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THE FLAME RETARDANT PROPERTIES OF SOME COMMON DECORATIVE TREATMENTS

by

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Introduction

Combustible building boards are often used as internal linings to walls and ceilings of buildings and the fire risk associated with some of these boards can be reduced by treatment with fire retardant paints. The majority of internal linings however receive only decorative treatments and although it is generally assumed that these afford some protection, there is little information on the degree of protection or on the relative merits of the treatments. Since surfaces with a Class 2 or Class 3 rating on the surface spread of flame test are recommended for many situations it is important to know with which decorative treatments these can be achieved.

Proprietary paints

The paints which would normally be used to decorate combustible building boards are -

Washable distempers.
Non washable distempers.
Flat oil paints.
Plastic emulsion paints.

Proprietary paints representative of each of the above groups were selected and the results of the tests are shown in Table 1. Samples from each group were tested on the small scale test, and on the large radiation panel as described in B.S. 476. The correlation between the two tests was very good in Classes 2, 3 and 4, but a number of specimens graded Class 1 on the small scale test were graded Class 2 on the standard test. The rest of the tests were carried out using the small scale test, and any specimens graded Class 1 were subsequently tested on the standard spread of flame test. The gradings of these are given in parentheses in Table 1.

A considerable improvement in the flame spread characteristics of the board was obtained by treatment with all but the plastic emulsion paints. It is important for the best results that the board should be completely covered with the treatment, and an improved performance was obtained when a sized board and a board specially prepared for decoration were used.

Table 1

Results of tests on proprietary paints applied to fibre insulating board

Type of paint	Weight of application		Classification on small scale SOF test *
UNTREATED BOARD			4
Washable distemper	1 coat	36 g/ft^2	2
	2 coat	65 g/ft^2	1 (2)
	3 coat	82 g/ft^2	1 (2)
Non washable distemper	1 coat	56 g/ft^2	1 (2)
	2 coat	108 g/ft^2	1 (2)
	3 coat	151 g/ft^2	1 (1)

Table 1 (contd.)

Type of paint	Weight of application		Classification on small scale SOF test *
Non washable distemper on sized board	1 coat 2 coat	40 g/ft² 79 g/ft²	1 (1) 1 (1)
Flat oil paint (A)	1 coat 2 coat		2 2
Flat oil paint (A) on proprietary board specially prepared for decoration	1 coat		1 (2)
Flat oil paint (B)	2 coats		2
Plastic emulsion paint (C) (Polyvinyl acetate)	1 coat 2 coat 3 coat	16 g/ft² 26 g/ft² 36 g/ft²	4 4 4
Plastic emulsion paint (D) Polyvinyl acetate	3 coat		3
Plastic emulsion paint (E) Polyvinyl acetate	3 coat		3
Plastic emulsion paint (F) Polyvinyl acetate	3 coat		4
Plastic emulsion paint (G) (alkyd resin)	3 coat		4

*Figures in parentheses are gradings on the standard spread of flame test of B.S. 476.

Experimental paints

Because of the poor performance of the boards treated with plastic emulsion paints a number of experimental paints of this type were prepared by the Paint Research Station and tested. It was thought that the pigmentation, type and amount of plasticiser and type of pigment might affect the flame retardant properties and these were varied in the experimental paints. Three coats of each type of paint were applied and the results are given in Table 2.

Table 2

Results of tests on experimental plastic emulsion paints applied to fibre insulating board

Paint No.	Emulsion type	Pigmentation* Ratio Pigment / Total medium by weight	Plasticiser % of medium	Small scale S.O.F. Classification
1	Polyvinyl acetate	3 : 1	Dibutyl phthalate (20%)	3
2	Polyvinyl acetate	2 : 1	Dibutyl phthalate (15%)	4
3	Polyvinyl acetate	1 : 1	Dibutyl phthalate (12%)	4
4	Polyvinyl acetate	3 : 1	Tricresyl phosphate (20%)	3
5	Polyvinyl acetate	3 : 1	Dibutyl phthalate and Chlorinated diphenyl (20%)	3
6	Polyvinyl acetate	3 : 1 (pigment 25% - powdered mica 75% - T_1O_2)	Tricresyl phosphate (20%)	1 ‡
7	Polystyrene	1·8 : 1	Dibutyl phthalate (40%)	4
8	Polystyrene	1·8 : 1	Chlorinated diphenyl (50%)	4
9	Polystyrene	1·8 : 1	Tricresyl phosphate (50%)	3

*Except in paint No. 6 the sole pigment was rutile T_1O_2.
‡Insufficient specimen to permit tests on the standard spread of flame test.

The normal limits of pigmentation for this type of paint are between 1 : 1 and 3 : 1. The results indicate that within this range the pigmentation has little effect on the flame retardant properties. Also the three types of plasticiser used did not have an appreciable effect.

The marked improvement achieved by the inclusion of powdered mica in the pigment shows that it is possible to improve the performance by special modification and there may in fact be a number of ways of achieving this result. The mechanism is not fully understood but it seems that the mica decreases the porosity of the heated paint film to the gases from the combustible material.

Conclusions

Of the paints most likely to be used for ordinary decorative purposes on combustible building boards, washable and non washable distemper and flat oil paint can improve the flame spread characteristics of the boards appreciably. A range of plastic emulsion paints commercially available gave little protection to the boards. The inclusion of powdered mica in the pigment (other modifications might be equally effective) can improve the fire performance of plastic emulsion paints so that they are comparable with the other common decorative treatments. Mica is a material sometimes added to paints for other purposes and its inclusion in plastic emulsion paints should not introduce any serious drawbacks.

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