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NAVY DEPARTMENT

Report of

Test on Insulating Material

Submitted by

Victor Insulators Incorporated

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D. C.

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TABLE OF CONTENTS

APPENDICES

AUTHORIZATION

1. This problem was authorized by Bureau of Ships letter, reference (a). References (b) and (c) are also pertinent.

References: (a) BuShips ltr. S67/61 (480V) of January 19, 1942
(b) Specifications, RE 13A 317-F
(c) Proc. I.R.E. Vol. 26 pp 1466-1497 Dec. 1938 by D.B. Sinclair.

OBJECT OF TEST

2. The object of this test was to determine: whether the six sample plates submitted by Victor Insulators Inc., comply with Specifications, for Grade F or G insulating material; also to determine the modulus of rupture of twelve sample rods.

ABSTRACT OF TEST

3. The six plates were tested for wet and dry loss factor and moisture absorption as required by reference (b). The twelve rods were tested for their modulus of rupture as required by reference (a).

DESCRIPTION OF MATERIAL UNDER TEST

4. The six plates of insulating material numbered 363 to 368 inclusive by N.R.L., measuring approximately 6" square and 1/4" thick were very unsatisfactory because of their irregular form. Six brown glazed rods numbered 1 to 6 inclusive by N.R.L., and six white unglazed rods numbered 7 to 12 inclusive by N.R.L. approximately 6" long and 1-1/8" in diameter were submitted for modulus of rupture measurement.

METHOD OF TEST

5. The samples were dried in an oven for one hour at 100°C and foil applied, with petroleum oil to both surfaces of each sample for the dry set of measurements.

6. The samples were then soaked in distilled water, at room temperature for 48 hours, after which their surfaces were wiped dry and foil applied for the wet set of measurements.

7. The capacity was determined by substituting each sample for a similar amount of variable air capacity (precision quartz insulated General Radio type 722-Q serial No. 460) in a 1000 Kc. resonant circuit. This resonant circuit was loosely coupled to a 1000 Kc. crystal controlled master oscillator power amplifier.

8. The dielectric constant, power factor and loss factor were determined, with this same equipment, by the shape of resonance curve, as measured with a vacuum tube voltmeter (General Radio type 726-A serial No. 1483), and the physical dimensions. This is known as the susceptance variation method of measurement described in reference (c).

9. The modulus of rupture tests were made on the samples as received. They were placed in a jig which allows the direct load from the testing machine to be applied midway between two supports separated by a distance of exactly 5". The two points of restraint and the one point for direct load applied have a radius of 1/8". A rate of approximately 250 pounds per minute direct load was applied.

10. The moisture absorption tests were carried out on newly fractured pieces as detailed in paragraph 6 of reference (b) where the newly fractured surface was approximately 50% of the unfractured surface of each sample. The samples were first dried in an oven at 120°C for 24 hours then accurately weighed. They were then immersed in distilled water at room temperature for 100 hours during which time the water was boiled for a period of one hour during the 1st, 25th, 49th and 74th hours. At the end of 100 hours all samples were removed from the water, carefully dried with filter paper and immediately weighed.

DATA RECORDED DURING TEST

11. Data recorded during the test are given in appended Tables No. 1, 2 and 3.

DISCUSSION OF PROBABLE ERROR

12. The probable error in determination of loss factor is 8%. 4 or 5 % of this error, in measurement of loss factor, was caused by the irregular and wavy test plates. The error in determination of weight for moisture absorption is not more than 0.00125%. This does not include any error assumed in the indicated loss of weight of the sample tested.

CONCLUSIONS

It is concluded that these ceramic samples, numbered 363 to 368 inclusive by N.R.L. submitted by Victor Insulators, Inc., comply with Specifications, reference (b), for Grade F insulating material in respect to moisture absorption and loss factor.

RECOMMENDATIONS

It is recommended that this ceramic material submitted by Victor Insulators, Inc., be approved as Grade F insulating material.

RESULTS OF TEST

13. The results given in Tables 1 to 3 indicate that all test samples are Grade F insulating material. The loss in weight indicated during the moisture absorption measurement can not be accurately accounted for, but dirt and dust particles collected from the air, or small pieces of the sample may have escaped when the water was drained. Loss in weight indicated in past measurements was attributed to the boiling out of some of the originally weighed material.

14. The material required a liberal application of petroleum oil to secure the electrodes a nd appeared quite porous. This was not borne out by measurements of moisture absorption, (Table No. 2).

15. The results of measurement for modulus of rupture on the twelve rods are given in the appended Table No. 3 and indicate consistent uniformity.

CONCLUSIONS

16. It is concluded that these ceramic samples, numbered 363 to 368 inclusive by N.R.L., submitted by Victor Insulators, Inc., comply with Specifications, reference (b), for Grade F insulating material in respect to moisture absorption and loss factor.

TABLE I

Victor Insulators Inc.

Dielectric Properties of Insulators

Square Samples

Sample No.	Dielectric Constant Dry	Dielectric Constant Wet	Power Factor % Dry	Power Factor % Wet	Loss Factor % Dry	Loss Factor % Wet	Grade Letter
363	5.3	5.3	0.876	0.884	4.65	4.68	F
4	5.5	5.5	.844	1.01	4.64	5.64	F
5	5.6	5.5	.856	0.988	4.79	5.44	F
6	5.5	5.6	.854	1.01	4.78	5.65	F
7		5.5	.824	0.844	4.54	4.64	F

8* Used for Moisture Absorption test.

Where the Loss Factor must not exceed 1% to qualify for Grade G insulating material.

TABLE II

Moisture Absorption Test

Sample No.	Weight in Grams Dry	Weight in Grams Wet	Gains
368	35.8026	35.7966	- 0.017 (Loss of weight)

Where the gain in weight must not exceed 0.1%

TABLE III

Sample No.	Direct Load lbs.	Diameter ins.	Rupture Modulus lbs/sq. in.
1	1140	1.129	10,090
2	1430	1.122	12,900
3	1510	1.118	13,780
4	1445	1.033	12,610
5	1450	1.152	12,100
6	1475	1.130	13,020
7	1055	1.130	9,230
8	1265	1.128	11,220
9	1224	1.132	10,740
10	1112	1.122	10,020
11	1242	1.118	11,320
12	1095	1.123	9,840