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Report of Tests
of

FR-1152

John E. Fast and Company Capacitors

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WASHINGTON, D. C.

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AUTHORIZATION

1. This problem was authorized by Bureau of Engineering letter, ref.(a), and other references pertinent to this problem are given as refs. (b) to (d) inclusive.

- Reference: (a) BuEng let.S67/48(3-16-W8) of 20 March 1935.
(b) INM Chicago let.file no. Reqn.694-1/2(4772)
of 4 March 1935 to NRL.
(c) Specifications RE 13A 488B.
(d) NRL Report on Problem M4-3 of 27 July 1933.

OBJECT OF TEST

2. The object of the test was to determine if the capacitors submitted by John E. Fast and Company comply with specifications, ref.(c), and are suitable for Naval use.

ABSTRACT OF TEST

3. The capacity and the d.c. leakage of the capacitors were measured as received. A flash test of 2-1/2 times the rated voltage was applied for 15 seconds to the terminals of the capacitors and from terminals to case. The units were then immersed in salt water at 50° C and after 2 hours were transferred to a salt water bath at 0° C for 2 hours, after which they were left for 24 hours in a saturated solution of salt water at room temperature. After the capacitors were rinsed in fresh water and allowed to dry for one hour, the capacity, d.c. leakage, and flash tests were repeated.

Conclusions

(a) The capacitors tested satisfactory before being immersed in salt water, but all samples failed to withstand the salt water immersion test.

Recommendations

(a) It is recommended that this design of Fast capacitor (see Plate 1, items B and C) be considered unsuitable for Naval use due to failure to withstand the salt water immersion test required in the governing specifications (par.4-4 of ref.(c)).

MATERIAL UNDER TEST

4. The material under test consisted of foil paper capacitors manufactured by John E. Fast and Company with a rated capacity of 0.5 microfarad and a working potential of 200 volts d.c. They correspond to Navy type No.48205. These capacitors have a different terminal seal from those made by the same manufacturer and reported on in ref.(d). See Plate 1.

METHOD OF TEST

5. The capacity was measured on a microfarad meter. The d.c. leakage was measured with a low range microammeter at the rated working potential. The flash test was made by applying 500 volts (2-1/2 times the rated d.c. potential) for 15 seconds. The effect of immersion in salt water at 50°C, at 0° C and at room temperature was determined by placing the capacitors in a saturated salt solution at these temperatures and then repeating the capacity, the d.c. leakage and the flash tests (as mentioned under ABSTRACT of TESTS).

DATA RECORDED DURING TEST

6. The data recorded during test included the capacity before and after immersion, the d.c. leakage before and after immersion, the temperature of the salt water baths and the duration of immersion and the effect of the flash test before and after immersion.

DISCUSSION OF PROBABLE ERRORS

7. The error in determination of capacity is not greater than $\pm 1/2\%$. The error in measurement of d.c. leakage is not greater than $\pm 2\%$. The flash potential was within 1% of the specified value. The temperatures of the hot and cold salt water solutions were within 1°C of those specified (except as noted in RESULTS OF TESTS).

RESULTS OF TESTS

8. A tabulation of data obtained is given in Table 1 for 9 capacitors which were subjected to the salt water immersion test. The capacity of all 69 units received was within 3% of the rated value, and the d.c. leakage of all prior to immersion was very low, the maximum being 0.12 microamperes per microfarad, whereas 0.80 microamperes is allowed. All units withstood the flash test of 500 volts between terminals and from both terminals to the case.

9. When the 9 capacitors were immersed in salt water at a temperature of 50°C, bubbles rose from around the insulating terminal strips, at first rapidly and then more slowly, and after several minutes an occasional bubble formed at the edge of the terminal strips, indicating the penetration of water into the case. Condensers #1-6 were inadvertently heated beyond 50°C, to about 65°C during the test, but not until after a large number of bubbles had escaped from the containers. Capacitors 7-9 were kept within 1° of 50°C during the 2 hour heat run.

10. The capacitors comply with all items of specifications, ref.(c), so far as could be determined, except those mentioned below:

(Marginal numbers refer to paragraphs in the specifications.)

- 3-5. The containers are not moisture-proof as evidenced by the escape of bubbles of air on immersion in water at 50°C, and by the failure of the capacitors due to salt water immersion.
- 3-9. The height of the container is 1/16" greater than shown on sheet 9B of ref.(c), the height being 7/8" instead of 13/16".
- 3-16. See comment under 3-5 above in regard to air spaces inside the container.
- 4-4. The leakage in all 9 capacitors after the immersion test was greater than the allowed value of 2 microamperes per microfarad. Six of the capacitors were shorted and the leakage in the other 3 was more than 20 times the limit allowed.
- 4-5. No life test was conducted on these samples due to their failure on the immersion test.

11. Attention is directed to the fact that the type of terminal seal employed on these capacitors is different from that used on the capacitors manufactured by the same company and reported on in ref.(d). The appearance of these two types of capacitors is shown on Plate 1. Capacitor A is the style mentioned in ref.(d), while capacitors B and C are two of those reported on herein. The photograph was taken after capacitors B and C had been rinsed, dried several hours and the accumulation of salt from the evaporation of water which had penetrated into the containers removed. The amount of salt which afterward was deposited on the outside of two of the containers after air drying over night is shown in the photograph of capacitors B and C.

CONCLUSIONS

12. The capacitors tested satisfactory before being immersed in salt water, but all samples failed to withstand the salt water immersion test.

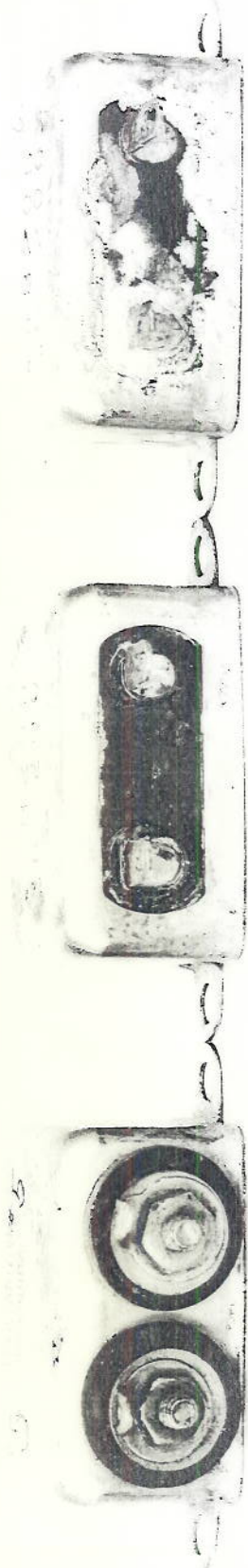
Table 1

Test Data on Fast Foil Paper Capacitors

Navy Type - 48205

Sample No.	Cap. Mfd.	D.C. Leakage Microamperes per microfarad			Flash Test	
		Before Soaking	After drying 1 hour	After drying 5 days	After drying 1 hour	After drying 5 days
1	.502	.04	Shorted	Shorted	Both terminals shorted to case.	Both terminals shorted to case.
2	.511	.06	"	"	"	"
3	.507	.12	"	"	"	"
4	.502	.10	"	"	"	"
5	.496	.08	"	"	"	"
6	.500	.10	1800	1.6	Excessive leakage terminals to case.	No breakdown, slight leakage.
7	.496	.02	44	.2	"	"
8	.516	.05	Shorted	1.6	Same as #1	"
9	.498	.06	76	6.0	" " #6	Excessive leakage one terminal to case.

NOTE: Before immersion, all capacitors withstood a flash test of 500 volts between terminals and from each terminal to case.



C

B

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