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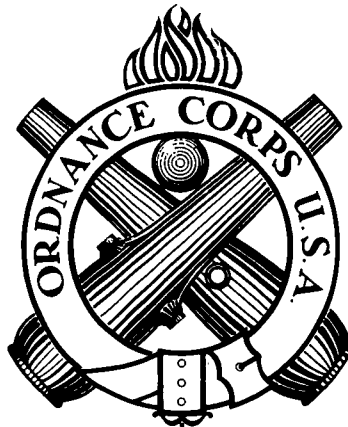
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LABORATORIES DIVISION

INFORMAL REPORT

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INSTRUMENT-ELECTRICAL LABORATORY

Project Title: Type 2HN Storage Battery - Qualification Test

Report No. 3452 (Final)

Date: 13 February 1956

Laboratory Work Order No. 2430

Ord. Project No. TTL-720B

**DETROIT ARSENAL
CENTER LINE, MICHIGAN**

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DETROIT ARSENAL
Center Line, Michigan

LABORATORIES DIVISION
Instrument-Electrical Laboratory

PROJECT TITLE: Type 2HN Storage Battery - Qualification Test

Report No. 3452 (Final)

Date: 13 February 1956

Prepared By: Joseph H. Reinman

Initiation Date of Project: 13 January 1955

Laboratory Work Order No. 2430

Ord. Project No. TT1-720B

DETROIT ARSENAL
Laboratories Division

Report No. 3452 (Final)
13 February 1956

PROJECT TITLE: TYPE 2HN STORAGE BATTERY - QUALIFICATION TEST

OBJECT:

Determine compliance of Code "A" storage batteries with Specification MIL-B-11188A, dated 22 March 1954, and ECO No. 44185, dated 27 July 1954.

SUMMARY:

1. Code "A" batteries 1, 2 and 3 failed to meet the requirements of the Overcharge test.
2. Batteries 4, 5 and 6 failed to meet the requirements of the Life Cycle test.
3. The results of the tests on batteries 1 through 6 are tabulated in Inclosures 1 through 8.
4. Tests on the remaining batteries were discontinued at the request of the project engineer.

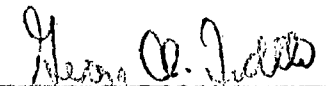
CONCLUSIONS:

Code "A" Type 2HN storage batteries did not meet the requirements of Specification MIL-B-11188A, dated 22 March 1954, and ECO No. 44185, dated 27 July 1954.


Written By:


JOSEPH H. REINMAN

Approved By:


GEORGE A. TUTTLE
Major, Ordnance Corps
OIC, Laboratories Division

Reviewed By:


RALPH MARINELLI, Acting Chief
Instrument-Electrical Laboratory

DETROIT ARSENAL
Laboratories Division

TECHNICAL REPORT DISTRIBUTION

Report No. 3452 (Final)

PROJECT TITLE: TYPE 2HN STORAGE BATTERY - QUALIFICATION TEST

OIC, Research & Development Division	(1)
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Chief, Instrument-Electrical Laboratory	(2)
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INCLOSURE SHEET

- Inclosure 1 - Table I - Filled Discharge Test
- Inclosure 2 - Table II - Capacity Test
- Inclosure 3 - Table III - Low Temperature Cranking Test
- Inclosure 4 - Table IV - Retention of Charge Test
- Inclosure 5 - Table V - Type 2HN Overcharge Cycle Test
- Inclosure 6 - Table VI - Type 2HN Life Cycle Test
- Inclosure 7 - Table VII - Disassembly Report
- Inclosure 8 - Table VIII - Disassembly Report
- Inclosure 9 - Laboratory Work Order 2430

Control Number	Battery Type	Electrolyte Temp. °F	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6
A-1	2HN	84	1.260	1.252	1.252	1.258	1.242	1.259
A-2	2HN	84	1.257	1.273	1.262	1.259	1.257	1.259
A-3	2HN	84	1.264	1.252	1.258	1.267	1.262	1.269

Specific Gravities 4 Hours After Filling

Battery Number	Rate In Amperes	Open Circuit Voltage	5 Second Voltage	Time In Minutes	End Voltage
A-1	150	12.60	9.30	4.28	6.00
A-2	150	12.60	10.10	4.84	6.00
A-3	150	12.61	9.80	4.72	6.00

80° F Discharge

FILLED DISCHARGE TEST

Inclosure 1

TABLE I

Battery Numbers	Battery Type	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6
A-1	2HN	1.297	1.297	1.296	1.296	1.292	1.294
A-2	2HN	1.302	1.301	1.301	1.296	1.297	1.297
A-3	2HN	1.302	1.297	1.301	1.298	1.299	1.301

Specific Gravities Prior to Test

Battery Number	Test Temp. ° F	Rate In Amperes	End Voltage	Time In Hours	Capacity In A. H.
A-1	80	2.25	10.50	21.40	48.15
A-2	80	2.25	10.50	21.34	48.01
A-3	80	2.25	10.50	21.23	47.77

20 Hour Rate Discharge

CAPACITY TEST

Inclosure 2

TABLE II

Battery Number	Battery Type	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6
A-1	2HN	1.295	1.299	1.290	1.287	1.290	1.295
A-2	2HN	1.300	1.299	1.299	1.300	1.292	1.295
A-3	2HN	1.295	1.298	1.295	1.298	1.290	1.298

Specific Gravities Prior to Test

Battery Number	Rate In Amperes	Open Circuit Voltage	5 Second Voltage	Time In Minutes	End Voltage	Test Temp. ° F
A-1	150	13.20	7.50	1.35	6.00	-41
A-2	150	13.20	7.50	1.24	6.00	-41
A-3	150	13.20	7.55	1.34	6.00	-41

Note: 5 Second requirement, 7.0 Volts. Time requirement 1.25 minutes average.

-40° F Discharge

LOW TEMPERATURE CRANKING TEST

Inlosure 3

TABLE III

Battery Number	Battery Type	Date Recorded	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6
A-1	2HN	2/10/55	1.301	1.302	1.292	1.292	1.292	1.288
A-2	2HN	2/10/55	1.305	1.302	1.302	1.307	1.297	1.302
A-3	2HN	2/10/55	1.302	1.303	1.300	1.302	1.297	1.302

Specific Gravities Before Retention Test

A-1	2HN	3/10/55	1.263	1.264	1.258	1.265	1.257	1.263
A-2	2HN	3/10/55	1.258	1.268	1.263	1.275	1.268	1.260
A-3	2HN	3/10/55	1.273	1.260	1.268	1.268	1.268	1.271

Specific Gravities After Retention Test

Battery Number	Rate In Amperes	Time In Hours	End Voltage	Capacity In A. H.
A-1	2.25	19.86	10.5	44.68
A-2	2.25	19.62	10.5	44.14
A-3	2.25	19.84	10.5	44.64

Capacity Results

RETENTION OF CHARGE TEST

Inclosure 4

TABLE IV

Battery Code	Discharge Rate In Amps	Open Circuit Voltage	End Voltage	Time In Minutes	Total Cycles	Date Conducted
A-1	150	12.80	6.00	8.12	1	4/12/55
A-2	150	12.82	6.00	8.28	1	4/12/55
A-3	150	12.82	6.00	8.92	1	4/12/55
A-1	150	12.61	6.00	6.35	2	4/21/55
A-2	150	12.75	6.00	6.95	2	4/21/55
A-3	150	10.60	6.00	*	1	4/21/55
A-1	150	10.60	6.00	*	2	4/28/55
A-2	150	12.89	6.00	6.75	3	4/28/55
A-3	150	10.60	6.00	*	1	4/28/55
A-1	150	10.40	6.00	*	2	5/5/55
A-2	150	12.82	6.00	5.92	4	5/5/55
A-2	150	12.79	6.00	9.80	5	5/13/55
A-2	150	12.70	6.00	4.38	6	5/20/55
A-2	150	12.71	6.00	2.78	7	5/27/55
A-2	150	12.81	6.00	1.97	8	6/3/55
A-2	150	8.85	6.00	*	8	6/13/55

* Fell below end voltage when load was applied

TYPE 2HN OVERCHARGE CYCLE TEST

Inclosure 5

TABLE V

Battery Number	Discharge Rate In Amps	Open Circuit Voltage	End Voltage	Time In Hours	Capacity In A. H.	Total Passing Cycles	Date Conducted
A-4	20.0	13.00	10.20	2.04	40.80	23	2/14/55
A-5	20.0	13.01	10.20	2.03	40.60	23	2/14/55
A-6	20.0	12.99	10.20	1.98	39.60	23	2/14/55
A-4	20.0	12.99	10.20	1.84	36.80	51	2/21/55
A-5	20.0	13.00	10.20	1.79	35.80	51	2/21/55
A-6	20.0	13.00	10.20	1.71	34.20	51	2/21/55
A-4	20.0	13.20	10.20	1.58	31.60	76	3/1/55
A-5	20.0	13.29	10.20	1.46	29.20	76	3/1/55
A-6	20.0	13.25	10.20	1.40	28.00	76	3/1/55
A-4	20.0	12.80	10.20	1.48	29.60	100	3/9/55
A-5	20.0	12.75	10.20	1.11	22.20	100	3/9/55
A-6	20.0	12.75	10.20	0.98	19.60	100	3/9/55
A-4	20.0	12.70	10.20	0.79	15.80	125	3/16/55
A-5	20.0	12.70	10.20	0.79	14.00	100	3/16/55
A-6	20.0	12.70	10.20	0.74	14.80	100	3/16/55
A-4	20.0	12.90	10.20	0.94	18.80	149	3/23/55
A-5	20.0	12.80	10.20	0.72	14.40	100	3/23/55
A-6	20.0	12.79	10.20	0.71	14.20	100	3/23/55
A-4	20.0	12.80	6.20	0.74	14.80	149	3/30/55
A-5	20.0	12.60	10.20	0.36	7.20	100	3/30/55
A-6	20.0	12.60	10.20	0.30	6.00	100	3/30/55

TYPE 2HN LIFE CYCLE TEST

Manufacturer Code "A"
Type 2HN
Battery Code A-5
General Appearance Before Disassembly

Date 6 April 1955
Test Life
Cycles 105
Good

POSITIVE PLATES

Upper quarter bare Yes
Lower quarter bare No
Bare in spots Yes
Shedding uniform No
Shedding normal No
Remainder surf. smooth No
Remainder surf. pitted Yes
Remainder appeared lumpy No
Remainder soft & loose Yes
Surface scaly No
Loose matl. stuck to sep Yes
Oxidation of grids Yes
Buckling No
Distortion of grid frames No
Grid frames broken No

SEDIMENT SPACES

Level full Yes
Overflowing-elements bridged Yes
Color Brownish

NEGATIVE PLATES

Color Gray
Expanded Yes
Uniformity of expansion Entire Plate
Surface blistered No
Surface firm Yes Sandy Yes
Density of interior-upper half Good
Density of interior-lower half Good
Material contracted Yes

SEPARATORS

Type Rubber (Microporous)
Flexibility Good
Degree of oxidation Very Slight
Any holes No
Fringed at bottom No
Exceptionally thin No
Capable of being handled intact Yes
Badly disintegrated parts missing No
Treeing No
Broken separators No

GENERAL INFORMATION

Elements hard to remove from jars Yes No. of spacers per cell 2
Probable cause of failure Bridging across separators on side and bottom.
Shedding of positive plate active material.

Observer Claude Merrill, Jr.

Checked By Louis Mastaler

DISASSEMBLY REPORT

Inclosure 7

TABLE VII

Manufacturer's Code Code "A" Date 20 July 1955
 Type 2HN Test Overcharge
 Battery Code A-2 Cycles 8

General Appearance Before Disassembly Good

POSITIVE PLATES

Upper quarter bare Yes
 Lower quarter bare No
 Bare in spots (Top) Yes
 Shedding in chunks No
 Shedding uniform No
 Shedding normal No
 Remainder firm-surf.smooth Yes
 Remainder firm-surf.pitted No
 Remainder appeared lumpy No
 Remainder soft & loose Loose
 Surface scaly No
 Loose matl.stuck to sep Yes
 Oxidation of grids Yes
 Buckling No
 Distortion of grid frames Yes
 Grid frames broken Yes

NEGATIVE PLATES

Color Grey
 Expanded Slight
 Surface blistered No
 Surface spongy Yes sandy Yes
 Density of interior-upper half Good
 Density of interior-lower half Good

SEPARATORS

Type Microporous rubber
 Flexibility Good
 Degree of oxidation No
 Any holes No
 Fringed at bottom No
 Exceptionally thin No
 Capable of being handled intact Yes
 Badly disintegrated parts missing No
 Treeing No
 Broken separators No

SEDIMENT SPACES

One fourth full Yes
 Treed No
 Overflowing-elements bridged No
 Color Brownish

GENERAL INFORMATION

Elements hard to remove from jars No No. of spacers per cell None
 Probable cause of failure Almost complete disintegration of positive grid.

Observer Robert Young

Checked By Louis Mastaler

DISASSEMBLY REPORT

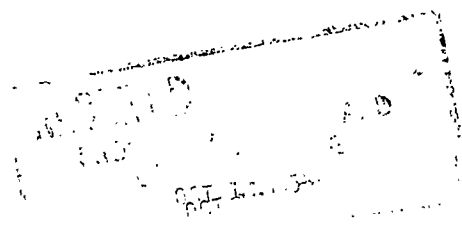
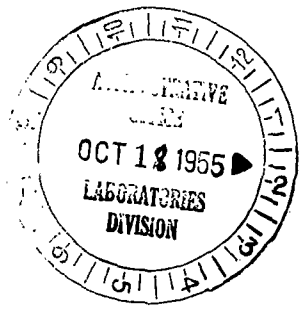
Inclosure 8

TABLE VIII

LABORATORY WORK ORDER
Use by Dev. & Eng. Dept.

TO: Chief, Laboratories Division 12 September 1955

DESCRIPTION OF WORK IN DETAIL:
YMS.
PROJECT ENGINEER: R. H. Sage/1a/3-4134 - ORDMX-ECPE
SUBJECT: Tests of [redacted] Type 2HN Batteries
1. Subject [redacted] type 2HN batteries to all tests prescribed in Specification MIL-B-11188A.
2. Monthly memo report is requested, and final report upon completion of project.



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Mr. Zach RS/10/14

ELECTRICAL LABORATORY

SERIAL NO. 2430

COMPLETION NOTICE	ESTIMATE MUST NOT BE EXCEEDED. QUOTE FULL X.O. AND PART NOS. ON ALL PROCUREMENTS AND JOB CARDS.		PROJ. NO. TT1-720B
COMPLETION DATE	LAB. LABOR ONLY	EST.	EX. ORDER 1640-1-3
LAB. BR. CHIEF	MATERIAL AND WORK OF OTHER DEPARTMENTS	EST.	EX. ORDER
	APPROVED		
LAB. DIV. CHIEF	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
	BRANCH CHIEF OF Components	DIVISION CHIEF OF Res & Dev	CHIEF, DEV. & ENG. DEPT.

[Handwritten mark]