FIRE-RETARDING COATINGS

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FIRE-RETARDING COATINGS

The present emergency has stimulated considerable interest in fire-protective treatments for wood. Wood is replacing steel for construction purposes in many new structures, and there is some anxiety concerning potential fire danger not only from normal sources but also from incendiary bombs. There is likewise more than usual interest in fire protection for wood structures already built.

Such protection can be provided by two types of treatments, impregnation with fire-retarding chemicals and surface coverings of fire-retarding coatings. Impregnated wood has been in use to a limited extent for many years and is an established commodity. Fire-retarding coatings, on the other hand, have not received much recognition, partly because of extravagant claims made by manufacturers of preparations possessing very little fire-retarding effectiveness and partly because of a lack of standards for minimum requirements. The Forest Products Laboratory has been interested for some time in the possibilities of fire-retarding coatings to check the spread of fires of small size and has made many fire tests of the effectiveness of such materials. This mimeograph outlines what can be expected in the way of protection from known fire-retarding coating formulations and contains information on the properties of such preparations.

At the outset, it should be remembered that wood exposed to fire temperatures will char, regardless of whether it is coated or not. The best that can be expected of a paint-type coating is to stop or retard the spread of flame along the surface. The degree to which flame spread is checked is dependent on the type of coating and its thickness and on the fire conditions present, such as design of the painted structure, size of the fire, duration of exposure, presence of draft, and temperature of the air. After fires develop to large size and burn rapidly or for considerable periods, they may overcome the resistance of fire-retarding coatings; but small fires can often be kept small or even caused to die out by suitable coatings.

Various tests have been devised to measure the effectiveness of fire-retarding coatings in checking flame spread under varying conditions of severity, but insufficient work has as yet been done to determine how effective such coatings are in actual use. This Laboratory has used the fire-tube test for much of its fire-testing work. In this test, a specimen measuring 40 inches by 3/4 inch by 3/8 inch is suspended vertically within a sheet-iron cylinder 3 inches in diameter, and a Bunsen burner with an 11-inch flame is placed beneath the specimen. The percentage loss in weight of the specimen and the temperature at the top of the fire tube are recorded at intervals of 30 seconds. At the end of 4 minutes the burner is removed, but percentage losses in weight and temperatures are recorded until burning ceases. In this test untreated or uncoated wood loses about 50 percent of its weight after 4 minutes' exposure to the flame and 70 percent or more of its weight when blazing and glowing cease. In evaluating the degree of protection afforded

by coatings, a loss of weight of less than 30 percent after 3 minutes' exposure is considered to indicate protection against mild fires, whereas a final loss of weight of less than 25 percent is considered to indicate protection against fires of moderate severity.

Another method of test being used is a modification of one developed by Ragnar Schlyter of the Swedish Government Testing Institute. In this method two plywood panels, 12 inches by 31 inches by 3/8 inch, are stood in a vertical position, parallel to each other and 2 inches apart, with the bottom of one panel 4 inches above that of the other. A wing-top Bunsen burner flame is placed between the two panels and readings are taken of the progress of the flame spread with time. With unprotected wood, the flame will spread over the surfaces and destroy the specimens but, with effective fire-retarding coatings on the exposed surfaces, the flame ceases to spread as soon as the gas burner is removed.

In recent months a flame with more intense ignition properties has been used in the Schlyter-type test, and a limited number of tests on a larger scale have been made using incendiary bombs.

The Forest Products Laboratory has used the foregoing methods to study the performance of a large number of formulations in its efforts to find good fire-retardants and determine their ability to provide good protection with a reasonable number of coats. In addition to fire-retarding effectiveness, other properties must be taken into consideration. Among these are reasonable permanence of both fire-retarding effectiveness and adherence of coating to the wood, resistance to comparatively high relative humidity, and, to some extent, the appearance of the coating. Resistance to weather is also desirable but usually absent.

On the basis of the examination of numerous coatings, this Laboratory has drawn the following conclusions regarding certain types of preparations tested.

Borax-Linseed Oil Fire-retardant Paints

Linseed oil base paints of good fire-retarding effectiveness can be made by replacing an appreciable portion of the pigment with finely ground borax. The percentage of borax required varies with the kind of pigment. The following table gives four examples of single pigment formulations, heavy coats of which were found to provide sufficient protection to keep the final loss in weight in the fire-tube test under 25 percent; 3 or 4 thick coats or approximately 1 gallon per 125 square feet are required.

Coatings of ordinary thickness undoubtedly would provide protection against comparatively weak fires, but for highest resistance thick coatings must be used. This type of paint is good for interior use from the standpoints of appearance, moderate moisture resistance, and permanence. It will not retain its effectiveness, however, after repeated exposure to rain and for that reason it is not suitable for outdoor use.