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Quarterly Development Report

- for -

DEVELOPMENT OF --

FILM DIELECTRIC CAPACITORS ---- HIGH TEMPERATURE

This report covers the period April 1, 1954 to July 1, 1954

TOBE DEUTSCHMANN CORPORATION

921 Providence Highway
Norwood, Massachusetts

NAVY DEPARTMENT BUREAU OF SHIPS ----- ELECTRONICS DIVISION

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Contract No. NObsr-57200

Index No. NE-111016, St. 1.

Date of Contract: Feb. 20, 1952

Date of Report: July 15, 1954

C M P Classification: Class "A" Product

Certification DO-A-7; certified under CMP Regulation #3

OCT 27 1954

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ABSTRACTPHASE I.

The leakage current of Foil Type Mylar Capacitors at 150° C. Life Test conditions, is considerably higher than was anticipated by the use of Dielectric Resistance vs. Temperature curves, previously obtained. This abnormally high current drain overloaded the power supplies which were installed for these tests. This high current also precluded the use of the automatic timing and clearing mechanism. By using heavy-duty voltage supplies and substituting manual control for automatic relay circuits, we were able to Life Test the six groups of capacitors reported on, in this document. The results with such a small total of test units is, of course, not conclusive, but the indications substantiate our past theory that our present Mylar C does not effectively operate at temperatures as high as 150° C.

PHASE II.

The greatest problem with Metallized Mylar C Capacitors to date was the high number of opens that occurred during Life Tests. All work done with such units during this quarter was devoted to solving this difficulty. The ensuing

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ABSTRACT (continued)

data in this report reveals that our efforts have not corrected the situation one hundred percent, but the comparative few opens that now occur are sufficient to make our test data significant.

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-499.

B. Phase I (continued)

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.
3. Submit reports as specified therein.

C. Phase II

1. Evaluate a V-200 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.
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

Life Tests were conducted at 125° C. and at stresses of 200, 300, 400, 500, 600 and 700 volts per mil. The 500 volts per mil stress produced a failure of 8% failures in 72 hours; the 600 volts per mil stress, 56% loss in 72 hours. Accordingly, the 30% point presumably will occur within these two values.

It was observed during this quarter that as a result of using manual controls on our Life Tests, thereby extending the exposure time to high temperature without voltage, that the failures occurring late in the Life Test (close to the 72-hour minimum) were more difficult to examine than those of shorter duration. In most cases, the outside half or two-thirds of the section would readily unwind, but the inner portion had become very brittle. In many instances, the Mylar would shatter into tiny fragments as the unit was being unwound.

The actual points of failure differ in physical appearance, also. All previous failures have caused ruptures in the Mylar, both inwardly and outwardly from the exact breakdown. The number of layers on either side of the failure, vary between 3 and 12. All failures that were found in the embrittled Mylar C never penetrated more than two layers.

A gradual decrease in leakage current occurred during Life Test

GENERAL FACTUAL DATA Phase I (continued)

indicating an effective increase in insulation resistance. This phenomenon seemed to occur to an equal degree without the application of voltage. This may indicate the possible requirement of long-term ageing to develop required characteristics.

PHASE II

During the last period, experiments were conducted to evaluate two methods of reducing opens during Life Test on Metallized Mylar Capacitors. The first method was to increase the margin of the capacitor and to melt down the excessive margin during the spraying operation. The hot copper spray melts back a sufficient amount of Mylar so that the use of the wider margin does not result in a larger capacitor.

This method has proven to be generally successful as indicated in the attached data.

The second method has been to fold the edge of the Mylar during the winding operation, thereby presenting a metal surface to the copper spray rather than the edge of a Mylar film. This method resulted in an excessive number of voltage breakdowns during the application of initial voltage tests.

The remaining capacitors went through Life Test satisfactorily without opens.

GENERAL FACTUAL DATA Phase II (continued)

The unusual amount of voltage breakdowns during initial voltage tests were traced to a cracking of the Mylar during the folding operation.

As this operation is difficult and did not produce a good yield, it was abandoned in favor of the first-mentioned method.

DETAIL FACTUAL DATA

PHASE I

All tests made in Phase I during the last quarter were conducted at 150° C. The capacitors used at this time were of similar design to those used previously -- namely 1 Mfd. constructed with two layers of .0005" Mylar C film between foils. The test units were constructed with Mylar C taken from the same lots that were used for the test units made previously. The gauge from roll to roll and within each roll varied between limits of .00048" and .0006".

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

1. Tested at 300 VDC, all units passed tests prior to Life Test. Twenty-five units were placed on Life Test, and all twenty-five completed 72 hours. (See Part III, P.1)
2. Tested at 300 VDC, all units passed tests prior to Life Test. Twenty-five units were placed on Life Test and all twenty-five completed 72 hours. (See

DETAIL FACTUAL DATA - Phase I (continued)

Part III, P. 2.)

3. Tested at 400 VDC, all units passed tests prior to Life Test. Twenty-five units were placed on test, and twenty-three completed 72 hours. Both failures were caused by Mylar faults. (See Part III, P. 3.)

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

1. Tested at 500 VDC, all units passed tests prior to Life Test. Twenty-five units were placed on test and twenty-three completed 72 hours. Both failures were caused by Mylar faults. One unit opened during the test. (See Part III, P. 4.)

2. Tested at 600 VDC, all units passed tests prior to Life Test. Twenty-five units were placed on Life Test, and eleven completed 76 hours. There were thirteen Mylar failures, 1 mechanical failure and 1 unit opened during the test. (See Part III, P. 5.)

3. Tested at 700 VDC, all units passed tests prior to Life Test. Twenty-five units were placed on Life Test, and sixteen completed 72 hours. All nine failures were caused by Mylar faults. (See Part III, P. 6.)

DETAIL FACTUAL DATAPHASE II

All tests performed this quarter were at 125° C. and the test unit was the .25 Mfd. Capacitor, constructed with a single layer of .0005" Metallized Mylar C. The material used was slit and margined by the TOBE DEUTSCHMANN CORP. from 2" rolls, slit to 1" rolls with 3/32" margins.

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

1. Tested at 600 VDC, all units passed tests prior to Life Test. Twenty-five units were placed on Life Test, and fifteen completed 250 hours. There were ten failures caused by Mylar faults. Two units opened during the test. (See Part III, P. 7.)
2. Tested at 700 VDC, two units failed during pre-breakdown voltage test. Both were caused by Mylar faults. The remaining twenty-three were placed on Life Test, and six completed 250 hours. There were seventeen failures caused by Mylar faults. Two units opened during the test. (See Part III, P. 10).
3. Tested at 800 VDC, five units failed tests prior to Life Test. One unit opened during the initial voltage test, and four units failed during the pre-breakdown voltage test. The remaining twenty units were placed on Life Test, and eight completed 250 hours.

DETAIL FACTUAL DATA - Phase II (continued)

There were twelve failures caused by Mylar faults.

(See Part III, P. 13)

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

1. Tested at 400 VDC, two units failed tests prior to Life Test. One unit opened and the other failed the initial voltage test. The remaining twenty-three units were placed on Life Test, and all twenty-three completed 251 hours. (See Part III, P. 16).
2. Tested at 500 VDC, one unit failed the initial voltage test. The remaining twenty-four units were placed on Life Test, and twenty-two completed 251 hours. Both failures were caused by Mylar faults. (See Part III, P. 19)
3. Tested at 600 VDC, one unit failed during the pre-breakdown voltage test. The remaining twenty-four units were placed on Life Test and sixteen completed 258 hours. Eight units failed because of Mylar faults. (See Part III, P. 22)

C. Sixty units were divided into three groups of twenty each:

1. Tested at 400 VDC, nine units failed tests prior to Life test. Eight units failed the initial voltage test and one failed during the pre-breakdown voltage test. The remaining eleven units were placed on Life Test, and all eleven completed 251 hours. (See Part III, P. 25)

DETAIL FACTUAL DATA -- Phase II (continued)

C. (continued)

2. Tested at 500 VDC, six units failed the initial voltage test prior to Life Test. The remaining fourteen units were placed on Life Test and all fourteen completed 251 hours. (See Part III, P. 28.)
3. Tested at 600 VDC, one unit failed during pre-breakdown voltage test. The remaining nineteen units were placed on Life Test, and sixteen completed 251 hours. The three failures were caused by Mylar faults. Three units opened during the test. (See Part III, P. 31)

Table I

.25 MFD. SINGLE .5 MH
METALLIZED MYLAR C CAPACITORS

NObsr M #	Temp.	Voltage	Number Started Test	Number			Number Opened	Number Temporary Opens	Margins
				Failed	Finished	Number			
1	85° C.	625	12	0	12	1	10	1/16"	
2	85° C.	700	10	0	10	0	16	1/16"	
3	85° C.	1200	12	0	?	?	8	1/16"	
4	85° C.	1500	12	1	?	?	13	1/16"	
5	85° C.	200	20	0	20	0	30	2/16"	
6	85° C.	1000	20	0	20	0	147	1/16"	
7	85° C.	1200	20	0	20	0	265	1/16"	
8	85° C.	1000	25	5	7	13	760	1/16"	
9	85° C.	1200	21	15	0	8	343	1/16"	
10	85° C.	1400	16	16	1	1	92	1/16"	
11	85° C.	600	25	0	25	0	108	1/16"	
12	85° C.	700	25	1	24	0	270	1/16"	
13	85° C.	800	24	1	23	0	213	1/16"	
20	85° C.	500	22	0	20	2	*31	1/16"	
21	85° C.	700	22	0	19	3	120	1/16"	

* Direct
Magnetic
Counter
First
Used.

TABLE I
(continued)

.25 MFD. SINGLE .5 MIL
METALLIZED MYLAR C CAPACITORS

NOber	Temp.	Voltage	Number Started	Number Failed	Number Finished	Number Opened	Number Temporary Opens	Margins
22	85° C.	800	20	0	11	9	59	1/16"
23	85° C.	900	20	0	18	2	488	1/16"
24	85° C.	1000	21	3	6	12	1690	1/16"
25	85° C.	1100	19	0	7	12	862	1/16"
26	85° C.	600	25	0	22	3	83	1/16"
27	85° C.	700	23	0	21	2	153	1/16"
28	85° C.	800	25	0	23	2	104	1/16"
29	85° C.	900	19	0	17	2	161	1/16"
30	85° C.	1000	19	1	13	6	342	1/16"
31	85° C.	1100	19	1	11	7	313	1/16"
32	85° C.	1200	20	0	10	10	416	1/16"
33	85° C.	1300	18	3	1	14	1028	1/16"
34	85° C.	1400	20	3	2	15	1233	1/16"
35	85° C.	800	19	0	19	0	190	1/16"

TABLE I
(continued)

.25 MFD. SINGLE .5 MIL
METALLIZED MYLAR C CAPACITORS

NObsr	Temp.	Voltage	Number Started	Number Failed	Number Finished	Number Opened	Number Temporary Opens	Margins
36	85° C.	900	21	0	18	3	309	1/16"
37	85° C.	1000	23	2	13	8	492	1/16"

TABLE II

38	125° C.	400	22	0	16	6	47	1/16"
39	125° C.	500	25	0	15	8	122	1/16"
40	125° C.	600	22	1	5	15	951	1/16"
41	125° C.	300	23	0	18	5	0	1/16"
42	125° C.	400	21	0	12	9	6	1/16"
43	125° C.	500	21	1	7	13	349	1/16"

TABLE II
(continued)

.25 MFD. SINGLE .5 MIL
METALLIZED MYLAR C CAPACITORS

NObsr	Temp.	Voltage	Number Started Test	Number Failed	Number Finished	Number Opened	Number Temporary Opens	Margins
44	125° C.	300	25	0	25	0	14	3/32"
45	125° C.	400	25	0	25	0	186	3/32"
46	125° C.	500	24	0	24	0	171	3/32"
47	125° C.	600	25	10	15	2	521	3/32"
48	125° C.	700	23	17	6	2	620	3/32"
49	125° C.	800	20	12	8	0	1350	3/32"
50	125° C.	400	23	0	23	0	8	3/32"
51	125° C.	500	24	2	22	2	39	3/32"
52	125° C.	600	24	8	16	0	249	3/32"
53	125° C.	400	11	0	11	0	2	3/32" 1/32 roll-over
54	125° C.	500	14	0	14	0	59	3/32" "
55	125° C.	600	19	3	16	3	237	3/32" "

CONCLUSIONS

PHASE I

The number of units tested at 150° C. is too small to yield conclusive results. Indications are that a 1 Mfd. Capacitor with two layers of .5 Mil Mylar C between foils will operate at this temperature for 1000 hours at 300 volts per mil, and 8000 hours at 200 volts per mil.

Capacitors operated at these rather low stresses are extremely bulky and their application probably will be limited by their size.

Obviously, this Mylar C does not yet provide an answer for miniaturization at this temperature.

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PHASE II

By reviewing the Tables found on pages 11, 12, 13 and 14, it is very evident that by changing our design to a slightly greater protective margin, we have practically eliminated the problem of opens occurring during Life Test. Before the change was made, the column headed "Number Opened" was heavy, and the column headed "Number Failed" was light. Now the

CONCLUSIONS (continued)

PHASE II

situation is completely reversed, which is what it should be since it is the purpose of this project to evaluate the units of Mylar C as a dielectric.

PART II.

PART II.

PROGRAM FOR
NEXT INTERVAL

PHASE I.

We have received from E. I. duPont de Nemours & Co., Inc. a very small trial lot of the new Mylar C which has been wound into capacitors and are now starting Life Test. Upon the performance of these units rests the decision whether additional work be done with plain Mylar C or whether this phase of the project be postponed until the manufacturer of the film can provide us with better and more consistent material.

PHASE II.

Now that the problem of "opens" occurring during Life Test has been corrected, it is our intention to review the entire Life Test program conducted with .25 Mfd. units constructed with a single .5 Mil of Metallized Mylar C. All tests, whether they be at 85° C. or 125° C. that resulted in excessive opens, will be run again with new units of similar construction, but with 3/32" margins.

PART III.

LIFE TEST RECORD

UNITS 1 MED 2 x .5 MIL U MYLAR C CAPACITORS LOT NO. 140681 138
 SPECIFICATION EXP ERIMENTAL FOR WHOM V. H. WINTROTH CONTRACT NO. 140681 57200
 HOURS ON TEST 72 + TEMPERATURE 150 °C VOLTAGE 200 V.D.C.
 Date started Clock # 7 3732 Tray # 7 8804 Total Hours 72
 41-9 me-54 4-9 me-54

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
Voltage 200 V.D.C.																								
DISSIPATION %																								
Cap. in % of 1000 %	1.013	1.063	1.073	1.053	1.013	1.019	1.033	1.063	1.076	1.000	1.077	1.091	1.033	1.029	1.071	1.040	1.026	1.026	1.071	1.019	1.019	1.019	1.019	1.019
Power factor %	.45	.46	.47	.46	.44	.46	.44	.44	.47	.48	.46	.45	.48	.44	.47	.45	.45	.45	.46	.46	.43	.46	.45	.43

LIFE TEST FAILURES IN HRS.

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
DISSIPATION %																								
Cap. in % of 1000 %	1.013	1.023	1.016	1.016	1.020	1.031	1.035	1.066	1.051	1.003	1.019	1.032	1.032	1.015	1.011	1.030	1.025	1.029	1.009	1.014	1.014	1.012	1.007	1.012
Power factor %	.28	.29	.28	.27	.27	.26	.26	.26	.26	.26	.26	.27	.27	.29	.29	.29	.28	.28	.29	.31	.27	.27	.29	.29

LIFE TEST RECORD

UNITS 1 MED 2 x .5 MIL U LOT NO. NObsr 139
 SPECIFICATION EXPERIMENTAL FOR WHOM V. H. WINTROTH CONTRACT NO. NObsr 57200
 HOURS ON TEST 72+ TEMPERATURE 160°C VOLTAGE 300 v.p.c.
 Date started 4-9-54 Date finished 4-8-54 Clock # 8 Total Hours 72
 Tray # 1 Tray # 4

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
VERTIGO 300V.D.C. PK																									
SOAK RES at 74°F																									
Cap. in oil at 1000°F	1.011	1.015	1.077	1.061	1.016	1.013	1.051	1.057	1.015	1.012	1.054	1.020	1.012	1.022	1.022	1.022	1.029	1.029	1.010	1.030	1.030	1.000	1.078	1.000	1.000
Power Factor %	.47	.48	.49	.42	.40	.40	.41	.41	.41	.41	.41	.43	.45	.42	.43	.42	.48	.43	.42	.46	.46	.42	.42	.44	.42

LIFE TEST FAILURES IN HRS.

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
SOAK RES at 74°F																									
Cap. in oil at 1000°F	1.031	1.069	1.097	1.066	1.032	1.077	1.030	1.073	1.037	1.049	1.003	1.076	1.086	1.041	1.030	1.072	1.044	1.026	1.029	1.024	1.015	1.022	1.019	1.052	1.000
Power Factor %	.28	.28	.26	.27	.28	.28	.28	.27	.26	.26	.26	.25	.29	.30	.30	.29	.29	.29	.27	.26	.26	.28	.28	.27	.27

LIFE TEST RECORD

UNIT 1 AFB 2 x 5 MIL U MYLAR C CAPACITORS LOT NO. 40bst 140

SPECIFICATION EX PERIMENTAL FOR WEM V. H. WINTATH CONTRACT NO. 40bst 57200

HOURS ON TEST 72+ TEMPERATURE 150 °C VOLTAGE 400 V.D.C.

Date started 7- June - 54 Clock # 11 3665 Tray # -

Date finished 4 - June - 54 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	
Voltage 400 V.D.C.																									
Cap. in % of 100%	100K																								
Power Factor in %	.43	.46	.47	.46	.47	.47	.45	.46	.45	.44	.44	.49	.46	.45	.41	.47	.47	.45	.46	.46	.46	.47	.47	.47	.48
LIFE TEST FAILURES IN HRS.																									17

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	
Cap. in % of 100%	50K	100K	50K	100K	75K	75K	100K	100K	100K	30K	30K	100K	50K	100K	100K	45K	75K	100K							
Power Factor in %	.33	.30	.29	.30	.30	.30	.29	.29	.30	.29	.30	.29	.30	.30	.29	.29	.29	.27	.27	.29	.29	.27	.27	.27	.28

LIFE TEST RECORD

UNITS / MFD. 2x.5 MIL U **NYLAR C CAPACITORS** LOT NO. 11031 # 143
 SPECIFICATION EXP. PERIMENTAL FOR WHOM V. H. WINRATA CONTRACT NO. 11031 57200
 HOURS ON TEST 72 + TEMPERATURE 150 °C VOLTAGE 700 V.D.C.
 Date started Clock # 11 9697 Date finished Clock # 11 9709
 18-9-54 Tray # 54 15-9-54 Tray # 51 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 700 V.D.C. PK																									
SD-R.P. E of 26.5																									
Cap in 100% 1000% 1000%																									
Power Load in %																									
LIFE TEST FAILURES IN HRS.	4		4										58	1		57	58	50	Inced				50		

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
SD-R.P. E of 26.5																									
Cap in 100% 1000% 1000%																									
Power Load in %																									

Data collected by V. Tyman, H. Toon, V. Lo

THE INTERNATIONAL ORGANIZATION

C.I.L. 1002

LIFE TEST RECORD

UNITS: 25 MED. SINGLE .5 MIL U METALLIZED MYLAR CAPACITORS LOT NO. NOBAC M-47
 SPECIFICATION: EXPR. MENTAL FOR WHOM V. H. VINTITH CONTRACT NO. NOBAC 57200
 HOURS ON TEST: 250 TEMPERATURE: 125°C VOLTAGE: 600 V.D.C.
 Date started: Clock # 1 4823 Date finished: Clock # 1 5073 Total Hours: 250
 23 - Quid - 64 17 - May - 64 Tray # -

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
Cap. 1000% Pwr. Redn in %	.2308	.2305	.2322	.2366	.2319	.2401	.2257	.2306	.2213	.2331	.2507	.2355	.2363	.2303	.2667	.2399	.2353	.2358	.2279	.2384	.2266	.2307	.2255	.2266	
Loss	.34	.46	.41	.35	.39	.36	.34	.36	.35	.114	.58	.36	.08	.36	.37	.36	.36	.36	.35	.49	.41	.32	.35	.33	
LIFE TEST FAILURES IN HRS.				1	144	.5			161			181					199	115	146				121	222	

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
Cap. 1000% Pwr. Redn in %	.2308	.2305	.2322	.2366	.2319	.2401	.2257	.2306	.2213	.2331	.2507	.2355	.2363	.2303	.2667	.2399	.2353	.2358	.2279	.2384	.2266	.2307	.2255	.2266	
Loss	.34	.46	.41	.35	.39	.36	.34	.36	.35	.114	.58	.36	.08	.36	.37	.36	.36	.36	.35	.49	.41	.32	.35	.33	
LIFE TEST FAILURES IN HRS.				1	144	.5			161			181					199	115	146				121	222	

NObsr M #47

Twenty-five .25 Mfd.
single half Mil Metallized
Mylar C Units.

The units (25) were wired to a Life Test rack after the initial tests were concluded, and the total capacitance measured at room temperature. Then they were heated in an oven to 125° C. Next, the units were exposed to 600 v.d.c. pre-breakdown test for one-half hour. During this period, there were 129 temporary breakdowns. The capacitance was again measured before the Life Test commenced.

<u>Temporary Breakdowns</u>	<u>Total Capacitance</u>	<u>Elapsed Time</u>
0	6.4 Mfd.	Start of test
		Unit #7 failed after .5 hours; 109 temporary breakdowns.
		Unit #5 failed after one hour; 249 temporary breakdowns.
283	5.25 Mfd.	23 hours
308	5.25 "	45 "
334	4.85 "	115 "
		Unit #18 failed after 334 temporary breakdowns.
		Unit #23 failed after 121 hours and 358 temporary breakdowns.
394	4.25 "	144 hours
		Unit #6 failed after 394 temporary breakdowns.
		Unit #19 failed after 146 hours and 405 temporary breakdowns.
414	4.00 "	151 hours
437	4.15	161 hours

NObsr M #47 (continued)

<u>Temporary Breakdowns</u>	<u>Total Capacitance</u>	<u>Elapsed Time</u>
		Unit #9 failed after 448 temporary breakdowns.
461	3.75 Mfd.	179 hours
		Unit #12 failed after 181 hours and 469 temporary breakdowns.
		Unit #17 failed after 199 hours and 478 temporary breakdowns.
481	3.10 "	1 99 hours
501	2.60 "	222 "
		Unit #24 failed after 222 hours and 501 temporary breakdowns.
521	2.68	250 hours
		Test completed

Number of units started on test..... 25

Number finished 15

Total capacitance before Life Test - room temperature 5.80 Mfd.

" " " " " at 125° C. 6.75 Mfd.

" " after pre-breakdown test 6.40 Mfd.

" " after Life Test 2.68 Mfd.

Number of permanent failures 10

Number of temporary failures 521

Number of opens at the end of the test 2

NObar M #48

Twenty-five .25 Mfd.
single half Mil Metallized
Mylar C units.

The units (25) were wired to a Life Test rack after the initial tests were concluded, and the total capacitance measured at room temperature. Then they were heated in an oven to 125° C. Next, the units were exposed to 700 v.d.c. pre-breakdown test for one-half hour. During this period, there were 154 temporary breakdowns. Unit #19 failed after 45 temporary breakdowns, and unit #12 after 141 temporary breakdowns. The capacitance was again measured before the Life Test commenced.

Temporary
BreakdownsTotal
CapacitanceElapsed
Time

0

5.80 Mfd.

Start of test

Unit #14 failed immediately after 83 temporary breakdowns; #16 after one hour - 167 breakdowns. #11 failed after one hour with 212 temporary breakdowns. Unit #15 failed after one hour having 250 temporary breakdowns. #13 failed after one hour - 252 temporary breakdowns. Unit #9 failed after one hour; this unit had 313 temporary breakdowns. Unit #5 failed after two hours - 324 temporary breakdowns. Unit #7 failed after three hours, and had 336 temporary breakdowns. Unit #25 failed after 21 hours - 346 temporary breakdowns.

346

3.10 Mfd.

21 hours

Unit #18 failed after 22 hours; this unit had 353 temporary breakdowns. Unit #6 failed after 24 hours - 368 temporary breakdowns. Unit #2 failed after 25 hours and had 373 temporary breakdowns.

NObsr M #48 (continued)

<u>Temporary Breakdowns</u>	<u>Total Capacitance</u>	<u>Elapsed Time</u>
405	2.20 Mfd.	96 hours. Unit #24 failed. Unit #21 failed after 98 hours - 425 temporary breakdowns. Unit #23 failed after 99 hours - 443 temporary breakdowns.
524	1.55 Mfd.	125 hours
582	1.20 "	148 hours Unit #3 failed.
590	.90	211 hours Unit #17 failed.
594	1.00	230 hours
620	.40	250 hours
Test Completed.		

Number of units started on test	23
Number finished	6
Total Capacitance before Life Test - room temp.	5.80 Mfd.
" " " " " at 125° C.	6.75 Mfd.
" " after pre-breakdown test	5.80 Mfd.
" " " Life Test40 Mfd.
Number of permanent failures	17
Number of temporary failures	620
Number of opens at the end of the test	2

LIFE TEST RECORD

UNITS 125 MED. SILVER 15 MIL U METALLIZED MYLAR C CAPACITORS LOT NO. NObsr M-49
 SPECIFICATION EXPARIMENTAL FOR WGM V. WINROTH CONTRACT NO. NObsr 57000
 HOURS ON TEST 260 TEMPERATURE 125°C VOLTAGE 800 V.D.C.
 Date started Clock # 8 8562 Date finished Clock # 3 3812 Total Hours 250
 28-2-62 Tray # May - 54

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 Service Pk																			100K						
Dist R in %																									
Cap. in %																									
Power %																									
LIFE TEST FAILURES IN HRS.	117				113	200			1		21	75					2	2	2	25				22	7

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
Dist R in %																									
Cap. in %																									
Power %																									

Date collected by V. Bannin, H. Bannin, V. W. Bannin
 TOBE DEUTSCHMAN CORPORATION
 ENGINEERING DEPT. C.I. 1002
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 FORMOD. 1002

NObsr M #49

Twenty-five .25 Mfd.
single half-Mil Metallized
Mylar C units.

The units (24) were wired to a Life Test rack after the initial tests were concluded, and the total capacitance measured at room temperature. Then 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 800 v.d.c. pre-breakdown test for one-half hour. During this period, there were 661 temporary breakdowns. Units #22, #20, #16, #23 failed after 64, 106, 415, and 661 temporary breakdowns respectively. The capacitance was then once again measured before the Life Test commenced.

Temporary
Breakdowns

Total
Capacitance

Elapsed
Time

0

4.80 Mfd.

Start of Test

Unit #9 failed after one hour - 533 temporary breakdowns. Unit #17 failed after 2 hours - 58 temporary breakdowns.

Unit #18 failed after two hours - 687 temporary breakdowns. Unit #25 failed after four hours - 768 temporary breakdowns.

Unit #12 failed after 21 hours - 855 temporary breakdowns.

855

2.55 Mfd.

21 hours

Unit #24 failed after 22 hours - 900 temporary breakdowns. Unit #1 failed after 24 hours - 912 temporary breakdowns.

Unit #21 failed after 25 hours - 928 temporary breakdowns. Unit #13 failed after 95 hours - 1039 temporary breakdowns.

NObsr M #49 (continued)

<u>Temporary Breakdowns</u>	<u>Total Capacitance</u>	<u>Elapsed Time</u>
1039	1.43 Mfd.	95 hours Unit #5 failed after 118 hours - 1132 temporary breakdowns. Unit #3 failed after 119 hours - 1179 temporary breakdo
1179	.98 Mfd.	120 hours
1237	.98 Mfd.	145 hours
1321	.65 Mfd.	209 hours Unit #6 failed.
1333	.88 Mfd.	227 hours
1350	.75 Mfd.	250 hours
Test Completed		

Number of units started on test	20
Number finished	8
Total capacitance before Life Test - room temperature	5.40 Mfd.
" " " " " at 125° C.	6.35 Mfd.
" " after pre-breakdown test	4.80 Mfd.
" " " Life Test75 Mfd.
Number of permanent failures	12
Number of temporary failures	1350
Number of opens at the end of the test	0

NObsr M#50

Twenty-five .25 Mfd.
single half-Mil
Metallized Mylar C
Units

The units (23) were wired to a Life Test rack after the initial tests were concluded, and the total capacitance measured at room temperature. Then 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 400 v.d.c. pre-breakdown test for one-half hour. During this period, there were 114 temporary breakdowns. The capacitance was measured again before the Life Test commenced.

<u>Temporary Breakdowns</u>	<u>Total Capacitance</u>	<u>Elapsed Time</u>
0	6.00 Mfd.	Start of Test
1	6.00 "	30 hours
1	5.95 "	57 "
1	6.00 "	76 "
1	6.00 "	106 "
6	6.00 "	169 "
6	6.00 "	196 "
8	6.00 "	222 "
8	6.00 "	251 "

Test Completed

NObsr M #50 (continued)

Number of units started on test 23
Number finished 23
Total capacitance before Life Test - room temperature..... 5.45 Mfd.
" " " " " at 125^o C. 6.20 Mfd.
" " after pre-breakdown test 6.00 Mfd.
" " Life Test 6.00 Mfd.
Number of permanent failures 0
Number of temporary failures 8
Number of opens at the end of the test 0

LIFE TEST RECORD

UNITS: .25 MFD. SINGLE .5 MILU METALLIZED MYLAR CAPACITORS LOT NO. H0631 M-61
 SPECIFICATION: EXPERIMENTAL FOR MDM V. H. N. IN RATH CONTRACT NO. H0631 57200
 HOURS ON TEST: 260 TEMPERATURE: 125°C VOLTAGE: 500 V.D.C.
 Date started: 4-9-54 Clock # 2 4948 Date finished: 18-9-54 Clock # 2 5194
 Tray # - 54 Tray # -

Total Hours 261

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 V.D.C. TC																										
Cap. in % of 1000 @ 1000 c/s	.231	.282	.280	.281	.285	.285	.250	.223	.229	.281	.251	.285	.240	.286	.288	.288	.286	.226	.283	.227	.227	.229	.229	.280		
Power Factor in %	.89	.89	.42	.37	.75	.70	.51	.62	.48	.86	.42	.37	.41	.40	.37	.40	.40	.45	.44	.40	.41	.40	.47	.41		
LIFE TEST FAILURES IN HRS.										202														248		

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
Cap. in % of 1000 @ 1000 c/s	3.6	<3	80	<3	<3	40	<3	<3	<3	200	<3	<3	<3	<3	<3	65	415	<3	<3	<3	<3	<3	<3	<3	<3
Power Factor in %	.57	.58	.89	.41	.40	.23	.37	-	.59	.31	2.58	.39	.40	.50	.46	.39	.41	.42	-	.82	.38	.38	.38	.38	.38

NObsr M #51

Twenty-five .25 Mfd.
single half-Mil
Metallized Mylar C
Units

The units (24) were wired to a Life Test rack after the initial tests were concluded, and the total capacitance measured at room temperature. Then they were heated in an oven to 125° C. for one-half hour. After this, 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 temporary breakdowns. The capacitance was again measured before the Life Test commenced.

<u>Temporary Breakdowns</u>	<u>Total Capacitance</u>	<u>Elapsed Time</u>
0	6.00 Mfd.	Start of Test
14	5.80 "	19 hours
15	5.90 "	45 "
17	5.95 "	65 "
24	6.00 "	95 "
27	5.80 "	138 "
28	5.80 "	185 "
33	5.60 "	209 "
		Unit #10 failed after 202 hours - 33 temporary breakdowns.
36	5.70	233 Hours
		Unit #23 failed after 248 hours - 39 temporary breakdowns.
39	5.40 "	231 hours
		Test Completed

NObsr M #51 (continued)

Number of units started on test	24
Number of units finished	22
Total capacitance before Life Test - room temperature	5.80 Mfd.
" " " " " at 125° C.	6.90 Mfd.
" " after pre-breakdown test	6.00 Mfd.
" " " Life Test	5.40 Mfd.
Number of permanent failures	2
Number of temporary failures	39
Number of opens at the end of the test	2

NObsr M #52

Twenty-five .25 Mfd.
single half-Mil Metallized
Mylar C Units.

The units (25) were wired to a Life Test rack after the initial tests were concluded, and the total capacitance measured at room temperature. Then they were heated in an oven to 125° C. for one-half hour. The capacitance was measured at 125° C; and the units were then exposed to 600 V.D.C. pre-breakdown test for one-half hour. During this period, there were 477 temporary breakdowns. Unit #19 failed after 444 temporary breakdowns. The capacitance was again measured before the Life Test commenced.

<u>Temporary Breakdowns</u>	<u>Total Capacitance</u>	<u>Elapsed Time</u>
0	5.70 Mfd.	Start of Test
49	5.50 "	19 hours
52	5.60 "	45 "
69	5.50 "	65 "

Unit #13 failed after 70 hours; there were 91 temporary breakdowns. #6 failed after 87 hours; 129 temporary breakdowns.

129	5.10 Mfd.	87 hours
133	4.70 Mfd.	147 "

Unit #3 failed. #18 failed after 151 hours. There were 150 temporary breakdowns.

Unit #2 failed after 167 hours; 206 temporary breakdowns.

NObsr M #52 (continued)

<u>Temporary Breakdowns</u>	<u>Total Capacitance</u>	<u>Elapsed Time</u>
206	4.20 Mfd.	167 hours
		Unit #9 failed after 184 hours; 210 temporary breakdowns.
		#7 failed after 188 hours; there were 216 temporary breakdowns.
221	3.70 Mfd.	190 hours
233	3.60 Mfd.	214 "
239	3.50 Mfd.	237 "
		Unit #21 failed after 258 hours - 249 temporary breakdowns.
249	3.20 Mfd.	258 hours
		Test Completed

Number of units started on test	25
Number finished	16
Total capacitance before Life Test - room temp.	5.55 Mfd.
" " " " " at 125° C.	6.35 Mfd.
Total capacitance after pre-breakdown test	5.70 Mfd.
" " " Life Test	3.20 Mfd.
Number of permanent failures	8
Number of temporary failures	249
Number of opens at the end of the test	0

NObsr M #53

Twenty .25 Mfd. single
 .5 Mil Metallized Mylar C
 Units.

The units (12) were wired to a Life Test rack after the initial tests were concluded, and the total capacitance measured at room temperature. Then they were heated in an oven to 125° C. for one-half hour. The capacitance was then measured at 125° C. After that, the units were exposed to 400 V. D. C. pre-breakdown test for one-half hour. During this period, there were 161 temporary breakdowns. Unit #18 failed after 157 temporary breakdowns. The capacitance was again measured before the Life Test commenced.

<u>Temporary Breakdowns</u>	<u>Total Capacitance</u>	<u>Elapsed Time</u>
0	3.00 Mfd.	Start of Test
2	2.70 "	19 hours
2	2.65 "	45 "
2	2.65 "	65 "
2	2.85 "	95 "
2	2.50 "	158 "
2	2.80 "	185 "
2	2.80 "	211 "
2	2.60 "	234 "
2	2.55 "	251 "
		Test Completed

NObsr M #53 (continued)

Number of units started on test	11
Number finished	11
Total capacitance before Life Test - room temperature	2.90 Mfd.
" " " " " at 125 ^o C.	3.30 Mfd.
" " after pre-breakdown test	3.00 Mfd.
" " " Life Test	2.55 Mfd.
Number of permanent failures	0
Number of temporary failures	2
Number of opens at the end of the test	0

NObsr M #54

Twenty .25 Mfd. single
 .5 Mil Metallized Mylar C
 Units

The units (14) were wired to a Life Test rack after the initial tests were concluded, and the total capacitance measured at room temperature. Then 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 500 V. D. C. pre-breakdown test for one-half hour. During this period, there were 48 temporary breakdowns. The capacitance was again measured before the Life Test commenced.

<u>Temporary Breakdowns</u>	<u>Total Capacitance</u>	<u>Elapsed Time</u>
0	3.80 Mfd.	Start of Test
44	3.80 "	19 hours
46	3.60 "	46 "
48	3.65 "	66 "
52	3.10 "	96 "
54	3.60 "	158 "
57	3.60 "	185 "
57	3.60 "	211 "
59	3.60 "	235 "
59	3.60	251 "
Test completed		

NObsr M #54 (continued)

Number of units started on test	14
Number finished	14
Total capacitance before Life Test - room temp.	3.30 Mfd.
" " " " " at 125° C.	3.90 Mfd.
" " after pre-breakdown test	3.80 Mfd.
" " " Life Test	3.60 Mfd.
Number of permanent failures	0
Number of temporary failures	59
Number of opens at the end of the test	0

NObsr M #55

Twenty .25 Mfd. single
.5 Mil Metallized Mylar
C units.

The units (20) were wired to a Life Test rack after the initial tests were concluded, and the total capacitance measured at room temperature. Then they were heated in an oven to 125° C. for one-half hour. The capacitance was then measured at 125° C. After that, the units were exposed to 600 v. d. c. pre-breakdown test for one-half hour. During this period, there were 265 temporary breakdowns. Unit #12 failed after 10 temporary breakdowns. The capacitance was again measured before the Life Test commenced.

<u>Temporary Breakdowns</u>	<u>Total Capacitance</u>	<u>Elapsed Time</u>
0	5.10 Mfd.	Start of Test
		Unit #17 failed after 3 hours -- 123 temporary breakdowns.
		#8 failed after 3 hours; 137 temporary break- downs.
145	4.30 Mfd.	30 hours
184	4.35 "	57 "
184	4.35 "	77 "
204	4.10 "	106 "
		Unit #6 failed.
225	4.00 Mfd.	169 hours
227	4.05 Mfd.	196 "
231	4.00 Mfd.	221 "

NObsr M#55 (continued)

<u>Temporary Breakdowns</u>	<u>Total Capacitance</u>	<u>Elapsed Time</u>
237	4.05 Mfd.	251 hours
		Test completed.

Number of units started on test	19
Number finished	16
Total capacitance before Life Test - room temperature	4.75 Mfd.
" " " " " at 125° C.	5.20 Mfd.
" " after pre-breakdown test	5.10 Mfd.
" " " Life Test	4.05 Mfd.
Number of permanent failures	3
Number of temporary failures	237
Number of opens at the end of the test	3