PLAINTIFF'S EXHIBIT
WH-993

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Fire Research Section

INVESTIGATION OF SURFACE BURNING CHARACTERISTICS OF DECORATIVE LAMINATE PANELS

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Final Report

Prepared for

United States Plywood Corporation
707 Third Avenue
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I. INTRODUCTION

This report is a presentation of the results of thirteen flame spread tunnel tests on decorative laminate panels submitted for evaluation by the United States Plywood Corporation, New York, New York. The report contains a description of the materials, the preparation and conditioning of the test specimens, the test procedure, and the test results.

The tests were conducted in accordance with the provisions of ASTM Designation E84-61, "Standard Method of Test for Surface Burning Characteristics of Building Materials." This is similar to the test specified in NFPA No. 255, Underwriters' Laboratories Bulletin No. 723, and UBC No. 42

The purpose of these tests is to evaluate the performance of a material in relation to the performance of asbestos-cement board and red oak fl ing under similar fire exposure. The results are in terms of flame spread, fuel contributed, and smoke developed during a 10-minute exposure and are numerically expressed as a ratio with asbestos-cement board "zero" and re oak flooring "100". Periodic calibration tests using select red oak flooring provide the "100" reference, and the "zero" reference is established by conducting a 10-minute test with asbestos-cement board prior to each test series.

The results presented apply only to the specimen tested and not necessarily to the entire production of these or similar materials. All test data are on file and are available for review by the sponsor or his authorize representative.

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II. DESCRIPTION OF MATERIAL

Thirty nine 21" X 8'0" X 7/8" (nominal) panels, and thirteen 21" X 16" X 6/8" (nominal) panels of laminated construction were received on March 17, 1965. These consisted of either a 3/4" plywood or a 3/4" flake board type core, surfaced on both sides with a thin plastic laminate, and represent eight different types of laminate construction, herein referred to as Specimens (A), (C), (D), (E), (F), (G), (I) and (J). The following description of each specimen was provided by the manufacturer:

Specimen (A): Face: 0.050 FR (asbestos) Micarta
Core: FR Treated Novoply
Back: 0.045 asbestos Micarta backing sheet
Adhesive: Phenol Resorcinal glue

Specimen (C): Same as (A) except with treated fir plywood core

Specimen (D): Face: 1/16" standard Micarta
Core: FR Treated Novoply
Back: 0.045 standard backing sheet
Adhesive: Phenol Resorcinal glue

Specimen (E): Same as (D) except with treated fir plywood core

Specimen (F): Face: 1/32" standard Micarta
Core: FR Treated Novoply
Back: 0.020 standard Micarta backing sheet
Glue: Phenol Resorcinal glue

Specimen (G): Same as (F) except with treated fir plywood core

Specimen (I): Face: 0.050 FR (asbestos) Micarta
Core: FR Treated Novoply
Back: 0.045 asbestos Micarta backing sheet
Adhesive: Phenol Resorcinal glue
Fabrication: 1" wide grooves, 3/8" deep, 5" o.c. on face side

Specimen (J): Same as (I) except with treated fire plywood core

The treated Novoply core material bore a UL label showing a 25 flame spread rate, and the treated plywood core material had a UL label indicating a flame spread rating of 15.

Average unit weights of the specimens submitted are listed in Table 1.

TABLE 1. AVERAGE UNIT WEIGHT

Specimen	(lb per sq ft)
A	3.43
C	3.19
D	3.25
E	3.02
F	2.61
G	2.68
I	2.94
J	3.05

III. PREPARATION AND CONDITIONING OF TEST SPECIMEN

No preparation of the specimens was necessary since the panels submitted were cut to dimensions necessary to form a complete 21" X 25'4" test specimen by placing three 21" X 8'0" panels and one 21" X 16" panel end-to-end.

The materials were conditioned in the furnace room where the atmosphere is maintained at between 70° and 75°F and between 35 and 40 percent relative humidity.

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IV. TEST PROCEDURE

The tests on these specimens were conducted on March 29 and 30, 1965 with Mr. C. A. Stevens as an observer from United States Plywood Corporation. Reference data were obtained and furnace operation checked by conducting a 10-minute test with asbestos-cement board. This provided a "zero" reference for flame spread, fuel contributed, and smoke density.

The "100" reference had been established using red oak flooring. Ignition over the burners occurred 46 seconds after the start of the test, and the flame reached the end of the specimen in 5-1/2 minutes.

The decorative laminate specimens were tested in accordance with the standard procedure, with the finished surface, described as the "face" in Section II exposed to the inside of the furnace.

V. TEST RESULTS

Test results, calculated on the basis of observed flame travel and the areas under the recorder curves of furnace temperature and light absorption, are presented as a numerical classification in Table 2.

Triplicate tests were conducted on Specimens (A) and (D) and duplicate tests on Specimen (F) at the request of the Sponsor.

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TABLE 2. CLASSIFICATION TABLE

Test Specimen	Flame Spread Rate	Fuel Contributed Rate	Smoke Density Factor
Asbestos-Cement Board	0	0	0
Red Oak Flooring	100	100	100
Specimen (A),			
Test - 1	*18	10	49
- 2	3	6	12
- 3	3	5	6
Specimen (C)	8	10	6
Specimen (D)			
Test - 1	49	33	78
- 2	44	34	54
- 3	49	36	66
Specimen (E)	70	42	102
Specimen (F)			
Test - 1	25	24	32
- 2	25	27	47
Specimen (G)	44	21	29
Specimen (I)	13	8	47
Specimen (J)	8	5	18

*A delamination of the surface at 7-3/4 minutes accounted for the higher flamespread and smoke density on Specimen A-1.

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VI. TEST OBSERVATIONS AND RECORDED DATA

Primary ignition times as they occurred on each test are listed in Table 3.

TABLE 3. PRIMARY IGNITION

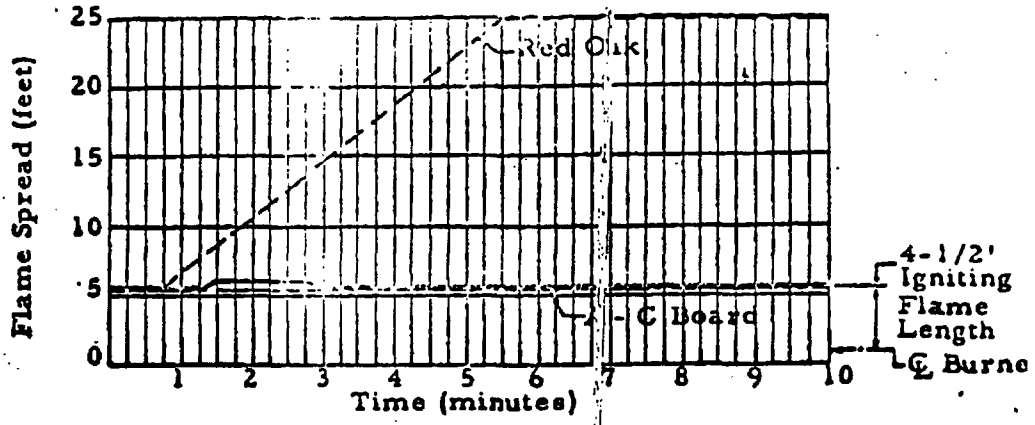
Specimen	Test No.	Time (Seconds)
(A)	1	30
	2	50
	3	50
(C)	1	68
(D)	1	105
	2	62
	3	85
(E)	1	40
(F)	1	60
	2	40
(G)	1	30
(I)	1	195
(J)	1	195

Observed flamespread, and recorded furnace temperature and light absorption (smoke density) typical of each specimen are shown in Figures 1 through 8 as a solid line on each graph.

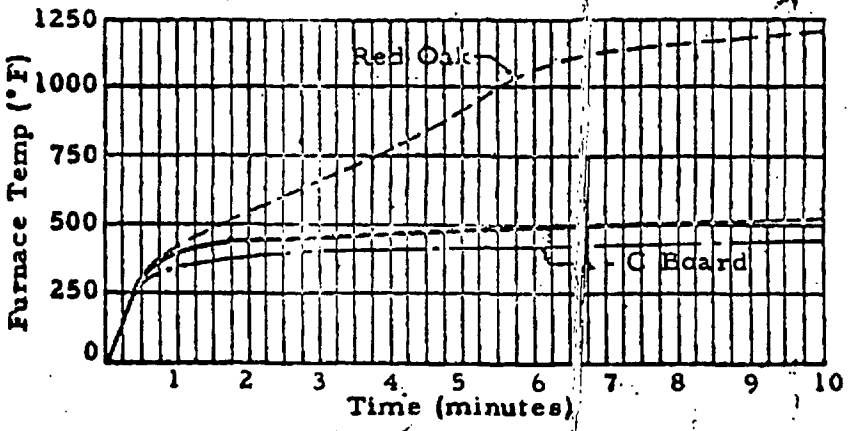
VIII. OBSERVATIONS AFTER TEST

Specimen (A) - Three Tests

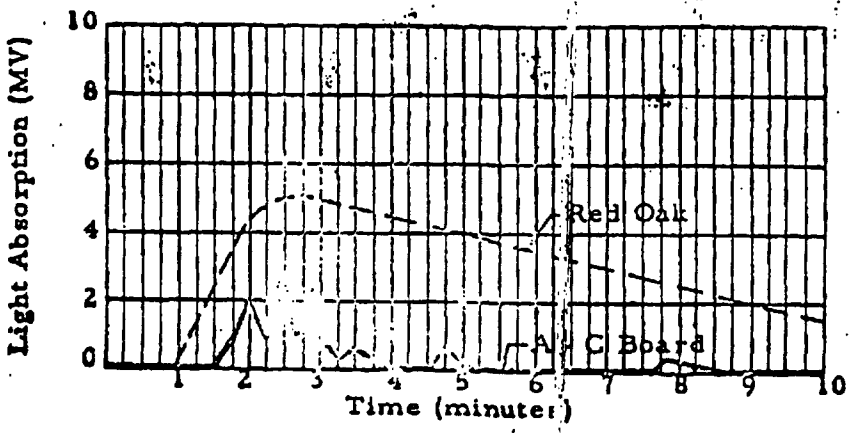
No afterflaming was observed when the burners were shut off at the end of the three 10-minute tests.



FLAME SPREAD



FURNACE TEMPERATURE
(Fuel Contribution)



LIGHT ABSORPTION (Smoke Density)

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FIGURE 1. GRAPHIC PRESENTATION OF TEST RESULTS

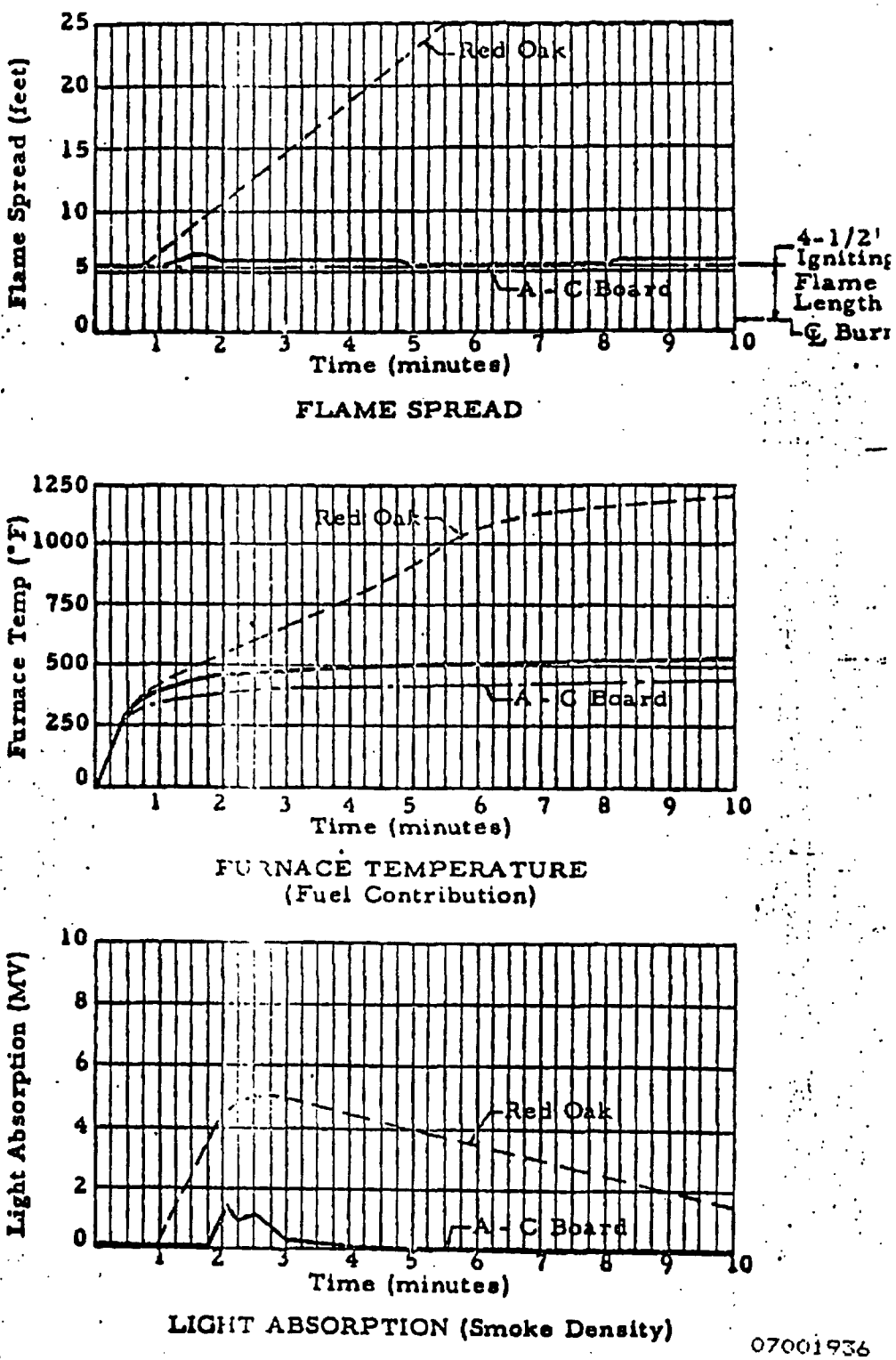
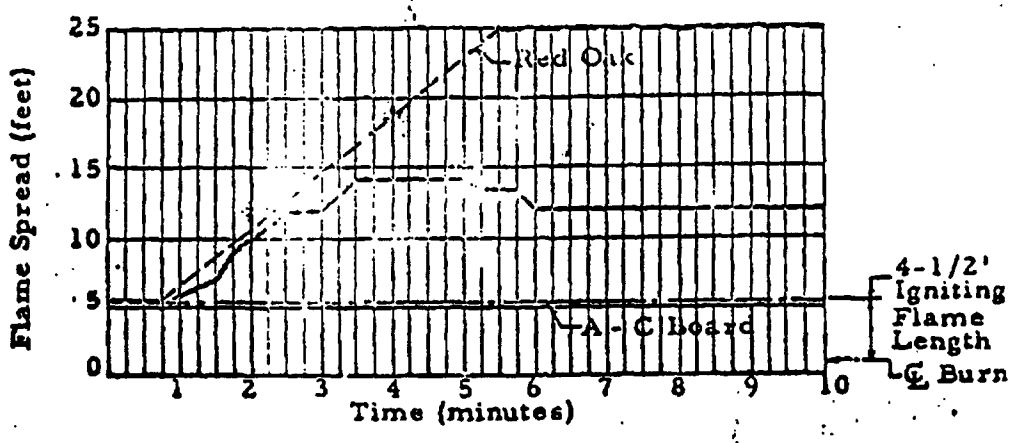
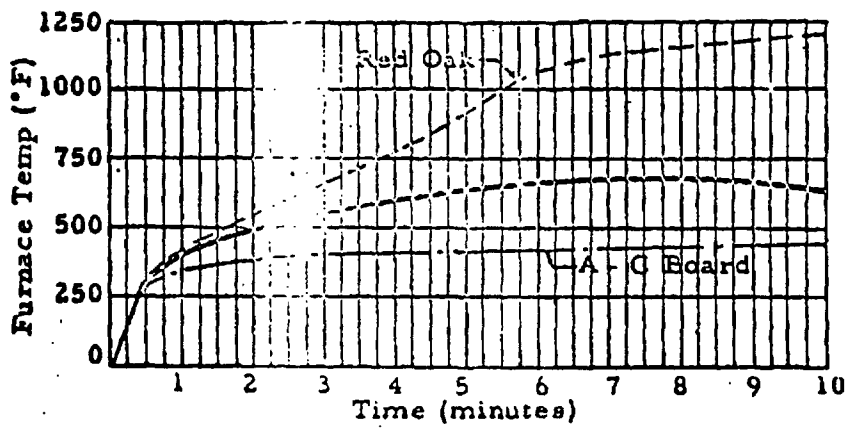


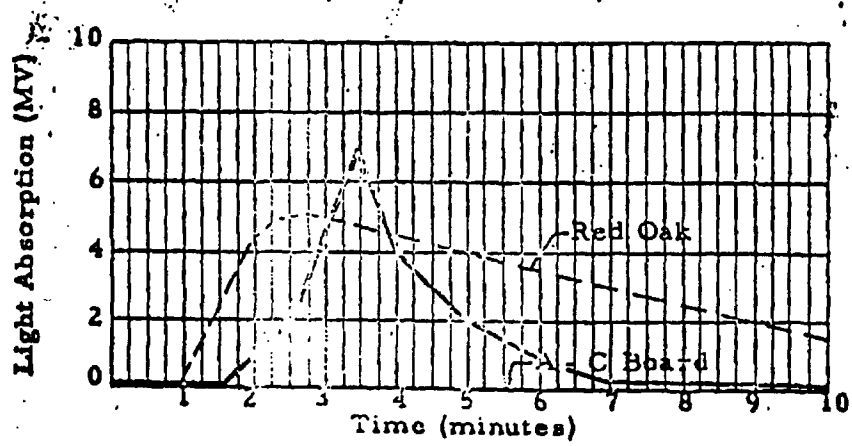
FIGURE 2. GRAPHIC PRESENTATION OF TEST RESULTS FOR SPECIMEN (C)



FLAME SPREAD



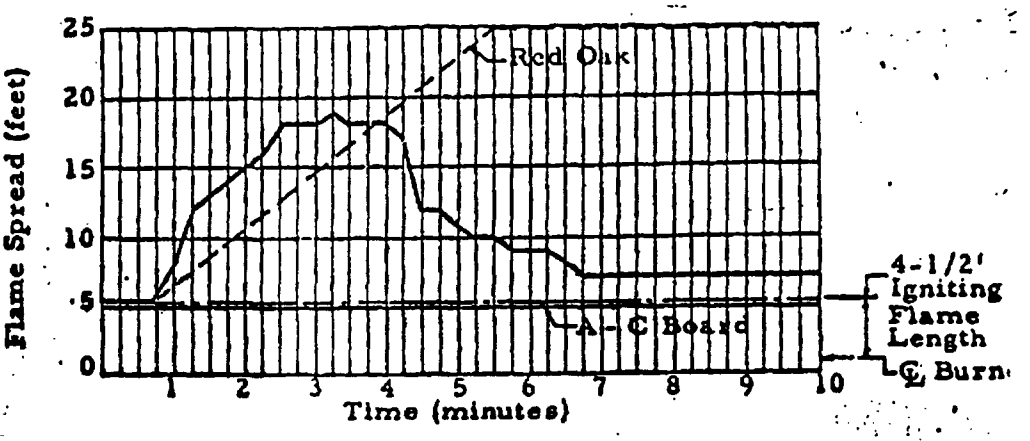
FURNACE TEMPERATURE
(Fuel Contribution)



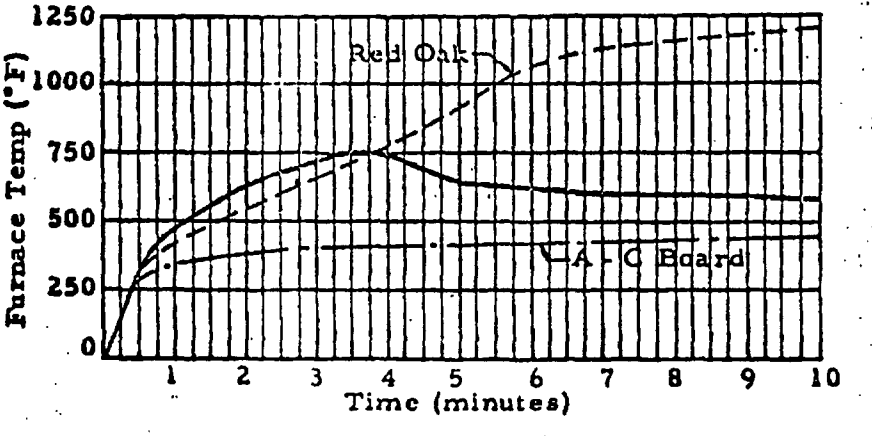
LIGHT ABSORPTION (Smoke Density)

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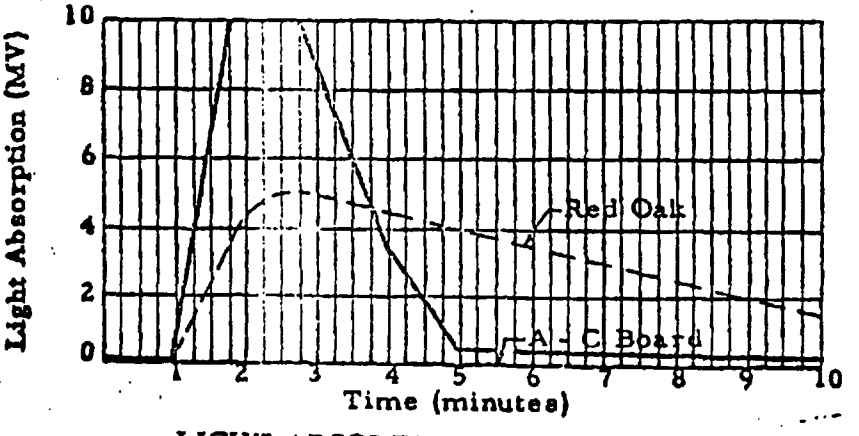
GRAPHIC PRESENTATION OF TEST RESULTS



FLAME SPREAD



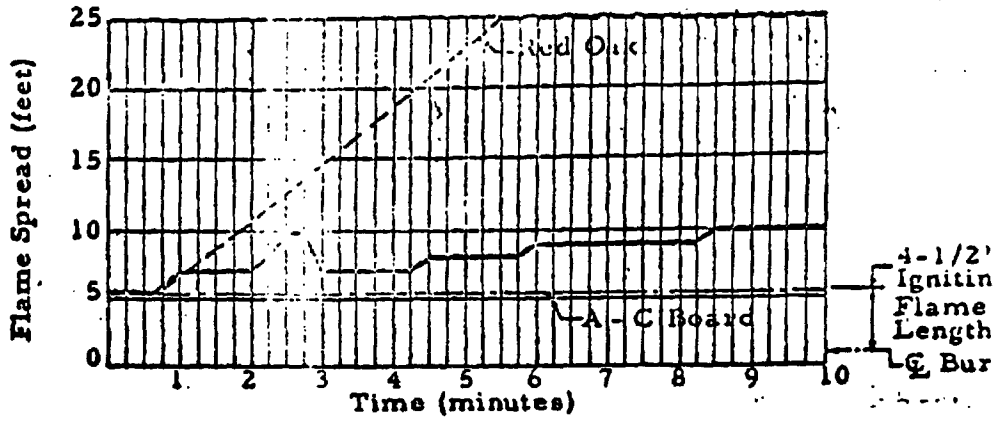
FURNACE TEMPERATURE
(Fuel Contribution)



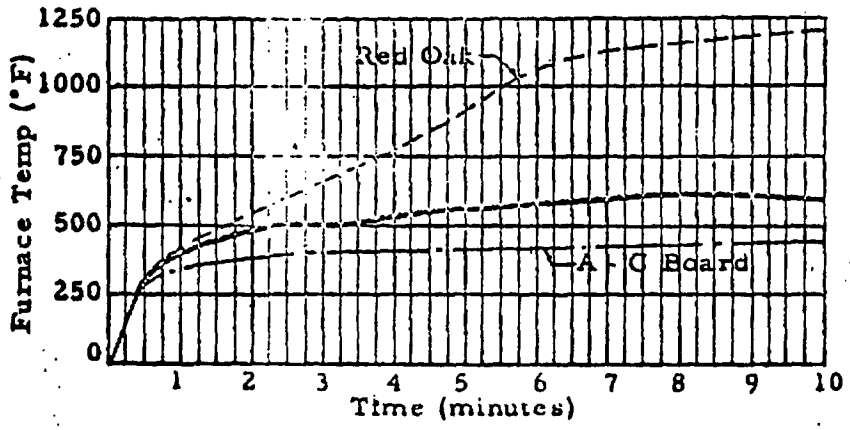
LIGHT ABSORPTION (Smoke Density)

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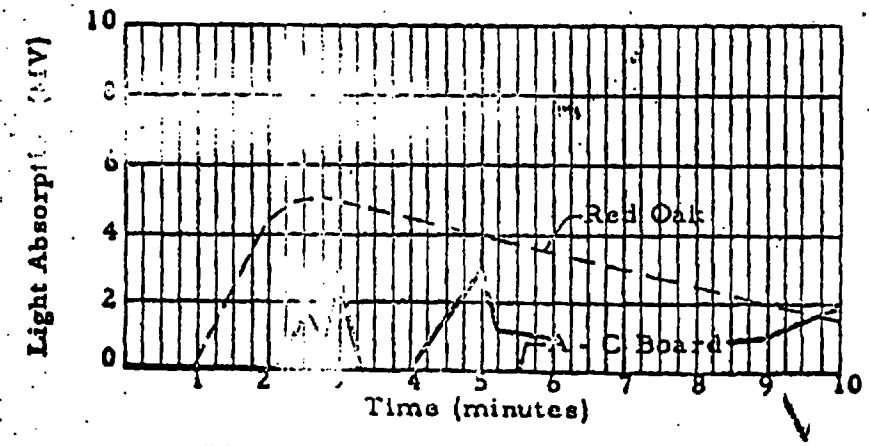
FIGURE 4. GRAPHIC PRESENTATION OF TEST RESULTS FOR SPECIMEN (E)



FLAME SPREAD



FURNACE TEMPERATURE
(Fuel Contribution)



LIGHT ABSORPTION (Smoke Density)

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FIGURE 5. GRAPHIC PRESENTATION OF TEST RESULTS

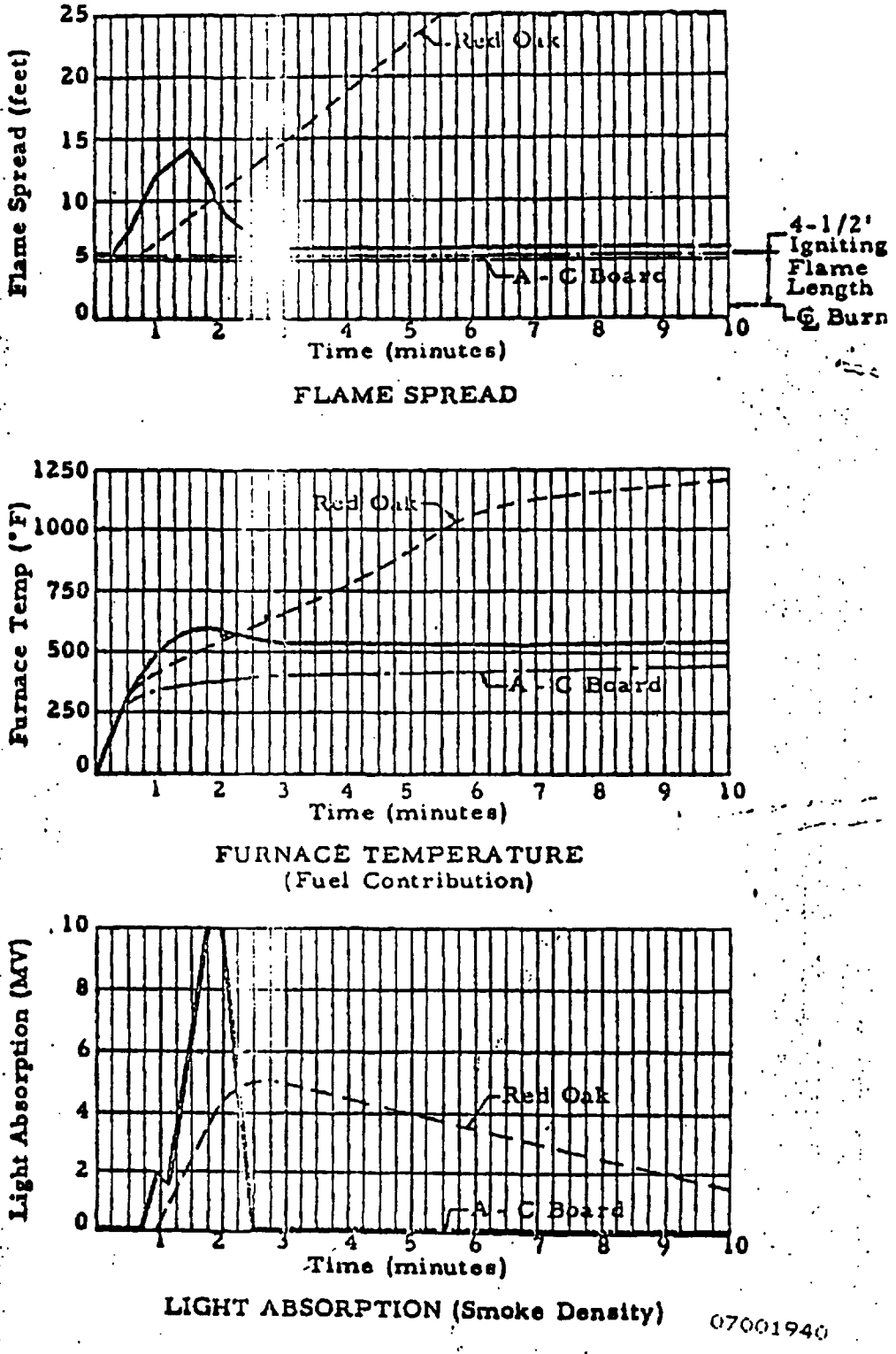
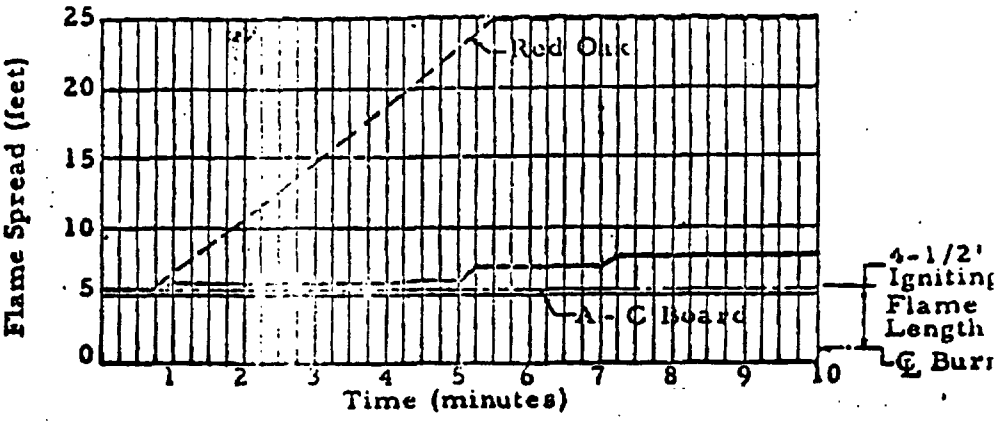
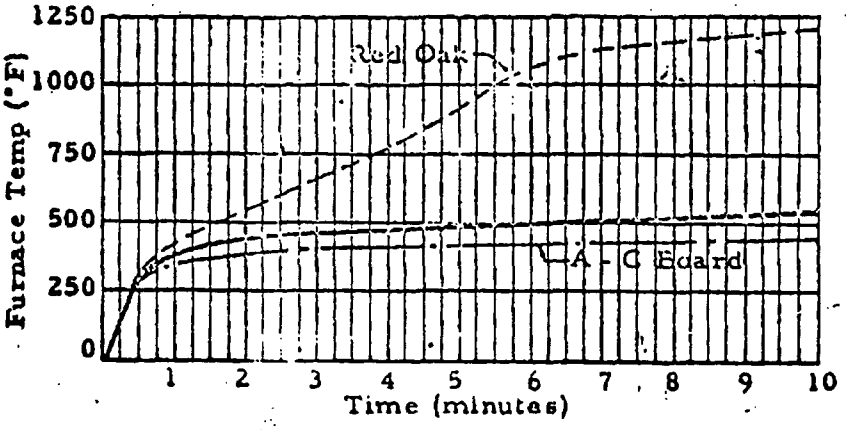


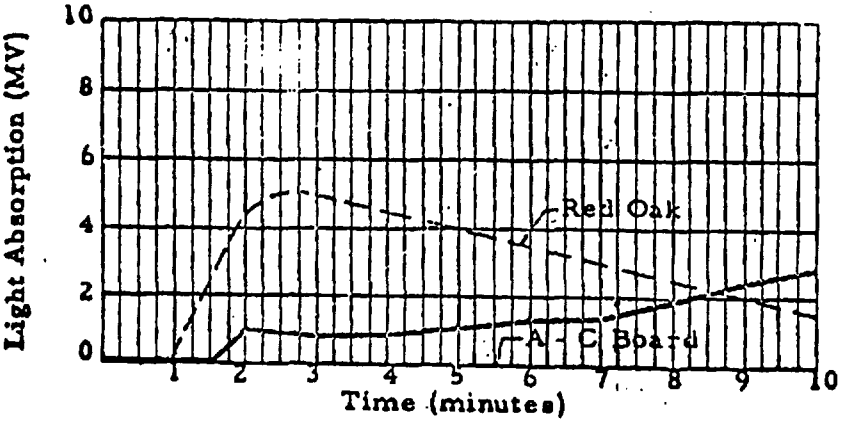
FIGURE 6. GRAPHIC PRESENTATION OF TEST RESULTS FOR SPECIMEN (G)



FLAME SPREAD



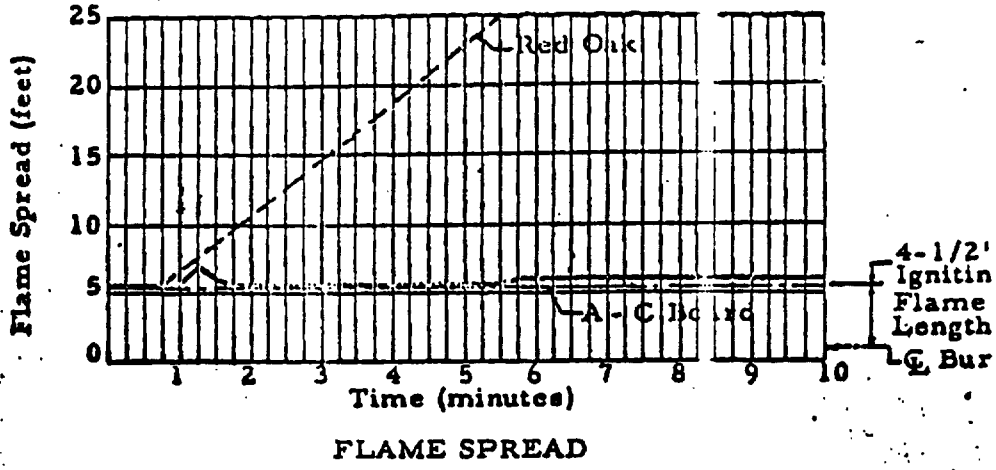
FURNACE TEMPERATURE
(Fuel Contribution)



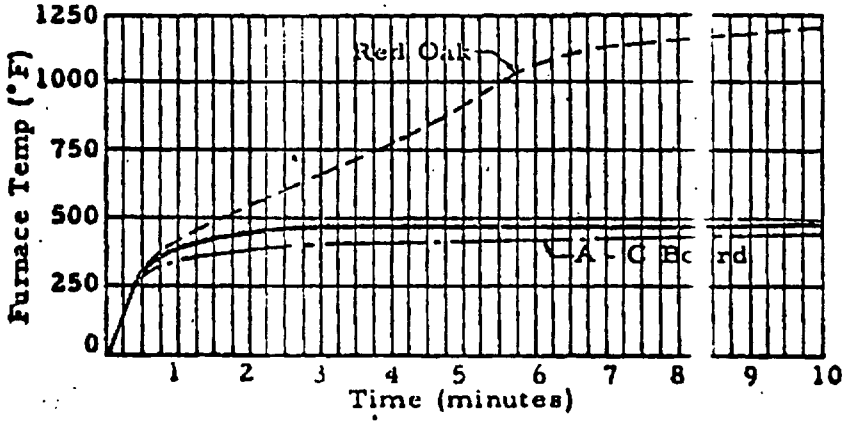
LIGHT ABSORPTION (Smoke Density)

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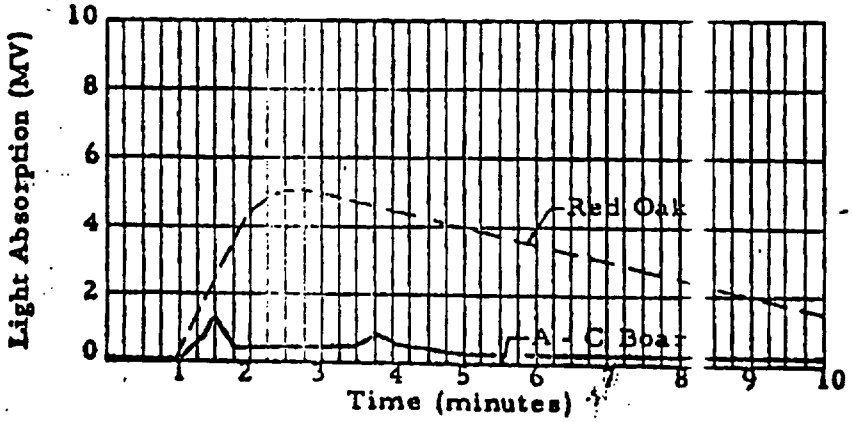
FIGURE 7. GRAPHIC PRESENTATION OF TEST RESULTS



FLAME SPREAD



FURNACE TEMPERATURE
(Fuel Contribution)



LIGHT ABSORPTION (Smoke Emissions)

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FIGURE 8. GRAPHIC PRESENTATION OF TEST RESULTS FOR SPECIMEN (J)

On an average for the three tests, the plastic laminate was blistered, charred or burned away for the first 12' from the burner end. The asbestos laminate was charred through over the area of flame impingement, slightly charred or discolored to about 8' and lost bond with core to 7'. The core damage was confined to a 1/8" deep char over the burner area which decreased to no char after 7'. No further damage to the panels was observed except stain along the exposed surface.

Specimen (C)

No afterflaming was observed at the end of the test.

The plastic laminate was blistered, charred or burned away to 16' from the burner end, with a large blister occurring at 20'. The asbestos laminate was charred through over the area of flame impingement and slightly charred or stained to 9'. Damage to the plywood core amounted to 1/8" char over the burners decreasing to surface char at 8'.

Specimen (D) - Three Tests

Afterflaming occurred in the three tests for approximately 1-1/2 minutes after the burners were extinguished.

On an average for the three tests, the laminate was burned away or charred and flaking off from 17' to 20'. Core char ranged from 5/32" to 1/4" deep over the burners with no damage at 10' in one case to 19' in another. Beyond 20' only stain was observed to the end of the specimens.

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Specimen (E)

Slight afterflaming and smoldering of the specimen was observed for 1 minute.

The plastic laminate was blistered, charred or burned away to 23' and stained beyond to the end. The core was charred 3/8" deep over the burners, 1/4" at 5', 1/16" at 10'. No further damage to the core was observed beyond 15'.

Specimen (F) - Two Tests

Some afterflaming occurred for 27 and 40 seconds at the end of the tests.

The plastic laminate was mostly destroyed on the first 10' from the burner end, and charred or blistered to approximately 17'. Core damage ranged from 1/4" deep char over burners to surface char at 11". Beyond 17' no further damage to either specimen was observed except stain.

Specimen (G)

No afterflaming was observed at the end of the test.

The plastic laminate was mostly burned away or charred to 12', and blistered at 14' and between 17' and 20'. The core was charred 3/8" deep over burners, and 1/4" at 5', with no further damage observed beyond 12'.

Specimen (I)

Afterflaming was observed for 23 seconds at the end of the 10-minute test.

The plastic laminate was burned away or chared to 9', and stained beyond to the end. The asbestos laminate was charred throughover the burner area, and slightly charred or discolored to 7'. Cracks in the surface laminate were observed along the edges of the 1" wide grooves to 21'. Core damage was confined to 3/8" deep char over the burners, 1/4" deep char at 6', and surface char at 8'.

Specimen (J)

No afterflaming was observed at the end of the 10-minute test.

The plastic laminate was mostly burned away or charred to 8', blistered to 16' and intermittently charred along the surface, and stained beyond to the end of the specimen. The asbestos laminate was charred through and delaminated over the burners, and discolored to 8'. Cracks in the surface laminate were observed along the edges of the grooves to 17'. The plywood core was charred approximately 1/8" deep over the burners and at 5'.

VIII. CONCLUSION

The flame spread characteristics of the decorative laminate panels described herein and tested in accordance with ASTM E84-61 are as presented in Section V of this report.

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