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TOBE

NObsr-57200

F I L M

D TRIC C A P A C I T O R S

Quarterly Report

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Quarterly Development Report

for

DEVELOPMENT OF -

FILM DIELECTRIC CAPACITORS --- HIGH TEMPERATURE

- 0 -

This report covers the period Sept. 30, 1953 to Dec. 30th, 1953

TOBE DEUTSCHMANN CORPORATION

Providence Highway
Norwood, Massachusetts

NAVY DEPARTMENT BUREAU OF SHIPS ---- ELECTRONICS DIVISION

Contract No. NObsr - 57200

Index No. NE-111016, St. 1

Date of Contract: Feb. 20, 1952

Date of Report: Jan. 9, 1954

FURTH... MILIT... ...D ONLY TO

C M P Classification: Class "A" Product

Certification DO-A-7; certified under CMP Regulation No. 3

~~SECURITY~~ INFORMATION ~~RESTRICTED~~

~~R-E-S-T-R-I-C-T-E-D~~

ABSTRACT

PHASE I.

All testing at 85° C. has been completed. Sufficient information on the characteristics of Mylar at 85° C. has been gathered so that capacitors may be designed for operation up to this temperature.

The testing program is now continuing at 125° C.

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PHASE II.

In the metallized version of a Mylar Capacitor, considerable information has been accumulated on the .25 MFD. Capacitors, constructed of a single .0005" Metallized Mylar film.

Method and equipment to produce the margin required for other film combinations has been developed.

During the next quarter, work will proceed on these other combinations.

Part I.

PURPOSE

A. Develop Film Dielectric Capacitors, high-temperature, utilizing DuPont "Mylar" Film (V-200) or equivalent, as a capacitor dielectric, in order to achieve higher temperature operation and greater reliability of fixed paper capacitors, in accordance with Bureau of Ships Contract Specification --- SHIPS F-400, dated 15 September, 1951, as follows:

B. Phase I.

1. Evaluate a V-200 film or equivalent in accordance with paragraph 3.2.1 of referenced Bureau of Ships Contract Specification SHIPS F-498.
2. Furnish fifty (50) each of various capacitors as described in paragraph 3.2.1 of referenced Bureau of Ships Contract Specification SHIPS F-498.
3. Submit reports as specified therein.

C. Phase II.

1. Evaluate a V-200 film or equivalent with metallized electrodes in accordance with paragraph 3.2.2. of referenced Bureau of Ships Contract Specification SHIPS F-499.
2. Furnish fifty (50) each of various capacitors as described in paragraph 3.2.1 of referenced Bureau of Ships Contract Specification SHIPS F-499.

C. Phase II (continued)

3. Furnish one (1) set of Type D, Class IV Manufacturing Drawings in accordance with Bureau of Ships Specification 16D19 (RE), dated 15 January 1946, and Amendment No. 2, dated 1 May 1948.

4. Submit reports as specified herein.

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GENERAL FACTUAL DATA Phase I.

Sufficient information has now been gathered at 85° C. to consider this phase of the project complete, and to establish characteristics of Mylar Capacitors at this temperature.

As much of this information as possible will be used to run parallel tests at 125° C. without the great multitude of tests that were necessary at the first test temperature.

When a large number of Mylar units were placed on Life Test at 125° C. during this last quarter, it was noted that an unforseen amount of current was required from the Life Test power supply.

Upon further investigation, it was found that the Insulation Resistance of Mylar Capacitors showed a considerable variation with applied test voltage at 125° C.

GENERAL FACTUAL DATA (continued) PHASE I

This characteristic of Mylar had not been revealed at the 85° test point, and it was necessary to reduce the number of units on test so as not to place a large overload on the Life Test protection circuits.

This characteristic of Mylar will necessitate the plotting of curves of Insulation Resistance vs. Applied Voltage at elevated temperature; and if the indications already given under Life Test are typical, the characteristic of Mylar under these conditions will be rather poor.

Examinations of the Life Test failures reveal that the Mylar undergoes significant physical changes at 125° C. It loses much of its flexibility when observed in combination -- that is, four layers of Mylar and two of Aluminum Foil.

When the individual layers are separated, the change is less apparent, but there is a definite crispness to the material that formerly was very soft.

It is not brittle and the entire section can be readily unwound, but it does not fall in a shapely mass.

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GENERAL FACTUAL DATA PHASE II.

To date, all information has been gathered on the .25 Mfd. unit construction of a single layer of .5 and .25 Metallized Mylar as a dielectric. This limitation is due to the fact that margining equipment to produce margins of any other width than those normally used on Metallized Paper have not been available.

GENERAL FACTUAL DATA (continued) PHASE II

During this last quarter, we have developed a machine and the necessary technique to margin any width required for Mylar.

This will allow us to resume testing on Metallized Mylar at a more reasonable rate.

0-0-0-0-0-0-0-0-0-0-0

DETAIL FACTUAL DATA PHASE I

According to plan, the work done this past quarter was conducted at the elevated temperature of 125° C. The type unit which was used for investigation was the 1 Mfd. capacitor, constructed with two layers of .0005" Mylar C Film between foils. The gauge of the individual rolls of Mylar used, varied between a low of .00048" and a high of .0006". The high rolls were balanced against the low ones to maintain a maximum total thickness not to exceed .00112"... the margins in all cases being 1/4".

A. Seventy-five units were divided into three groups of Twenty-five each:

1. Tested at 1000 v.d.c., one unit failed voltage test prior to Life Test. It was a mechanical failure.

   The remaining twenty-four units were placed on Life Test, and seventeen completed 83 hours. All seven failures were caused by Mylar breakdowns. (See Part III, P. 1.)

DETAIL FACTUAL DATA -- Phase I (continued)

2. Tested at 1200 v.d.c., one unit failed voltage test prior to Life Test. It was a mechanical failure. The remaining twenty-four units were placed on Life Test, and five completed 75 hours. All nineteen failures were caused by Mylar breakdowns. (See Part III, P. 2.)

3. Tested at 1500 v.d.c., three units failed voltage test prior to Life Test. All were mechanical failures. The remaining twenty-two units were placed on Life Test, and all failed within 41 hours. There were six mechanical failures and sixteen were caused by Mylar faults. (See Part III, P. 3.)

B. Seventy-five were divided into three groups of twenty-five each.

1. Tested at 800 v.d.c., three units failed voltage test prior to Life Test. Two were mechanical failures, and one a Mylar fault. The remaining twenty-two units were placed on Life Test, and fifteen completed 72 hours. There were six Mylar failures and one mechanical. (See Part III, P. 4.)

2. Tested at 900 v.d.c., two units failed voltage test prior to Life Test. Both were mechanical failures. The remaining twenty-three units were placed on Life Test, and fourteen completed 73 hours. There were eight Mylar failures, and one mechanical. (See Part III, P. 5.)

DETAIL FACTUAL DATA --- Phase I (continued)

3. Tested at 1000 v.d.c., one unit failed voltage test prior to Life Test. It was a mechanical failure. The remaining twenty-four units were placed on Life Test, and thirteen completed 73 hours. There were eight Mylar failures, and three mechanical. (See Part III, p. 6.)

-0-0-0-0-0-0-0-0-0-0-0-0-0-

DETAIL FACTUAL DATA PHASE II

Similarly, all tests performed during this last quarter were at 125° C. The unit used for test purposes was the .25 Mfd. capacitor, constructed with a single layer of .0005" Metallized Mylar as the dielectric.

A. Seventy-five units were divided into three groups of twenty-five each:

1. Tested at 400 v.d.c., three units failed tests prior to Life Test. One failed voltage test and two were "opens." All were mechanical failures.

The remaining twenty two units were placed on Life Test, and sixteen completed 250 hours. Six units opened during Life Test. (See Part III, PP. 8, 9, 10.)

DETAIL FACTUAL DATA --- Phase II (continued)

2. Tested at 500 v.d.c., all units passed tests prior to Life Test. All twenty-five units were placed on Life Test, and fifteen completed 251 hours.

Eight units opened during Life Test, and two units failed during pre-breakdown tests. One was a Mylar failure; the other a mechanical. (See Part III, pp. 11, 12, 13.)

3. Tested at 600 v.d.c., three units opened prior to Life Test. The remaining twenty-two units were placed on Life Test, and five completed 251 hours. Fifteen units opened during Life Test; one failed pre-breakdown test, and one failed completely at the start of the Life Test. (See Part III, pp. 14, 15, 16.)

B. Seventy-five units were divided into three groups of twenty-five each:

1. Tested at 300 v.d.c., two units opened prior to Life Test. The remaining twenty-three units were placed on Life Test, and eighteen completed 250 hours. Five units opened during Life Test. (See Part III, pp. 17, 18.)

2. Tested at 400 v.d.c., four units opened prior to Life Test. The remaining twenty-one units were placed on Life Test, and twelve completed 250 hours. Nine units opened during Life Test. (See Part III, PP. 19, 20.)

DETAIL FACTUAL DATA ---- Phase II (continued)

3. Tested at 500 v. d. c, four units opened prior to Life Test, and seven completed 254 hours. Thirteen units opened during Life Test, and one unit failed completely because of Mylar faults. (See Part III, pp. 21, 22.)

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CONCLUSIONS PHASE I.

All the data gathered on Mylar Capacitors at 85° C. up to this date point to the conclusion that Mylar is capable of producing a Capacitor of generally better characteristics than Kraft Paper capacitors over this same temperature range.

However, the characteristics of Mylar are extremely erratic from lot to lot of material and indications are that a considerable amount of work remains to be done in the control of the manufacturing process of Mylar Film.

If these processes could be controlled so that the bulk of the Capacitors produced would have characteristics equal to the best of these lots of Mylar, a capacitor greatly superior to Kraft Paper could be produced.

However, under present conditions, no reasonable prediction could be made of the characteristics of any production lots of Capacitors.

Indications have been found that the Insulation Resistance of Mylar capacitors drops very fast at elevated temperature as the voltage is increased.

Not enough data has been collected on this point to draw a conclusion.

CONCLUSIONS PHASE II

All indications from these tests point to one conclusion. With the present quality of Mylar, the Metallized version of the Mylar Capacitor seems to be the one which can produce a capacitor of consistent characteristics.

The faults and inconsistencies of the material are hidden or wiped out when the capacitor is first cleared of faults.

A considerable amount of work, remains to be done to improve the quality of margining and the methods of making corrections to the Metallized Mylar Capacitor so as to reduce the number of opens in Life Test.

This, however, is not a fault in the basic characteristics of the material, but a manner of improving manufacturing techniques, and no difficulty is anticipated in solving this problem.

P A R T

II

PROGRAM FOR NEXT INTERVAL

PROGRAM FOR NEXT INTERVAL

PHASE I

The number of tests conducted at 125° C. with the 1 Mid. capacitor constructed with two layers of .0005" Mylar C between foils are insufficient to form a conclusion.

Thus, approximately 12 groups of 25 each of these units will be made and tested until a definite maximum voltage stress is established for 125° C. test.

The 150° C. series of tests using the same number of samples as used for 85° C. - 125° C. series will begin in approximately six weeks.

PHASE II

The greatest difficulty encountered with Metallized Mylar C to date has been the number of "opens" that occur during Life Test. Our first objective during the next interval is to find the cause of the phenomenon and eliminate it.

This is not a characteristic peculiar to Mylar -- but a reflection on method used for making contact. Development is required on contacting methods before proceeding with further Life Test on this phase.

Then we will repeat the Life Test at varying voltage stresses with an attempt to establish a relationship between the number of temporary or self-healing breakdowns to the applied voltage stress per mil of dielectric.

PART III

TEST DATA

LIFE TEST RECORD

25 UNITS 1 mfd - 2X.5U - Mylar Capacitors LOT NO. Nobsr-123

SPECIFICATION Experimental FOR WHOM V. Winroth CONTRACT NO. Nobsr 57200

HOURS ON TEST 72+ TEMPERATURE 125° C VOLTAGE 1000 VDC

Date started 27 October 1953 Clock # 7 - 1919 Tray # Date finished 9 November 1953 Clock # 7 - 2002 Tray # Total Hours 83

ELECTRICAL TESTS BEFORE LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Voltage-1000 VDC	P ←				→ P	Mechanical failure top margin fused away by heat of the soldering iron	P ←																		→ P
Shunt R. Megs-75F	100K ←				→ 100K		100K ←																		→ 100K
Cap in mfd-1000%	.977	.985	.998	.989	.951		.939	.946	.956	.946	.978	.974	1.009	.927	.977	.961	.984	.956	.935	.978	.989	.984	.948	.921	.935
Power Factor-%	.36	.35	.33	.30	.31		.30	.30	.34	.29	.32	.35	.34	.29	.35	.33	.31	.35	.32	.37	.35	.34	.36	.32	.32
LIFE TEST FAILURES IN HRS.			8.5		16			83					8				16			16		18			

ELECTRICAL TESTS AFTER LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Shunt R. Megs-75F	100K	100K	Mylar failure: Inner 1/3 of the section. Middle of the film	100K	Mylar failure: Inner 1/3 of the section 3/8" from the margin		100K	Mylar failure: outer 1/4 of the section 1/4" from the margin	100K	100K	100K	100K	Mylar failure: Inner 1/4 of the section. Middle of the film	100K	100K	100K	Mylar failure: Inner 1/4 of the section. 1/4" from the margin	100K	100K	Mylar failure: outer 1/4 of the section. Middle of the film	100K	Mylar failure: Inner 1/4 of the section. 1/4" from the margin	100K	100K	100K
Cap in mfd-1000%	1.011	1.015		1.026			.979		.996	.969	1.002	.995		.972	1.00	.948		.982	.979		1.024		.963	.969	.969
Power Factor-%	.45	.45		.36			.43		.42	.46	.43	.47		.44	.42	.48		.49	.48		.44		.45	.45	.49

Data collected by HJ - VW

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LIFE TEST RECORD

25 UNITS 1. Mfd - 2X.5U — LOT NO. Nobsr # 124

SPECIFICATION Experimental — FOR WHOM V. Winroth — CONTRACT NO. Nobsr 57200

HOURS ON TEST 72+ — TEMPERATURE 125°C — VOLTAGE 1200 VDC

Date started 27 October 1953 — Clock # / Tray # 8 - 2150 — Date finished 13 November 1953 — Clock # / Tray # 8 - 2225 — Total Hours 75

ELECTRICAL TESTS BEFORE LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Voltage-1200DC	P	←																		→ P		P	←	→	P
Shunt R-MegΩ-80°F	100K	←																		→ 100K		100K	←	→	100K
Cap. in Mfd 1000~	.959	.990	.975	1.005	1.001	1.009	.984	.975	.950	.978	1.005	.939	.998	.972	.976	.987	.947	.976	.989	.988		.956	.983	.984	.948
Power Factor - %	.34	.39	.36	.38	.37	.37	.37	.36	.39	.35	.37	.35	.34	.35	.37	.36	.37	.34	.35	.35		.30	.35	.37	.33
LIFE TEST FAILURES IN HRS.		3.5			33	17	13	27	3	23	3	59	28	1	75	3		39		19	Voltage	23	22	7	40

Sample 21: Mechanical Failure. Top Margin fused away by heat of the soldering.

ELECTRICAL TESTS AFTER LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Shunt R. MegΩ-	100K		100K	100K													100K		100K						
Cap. in Mfd - 1000 ~/s	1.003		.993	1.011													.982		1.023						
Power Factor - %	.47		.47	.45													.40		1.0						

- 2: Mylar Failure. Outer 1/4 of the section 3/8" from the margin
- 5: Mylar Failure. Inner 1/8 of the section 3/8" from the margin
- 6: Mylar Failure. Inner 1/4 of the section. 1/4" from the margin
- 7: Mylar Failure. Inner 1st 24 turns. 1/4" from the margin
- 8: Mylar Failure. Inner 1/4 of the section. 3/8" from the margin
- 9: Mylar Failure. Outer 1/8 of the section 5/8" from the margin
- 10: Mylar Failure. Inner 1/3 of the section - of the margin.
- 11: Mylar Failure. Midway in the section. Middle of the film
- 12: Mylar Failure. Outer 1/4 of the section 1/4" from the margin
- 13: Mylar Failure. Inner 1/3 of the section. 1/2" from the margin
- 14: Mylar Failure. Outer 1/4 of the section 5/8" from the margin
- 15: Mylar Failure. Inner 1/4 of the section Middle of the film
- 16: Mylar Failure. Outer 1/4 of the section. 1/2" from the margin
- 18: Mylar Failure. First 24 turns section. 1/2" from the margin
- 20: Mylar Failure. Inner 1/4 of the section. 1/8" from the margin
- 22: Mylar Failure. Midway in the section Middle of the film
- 23: Mylar Failure. Midway in the section Middle of the film
- 24: Mylar Failure. Inner 1/3 of the section. 3/8" from the margin
- 25: Mylar Failure. Outer 1/4 of the section Middle of the film

Data collected by H.J. V.W.

ENGINEERING DEPT. C.L. 1002 — TOBE DEUTSCHMANN CORPORATION — NORWOOD, MASS

LIFE TEST RECORD

25 UNITS 1. µfd – 2X .5U – Mylar Capacitors LOT NO. Nobsr #125

SPECIFICATION Experimental FOR WHOM V. Winroth CONTRACT NO. Nobsr 57200

HOURS ON TEST 72 TEMPERATURE 125 °C VOLTAGE 1500 VDC

Date started 27 October 1953 Clock # 11 – 1923 Tray # Date finished 10 November 1953 Clock # 11 – 1964 Tray # Total Hours 41

ELECTRICAL TESTS BEFORE LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Voltage – 1500 VDC	P	←				→	P	Mechanical failure. A very start of the section. Film damaged by the mandrel.	P	←			→	P	Mechanical failure. Top outside margin fused away by the heat of soldering	P	P	Mechanical failure. Top outside margin fused away by the heat of soldering	P	←				→	P
Shunt R. Megs – 75°F	100K	←				→	100K		100K	←			→	100K		100K	100K		100K	←				→	100K
Cap. in µfd – 1000 ~	.937	.970	.957	.995	.967	.977	.993		.939	.999	.970	.972	.946	.913		.990	.971		.934	1.003	.974	.975	.997	.949	1.006
Power Factor – %	.41	.47	.45	.44	.44	.46	.43		.39	.44	.47	.45	.43	.47		.44	.45		.45	.40	.43	.42	.42	.41	.39
LIFE TEST FAILURES IN HRS.	39	9.5	13	9	immed.	9.5	34	voltage	immed.	16	immed.	37	36	immed.	voltage	11	2	voltage	immed.	11	41	37	10	16	32

ELECTRICAL TESTS AFTER LIFE TEST

Rows: Shunt R. Megs – 75°F; Cap. in µfd – 1000 ~; Power Factor – %

Sample Number	Remarks
1	Mylar failure. Midway in the section. Middle of the film.
2	Mylar failure. Outer 1/4 of the section 3/8" from the margin.
3	Mylar failure. Outer 1/4 of the section. 1/8" from the margin.
4	Mylar failure. Inner 1/4 of the section 1/4" from the margin.
5	Mechanical failure. Very start of the section 1/4" from the margin.
6	Mylar failure. Inner 1/4 of the section. 3/8" from the margin.
7	Mylar failure inner 1/4 of the section. Middle of the film.
8	
9	Mechanical failure. Very start of the section. Middle of the film.
10	Mylar failure. Inner 1/4 of the section 3/8" from the margin.
11	Mechanical failure. Very start of the section. at the margin.
12	Mylar failure. Outer 1/4 of the section 1/8" from the margin.
13	Mylar failure. Outer 1/4 of the section. 1/8" from the margin.
14	Mechanical failure. Very start of the section. Middle of the film.
15	
16	Mylar failure. Midway in the section. 1/2" from the margin.
17	Mechanical failure. Very start of the section. Middle of the film.
18	
19	Mechanical failure. Very start of the section. 1/2" from the margin.
20	Mylar failure. Inner 1/4 of the section. 1/4" from the margin.
21	Mylar failure. Outside the [illegible] of the margin.
22	Mylar failure. Midway in the section. 1/16" from the margin.
23	Mylar failure. Inner 1/3 of the section. 3/8" from the margin.
24	Mylar failure. Inner 1/3 of the section. 3/8" from the margin.
25	Mylar failure. Inner 1/4 of the section 3/8" from the margin.

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Data collected by H.J. V.W.

LIFE TEST RECORD

25 UNITS 1 μfd. - 2 X .5 u Mylar Capacitors — LOT NO. Nobsr #126

SPECIFICATION Experimental — FOR WHOM V. Winroth — CONTRACT NO. Nobsr 57200

HOURS ON TEST 72 — TEMPERATURE 125 °C — VOLTAGE 800 VDC

Date started 16 November 1953 — Clock # / Tray # 7 - 2002 — Date finished 10 December 1953 — Clock # / Tray # 7 - 2074 — Total Hours 72

ELECTRICAL TESTS BEFORE LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Voltage-800DC	P	←	→	→	→	→	→	→	→	→	→	→	→	P	Unable to locate the source of the failure.	P	← →	P	Mylar failure. Outer 1/4 of the section. 1/8" from the margin.	P	←	→	→	P	Mechanical failure. Top outside ... by the heat of the soldering.
Shunt R-Mega 75°F	100K	←	→	→	→	→	→	→	→	→	→	→	→	100K		100K	← →	100K		100K	←	→	→	100K	
Cap in μfd-1000~	.920[s]	.928	.990	.999	.990	.996	.969	1.054	.986	.961	.932	.965	1.006	.931		.984	.981	.996		.956	.973	.991	.939	.969	
Power Factor-%	.57	.33	.37	.36	.37	.37	.39	.40	.40	.37	.36	.35	.58	.37		.36	.39	.42		.35	.39	.40	.40	.35	
LIFE TEST FAILURES IN HRS.			18	72				7	7				4		Voltage		Immed.	7	Voltage						Voltage

ELECTRICAL TESTS AFTER LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Shunt R Mega-77°F	100K	100K	Mylar failure. Inner 1/4 of the section. 3/8" from the margin.	Mylar failure. Outer 1/4 of the section. 3/8" from the margin.	100K	100K	100K	Mylar failure. Inner 1/3 of the section 5/8" from the margin.	Mylar failure. First few turns of the section. 1/8" from the margin.	100K	100K	100K	Mylar failure. Inner 1/3 of the section. 5/8" from the margin.	100K		100K	Mechanical failure. Outside tape to container ... Mylar ... away by heat of the soldering.	Mylar failure. Inner 1/4 of the section. 1/2" from the margin.		100K	100K	100K	100K	100K	
Cap in μfd-1000~	.942	.969			.971	1.026	1.00			.983	.969	.994		.969		1.021				.992	.990	1.016	.974	.992	
Power Factor-%	.38	.35			.37	.41	.42			.44	.38	.41		.37		.44				.45	.42	.46	.37	.44	

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Data collected by HJ.-VW.

LIFE TEST RECORD

25 UNITS 1. μfd - 2X.5U - Mylar Capacitors LOT NO. Nobsr 127

SPECIFICATION Experimental FOR WHOM V. Winroth CONTRACT NO. Nobsr 57200

HOURS ON TEST 72+ TEMPERATURE 125 °C VOLTAGE 900 -VDC

Date started 16 November 1953 Clock Tray # 8-2225 Date finished Clock Tray # 8-2298 Total Hours 73

ELECTRICAL TESTS BEFORE LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Voltage-900 VDC	P	←			→	P	Mechanical failure. Top outside margin fused away by the heat of the soldering.	P	←						→	P	Mechanical failure. Top outside margin fused away by the heat of the soldering.	P	←					→	P
Shunt R. Megs 77F	100K	←			→	100K		100K	←						→	100K		100K	←					→	100K
Cap. in μfd-1000 c/s	1.02	.961	.981	.972	.951	.934		.959	.958	.948	.961	.951	1.003	.968	.967	.956		.979	.987	.985	.998	.979	.952	.956	.975
Power Factor - %	.36	.39	.31	.36	.37	.32		.39	.38	.35	.35	.35	.36	.32	.37	.37		.38	.40	.35	.43	.35	.34	.38	.35
LIFE TEST FAILURES IN HRS.	5				21		Voltage			11			5		30		Voltage	5	11		5	15			

ELECTRICAL TESTS AFTER LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Shunt R Megs 75F	Mechanical failure. At the very start of the section at the margin	100K	100K	100K	Mylar failure. Lost few turns of the section. 3/16" from margin	100K		100K	100K	Mylar failure. Lost few turns of the section. 5/8" from the margin	100K	100K	Mylar failure. Outer 1/4 of the section. Middle of the film	100K	Mylar failure. Outer 1/4 of the section. 3/8" from the margin	100K		Mylar failure. Inner 1/4 of the section at the margin	Mylar failure. Lost few turns of the section. 1/4" from the margin	100K	Mylar failure. Outer 1/4 of the section. 5/8" from the margin	Mylar failure. Outer 1/3 of the section. 5/8" from the margin	100K	100K	100K
Cap. in μfd-1000 c/s		.998	1.017	1.002		.983		.983	.980		.992	.997		1.005		.975				1.021			.974	.986	.993
Power Factor - %		.41	.44	1.45		.42		.44	37		.44	.38		.42		.38				.42			.43	.45	.42

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Data collected by HJ. - VW.

LIFE TEST RECORD

25 UNITS 1. uFd. - 2 X .5U Mylar Capacitors LOT NO. Nobsr 128

SPECIFICATION Experimental FOR WHOM V. Winroth CONTRACT NO. Nobsr 57200

HOURS ON TEST 72+ TEMPERATURE 125° C VOLTAGE 1000 VDC

Date started 16 November 1953 Clock # Tray # 11-1964 Date finished 11 December 1953 Clock # Tray # 11-2037 Total Hours 73

ELECTRICAL TESTS BEFORE LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Voltage - 1000 DC	P	←	→	P	Mechanical failure: Top outside of the margin fused over at solder, heat of the solder lug.	P	←																	→	P
Shunt R - Megs 77°F	100K	←	→	100K		100K	←																	→	100K
Capacitance in uFd @ 1000 c/s	.978	.986	.926	.962		.947	.927	1.001	.943	.928	1.003	.937	.977	.944	.987	.937	.939	.986	.960	.934	.975	.960	.912	.985	.984
Power Factor %	.31	.29	.31	.31		.35	.35	.37	.30	.31	.42	.32	.40	.37	.38	.35	.31	.32	.30	.34	.32	.40	.35	.30	.36
LIFE TEST FAILURES IN HRS.	5	30			Voltage			immed	6	13	27								61	immed	5	11	immed		

ELECTRICAL TESTS AFTER LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Shunt R Megs - 75°F	Mylar failure: Inner 1/4 of the section. 1/2" from the margin	Mylar failure: Outer 1/4 of the section. 5/16" from the margin	100K	100K		100K	100K	Mechanical failure: Outside turn of section. Mylar [illegible] at very start of section fused away of the margin	Mylar failure: Inner 1/4 of the section. 7/16" from the margin	Mylar failure: Inner 1/4 of the section. 5/8" from the margin	Mylar failure: Inner 1/3 of the section. 7/16" from the margin	100K ←					→	100K	Mylar failure: Lost few turns of the section. 7/8" from the margin	Mechanical failure: A very bad wrinkle at the start of the section at the margin	Mylar failure: Inner 1/3 of the section. 7/8" from the margin	Mylar failure: Inner 1/3 of the section. 3/16" from the margin	Mechanical failure: Outside turn at the top margin fused away [illegible] of solder	100K	100K
Capacitance in uFd @ 1000 c/s			.972	.981		.971	.966					.976	.992	.981	1.017	.974	.967	1.009						.994	1.013
Power Factor - %			.48	.47		.38	.43					.44	.30	.42	.45	.37	.41	.43						.34	.39

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Data collected by H. J. V.W.

1 Mfd. 2 x .5 Mil U

Nobsr #	Voltage	Temp.	Number of Units	Failed Before Life	Started on Life	Mechanical Failures	Mylar Failures	% Mylar Failures	Lot Material	Margin	Number Open After Life
123	1000 VDC	125° C.	25	1	24	0	7	29%	2 & 3	1/4"	0
124	1200 VDC	125° C.	25	1	24	0	19	79%	2 & 3	1/4"	0
125	1500 VDC	125° C.	25	3	22	6	16	100%	2 & 3	1/4"	0
126	800 VDC	125° C.	25	3	22	1	6	28.5%	2 & 3	1/4"	0
127	900 VDC	125° C.	25	2	23	1	8	36%	2 & 3	1/4"	0
128	1000 VDC	125° C.	20	1	24	3	8	38%	2 & 3	1/4"	0

Table I

TH

LIFE TEST RECORD

25 UNITS .25 ufd. – single .5 MIL – Metallized Mylar Capacitors   LOT NO. Nobsr M# 38

SPECIFICATION Experimental   FOR WHOM V. Winroth   CONTRACT NO. Nobsr 57200

HOURS ON TEST 250   TEMPERATURE 125 °C   VOLTAGE 400 VDC

Date started 11 November 1953   Clock # 1 - 4055 Tray #   Date finished 1 December 1953   Clock # 1 - 4305 Tray #   Total Hours 250

ELECTRICAL TESTS BEFORE LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Voltage - 400 DC	P	Pigtail to insulated terminal loosened away from the section	P	↔	P	unable to locate the source of the failure	P	←								→	P	Pigtail to the insulated terminal loosened away from section	P	←				→	P
Shunt R. Mego. 72°F	100K		100K	↔	100K		100K	←								→	100K		100K	←				→	100K
Cap. in ufd. - 1000 c/s	.261		.244	.244	.260		.261	.247	.261	.239	.264	.262	.242	.262	.246	.258	.250		.245	.298	.266	.246	.259	.262	.261
Power Factor - %	1.07		.49	.45	20.		.48	.44	.61	1.04	.78	.48	35.	.50	.53	9.0	.50		1.45	.61	6.8	.45	2.5	1.55	.48
LIFE TEST FAILURES IN HRS.		open			open	voltage							open			open		open	open		open		open		

ELECTRICAL TESTS AFTER LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Shunt R. Mego. 76°F	2K		4K	3K	Pigtail to insulated terminal loosened away from the section		100K	100K	30K	100K	15K	80	Pigtail to insulated terminal loosened away from the section	100K	100K	Pigtail to insulated terminal loosened away from the section	100K		Pigtail to insulated terminal loosened away from the section	100K	Pigtail to insulated terminal loosened away from the section	2K	Pigtail to insulated terminal loosened away from the section	200	100K
Cap. in ufd. 1000 c/s	.258		.240	.240			.257	.246	.257	.238	.261	.258		.261	.243		.249			.294		.243		.261	.260
Power Factor - %	1.25		.49	.45			1.04	1.38	1.0	1.35	1.0	.68		.70	.46		.63			1.6		.50		1.4	.70

Page 8   Data collected by H.J. V.W.

R-E-S-T-R-I-C-T-E-D

NObsr M #38

Twenty-five .25 Mfd.
single .5 mil
Metallized Mylar C Units

The units (22) were wired to a Life Test rack, and the total capacitance measured at room temperature. Following this, they were heated in an oven to 125° C. for one-half hour. The capacitance was measured at 125° C.

Then the units were exposed to 400 v.d.c. pre-breakdown test for one-half hour. During this period, there were 33 self-healing breakdowns. The capacitance was again measured before the Life Test commenced.

Temporary Breakdowns	Total Capacitance	Elapsed Time
0	6.15 Mfd.	Start of Test
46	5.90 "	22 hours
46	5.80 "	46 "
47	4.80 "	118 "
47	5.00 "	140 "
47	5.15 "	164 "
47	5.65 "	186 "
47	5.70 "	210 "
47	5.60 "	217 "
47	5.40 "	239 "
47	5.15 "	244 "
47	5.50 "	250 "

Test Completed

R-E-S-T-R-I-C-T-E-D

NObsr M #38 (continued)

Number of units started on test	22
Number finished	16
Total capacitance before Life Test at room temperature	5.70 Mfd.
Total capacitance before Life Test at 125° C.	6.60 Mfd.
Total capacitance after pre-breakdown test	6.15 Mfd.
Total capacitance after Life Test	5.50 Mfd.
Number of permanent failures	0
Number of temporary failures	47
Number of opens at the end of the test	6

LIFE TEST RECORD

25 UNITS .25 Mfd. - Single .5 MIL - Metallized Capacitors LOT NO. Nobsr M*39

SPECIFICATION Experimental FOR WHOM V. Winroth CONTRACT NO. Nobsr 57200

HOURS ON TEST 250 TEMPERATURE 125°C VOLTAGE 500 VDC

Date started 17 November 1953 Clock # 2 - 3923 Tray # Date finished 1 December 1953 Clock # 2 - 4174 Tray # Total Hours 251

ELECTRICAL TESTS BEFORE LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Voltage 500DC	P	K																							→ P
Shunt R. Megs - 75°F	100K	K																							100K
Cap. in mfd - 1000 c/s	.255	.248	.262	.261	.258	.266	.267	.245	.268	.259	.266	.252	.246	.248	.258	.256	.251	.268	.249	.261	.251	.253	.248	.271	.259
Power Factor - %	1.3	.48	.57	.56	.48	.49	.45	.43	2.0	1.35	.45	2.0	.39	.42	.44	.44	.52	.68	.47	.46	.45	.41	.47	.48	1.25
LIFE TEST FAILURES IN HRS.	open		open					Pre Break Down	open	open		open		Pre Break Down				open			open				open

ELECTRICAL TESTS AFTER LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Shunt R. Megs - 75°F	Pigtail to insulated Terminal Lossened away from the section	100K	Pigtail to insulated Terminal Lossened away from the section	100K	100K	100K	50K	Mylar Failure Inner ¼ of the section Bridges the entire film	Pigtail to insulated Terminal Lossened away from the section	Pigtail to insulated Terminal Lossened away from the section	30K	Pigtail to insulated Terminal Lossened away from the section	100K	Mechanical Failure At the very start of the section	100K	100K	25K	Pigtail to insulated Terminal Lossened away from the section	3K	100K	Pigtail to insulated Terminal Lossened away from the section	100K	100K	100K	Pigtail to insulated Terminal Lossened away from the section
Cap. in Mfd - 1000 c/s	.242		.257	.253	.261	.262					.241		.215		.253	.251	.248		.245	.259		.249	.246	.269	
Power Factor - %	.60		1.2	1.45	2.6	1.15					.62		50.		.33	.65	1.95		1.7	.73		.59	2.15	1.85	

Data collected by HJ. VW.

R-E-S-T-R-I-C-T-E-D

NUMBER OF TEMPORARY BREAKDOWNS vs. TEMPERATURE

NObsr # 39

Twenty-five .25 Mfd.
Single .5 mil
Metallized Mylar C Units

The units (25) were wired to a Life Test rack, and the total capacitance measured at room temperature. Following this, they were heated in an oven to 125° C, for one-half hour. The capacitance was measured at 125° C. Then the units were exposed to 500 v.d.c. pre-breakdown test for one-half hour.

Unit #14 failed completely after 109 temporary failures, and unit #8 after 118 temporary failures. In all, there were 122 self-healing failures during this period. The capacitance was again measured before the Life Test commenced.

Temporary Breakdowns	Total Capacitance	Elapsed Time
0	5.95 Mfd.	Start of Test
21	5.10 "	22 hours
26	5.70 "	44 "
28	5.20 "	68 "
29	5.40 "	135 "
29	5.50 "	158 "
29	5.25 "	180 "
29	5.25 "	228 "
29	5.40 "	251 "
		Test Completed

NObsr M #39 (continued)

Number of units started on test	25
Number finished	15
Total capacitance before Life Test at room temperature	6.20 Mfd.
Total capacitance before Life Test at 125° C	7.50 Mfd.
Total capacitance after pre-breakdown test	5.95 Mfd.
Total capacitance after Life Test	5.40 Mfd.
Number of premanent failures	0
Number of temporary failures	122
Number of opens at the end of the test	8

LIFE TEST RECORD

25 UNITS .25 ufd. – single .5 Mil – metallized Mylor Capacitors LOT NO. Nobsr M 40

SPECIFICATION Experimental FOR WHOM V. Winroth CONTRACT NO. Nobsr 57200

HOURS ON TEST 150 TEMPERATURE 125 °C VOLTAGE 600 VDC

Date started 11 November 1953 Clock # 3 – 2798 Tray # Date finished 23 November 1953 Clock # 3 – 3049 Tray # Total Hours 251

ELECTRICAL TESTS BEFORE LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Voltage-600 DC	P	←					→	P	Pigtail to insulated terminal loosened away from the section	P	←				→	P	Pigtail to the can loosened away from the section.	P	P	P	Pigtail to insulated terminal loosened away from the section	P	←	→	P
Shunt R-Meg Ω 76°F	100K	←					→	100K		100K	←				→	100K		100K	100K	100K		100K	←	→	100K
Cap in ufd. 1000 c/s	.245	.265	.246	.251	.242	.250	.261	.256		.263	.248	.244	.262	.248	.246	.269		.263	.251	.258		.265	.243	.263	.271
Power Factor - %	2.6	30.	.41	4.4	1.3	.70	.78	50.		20.	.40	.44	5.2	.45	1.1	.46		.74	5.	2.6		1.0	.48	.51	.80
LIFE TEST FAILURES IN HRS.	open	open	Immed.	open	open	open	open	open	open	open		open	open			open	open	open	Pre Break Down	open	open	open		open	

ELECTRICAL TESTS AFTER LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Shunt R-Meg Ω 75°F											50K			100K	100K								100K		35K
Cap in ufd. - 1000 c/s											.245			.243	.228								.225		.260
Power Factor - %											.50			.55	2.2								1.0		2.5
	Both pigtails loosened away from the section	Pigtail to the insulated terminal loosened away from the section	Mylor failure. Inner 1/4 of the section	Pigtail to the can loosened away from the section.	Pigtail to the insulated terminal loosened away from the section	Pigtail to the insulated terminal loosened away from the section	Pigtail to insulated terminal loosened away from the section	Pigtail to insulated terminal loosened away from the section		Pigtail to insulated terminal loosened away from the section		Pigtail to the insulated terminal loosened away from the section	Both pigtails loosened away from the section			Both pigtails loosened away from the section		Pigtail to the can loosened away from the section	Unable to locate exact source of the failure.	Pigtail to the insulated terminal loosened away from the section		Both pigtails loosened away from the section		Both pigtails loosened away from the section	

Data collected by HJ. - VW.

R-E-S-T-R-I-C-T-E-D

NUMBER OF TEMPORARY BREAKDOWNS vs. TEMPERATURE

NObsr M #40

Twenty-five .25 Mfd.
single .5 mil
Metallized Mylar C Units

The units (22) were wired to a Life Test rack, and the total capacitance measured at room temperature. Following this, they were heated in an oven to 125° C. for one-half hour. The capacitance was measured at 125° C. The units were then exposed to 600 v. d. c. pre-breakdown test for one-half hour.

Unit #19 failed completely after 124 temporary breakdowns. In all, there were 312 self-healing failures during this period. The capacitance was again measured before the Life Test commenced.

Temporary Breakdowns	Total Capacitance	Elapsed Time
0	4.35 Mfd.	Start of Test
387	3.95 "	0 hours #3 failed completely
453	3.60 "	19 hours
830	3.90 "	43 "
947	2.90 "	115 "
950	2.55 "	138 "
950	2.80 "	162 "
950	2.55 "	184 "
951	2.20 "	251 "
		Test completed

R-E-S-T-R-I-C-T-E-D

NObsr M #40 (continued)

Number of units started on test 22

Number finished 5

Total capacitance before Life Test at room temperature ..... 5.40 Mfd.

Total capacitance before Life Test at 125° C..... 6.60 Mfd.

Total capacitance after Life Test ..... 2.20 Mfd.

Total capacitance after pre-breakdown test ..... 4.35 Mfd.

Number of permanent failures 1

Number of temporary failures 951

Number of opens at the end of the Life Test 15

LIFE TEST RECORD

25 UNITS .25 Mfd. single .5 Mil - Metallized Mylar Capacitors LOT NO. Nobsr M-41

SPECIFICATION Experimental FOR WHOM V. Winroth CONTRACT NO. Nobsr 57200

HOURS ON TEST 250 TEMPERATURE 125 °C VOLTAGE 300 VDC

Date started 11 December 1953 Clock # Tray # 1 - 4306 Date finished 23 December 1953 Clock # Tray # 1 - 4562 Total Hours 256

ELECTRICAL TESTS BEFORE LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Voltage - 300DC	P	←				→	P	Pigtail to the can Loosened from the section	P	P	P	Pigtail to the can Loosened from the section	P	←										→	P
Shunt R. Meg. - 75°F	100K	←				→	100K		100K	100K	100K		100K	←										→	100K
Cap. in Mfd. - 1000 ~	.243	.248	2.5	.247	.243	.251	.246		.264	.263	.264		.248	.254	.245	.244	.243	.245	.249	.246	.246	.246	.264	.246	.251
Power Factor - %	.34	.69	25.	.50	.41	.60	.43		1.2	1.08	1.25		.59	25.	.68	.43	10.	7.0	2.9	84	.50	5.5	.55	4.5	1.15
LIFE TEST FAILURES IN HRS.			Open					Open				Open						Open				Open	Open	Open	

ELECTRICAL TESTS AFTER LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Shunt R - Meg. - 75°F	100K	100K		100K	100K	100K	100K		100K	100K	100K		100K	100K	100K	100K	100K		30K	100K	100K				100K
Cap. in Mfd - 1000 ~	.242	.246		.244	.241	.248	.243		.263	.263	.262		.245	.217	.244	.241	.241		.298	.243	.243				.249
Power Factor - %	.35	.75		.47	.43	1.5	.56		1.14	4.0	1.5		1.46	50.	1.6	.48	50.		3.0	2.5	.52				1.65
			Both pigtails Loosened away from the section.															Pigtail to the can Loosened away from the section.				Pigtail to the can Loosened away from the section.	Pigtail to the can Loosened away from the section.	Pigtail to the can Loosened away from the section.	

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Data collected by HJ. VW.

R-E-S-T-R-I-C-T-E-D

NObsr M #41

Twenty-five .25 Mfd.
single .5 mil
Metallized Mylar C Units

The units (23) were wired to a Life Test rack and the total capacitance measured at room temperature. Following this, they were heated in an oven to 125° C. for one-half hour. The capacitance was then measured at 125° C.

Next, the units were exposed to 300 v.d.c. pre-breakdown test for one-half hour. During this period, there were no breakdowns. The capacitance was again measured before the Life Test commenced.

Temporary Breakdowns	Total Capacitance	Elapsed Time
0	6.20 Mfd.	Start of Test
0	6.20 "	69 hours
0	6.0 "	96 "
0	5.90 "	143 "
0	6.0 "	214 "
0	5.90 "	234 "
0	5.90 "	256 "

Test completed

Number of units started on test 23

Number finished 18

Total capacitance before Life Test at room temperature .... 5.60 Mfd.

Total capacitance before Life Test at 125° C ..... 6.2 Mfd.

Total capacitance after pre-breakdown test ..... 6.2 Mfd.

Total capacitance after Life Test ..... 5.90 Mfd.

Number of permanent failures 0

Number of temporary failures 0

Number of opens at the end of the test 5

LIFE TEST RECORD

25 UNITS .25 ufd - single .5 MIL - Metallized Mylar Capacitors — LOT NO. Nobsr M #42

SPECIFICATION Experimental — FOR WHOM V. Winroth — CONTRACT NO. Nobsr 57200

HOURS ON TEST 250 — TEMPERATURE 125 °C — VOLTAGE 400 VDC

Date started 11 December 1953 — Clock # Tray # 2-4175 — Date finished 23 December 1953 — Clock # Tray # 2-4432 — Total Hours 257

ELECTRICAL TESTS BEFORE LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Voltage - 400 DC	P	←		→	P	Pigtail to the can loosened away from the section	P	P	Pigtail to the can loosened away from the section	Pigtail to the can loosened away from the section	P	←							→	P	Pigtail to the can loosened away from the section	P	←	→	P
Shunt R - Meg. 78°F	100K	←		→	100K		100K	100K			100K	←							→	100K		100K	←	→	100K
Cap. in ufd - 1000 c/s	.248	.244	.266	.244	.255		.262	.254			.246	.249	.242	.189	.246	.244	.243	.240	.249	.258		.259	.246	.262	.264
Power Factor - %	.64	.42	.62	.84	1.5		.95	50.			50.	.43	1.28	50.	.47	50.	1.23	1.4	50.	.43		1.4	1.46	.59	1.5
LIFE TEST FAILURES IN HRS.						open		open	open	open	open			open		open		open	open		open		open	open	open

ELECTRICAL TESTS AFTER LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Shunt R - Meg. 75°F	100K	←		→	100K		100K	Both pigtails loosened away from the section.			Pigtail to the can loosened away from the section	2.5K	100K	Pigtail to the can loosened away from the section	100K	Pigtail to the can loosened away from the section.	100K	Both pigtails loosened away from the section	Pigtail to the insulated terminal loosened away from the section	100K		100K	Pigtail to the can loosened away from the section	Pigtail to the insulated terminal loosened away from the section	Pigtail to the can loosened away from the section
Cap. in ufd - 1000 c/s	.244	.242	.262	.242	.254		.260					.246	.239		.242		.242			.257		.258			
Power Factor - %	1.15	.39	2.05	5.6	2.3		3.4					.38	2.3		.51		1.82			.41		1.75			

Page 19 — Data collected by HJ. VW.

R-E-S-T-R-I-C-T-E-D

NObsr M #42

Twenty-five .25 Mfd.
single .5 mil
Metallized Mylar C Units

The units (21) were wired to a Life Test rack, and the total capacitance measured at room temperature. Following this, they were heated in an oven to 125° C. for one-half hour. The capacitance was measured at 125° C.

The units were then exposed to 400 v.d.c. pre-breakdown test for one-half hour. During this period, there were no breakdowns. The capacitance was again measured before the Life Test commenced.

Temporary Breakdowns	Total Capacitance	Elapsed Time
0	5.3 Mfd.	Start of Test
6	5.6 "	69 hours
6	5.4 "	96 "
6	5.2 "	143 "
6	4.95 "	214 "
6	4.80 "	234 "
6	4.75 "	257 "
		Test Completed

Number of units started on test.............. 21
Number finished 12
Total capacitance before Life Test at room temperature .. 4.85 Mfd.
Total capacitance before Life Test at 125° C. .... 5.90 Mfd.
Total capacitance after pre-breakdown test .... 5.3 Mfd.
Total capacitance after Life Test .... 4.75 Mfd.
Number of permanent failures 0
Number of temporary failures 6
Number of opens at the end of the test 9

LIFE TEST RECORD

25 UNITS 25 Mfd - single 5 MIL - Metallized Mylar Capacitors LOT NO. Nobsr M #43

SPECIFICATION Experimental FOR WHOM V. Winroth CONTRACT NO. Nobsr 57200

HOURS ON TEST 250 TEMPERATURE 125 C VOLTAGE 500 VDC

Date started 11 December 1953 Clock # 3 - 3050 Tray # Date finished 23 December 1953 Clock # 3 - 3304 Tray # Total Hours 254

ELECTRICAL TESTS BEFORE LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Voltage - 500 DC	P ←											→ P		P	←	→	P		P	P	P			P	P
Shunt R Meg Ω - 76°F	100K ←											→ 100K		100K	←	→	100K		100K	100K	100K			100K	100K
Cap. in Mfd. 1000 ∿	.263	.264	.266	.261	.263	.263	.250	.251	.250	.250	.263	.262		.262	.246	.259	.265		.245	.258	.250			.257	.251
Power Factor - %	1.65	3.3	.60	15.	1.24	16.	.74	48	2.3	5.0	.54	10.		.80	.47	.58	14.	20.	25.	.43	.40			2.2	.93
LIFE TEST FAILURES IN HRS.	open	open		open	open	open	open	67	open	open	open	open	open				open	open	open			open	open	-	open

Notes written in columns: 13 – Pigtail to the can Loosened away from the section; 18 – Pigtail to the can Loosened away from the section; 22 – Pigtail to the can Loosened away from the section; 23 – Pigtail to the can Loosened away from the section.

ELECTRICAL TESTS AFTER LIFE TEST

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Shunt R Meg Ω - 77°F			100K											100K	100K	100K				100K	100K			100K	
Cap. in Mfd. - 1000 ∿			.264											.258	.243	.134				.254	.236			.256	
Power Factor - %			35											2.9	1.74	50.				1.4	.88			15.	

Notes written in columns: 1 – Pigtail to the insulated term. and Loosened away from the section; 2 – Pigtails insulated Terminal Loosened away from the section; 4 – Pigtail to the can Loosened away from the section.; 5 – Both pigtails Loosened away from the section; 6 – Both pigtails Loosened away from the section; 7 – Pig tail to the can Loosened away from the section.; 8 – Mylar Failure. At the start of the section. Middle of the film; 9 – Pigtail to the can Loosened away from the section; 10 – Both pigtails Loosened away from the section; 11 – Pig tail to the insulated terminal Loosened away from the section; 12 – Pigtail to the can Loosened away from the section; 17 – Pigtail to the can Loosened away from the section; 19 – Pigtail to the can Loosened away from the section; 25 – Pigtail to the can Loosened away from the section.

Data collected by H.J. V.W.

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NObsr M #43

Twenty-five .25 Mfd.
single .5 mil
Metallized Mylar C Units

The units (21) were wired to a Life Test rack, and the total capacitance measured at room temperature. Following this, they were heated in an oven to 125° C. for one-half hour. The capacitance was measured at 125° C.

Next, the units were exposed to 500 v.d.c. pre-breakdown test for one-half hour. During this period, there were 57 self-healing breakdowns. The capacitance was again measured before the Life Test commenced.

Temporary Breakdowns	Total Capacitance	Elapsed Time
0	6.00 Mfd.	Start of Test
303	3.42 Mfd.	67 hours
349	4.0 Mfd.	94 "
349	3.85 Mfd.	141 "
349	3.85 Mfd.	212 "
349	3.80 Mfd.	232 "
349	3.70 Mfd.	254 "
		Test Completed

- -

Number of units started on test 21
Number finished 7
Total capacitance before Life Test at room temperature .... 5.25 Mfd.
Total capacitance before Life Test at 125° C. .... 5.90 Mfd.
Total capacitance after pre-breakdown test .... 6.00 Mfd.
Total capacitance after Life Test .... 3.70 Mfd.
Number of permanent failures 1
Number of temporary failures 349
Number of opens at the end of the test 13