Resene

Resene Paints Limited

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APPLIED FINISHES FOR TIMBER EXTERIOR SITUATIONS IN NEW ZEALAND - PART 1

Before developing the main theme of this memo, it will be advantageous to consider the timber surface which is to be coated.

Most timber is made up of cellulose fibres arranged in long, slender, hollow tubes or cells. The cellulose fibres are bound together with lignins, hemicellulose, and a wide variety of compounds lumped together under the term "extractives". The thickness of the cell walls and the ratio of cellulose to lignins varies with seasonal growth so that the surface of any piece of timber is, by nature, a non-uniform substrate.

Timber is in general a very stable material retaining its mechanical and chemical properties over long periods of time. It will however, undergo cyclical changes of expansion and contraction with heat and cold; and swelling and shrinking with the ingress and egress of moisture. This dimensional instability with moisture varies from species to species and has been correlated with the "paintability" of individual species.

The chemical stability of the timber surface is poor under the influence of UV light. Under such circumstances wood loses methoxy groups and lignin, with a corresponding increase in acidity and the evolution of formaldehyde and methanol. Loss of these elements creates voids in the timber which results in enlargement of the cell orifices and cracking of the cell walls. Areas of high lignin content are more prone to UV damage than areas of low lignin content. These chemical changes are accompanied by a colour change towards grey and the exposure of loosely bound cellulose fibres on the surface of the timber.

The prime considerations for a coating for timber, therefore, must be:

(a) moisture impermeability
(b) ability to resist UV degradation of itself and to screen the timber from UV
(c) flexibility
(d) heat reflection.

It is assumed that the timber requiring coating is in ideal condition, i.e. it has had the correct pretreatment commensurate with the projected exposure conditions; it has been dried to the correct moisture content; it has been carefully stored and is free from surface checking; and has been correctly detailed to avoid sharp arrisses and allow free drainage of water. The next all-important step is in the choice of a primer.

The principal requirement of a primer is that it adheres tenaciously to the substrate both initially and long term (ideally the life of the structure). Other properties which are desirable in a wood primer are:

1. **Long term flexibility.** This function is more easily achieved with saturated high polymers (such as acrylics) than unsaturated vegetable oils and alkyds. Within the oil-based varieties, oils with the least degree of unsaturation (whilst still allowing air-drying), have the potential for longer term flexibility than the more unsaturated oils such as linseed.
2. **The ability to make uniform the porosity of the non-uniform substrate.** It is accepted that the porosity of timber surface varies widely on the same piece of timber, and the need for the primer to cope with this can lead to some archaic concepts. The phrase "oil-based paints feed the timber surface" has for many years "coloured" the thinking of the primer function. Though penetration into timber pores can occur, it takes place in a selective manner; usually the solvent first followed by low molecular weight vehicle fractions and so on as viscosity increases and drying speed permits. This then can also lead to lack of uniformity in the primer surface. It is the Author's belief that penetration should be reduced to a minimum by formulation, and uniformity of surface achieved by a tightly adhering primer film on top of the timber surface.
3. **Water Resistance.** Accepting that water is one of the most severe degrading influences on timber it is obvious that the ability of the primer (and the rest of the system) to keep the timber dry is beneficial. However totally waterproof coatings are rarely a practical proposition and it must be accepted, even in a well coated system, that the moisture content of the timber will vary with subsequent swelling and shrinking. There is a case for inducing into primers a degree of hydroplasticity such that it can move sympathetically with the timber.
4. **Stain Resistance.** Timbers, according to species, contain extractives which can migrate through paint films causing objectionable staining on the surface. It is yet another function of the primer to prevent or reduce this phenomenon. Since the majority of the extractives are water soluble, the problems are most noticeable (but not wholly confined to) water-based primers. Reactive pigments and ion-exchange type resins are useful in reducing these problems, as is the careful screening of the water-phase components of the primer. In the Author's experience there will always be one bit of timber that will beat the system!
5. **Fungal Resistance.** The timber surface is often a happy hunting ground for moulds and fungi. Hoffman has shown that increased fungal resistance occurs when fungicides are incorporated throughout the paint system rather than concentrated in the top coat. A good timber primer should show fungicidal properties.
6. **Corrosion Resistance.** Whilst it may seem strange discussing corrosion resistance in relation to wood primers, it is a fact that the appearance of many otherwise satisfactory paint jobs can be marred by the presence of rust stains derived from nail head corrosion. Wood primers should assume the job of combatting this.
7. **Toxicity.** The law in New Zealand states that paints containing more than 0.5 percent by weight (dry film) of lead must not be used on surfaces which children can chew. This is a fact of life which must be accepted. It is the responsibility of paint manufacturers to ensure that suitable products are available to specifiers and painters.
8. **Recoatability.** The primer must present a surface suitable for recoating.

Wood primers in New Zealand are traditionally a shade of pink (even though the base paint may be white) notwithstanding considerable pressure from the painting trade to have them white. The painters reasons are obvious—the manufacturers not so. The primers are shaded pink so that they do not contribute to the hiding of the system. A contribution to the hiding implies a contribution to the absorption and reflection of light including the damaging UV component. In the interests of maximum durability of the primer, this is not desirable. As listed above, the primer has sufficient functions to perform as it is.

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