RG 19 Box 549 S.M-1a.5
Entry 1416

29 November 1941. 47 Test No. 4360

REPORT OF TEST

of

"MARINITE" and "MARINE SHEATHING"
ASBESTOS FURRING FOR HEAT INSULATION

Submitted By

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Reference:
(a) Bu. C&R. let. S39-(6)(3) of 17 December 1938.
(b) Fed. Specn. 35-A-115; Acoustical-Units, Prefabricated, of 20 November 1939.
(c) Fed. Specn. LLL-F-321a; Fibre-Board; Insulating, of 21 May 1938.
(d) Bushps and Interim Specn. 32A2(INT); Asbestos, Block, Cellular (Heat Insulation), of 15 March 1941.
(e) Bu. C&R. Specn. 32F4(INT); Felt, Mineral, Insulating, of 20 July 1939.
(f) Lab. Off., Navy Yard N. Y. Memo to Asst. Design Supt. (Hull) - 339/L5-1(V-1-5-7) of 7 June 1939, with copy to Bu. C&R.
(g) American Society for Testing Materials Report of Comm. C-16 on Thermal Insulating Materials, 1941 Preprint No. 59
(h) American Society for Testing Materials, Paper by J. W. McBurney - Indentation of Asphalt Tile, 1934 Preprint No. 81.
(i) Bu. C&R. let. B355 and 86/S39(TD) of 29 June 1939.
(j) Bu. C&R. let. B355 and 56/S39(TD) of 5 July 1939.

Enclosure:
(A) Photos Nos. 4201-1 to 11 (inclusive)
(B) Curves of Repeated Blow Impact Tests
(C) Table II, Results of Shop Tests.

AUTHORITY

1. In accordance with reference (a), tests have been conducted in the Material Laboratory, Navy Yard, New York, on samples of Marinite and Marine Sheathing submitted by Johns-Manville. Samples were received and the tests were started on 28 April 1939. Tests were completed 15 October 1941.

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Test No. 4340

OBJECT OF TEST

2. To determine the suitability of Marinite and Marine Sheathing for use as furring strips and as supports for chairs used to insulate aluminum sheathing from steel bulkheads.

3. To investigate and determine the specification requirements for furring and sheathing material suitable for the above conditions of service, and to prepare specifications to include the following two classes:

Class A - Lightweight (similar to Marinite)

Class B - Heavyweight (similar to Marine Sheathing)

The above materials are hereinafter referred to as Class A and Class B, respectively, where not designated by name.

DESCRIPTION

4. Both the Marinite and the Marine Sheathing, in untreated condition, are very light in color and resemble the regular commercial plaster board or asbestos board in appearance, texture and color. The Marinite sheet, as furnished, was impregnated to a depth of about 1/16" on each face, in which condition the material is a light brown color.

METHOD OF TEST

5. The material was subjected to tests in the following specifications, or modifications of the tests, which were considered to be applicable to the type of insulation under investigation:

Test	Specification
(a) Fire Test	Reference (b), par. F-2c.
(b) Alkalinity	" (c), par. F-2d.
(c) Physical Properties	" (g), par. F-2d (based on exhibitor's recommendations)
(d) Moisture Absorption	Reference (c), par. F-2f.
(e) Thermal Conductivity	Reference (c), par. F-2b.

6. None of the tests outlined in specification, reference (d) covering cellular asbestos block, is considered to be applicable to this type of material.

7. Shop fabrication tests were made, in which personnel of the Joiner, Shipwright and Boat Shops used the materials under direction of personnel of the Material Laboratory in such applications as to determine the workability. These tests were supplemented by laboratory tests of the screw holding strength of the materials.

conditions of loading were arranged to simulate the use of materials Class A and Class B as furring strips.

8. The strength of anchorage of wood screws was tested by measuring the load required to pull out screws which had been driven into the material. Tests were made in a Scott horizontal testing machine with moving head traveling at a rate of one inch per minute. A clearance of one-eighth inch under the screw head was allowed in order to provide a grip on the screw for pulling in the test machine.

9. The effect of vibration on the screw holding power of the subject material was investigated, using 3/4" - #12 Parker Kalon screws fastened into test specimens of Marinite and Marine Sheathing. Duplicate test pieces were prepared except that the screws intended for the vibration test (48 hours, 800-900 cycles per minute, 1/16" amplitude) were weighted by means of a small cylinder of steel weighing approximately 1 ounce. This cylinder allowed the screws to be driven to within 1/8" of their full length and was arranged to fasten to the head of the testing machine. The weight of one ounce was computed as simulating the load per screw imposed by the aluminum sheathing ordinarily used over the furring strips.

RESULTS OF TEST

10. The results of tests listed in paragraph 8 above are as follows:

(a) Fire Test. Both Marinite and Marine Sheathing are assigned a rating of "Incombustible" on the basis of the test results. The test specimens, after the completion of the fire test are shown in Figs. 1 and 2, respectively, of enclosure (A).

(b) Alkalinity. The alkalinity expressed as equivalent sodium oxide (Na2O), was found to be:

Class	A	B
Alkalinity equivalent, %	0.05	0.04

(c) Weight. The weight of the materials in the "as received" condition, and after drying to constant weight at 105°C. was:

Class	A	B
Density, as received, lbs./cu. ft.	46.2	69.8
Density, dry	44.8	68.1

(d) Transverse Strength.

Class	A	B
Modulus of rupture, lbs./sq.in.	1800	1500
" elasticity	440,000	605,000

The test jig used is shown in Fig. 3 of enclosure (A).

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(e) Compressive Strength.

Class	A	B
Compressive Strength, lb./sq.in.	8,200	12,100

Test specimens before and after compression tests are shown in Figure 4 of enclosure (A).

(f) Impact Strength. The impact test apparatus and a typical specimen are shown in Figs. 5, 6 and 7 of enclosure (A).

TABLE NUMBER I

RESULTS OF FLEXURAL IMPACT TESTS.
See Curves on Enclosure (B)

Impact Test - 4 lb. Hammer	Height of Drop - Inches						
	2-½	3	4	6	8	10	12
Class A - 4" x 10" x 1" thick, 8" between supports							
Number blows to fracture	1373		73				
	6046	127	17	3			
	868	352	48	3	2		
Average	2662	236	46	3	2		
Energy, in. lbs.		9	12	16	24	32	
ft. lbs.		0.75	1.0	1.33	2.0	2.6	
Volume, cu. in.		40	40	40	40	40	
Strength, ft.lbs./cu.in.		0.013	0.025	0.033	0.05	0.065	

Strength, for 1 blow, ft.lbs./cu. in. = 0.056, obtained from curve, enclosure (B).

Class B - 6" x 14" x 1½" thick, 12" between supports						
Number blows to fracture		703	16			
	1878	173	32	9	3	
	2347	316	40	8	3	
Average	2112	397	29.3	8.5	3	
Energy, in. lbs.		16	24	32	40	48
ft. lbs.		1.33	2.0	2.5	3.33	4.0
Volume, cu. in.		126	126	126	126	126
Strength, ft.lbs./cu.in.		0.01	0.016	0.020	0.026	0.032

Strength for 1 blow, ft.lbs/cu.in. = 0.38, obtained from curve, enclosure (B).

(g) Hardness. Determinations made with the McBurney apparatus, see reference (h) and Fig. 8 of enclosure (A), were:

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Test No. 4886

Class	A	B
Indentation, 1 min., mils	1.0	1.0
Indentation 10 min., mils	1.5	1.5
Factor "a", mils	0.49	0.49
Factor "n"	0.176	0.176
	0.176	0.176

Indentation: $i = at^n$

Where: t = time in seconds
a = indentation in mils in one second
n = constant measuring the tendency to indent with time.

Brinell Hardness was found to be:

Class	A	B
B.H.N.	2.5	4.1

(h) Shearing Strength.

Class	A	B
Shearing Strength, lb./sq.in.	788	1,032

The test jig and the specimens used in the shear test are shown in Figs. 9 and 10, respectively, of enclosure (A).

(i) Tensile Strength.

Class	A	B
Tensile Strength, lb./sq.in.	775	546

The test specimens after rupture are shown in Figure 11 of enclosure (A).

(j) Water Absorption. The average increase in weight after 24 hours' immersion at room temperature for two specimens of each class of material was:

Class	A	B
Water Absorption, %	82.5	37.4

(k) Thermal conductivity. The k value, in B.T.U. per square foot, per hour, per degree Fahrenheit, per inch of thickness was found for specimens of the density noted, as follows:

Class	A	B
Density, lbs./cu.ft., as received	43.9	74.2
Density, lbs./cu.ft., dried to constant weight	42.2	71.2
Mean Temperature, Degrees F.	71.2	71.8
k Value	0.73	1.72

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(1) Shop fabrication tests:

The results obtained are shown in Table II, Enclosure (C), giving data on pre-drilling and counterbores found to be suitable.

(m) Strength of Screw Anchorage:

TABLE III

Test No.	Size of Screw	Pre-Drill Dia. Hole, In.	Pull-Out Load-Lbs.
1	#12 - 3/4"	1/8"	170
1	12 - 3/4	1/8	130
1	12 - 3/4	1/8	170
2	12 - 1/2	1/8	40
2	12 - 1/2	1/8	55
2	12 - 1/2	1/8	60
1	12 - 3/4	5/32	170
1	12 - 3/4	5/32	150
1	12 - 3/4	5/32	190
2	12 - 1/2	5/32	50
2	12 - 1/2	5/32	50
2	12 - 1/2	5/32	60

(n) Effect of Vibration on Strength:

TABLE IV

Pull-Out Load in Pounds for Parker-Kalon #12 - 3/4" R.H. Screws, with pre-drill hole 5/32" diameter.

Test Specimens 1-1/4" wide x 1" deep x 24" long.

Test No.	Test Specimens Material	Test Condition	Pull-Out Load-Lbs.
1	Marinite	As driven	179
1	Marinite	As driven	150
1	Marinite	As driven	193
3	Marine Sheathing	" "	312
3	Marine Sheathing	" "	380
3	Marine Sheathing	" "	341
1	Marinite	Vibrated 48 hours	213
1	Marinite	900 cycles per min.	190
1	Marinite	1/16" amplitude	170
3	Marine Sheathing	"	420
3	Marine Sheathing	"	340
3	Marine Sheathing	"	400

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Test No. 4280

CONCLUSIONS

11. A preliminary report of tests of the subject materials was submitted in reference (f). However, references (i) and (j) indicate that the proposed use of the materials was abandoned on account of considerations of relatively high weight and cost, possibility of splitting in case screws are placed in the edge of the material at right angles to the holding pressure, and uncertainty as to the behavior of the material under impact loads or the shock due to gun fire.

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New York Navy Yard Report of Test of Marinite and Marine Sheathing as Furring for Heat Insulation (1941)
ACL Doc 25557 · Page 7 of 7
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