals.

*3.4.2 Battery Connector. -- The battery connector specified in SK9(1432)26888 shall be used. The lugs on the battery end may require modification.

The pin connections shall be:

A and B. Match No. 1
C. Battery Positive
D and E. Monitor
F. Battery Negative
A and G. Match No. 2

*3.4.3 Size, Shape, and Weight. -- Maximum dimensions of the battery shall not exceed 2-1/2" x 1" x 1-1/4". Weight shall be kept at a minimum.

3.4.4 Mounting. -- Provision shall be made for mounting the battery to a flat metal surface.

3.4.5 Monitor. -- Provisions shall be made for monitoring the battery which shall give positive electrical indication of battery firing. The resistance of the monitor circuit before firing shall be less than 1 ohm. The resistance shall change to 30K ohms or greater within 30 seconds after firing.

3.5 Performance Requirements

*3.5.1 Voltage Regulation

a. Minimum voltage at 150 milliseconds -- 3.0 volts.
b. Minimum voltage from 150 to 600 milliseconds -- 18.0 volts.
c. Voltage from 600 to 750 milliseconds shall be between 14.5 and 20.0 volts.

3.5.2 Activation. -- The battery shall be activated electrically by either of two igniters employing 4-5 ohms, 30,000 erg bridge wires. No igniter shall fire with 100 ma input; each igniter must fire with a 580 ma, 2 millisecond pulse.

3.5.3 Rise Time. -- The maximum time interval between power application to the igniter until a potential of 3.0 volts is reached at the battery output terminals while the battery is under a load of .5 ohm shall not exceed 0.15 second.

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*3.5.4 Activated Life. -- The activated life of the MC-1192 shall be 750 milliseconds minimum measured from the time of activation to that time when the voltage in decline drops to 14.5 volts under the load specified in paragraph 3.5.5.

*3.5.5 Load Requirements. -- The MC-1192 shall meet the performance requirements under the following load conditions. The resistance load specified is measured from the power terminals.

a. .5 ohm for 150 milliseconds.
b. Open circuit from 150 to 600 milliseconds.
c. 5.0 ohms from 600 milliseconds to end of activated life.

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3.6 Environmental Conditions. -- The battery shall be designed to function as specified in 3.5 under the operating conditions described in 3.6.1 after subjection to the conditions of 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. Temperature between +85° F and 165° F with relative humidities decreasing linearly from 30 per cent at 85° to 5 per cent at 165° F.

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

*3.6.1.2 Pressure

a. Any pressure from 30 to 2 inches mercury absolute at temperature between -65° and 165° F for 20 hours.

b. Any pressure change beween 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 165° F in accordance with the following table.

Frequency range (cps)	Constant acceleration or double amplitude
10 - 73.7	.072 inch
73.7 - 2000	20g

3.6.1.4 Shock. -- Shock loads of 100g of 50 milliseconds duration in any direction while activated.

3.6.1.5 Linear Acceleration. -- Accelerations up to 15g applied in a direction perpendicular to longitudinal axis of the battery 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.

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3.6.2.2 Marine Atmosphere. — Exposure and storage conditions generally encountered on a wharf or dock near a large body of salt water for a period of 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. Tests in Section 4 will be considered adequate for this requirement.

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 +165°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:	±10 per cent (shall approximate
Acceleration or amplitude	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.

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4.2 Basic Tests

*4.2.1 Function. -- The battery shall be capable of activating ten 4-5 ohm electric matches (SA-586 low energy match), connected in parallel, at any time during the required battery life.

*4.2.1.1 Reliability. -- The failure probability of a single channel unit is not to exceed 1/200.

*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 igniter 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 165°F at a maximum relative humidity of 5 per cent. The temperature of the assembly shall be stabilized and maintained at this level for 10 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-005272B, Section 4.3.1; except that the high temperature shall be 165°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.

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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.

4.3.3.2 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.

4.3.3.2.1 Resonance

4.3.3.2.1.1 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 at 165°F, through a range of frequencies from 10 to 2000 to 10 cps, varied slowly at the following double amplitudes or accelerations.

Frequency range (cps)	Constant acceleration or double amplitude
10-73.7	.072 inch
73.7-2000	20g

4.3.3.2.1.2 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 200°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.

*4.3.3.2.2 Cycling. -- The assembly shall be vibrated through a frequency range of 10 to 2000 to 10 cps in 15-minute cycles at an applied double amplitude of 0.072 inch in the frequency range of 10 to 73.7 cps and an applied constant acceleration of 20g in the 73.7 to 2000 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 165°F.

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

4.3.4.1 Linear Acceleration. -- The assembly shall be subjected to a constant acceleration of 15g 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.

4.3.4.1.1 Shock. -- The assembly shall be subjected to a 100g shock of 50 milliseconds duration applied in each direction along three mutually perpendicular axes. Upon completion of the test, the assembly shall meet the requirements of 4.2.1.

4.3.5 Rain Test.-- The assembly shall be tested in accordance with MIL-E-005272B, Section 4.10.1. At the end of the test period, it shall meet the requirements of 4.2.1.

4.3.6 Salt Spray. -- The assembly shall be tested in accordance with MIL-E-005272B, 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.

4.3.7 Radiation. -- The assembly shall be radiation resistant.

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 1003-A (6-57)

SANDIA CORPORATION
Sandia Base, Albuquerque, New Mexico
REVISION TRANSMITTAL SHEET
FOR
[redacted]

TO: Mavis Randle - 4721-2 5-7-59

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SIGNATURE OF PERSON WITNESSING DESTRUCTION

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SC 1003-E (4-54)

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3	2, 8, 9-12			9/9/60	[illegible]	
4	2a, 8 8a		2a, 8	10-21-60	[illegible]	

SC 1003-A (11-54)

1921

SANDIA CORPORATION

SANDIA BASE, ALBUQUERQUE, NEW MEXICO

7-17-59

REVISION TRANSMITTAL SHEET

FOR

[redacted]

TO: M. Randle - 4721-2

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Signature Lee Graham Date 7/20/59

Maxine Randle

SIGNATURE OF PERSON WITNESSING DESTRUCTION

Return signed original to Section ~~2444-2~~ 4766-1

SC 1003-A (7-60)

SANDIA CORPORATION
Sandia Base, Albuquerque, New Mexico
CHANGE TRANSMITTAL SHEET
FOR
[redacted]

1922

TO: MAVIS RANDLE - 3421-2

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Signature [signature] Date 10-21-60

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