

SURFACE FLAMMABILITY OF VARIOUS WOOD-BASE BUILDING MATERIALS

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In Cooperation with the University of Wisconsin

SURFACE FLAMMABILITY OF VARIOUS WOOD-BASE BUILDING MATERIALS

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Summary

Surface flammability of 29 species of wood in lumber form and 50 commercially produced plywoods, hardboards, fiberboards, and particle boards was measured at the Forest Products Laboratory in the 8-foot tunnel furnace. Results indicate the range in surface flammability that can be expected from the types of lumber and fabricated boards tested.

Introduction

Fire protection engineers have long realized that an important property of a building material is its surface flammability, or the ease with which flames may spread over its surface. Methods of measuring surface flammability have been developed but have not been standardized, and until recently few data were published.

The Underwriters' Laboratories have made flame-spread measurements on a variety of materials including plywood, Douglas-fir lumber and cellulose board coated with fire-retardant paints, lumber of several species impregnated with fire-retardant chemicals, asbestos-cement boards, and acoustical tile. They released the test results in their Fire Protection Equipment List of 1957.

Gross and Loftus of the National Bureau of Standards published the paper, "Flame-Spread Properties of Building Finish Materials," in the May 1958 Bulletin of the American Society for Testing Materials. This paper gave test results on 3 base materials, 25 finishes, 12 plastics, and 10 other materials.

J. E. Ferris of the Commonwealth Experimental Building Station, Australia, in the 1955 paper, "Fire Hazards of Combustible Wallboards," gave flame-spread data for six types of unpainted wallboard and for a hardboard, fiberboard, and plywood finished with a variety of paints and varnishes.

¹Maintained at Madison, Wis., in cooperation with the University of Wisconsin.
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In this report are presented test data obtained on surface flammability of 29 species of wood in lumber form and 50 commercially produced plywoods, hardboards, fiberboards, and particle boards.

Test Method

The method of test was that described by Bruce and Miniutti in "Measuring Surface Flammability," ASTM Bulletin 230 of May 1958, and Forest Products Laboratory Report No. 2097, "Small Tunnel Furnace Test for Measuring Surface Flammability," 1957. In this test a specimen 14 inches wide by 8 feet long, conditioned to moisture equilibrium in an atmosphere at 30 percent relative humidity and 80° F., is laid in the furnace (fig. 1) and weighted down by a heavy cover, with asbestos millboard directly against its back. The progression of flame along the underside of the specimen is measured and expressed as an index number. Basis for this index is a rating of 100 for the progression of flame on select red oak flooring 39 pounds per cubic foot in density and a rating of 0 for progression on asbestos millboard.

Along with flame-spread rates, smoke density and heat contributed by the test specimen were also measured and expressed as index numbers relative to red oak and asbestos, as explained in the reports describing the test method.

Two tests were made on each material, with a third test when the results of the first two were not in adequate agreement.

Test Materials

The fiberboards, hardboards, particle boards, and plywoods were obtained largely through the courtesy of the respective manufacturers' associations.² All were specimens of commercial mill-run production. The sheets were usually 4 by 8 feet in size. From each 4- by 8-foot sheet, three test specimens 14 inches wide by 8 feet long were cut.

The lumber, nominally 1 inch thick, was obtained from sawmills or retail dealers. When conditioned to moisture equilibrium in 30 percent relative humidity and 80° F., the boards were surfaced to a thickness of about 3/4 inch, tongued and grooved,³ and assembled into panels held together by three nailed cleats on the back. Pieces shorter than 8 feet were end-squared and butt-joined.

²The Insulation Board Institute, the Hardboard Association, the Particle Board Association, the Hardwood Plywood Institute, and the Douglas Fir Plywood Association.

³An exception to this method of assembly was made for the redcedar, which could not be tongued and grooved. The redcedar boards were nailed to a backing of 1/4-inch Douglas-fir plywood to form the test panel.

Results

The results of all tests are given in tables 1 through 5. The range in index values found for the several groups of materials is shown in table 6. No attempt was made to analyze the results to explain the differences in the index values; to do so would require an intimate knowledge of the composition of the commercial materials and research on the effects of various ingredients. The tests, however, indicate the range in surface flammability that can be expected from the types of lumber and fabricated boards tested, and now available for construction purposes, as given by the Forest Products Laboratory 8-foot tunnel-furnace test.

In earlier tests, close correlation was found between results of the 8-foot tunnel tests and wall-corner tests, which simulate room fires, on 11 different materials. It is believed, therefore, that the results given in this report provide a realistic relative measure of the surface flammability of the various materials tested.

Table 1.--Results of tunnel-furnace tests on 1-inch lumber

Species	Weight	Moisture: content	Index numbers ¹		
			Flame- spread	Smoke- density	Heat- contributed
	Lb. per cu. ft.	Percent			
1.Alder (<u>Alnus rubra</u>)	: 29.6	: 6.4	: 118	: 108	: 122
.....do.....	: 29.9	: 6.5	: 124	: 116	: 119
2.Aspen (<u>Populus tremuloides</u>)	: 26.5	: 6.1	: 128	: 63	: 130
.....do.....	: 28.4	: 5.9	: 110	: 36	: 108
.....do.....	: 27.0	: 6.4	: 125	: 118	: 134
3.Basswood (<u>Tilia americana</u>)	: 28.6	: 5.4	: 123	: 78	: 131
.....do.....	: 27.4	: 5.4	: 134	: 80	: 124
4.Beech (<u>Fagus grandifolia</u>)	: 46.5	: 6.1	: 99	: 112	: 136
.....do.....	: 47.0	: 5.4	: 102	: 152	: 144
5.Baldcypress (<u>Taxodium distichum</u>)	: 29.2	: 6.6	: 103	: 420	: 109
.....do.....	: 27.2	: 7.2	: 122	: 359	: 105
.....do.....	: 32.4	: 6.8	: 107	: 388	: 112
6.Birch (<u>Betula alleghaniensis</u>)	: 39.6	: 5.4	: 91	: 93	: 92
.....do.....	: 39.2	: 5.8	: 106	: 84	: 101
.....do..(grain perpendicular)	: 39.4	: 6.0	: 100	: 83	: 95
.....do..(.....do.....)	: 39.4	: 5.9	: 86	: 143	: 99
7.Chestnut (<u>Castanea dentata</u>)	: 28.5	: 6.1	: 114	: 16	: 89
.....do.....	: 29.5	: 6.2	: 127	: 17	: 95
8.Cottonwood (<u>Populus trichocarpa</u>)	: 27.6	: 4.9	: 136	: 134	: 135
.....do.....	: 27.0	: 5.0	: 132	: 115	: 135
9.Douglas-fir (<u>Pseudotsuga menziesii</u>)	: 27.7	: 5.9	: 117	: 93	: 79
.....do.....	: 26.5	: 5.9	: 115	: 69	: 72
.....do..(grain perpendicular)	: 27.1	: 6.3	: 108	: 46	: 89
.....do..(.....do.....)	: 27.1	: 6.3	: 102	: 54	: 88
10.Elm, slippery (<u>Ulmus rubra</u>)	: 37.4	: 6.3	: 79	: 130	: 111
.....do.....	: 38.8	: 6.2	: 93	: 169	: 102
.....do.....	: 39.4	: 5.9	: 96	: 155	: 110
.....do..(grain perpendicular)	: 38.5	: 5.6	: 76	: 179	: 98
.....do..(.....do.....)	: 38.5	: 5.8	: 98	: 177	: 102
.....do..(.....do.....)	: 40.1	: 5.8	: 84	: 171	: 116
11.Fir, white (<u>Abies concolor</u>)	: 30.0	: 6.5	: 112	: 112	: 93
.....do.....	: 29.7	: 6.9	: 118	: 106	: 98

Table 1.--Results of tunnel-furnace tests on 1-inch lumber (Continued)

Species	Weight	Moisture: content	Index numbers ¹		
			Flame- spread	Smoke- density	Heat- contributed
	Lb. per cu. ft.	Percent			
12. Hemlock (<u>Tsuga heterophylla</u>)	29.9	7.3	113	87	95
.....do.....	28.2	7.5	102	69	95
13. Lauan, Philippine mahogany	31.7	5.2	109	38	86
.....do.....	37.6	5.5	103	72	76
.....do. (grain perpendicular)	34.6	5.2	98	59	74
.....do. (.....do.....)	34.6	5.0	99	68	70
14. Larch (<u>Larix occidentalis</u>)	34.4	6.8	107	72	98
.....do.....	35.4	6.8	105	41	98
15. Mahogany (<u>Swietenia macrophylla</u>)	30.7	6.5	100	52	69
.....do.....	28.6	6.6	107	15	70
16. Maple, sugar (<u>Acer saccharum</u>)	43.4	6.2	93	79	79
.....do.....	40.0	6.2	97	73	86
17. Oak, red (<u>Quercus rubra</u>)	39.0	5.2	100	100	100
.....do.. (grain perpendicular)	39.0	4.5	99	59	102
.....do.. (.....do.....)	39.0	5.2	99	69	105
18. Oak, white (<u>Quercus alba</u>)	40.8	6.3	99	32	90
.....do.....	40.7	6.5	91	49	92
19. Pine, northern white (<u>Pinus</u> <u>strobus</u>)	23.7	5.7	130	149	100
.....do.....	24.0	5.7	134	237	108
20. Pine, ponderosa (<u>Pinus ponderosa</u>)	26.6	6.5	110	182	100
.....do.....	27.0	6.6	124	183	102
.....do.....	29.6	6.3	109	325	103
21. Pine, southern yellow ²	28.4	6.8	102	158	111
.....do.....	30.0	6.7	102	157	120
22. Pine, sugar (<u>Pinus lambertiana</u>)	24.7	6.3	118	282	88
.....do.....	22.7	5.9	130	255	104
.....do.....	24.7	6.4	128	248	101
23. Pine, western white (<u>Pinus</u> <u>monticola</u>)	26.4	6.1	128	282	123
.....do.....	27.0	6.1	113	362	112
.....do.....	24.2	5.8	129	177	104

Table 1.--Results of tunnel-furnace tests on 1-inch lumber (Continued)

Species	Weight	Moisture:	Index numbers ¹		
			content:	Flame-:Smoke-:Heat-	spread: density: contributed
	Lb. per	Percent			
	cu. ft.				
24.Redcedar (<u>Juniperus virginiana</u>)	: 33.5	: 9.0	: 105	: 212	: 94
.....do.....	: 34.2	: 8.8	: 114	: 236	: 94
25.Redwood (<u>Sequoia sempervirens</u>)	: 25.9	: 6.4	: 120	: 170	: 64
.....do.....	: 25.2	: 6.4	: 122	: 207	: 72
26.Spruce, Sitka (<u>Picea sitchensis</u>)	: 27.0	: 7.0	: 116	: 72	: 77
.....do.....	: 26.6	: 6.5	: 108	: 42	: 82
27.Sweetgum (<u>Liquidambar styraciflua</u>)	: 31.2	: 6.4	: 94	: 66	: 82
.....do.....	: 32.4	: 6.2	: 107	: 86	: 114
.....do.....	: 33.2	: 7.2	: 113	: 52	: 119
28.Walnut, black (<u>Juglans nigra</u>)	: 35.6	: 5.0	: 105	: 80	: 111
.....do.....	: 39.3	: 5.2	: 108	: 90	: 118
29.Yellow-poplar (<u>Liriodendron tulipifera</u>)	: 30.9	: 5.7	: 121	: 123	: 120
	: 31.2	: 5.7	: 128	: 188	: 130

¹Relative to 100 for red oak lumber and 0 for asbestos board.

²Botanical species not determinable from wood alone.

Table 2.--Results of tunnel-furnace tests on plywood

Description of plywood	Thick-	Weight	Moisture:	Index numbers ¹		
	ness :	:	content:	Flame-	Smoke-	Heat-
	:	:	:	spread:	density:	contrib-
	:	:	:	:	:	uted
	Inch	Lb. per	Percent	:	:	:
	:	cu. ft.:	:	:	:	:
30. Douglas-fir, 3 ply, Interior,	1/4	31.2	6.6	129	152	125
A-D, cold-press, protein glue:	1/4	31.0	6.5	117	182	121
31. Douglas-fir, 3 ply, Interior,	1/4	30.0	6.2	120	111	111
A-D, hot-press, protein glue	1/4	30.4	6.0	125	99	117
32. Douglas-fir, 3 ply, Interior,	1/4	34.7	4.9	119	95	120
A-D, hot-press, extended	1/4	34.6	5.1	123	68	125
phenol resin glue	:	:	:	:	:	:
33. Douglas-fir, 3 ply, Exterior,	3/8	32.0	4.8	118	77	116
A-C, resin glue	3/8	32.0	5.0	114	41	102
34. Douglas-fir, 3 ply, Exterior,	3/8	35.7	4.7	112	57	120
A-C, resin glue	3/8	36.6	4.6	115	97	124
35. Douglas-fir, 3 ply, Exterior,	3/8	² 32.8	5.1	114	140	107
A-C, resin glue	3/8	² 32.8	4.9	112	166	100
36. Douglas-fir, 3 ply, Exterior,	3/8	34.8	5.0	83	406	56
A-C, resin glue - 1 coat of	3/8	34.9	4.7	83	548	59
fire-retardant paint A.	:	:	:	:	:	:
37. Douglas-fir, 3 ply, Exterior,	3/8	34.0	5.1	52	1022	18
A-C, resin glue - 2 coats of	3/8	33.7	5.1	53	914	21
fire-retardant paint A.	:	:	:	:	:	:
38. Douglas-fir, 3 ply, Exterior,	3/8	² 34.1	5.0	59	722	16
A-C, resin glue - 1 coat of	3/8	² 34.1	5.0	70	773	26
fire-retardant paint B.	:	:	:	:	:	:
39. Douglas-fir, 3 ply, Exterior,	3/8	² 34.1	5.0	34	1117	9
A-C, resin glue - 2 coats of	3/8	² 34.1	5.0	34	1169	11
fire-retardant paint B.	:	:	:	:	:	:
40. Douglas-fir, 3 ply, Exterior,	3/8	² 34.1	5.2	79	1000	37
A-C, resin glue, 2 coats fire-	3/8	² 34.1	4.8	84	1001	39
retardant paint C.	:	:	:	:	:	:
41. Douglas-fir, 3 ply, Exterior,	3/8	32.3	4.7	115	135	120
medium density paper plastic	3/8	32.4	4.9	118	113	118
overlay	:	:	:	:	:	:

Table 2.--Results of tunnel-furnace tests on plywood (Continued)

Description of plywood	Thick-	Weight	Moisture	Index numbers ¹		
	ness		content	Flame-	Smoke-	Heat-
				spread	density	contrib-
						uted
	Inch	Lb. per	Percent			
		cu. ft.				
42.Douglas-fir, 3 ply, Exterior, medium density paper plastic overlay	3/8 3/8	36.7 37.3	5.0 5.5	97 86	194 163	115 111
43.Douglas-fir, 3 ply, Exterior, medium density paper plastic overlay	1/2 1/2	40.6 40.2	4.6 4.7	113 113	232 234	119 112
44.Douglas-fir, 3 ply, Exterior, high density paper plastic overlay	3/8 3/8	35.9 36.4	4.3 4.2	105 105	166 146	102 101
45.Douglas-fir, 3 ply, Exterior, high density paper plastic overlay	3/8 3/8	33.4 33.4	4.9 5.3	106 108	116 96	115 115
46.Birch face, 40 mils, yellow poplar core, urea glue	1/4 1/4	35.0 39.0	5.9 5.9	117 116	78 59	122 135
47.Lauan face, 44 mils, lauan core, urea glue, 3 ply	1/4 1/4	29.4 32.3	6.7 6.8	111 113	32 68	113 99
48.Red oak face, 40 mils, lauan core, urea glue	1/4 1/4	35.2 34.2	6.3 6.3	124 124	74 85	139 146
49.Water oak, 3 ply, Exterior, phenolic film glue	1/4 1/4	41.4 43.0	3.7 3.8	108 111	49 65	127 137
50.Pecan, 3 ply, Exterior, phenolic film glue	1/4 1/4	42.9 44.2	4.2 4.2	119 125	38 40	134 151
51.Tupelo gum face, 50 mils, tupelo core, urea glue	1/4 1/4	40.4 41.7	5.1 5.6	107 111	148 139	138 145
52.Black walnut face, 30 mils, lauan core	1/4 1/4	28.5 31.2	7.5 6.4	117 130	72 94	90 140
53.Black walnut face, 30 mils, fuma core	1/4 1/4	25.8 27.6	6.2 6.6	122 135	39 65	95 72

¹Relative to 100 for red oak lumber and 0 for asbestos board.²Approximate.

Table 3.--Results of tunnel-furnace tests on fiberboards

Description of fiberboard	Thick-	Weight	Moisture:	Index numbers ¹		
	ness	:	content:	Flame-	Smoke-	Heat-
				spread:	density:	contrib-
						uted
	Inch	Lb. per	Percent:			
		cu. ft.:				

STRUCTURAL INSULATING BOARD

54. Douglas-fir fiber,	: 1/2	: 18.0	: 4.6	: 124	: 171	: 73
"D" factory	: 1/2	: 18.0	: 4.7	: 72	: 153	: 71
finish	: 1/2	: 18.0	: 4.8	: 76	: 238	: 59
55. Southern yellow pine	: 1/2	: 18.5	: 6.0	: 59	: 168	: 40
fiber, "F" factory	: 1/2	: 18.3	: 5.8	: 46	: 213	: 36
finish	: 1/2	: 18.2	: 5.3	: 47	: 122	: 34
56. Southern yellow pine fiber, "D"	: 1/2	: 19.2	: 5.5	: 127	: 95	: 114
factory finish, acoustical	: 1/2	: 19.2	: 5.5	: 130	: 55	: 109
tile (no perforations)	:	:	:	:	:	:
57. Aspen fiber, "D" factory	: 1/2	: 19.3	: 5.2	: 153	: 41	: 138
finish	: 1/2	: 19.3	: 5.0	: 163	: 47	: 138
58. Aspen fiber, asphalt im-	: 3/4	: 19.8	: 3.6	: 170	: 954	: 173
pregnated	: 3/4	: 20.2	: 3.7	: 169	: 969	: 172
59. Bagasse fiber, "D" factory	: 1/2	: 21.0	: 4.7	: 135	: 52	: 57
finish	: 1/2	: 21.0	: 4.7	: 145	: 94	: 59
60. Southern yellow pine and cotton	: 1/2	: 24.1	: 3.7	: 145	: 2167	: 148
wood fiber, asphalt impreg-	: 1/2	: 24.0	: 3.6	: 158	: 2323	: 198
nated	:	:	:	:	:	:

MEDIUM DENSITY BUILDING FIBERBOARD

61. Reclaimed paper, laminated	: 3/16	: 31.8	: 6.0	: 100	: 197	: 81
.....do.....	: 3/16	: 31.7	: 5.8	: 132	: 100	: 96
.....do.....	: 3/16	: 29.8	: 5.6	: 139	: 68	: 204
62. Reclaimed paper, laminated,	: 3/8	: 31.8	: 4.9	: 144	: 156	: 208
weatherproof	: 3/8	: 31.6	: 5.2	: 144	: 128	: 205
63. Aspen fiber, resin impregnated	: 0.43	: 33.6	: 1.8	: 102	: 1201	: 160
factory primed for house paint:	: 0.43	: 33.5	: 1.8	: 97	: 1214	: 174

¹Relative to 100 for red oak lumber and 0 for asbestos board.

Table 4.--Results of tunnel-furnace tests on hardboards

Description of hardboard	Thick-	Weight	Moisture:	Index numbers ¹		
	ness	:	content:	Flame-	Smoke-	Heat-
				spread:	density:	contrib-
						uted
	Inch	Lb. per	Percent:			
		cu. ft.:				
64.Aspen and yellow pine fiber,	1/4	60.6	3.9	100	330	195
phenol resin, wax, wet felted,	1/4	61.7	3.9	99	406	201
screen back						
65.Douglas-fir fiber plus bark,	1/4	58.8	4.3	97	225	150
phenol resin, wet felted,	1/4	61.3	4.7	97	272	156
screen back						
66.Douglas-fir fiber, wax, phenol	1/4	67.5	5.0	93	576	163
resin, air felted, dry pressed:	1/4	65.6	5.0	94	596	170
67.Douglas-fir fiber, wax, phenol	1/4	57.6	3.9	94	424	162
resin, wet felted, screen back	1/4	57.9	3.9	93	428	161
68.Willow plus oak fiber, wax,	0.22	50.5	3.2	119	147	176
resin, wet felted, dry pressed:	0.22	52.3	3.1	119	116	178
69.Douglas-fir fiber, oil-tempered:	1/4	61.3	4.3	94	227	165
wax, phenol resin, wet felted,	1/4	63.6	4.1	94	259	178
screen back						
70.Douglas-fir and redwood fiber,	1/4	72.0	3.2	87	662	164
oil-tempered, wet felted, dry	1/4	69.6	3.0	92	652	167
pressed						

¹Relative to 100 for red oak lumber and 0 for asbestos board.

Table 5.--Results of tunnel-furnace tests on particle boards

Description of particle board	Thick-	Weight	Moisture	Index numbers ¹		
	ness	:	content	Flame-	Smoke-	Heat-
				spread	density	contrib-
						uted
	Inch	Lb. per	Percent			
		cu. ft.				
71. Douglas-fir hammer-mill par-	: 3/4	: 36.0	: 5.0	: 98	: 270	: 107
ticles, wax, phenol resin	: 3/4	: 35.8	: 5.1	: 102	: 270	: 107
72. Ponderosa pine sawdust, phenol	: 1/4	: 68.4	: 5.4	: 87	: 742	: 149
resin	: 1/4	: 67.3	: 5.3	: 87	: 654	: 157
73. Southern yellow pine chips,	: 7/8	: 41.4	: 6.0	: 83	: 52	: 75
phenol resin, extruded	:	:	:	:	:	:
74. Southern yellow pine chips,	: 7/8	: 36.9	: 5.5	: 90	: 59	: 87
urea resin, extruded	:	:	:	:	:	:
75. Southern yellow pine flakes	: 3/4	: 47.4	: 6.6	: 92	: 71	: 117
and chips, urea resin	: 3/4	: 46.7	: 6.7	: 97	: 87	: 120
76. Pine, maple, cottonwood chips	: 11/16	: 42.1	: 4.6	: 99	: 64	: 110
and fiber, urea resin	: 11/16	: 42.2	: 5.2	: 97	: 73	: 114
77. Pine, ash, maple, sweetgum	: 1.2	: 50.2	: 4.2	: 97	: 182	: 111
chips, urea resin, extruded	: 1.2	: 48.8	: 3.6	: 95	: 208	: 113
78. Pine, ash, maple, sweetgum	: 1.2	: 50.1	: 3.8	: 91	: 124	: 104
chips, phenol resin, extruded	: 1.2	: 47.5	: 3.8	: 93	: 155	: 109
79. White pine chips, urea	: 3/4	: 41.3	: 6.0	: 102	: 144	: 135
resin	: 3/4	: 38.8	: 6.1	: 106	: 157	: 142

¹Relative to 100 for red oak lumber and 0 for asbestos board.

Table 6.--Maximum and minimum index numbers found for each type of material tested

Description of material	Index values ¹					
	Flame-spread		Smoke-density		Heat-contributed	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
<u>Lumber (29 species tested)</u>	:	:	:	:	:	:
10.Elm, slippery	76	:	:	:	:	:
8.Cottonwood	:	136	:	:	:	:
15.Mahogany	:	:	15	:	:	:
5.Baldcypress	:	:	:	420	:	:
25.Redwood	:	:	:	:	64	:
4.Beech	:	:	:	:	:	144
<u>Uncoated Plywood</u>	:	:	:	:	:	:
(19 kinds tested)	:	:	:	:	:	:
42.Douglas-fir, 3 ply, 3/8 inch, Exterior, medium density overlay	86	:	:	:	:	:
53.Black walnut face, 30 mils, fuma core, 3 ply, 1/4 inch	:	135	:	:	72	:
47.Lauan face, 44 mils, lauan core, urea glue, 3 ply, 1/4 inch	:	:	32	:	:	:
43.Douglas-fir, 3 ply, 1/2 inch, Exterior, medium density overlay	:	:	:	234	:	:
50.Pecan, 3 ply, 1/4 inch, Ex- terior phenolic film glue	:	:	:	:	:	151
<u>Structural Insulating boards</u>	:	:	:	:	:	:
(7 kinds tested)	:	:	:	:	:	:
55.Southern yellow pine fiber, "F" factory finish, 1/2 inch	46	:	:	:	34	:
58.Aspen fiber, asphalt impreg- nated, 3/4 inch	:	170	:	:	:	:
57.Aspen fiber, "D" factory finish, 1/2 inch	:	:	41	:	:	:
60.Southern yellow pine and cottonwood fiber, asphalt impregnated, 1/2 inch	:	:	:	2323	:	198

Table 6.--Maximum and minimum index numbers found for each type of material tested
(continued)

Description of material	Index values ¹					

	Flame-spread		Smoke-density		Heat-contributed	
	-----		-----		-----	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum

Medium density building fiber-board (3 kinds tested)	:	:	:	:	:	:
63. Aspen fiber, resin impregnated, factory primed, 0.43 inch	97	:	:	1214	:	:
62. Reclaimed paper, laminated, weatherproof, 3/8 inch	:	144	:	:	:	208
61. Reclaimed paper, laminated, 3/16 inch	:	:	68	:	81	:
Hardboard (7 kinds tested)	:	:	:	:	:	:
70. Douglas-fir and redwood fiber; oil-tempered, wet felted, dry; pressed, 1/4 inch	87	:	:	662	:	:
68. Willow plus oak fiber, wax, resin, wet felted, dry pressed, 0.22 inch	:	119	116	:	:	:
65. Douglas-fir fiber plus bark, phenol resin, wet felted, screen back, 1/4 inch	:	:	:	:	150	:
64. Aspen and yellow pine fiber, wax, phenol resin, wet felted; screen back, 1/4 inch	:	:	:	:	:	201
Particle board (9 kinds tested)	:	:	:	:	:	:
73. Southern yellow pine chips, phenol resin, extruded, 7/8 inch	83	:	52	:	75	:
79. White pine chips, urea resin, 3/4 inch	:	106	:	:	:	:
72. Ponderosa pine sawdust, phenol resin, 1/4 inch	:	:	:	742	:	157

¹Relative to 100 for red oak lumber and 0 for asbestos board.
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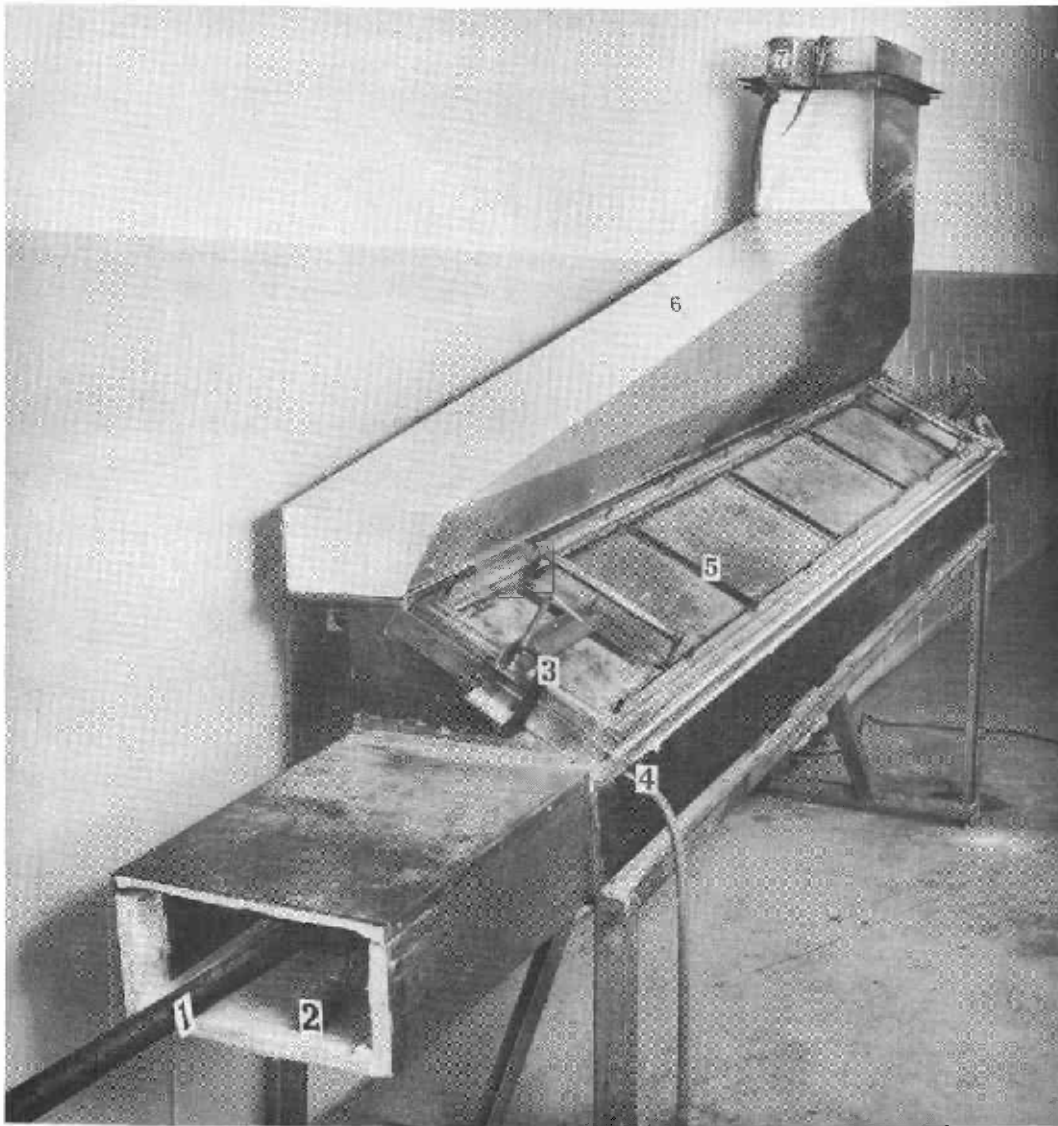


Figure 1. --Specimen side of FPL small tunnel furnace. 1, gas supply to main burner; 2, firebox; 3, clamp to hold down cover over test specimen; 4, gas supply to igniting burner; 5, cover over test specimen; 6, hood to collect combustion gases for temperature and smoke measurement; and 7, photoelectric cell for smoke-density measurement.