

Discolouration of coated joinery

Causes and solutions

Discolouration of coated joinery is one of the most common site complaints on newly installed factory finished joinery.

Milking and blistering

Milky discolouration in translucent systems can happen in cold conditions, when the joinery has been wrapped or is stored in damp conditions. This discolouration will disappear within a few days of the joinery being installed as the residual moisture dissipates to atmosphere and the coating achieves full cure. For opaque systems the issue will show itself as micro blistering, but in severe cases the blisters can be much larger. Again, these will disappear as the moisture dissipates to atmosphere.

Tannin staining

Staining of opaque coated joinery is a more complex phenomenon, and generally results from two main sources: soluble extractives or tannins; and resins, both of which are naturally present in timber. Tannins are the main cause of staining in hardwoods, whilst resin exudation tends to be more prevalent in softwood varieties, particularly around knots.

As well as timber species, the severity of staining is also influenced by the following: - growing region; knots; preservation treatment; processing and exposure conditions. Moisture plays a major part in tannin migration through the coating system and site problems occur most often when dry joinery from the factory is exposed in warm moist conditions: the rapid uptake of moisture as the joinery conditions tends to mobilise the resin and tannins whilst heat and sunlight draw them to the coating surface.

With good timber selection, care in the preservation process and appropriate coating selection, the problems can be significantly reduced and in some cases wholly eliminated.



Moisture

Following application, waterborne coatings are touch dry very quickly as the carrier (water) evaporates from the surface of the applied coating. However, it takes significantly longer for the coating to through dry and even longer to fully cure.

The drying of the applied coating system is dependant on many factors including temperature, the moisture content of the timber, applied coating thickness, drying times, elapsed time between applied coats, storage conditions and relative humidity. This means that in times of high humidity or cold damp weather, the joinery may be exposed to weather or excessive moisture from the building process before the drying / curing process is completed. Under these circumstances it is possible that translucent finishes will become milky in appearance and the surface of opaque finishes will blister.

As the coating cures these effects will disappear and is no way detrimental to the long term performance of the coating system.

The process of drying described enables the coating to maintain its elasticity and therefore its long term durability.

Solutions

Timber selection may help to minimise the problem, though in many cases it can be difficult to predict if tannin staining will occur.

Fortunately, with the appropriate selection of coatings, preventing tannin staining is relatively straightforward in most situations.

Water based isolating primers, such as Teknos' "Anti Stain Aqua 2901", which form a barrier against tannins and help inhibit their mobility, will in most cases eliminate the problem, and in extreme cases a solvent based Teknal isolating primer will give almost total protection. When applying stain inhibiting primers it is important that subsequent sanding is kept to a minimum to avoid removing the protective layer and this is particularly important on profile edges and rounds.

Resin staining and exudation

In addition to soluble extractives, the cell structure of wood contains groups of chemicals, often referred to as exudates. In softwoods, the principle exudate is referred to as resin and can show itself in coating discolouration, viscous liquid or crystalline solids on the surface of the timber or coating, or a combination of both.

Resin staining and exudation is commonly seen at knot margins, but is also found in resin ducts and sometimes on latewood bands. Timber species, age, growth conditions, season of harvest, the ratio of sapwood to heartwood and the number of live knots all have an influence.

The staining associated with resin is chemically different from the tannin stains of hardwoods and many hardwood isolating primers offer relatively ineffective protection against resin staining.



Resin exudation is usually initiated by a combination of heat and moisture, which changes the resin from a solid to a liquid and in severe cases to a gas. In joinery processing, drying equipment, heated storage, stretch wrap packaging, and heating systems in buildings post fitting are common initiators.

In service, specific weather conditions can trigger the problem and discolouration will occur most rapidly on warmer southern elevations when humidity levels are high. Darker coating colours, which absorb more energy, may initially disguise staining, but can accelerate resin migration leading to blistering and adhesion failure.

Preservative solvents can also be a factor. If insufficient drying time is allowed, residual solvent that has absorbed resin, colour and natural extractives from the timber can discolour subsequent coatings. The problem is often seen around knots, where the preservation fluid will partly dissolve resin concentrates, bringing them to the timber surface, producing severe staining and blistering even when knotting solution is used.

To reduce the problem, allow sufficient drying time between preservation treatment and subsequent coating or switch to a surface applied, water based preservative such as Teknol Aqua 1410. Preserved timber will dry faster if air is allowed to circulate the surface of the substrate, and stacked timber should always be separated with spacing bars.

Solutions

There is no foolproof solution to the problem of resin exudation, though timber selection to exclude knots from decorative surfaces is increasingly common and effective. Finger jointing or laminating can offer an economic route to knot free surfaces and with careful selection of basecoats an aesthetically pleasing result can be achieved even with translucent finishes.

When a coating solution is required, Teknos' preferred method involves filling the knots with Teknofill 5001 fine surface filler, sealing the knot area with Teknos knotting solution, and over-coating with a specially formulated isolating primer, Anti Stain Aqua 2901. This system will not prevent the exudation of liquid resin in extreme cases, but has proved to be highly effective in minimising resin stains and restricting the affected areas.

Other common coating solutions include: -

1. Primers with barrier pigments such as leafing aluminium provide short-term protection against staining, but only delay the exudation process and ,because they embrittle, can lead to other failures.
2. Two pack epoxy and polyurethane coatings form a dense coating layer that encapsulates the timber restricting movement of extractives and resin through the paint film. These coatings offer good initial protection, though pressure from resin exudates can, over time, push these coatings off the timber surface, leading to total adhesion failure.

Resin exudation remedial measures

When resin has exuded through a permeable coating, the best remedial treatment is to allow the resin to weather until it dries and oxidises, forming a white crystalline powder. The dried resin can then be removed with a stiff nylon or natural bristle brush, and any remaining residues washed off with a cloth.

Water based coatings with their relatively high degree of moisture vapour permeability are more likely to allow the passage of resin to the surface without damage to the coating, and if the finish is not damaged by over-vigorous scrubbing during crystal removal, re-coating is often unnecessary.

Although it may be unsightly, it is better not to remove fresh sticky resin. In practice, this can be very difficult, and the presence of sticky resin indicates that the exudation is still continuing.

The remedial work for resin exudation is often best left until the first maintenance period, by which time the resin has normally fully crystallised. After removal as described above, the overall application of one maintenance coat of finish restores the general appearance of the timber and maintains its protection.

Teknos UK and Ireland

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