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Report

on

Test of Insanol, Composition No. 193,

submitted by

Westinghouse Electric and Manufacturing Company

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D. C.

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Authorization: BuEng let.S67/61/L5(3-8-R6) of 25 March 1939.

Date of Test: 31 May - 13 June 1939.

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AUTHORIZATION

1. This problem was authorized by Bureau of Engineering letter, reference (a). Reference (b) is also pertinent.

Reference: (a) BuEng let.S67/61/L5(3-8-R6) of 25 March 1939.
(b) Specifications RE 13A 317F.

OBJECT OF TEST

2. The object of the test was to determine if the samples of Insanol, Composition No. 193, submitted by the Westinghouse Electric and Manufacturing Company, complied with specifications, reference (b), for Grade F or G insulating material, together with their relative machinability and suitability for Naval use.

ABSTRACT OF TEST

3. The loss factor of the material was determined on the samples after they had been soaked in distilled water for 96 hours. The moisture absorption tests were made by breaking up a piece of this material into small pieces, the total weight of which was less than 50 grams. These specimens were dried in an oven at 120° C for 24 hours, and then immersed in distilled water. They were then boiled as required in reference (b). All data for these tests were taken after 100 hours of immersion.

Conclusions

(a) Insanol, Composition No. 193, complies with specifications, reference (b), as regards moisture absorption and also as Grade F insulating material with respect to loss factor.

(b) This material is considered to be satisfactorily machinable.

Recommendations

(a) It is recommended that Insanol, Composition No. 193, manufactured by the Westinghouse Electric and Manufacturing Company, be approved as Grade F ceramic insulating material as regards its electrical properties.

DESCRIPTION OF MATERIAL UNDER TEST

4. Three samples of Insanol, Composition No. 193, approximately 6" x 6" x 1/4", were tested.

METHOD OF TEST

5. The dry loss factor was determined by measuring the samples as they were received, cleaning this surface with ether and drying in an oven for a few hours. The samples were then soaked in distilled water for 96 hours, after which their surfaces were wiped dry and the wet loss factor determined as per paragraph 6-1 of reference (b). The measurements were made at a frequency of 500 kilocycles, but their results do not differ from those which would be obtained at 300 kilocycles, which frequency is mentioned in paragraph 6-1 of reference (b).

6. Moisture absorption tests were carried out on newly fractured pieces as detailed in paragraph 6-2 of reference (b) but where the newly fractured surface area was less than 50 per cent of the total surface area. The samples were first dried at 120° C for 24 hours and accurately weighed to a precision of 1/10 milligram by a newly acquired balance. They were then immersed in distilled water for 100 hours during which time the water was boiled for a period of one hour at four different intervals. The weight was then obtained within a few minutes after the material had been removed from the water and the surfaces carefully dried. Care was used to blow compressed air through these fractured pieces to remove any possibility of small fragments being boiled from the samples. This was done after the small beaker into which all samples were placed had been shaken sufficiently to loosen detachable particles. While there were no visible particles left in the beaker in which the specimens were boiled and soaked, the difference between the dry weight and the wet weight was negative, indicating that the boiling process had actually dissolved some of the composition.

DATA RECORDED DURING TEST

7. The data recorded during the test are given in Tables 1, 2, and 3.

PROBABLE ERROR IN RESULTS

8. The error in the determination of the loss factor is less than 10 per cent. The error in determinations of the weight in the moisture absorption test is not more than one part in 800,000, or .00125 per cent.

RESULTS OF TESTS

9. Results of tests are given in Tables 1 and 2, and may be summarized as follows. Table 1 shows all three Insanol samples numbered 229, 230, and 231, as passing specifications, reference (b), for Grade F materials, as defined in paragraph 6-1 as indicated by the loss factor in per cent.

10. Table 2 gives the results of the moisture absorption test by weight on one sample, which was not part of a specimen from which the loss factors were determined in Table 1. This was done to facilitate the length of time required to complete these tests due to the urgent need for this information, the time saved being approximately 100 hours. It is believed that the loss in weight noted is due to the ability of some of the substance of the test material to dissolve in the process of agitation due to boiling. These samples were dried for 100 hours after soaking and reweighed, showing an increase in weight due to moisture absorption of 3.1 milligrams.

11. As requested in reference (a), the relative machinability and general suitability of Insanol for Naval use was tested in the following manner. A specimen of one of the test samples submitted was machined as follows.

Drill and tap for 1/2" - Standard thread.
Drill and tap for 10 - 32 thread.
Drill and tap for 6-32 thread.
Turn and thread for 10-32" 1 rod - 2 in.long.
Counterbore 1/16" deep with 1/2" diam. tool.
Band saw a strip 1/4" x 1/4" x 2".
File one edge to 1/4 round for 1-1/4 inch length.
Mill slot 1/8" deep and 1/4" wide.

The same operations were performed on a random sample of stock Mycalex. The results of these tests are shown in Table 3.

CONCLUSIONS

12. Insanol, Composition No. 193, complies with specifications, reference (b), as regards moisture absorption and also as Grade F insulating material with respect to loss factor.

13. This material is considered to be satisfactorily machinable.

Table 1

Loss Factor Test Data
(500 kilocycles)

Sample No.	Dielectric Constant		Power Factor %		Loss Factor		Grade
	Dry	Wet	Dry	Wet	Dry	Wet	
229	8.53	8.55	0.183	0.315	1.557	2.693	F
230	8.09	8.14	0.173	0.441	1.396	3.590	F
231	8.41	8.39	0.170	0.372	1.428	3.121	F

Table 2

Moisture Absorption Test

Sample No.	Specimens 1" x 1" x 1/2" approximately		Loss in Weight %
	Before soaking Weight gm	After soaking Weight gm	
Not numbered	45.7206	45.7061	0.0317

Drying for 100 hours at 100° C. after soaking	45.7030
Moisture absorption	.0031
% Increase	.0067%

Table 3

Machinability Tests

Operations	Insanol Time in Secs.	Mycalex Corp. sample Time in Secs.
Drill for 1/2" tap	7	6
Tap 1/2" - Std.	53	37
Drill for 10-32 tap	12	9
Tap 10-32	36	32
Drill for 6-32 tap	9	10
Tap 6-32	40	32
Turn 3/16" rod-2 in. long) Thread with 10-32 die)	607	582
Counterbore 1/2 diam. 1/16" deep	20	20
Machine band saw 1/4 x 1/4 x 2"	40	36
File one edge to 1/4 round) and 1-1/4" long)	48	28
Mill 1/4" slot, 1/8" deep for 2" length	30	25
Total time	902 seconds	817 seconds

The work sheets indicate it requires approximately 10.4% longer time to perform identical operations on Insanol than on a random sample of Mycalex drawn from stock. The fidelity of operations appears equal except in tapping of the 1/2" - Standard Thread in second row of above table where the Mycalex sample took the best form.

The mechanic's impressions were, however, that Insanol was more brittle, requiring more care in working than the reference sample.