

B
7 February 1940

NRL Report No. R-1592
BuEng. Prob. ML-17

NAVY DEPARTMENT

Report of
Test of Stupakoff No. 352 Ceramic
Insulating Material

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D. C.

FR-1592

Number of Pages: Text - 3 Tables - 2

Authorization: BuEng. ltr. S67/61 (10-21-DR6) of 20 November 1939.

Date of Test: 9 to 19 January 1940.

Prepared by:

R. B. Owens, Associate Radio Engineer,
Chief of Section.

Reviewed by:

A. Hoyt Taylor, Head Physicist,
Superintendent, Radio Division.

Approved by:

H. G. Bowen, Rear Admiral, USN, Director.

Distribution:
BuEng. (10)

jlh

APPROVED FOR PUBLIC
RELEASE - DISTRIBUTION
UNLIMITED

FEB 16 1940

TABLE OF CONTENTS

| <u>Subject</u> | <u>Page</u> |
|--|-------------|
| Authorization. | 1 |
| Object of Test | 1 |
| Abstract of Test | 1 |
| (a) Conclusions. | 1a |
| (b) Recommendations. | 1b |
| Description of Material under Test | 2 |
| Method of Test | 2 |
| Data Recorded during Test. | 2 |
| Discussion of Probable Errors. | 2 |
| Results of Test. | 2 |
| Conclusions. | 3 |

APPENDICES

| | |
|--|---------|
| Loss Factor Data on Stupakoff #352 Ceramic Insulation. | Table 1 |
| Moisture Absorption Data. | Table 2 |

AUTHORIZATION

1. The work reported herein was authorized by Bureau of Engineering letter, reference (a). References (b) to (d) are also pertinent to this problem.

- Reference:
- (a) BuEng. ltr. S67/61 (10-21-DR6) of 20 November 1939.
 - (b) Specification RE 13A 317F.
 - (c) Stupakoff Laboratories, Incorporated, Report of Tests on Stupakoff No. 352 Ceramic Material, dated 22 December 1939.
 - (d) Tentative Standards of the American Society for Testing Materials, 1927, Serial Designation D150-27T.

OBJECT OF TEST

2. The object of the test was to determine whether the ceramic insulation No. 352, submitted by the Stupakoff Laboratories, Incorporated, complies with the requirements of specifications, reference (b), and is suitable for Naval use.

ABSTRACT OF TEST

3. The dielectric constant and the power factor of the samples were determined (from which the loss factor was computed) both before and after the material had been immersed in water for 96 hours. The moisture absorption of the material was determined by accurately weighing fragments of the samples both before and after soaking them in distilled water for 100 hours.

FEB 16 1940

Conclusions

(a) These samples of Stupakoff No. 352 ceramic insulating material comply with the requirements of specifications, reference (b), for Grade G insulation.

(b) This material is considered suitable for Naval use.

Recommendations

(a) It is recommended that Stupakoff No. 352 ceramic insulating material be considered suitable for Naval use as Grade G insulation.

FEB 16 1940

DESCRIPTION OF MATERIAL UNDER TEST

4. The material under test consisted of five samples of ceramic insulation submitted by Stupakoff Laboratories, Incorporated, and is identified by number 352. The samples were approximately 6 inches square and 0.2 inch thick.

METHOD OF TEST

5. In the loss factor test, the samples were covered with tinfoil electrodes cut to the exact size and made to adhere to the plates by the use of a few drops of petrolatum spread over the surface of the foil, to form a condenser with the insulation as the dielectric. The dielectric constant and power factor of the material were measured by the parallel substitution method as specified in reference (b), paragraph 6-1, and as detailed in reference (d). These measurements were made both with the samples as received and again after the samples had been immersed in distilled water for 96 hours and surfaces wiped dry. The latter measurement was made within approximately five minutes of the removal of the samples from the water. These measurements were made at a frequency of 300 kilocycles.

6. The moisture absorption test was carried out with parts of two of the samples as detailed in reference (b), paragraph 6-2. In this test, fragments with newly fractured edges were immersed in distilled water for 100 hours and the water was boiled during the 1st, 25th, 49th and 73d hours. Upon removal from the water, the fragments were wiped with a dry cloth, dipped in pure alcohol, then in ether to remove surface moisture and weighed immediately. The dry weight of the samples was determined after they had been heated in an oven at 120° C. for 24 hours and cooled in a desiccator to room temperature.

DATA RECORDED DURING TEST

7. The data recorded during test, or values computed therefrom, are given under "Results of Test" and in the appended tables.

DISCUSSION OF PROBABLE ERRORS

8. The error in determination of the loss factor is believed to be less than ± 10 per cent. The error in the determination of the weight of samples in the moisture absorption test is not more than ± 0.0002 gram.

RESULTS OF TEST

9. The results of test are given in Table 1 and 2 appended. From Table 1 it will be noted that the loss factor of each of the three samples is less than 1.0, and the mean value is 0.79; therefore, this material complies with the loss factor requirements for classification as Grade G insulating material under specifications, reference (b).

10. The gain in weight due to moisture absorption as determined on two fragments from each of two plates was less than 0.10 per cent. The mean value of the gain in weight of the four fragments was 0.04 per cent.

FEB 16 1940

CONCLUSIONS

11. These samples of Stupakoff No. 352 ceramic insulating material comply with the requirements of specifications, reference (b), for Grade G insulation.

12. This material is considered suitable for Naval use.

TABLE 1

Loss Factor Data on Stupakoff #352 Ceramic Insulation

| Sample No. | Dielectric Constant* | | Power Factor % | | Loss Factor | | |
|------------|----------------------|------|----------------|-------|-------------|------|------|
| | Dry | Wet | Dry | Wet | Dry | Wet | |
| 1 | 352-42 | 5.38 | 5.48 | 0.072 | 0.175 | 0.39 | 0.96 |
| 2 | 352-46 | 5.47 | 5.29 | 0.069 | 0.140 | 0.38 | 0.74 |
| 3 | 352-47 | 5.46 | 5.42 | 0.078 | 0.123 | 0.43 | 0.67 |
| | Mean | 5.43 | 5.40 | 0.073 | 0.146 | 0.40 | 0.79 |

*These measurements made with foil electrodes cut to exact size of plate; use of smaller electrodes such as 4-1/2" discs gives slightly larger value for dielectric constant. See reference (c).

TABLE 2

Moisture Absorption Data

| Sample No. | Weight-Grams | | Gain in Weight | |
|------------|--------------|--------|----------------|----------|
| | Wet | Dry | Grams | Per Cent |
| 352-40 | 31.479 | 31.463 | .016 | 0.051 |
| 352-40 | 31.460 | 31.451 | .009 | 0.029 |
| 352-45 | 44.690 | 44.670 | .020 | 0.045 |
| 352-45 | 33.685 | 33.674 | .011 | 0.033 |
| Mean | | | | 0.04 |