

# BUILDING DIGEST

CENTRAL BUILDING RESEARCH INSTITUTE INDIA



## PAINTING OF WOOD AND WOOD-BASED MATERIALS\*

Wood and wood-based materials are painted for decoration and for protection. The paint or pigmented coating masks the grain and colour of the wood and substitutes in their place a surface of an entirely different colour and texture. Paint protects wood by retarding the rate of moisture change in it. Transparent finishes are used when it is desired to bring out the colour and grain of the wood. They are less durable than pigmented coatings, particularly on external woodwork.

### Painting Woodwork

There are many different species of wood, each with its own surface characteristics, and even within the same species there are wide variations. Depending on the conditions of growth and on the methods adopted for cutting there may also be substantial variation in a single piece of wood. Wood may be dense, soft, resinous and may contain a variety of extractives.

Wood has a cellular structure and it always tries to reach a state of equilibrium with atmospheric moisture. Changes in moisture content are accompanied by swelling and shrinkage and these are most pronounced across the grain. Summerwood swells to a greater extent than springwood and these movements place a considerable strain on the paint film.

The cellular structure of wood, particularly of springwood and sapwood, has a strong influence on the absorption of the liquid component of paint. The first coat may be largely consumed, resulting in a poor matt finish, which affects the life of the coating.

The most important factor in painting wood is its moisture content which, at the time of painting, should not be more than 10 to 15 per cent, to avoid blistering and premature failure of the paint. Too low a moisture content is also not desirable. The optimum moisture content for wood in different regions of the country is given in Indian Standard 287-1960.

### Surface Preparation

Paint failure takes place very often due to inadequate surface preparation. The ideal substrate for painting should be dry, free from dirt and grease and must possess a moderate uniform suction.

New wood, if not properly seasoned, should be allowed to dry to 10-15 per cent moisture content, rubbed down with abrasive paper and then sanded with 00 emery paper. Softwoods like *chir*, *kial* and deodar

invariably contain knots and resin streaks. It is advisable to remove dead and encased or loose knots and the gap should be filled with plastic filler wood (IS:423-1961). Tight and firm knots need a sealer coat before or after the priming coat to check the softening and discolouration of the paint film. Shellac knotting (15 per cent shellac solution in methylated spirit) provides an effective seal over deodar knots whereas aluminium wood primer followed by shellac knotting perform best on *chir* knots. Over *kail* knots a thin coat of polyvinyl alcohol gives satisfactory results.

Unprotected timber exposed to weather gradually becomes porous, soft, friable and often infected with fungus. It does not offer a stable foundation for paint. The decayed and porous part of the wood should be removed by scraping or planing and a good alkyd varnish well thinned with white spirit should be applied as a sealing coat before priming.

### Painting Systems

A paint system consists of primer, undercoat and finishing paint. For a finish of high standard and for new outdoor woodwork a four coat paint system is advised—primer, two undercoats, and a finishing coat. For repainting a surface where the paint film is intact, one undercoat and a finishing coat should be satisfactory.

### Priming

Although primer coat is covered by succeeding coats of undercoat and finishing, it is on the nature of this coat that the life of the paint largely depends. White lead primer, wood primer type A and type B and pink primer are in common use. These are covered by relevant Indian Standard Specifications. In recent years aluminium wood primer has also been recommended. Owing to the leafing, i. e. overlapping, action of aluminium particles in the film, it imparts greater resistance to moisture penetration. PVA emulsion paints are also sometimes used on damp wood surfaces, with the intention of repainting it at a later stage with a more durable coating. Unlike the conventional primers, PVA emulsion paint is porous and cannot compare in strength and quality with oil paints. It constitutes a weak link in the paint system.

The selection of a primer depends on the type and condition of the wood surface. On damp surfaces aluminium wood primer should not be applied as it will seal in the moisture and cause blistering. It is recommended

\*This Digest supersedes Building Digest No. 10 on Painting wood work.

for hardwoods and for treatment of end grain surfaces because of its sealing characteristics. It is also good for priming softwoods. White lead primer, wood primers type A and type B and pink primer permit minute quantities of moisture to pass through the film and hence can tolerate a slightly higher moisture content in wood. White lead primer has, however better adhesion to wood and gives a longer service life.

Timbers like teak and sissoo may retard drying of oil paint and develop poor adhesion. Their surface should be wiped with a solvent such as white spirit or acetone in order to remove surplus oil before the primer coating is applied.

Wood treated with preservatives dissolved in water or volatile solvents may be primed as untreated wood provided the solvent has dried out completely. Creosote, which possesses great solvent action on oil paints, is always liable to bleed through and discolour paint film unless some form of a sealer coat is applied. One or two coats aluminium wood primer is recommended. Care should be exercised during its application as the solvent present in the paint might soften creosote and carry it into the paint. Since this is more likely to happen with recently creosoted wood, a shellac varnish is preferred in such cases.

Wood primer should always be well brushed into the grain so that it fills the pores and cavities, and provides a good key for succeeding coats. Slight penetration of the liquid portion of the priming paint into the wood assists better adhesion. Since deeper penetration is neither necessary nor desirable, no thinner should be added to the primer unless the paint has become abnormally thick from long standing. High viscosity primers are required on end grain surfaces and on porous timbers. Low viscosity primers perform better on dense impermeable hardwoods.

When the primer coating has dried, but not hard dried, all cracks, large cavities, nail holes, etc., are filled with hard stopping. White lead in gold size has long been satisfactorily used as stopping. Linseed oil putty is also in use as it is cheap and easily available but it lacks the cohesiveness and tenacity of white lead/gold size mixture. This is especially true where shallow indentations are concerned which may therefore be made up with a paste filler (IS:426-1961).

### Filling

In general, hardwoods require filling. The first coat of filler is laid off with the direction of the grain, and the second coat perpendicular to it, on the same day. Brush filler (IS:110-1950) is applied heavily and the application must be quickly carried out to keep down brush marks and to obtain a uniform spread.

It is undesirable to leave the primed surface for more than a few days before the next coat of paint is applied. Sometimes a delay of this kind is responsible for premature failure of paint.

### Undercoat

The undercoat builds up film thickness and obliterates the surface. It should provide a smooth film not far removed in colour from the finishing coat. The number of undercoats applied will depend on the standard of finish required. For outdoor work two coats are necessary. These are applied by brush or spray after the primer coat has dried fairly hard.

The final appearance of the surface depends to a large extent on the undercoats and it is therefore necessary to ensure that its application is uniform and the surface is free from brush marks.

### Finishing

After the undercoat has thoroughly dried it is carefully rubbed down and smoothed before the finishing coat is applied. For interior wood painting greater emphasis is placed on the smoothness of the finish. Hence undercoating should be well flatted to produce a smooth level surface. Cleanliness is essential and the work should be carried out in a draught free dry atmosphere.

For interior woodwork the traditional flat oil paints or gloss paints may be employed. For external surfaces full gloss finish based on synthetic resins should be preferred. They are quicker drying and easier to work than oil gloss paints. However, working with them requires special care as they set quickly. Interior window sills, frames and sashes should be regarded as external woodwork so far as painting is concerned. As far as possible green and blue pigmented finishes should be avoided on exterior woodwork as they are likely to fade early. For kitchens and bathrooms where paints of better washability are desired, synthetic enamels or finishes based on synthetic resins should be used.

### Repainting

Paint film showing signs of flaking or disintegration should be burnt off or removed completely and the surface painted as new wood. If the paint is in sound condition except for chalking and loss of colour, dirt, soot, grease and other contaminants should be carefully removed using neutral detergents. Washing soda and alkaline detergents should not be used because any trace left on the surface may attack the new coating especially that of oil paint. Painted surfaces which have been wax-polished and are to be repainted should be cleaned first with white spirit or any other suitable solvent to remove the waxy material.

The paint film is finally rubbed down with sand paper to provide good adhesion to the new coat of paint. All bare patches should be touched up with a primer paint. Cracks and depressions should then be made up with stopping or filler. One coat each of undercoating and finishing paint are then applied. Information on repainting is summarised in Table 1.



**TABLE I**

**Maintenance painting of wood**

| Condition of surface and type of failure of existing finish | Surface preparation and painting  |
|---|---|
| 1. Chalking and/or checking                                 | Flat down to even up the checked film and clean the surface free of loose pigment particles. Apply one coat each of undercoating and finishing paint.   |
| 2. Localized blistering and/or cracking                     | Scrape off blistered, cracked and loosely adhering paint. Rub down to even up checks, if any. Touch up bare spots with priming paint and apply one coat each of undercoating and finishing paint. |
| 3. Extensive blistering and/or cracking                     | Remove paint film from the whole surface and finish as new wood.  |

**Painting Wood-based panels**

The anisotropic behaviour of wood exhibited in its swelling and shrinkage characteristics is absent in particle board and hardboard and they provide a more uniform surface for painting. Plywood and blockboard also exhibit greater dimensional stability than wood.

**Painting of Plywood**

The paint holding properties of plywood are essentially the same as of the wood of the face ply. Surface checks and end grain are usually present. They must be filled after the application of primer paint. The filler is heavily applied and the excess material is removed by wiping, leaving a smooth base over which additional coats of paint are applied. The paint system recommended for wood is suitable for plywood also. Blockboards are similar to plywood in their painting characteristics.

Repainting should be done before microchecking of the paint film has started since once the surface checks on plywood have forced their way through the paint film it becomes difficult to obtain a smooth finish. In general repainting is necessary after two years' weathering.

**Painting of Hardboard**

Two types of hardboard are available in the country: (1) normal hardboard, (2) tempered hardboard. They are painted both for protection and decoration. Painting enhances the smoothness of the surface. Hardboard, especially tempered hardboard, with smooth hard surface can be painted without any pretreatment. However, any manufacturing stains due to wax and grease should be removed. The three coat

painting system consisting of primer, undercoat and finish is normally applied.

Normal hardboard should be sealed with shellac varnish or a thin coat of polyvinyl acetate or acrylic resin emulsion paint to reduce excessive absorption of the paint and to obtain a smoother finish. If emulsion paint is applied, excess moisture is allowed to dry and the board is then finished with undercoating and finishing paint.

In external work it is essential to pay due regard to the adequate protection of the edges of the board as well. The same paint treatment should be given to edges as is provided on the surface taking care to fill cracks that may have developed during cutting.

When it is desired to distemper hardboard a coat of petrifying liquid or size solution is first applied over it. For emulsion paint, a thin emulsion paint priming will provide a good sealing effect.

For repainting, the same procedure as for wood may be followed, but under no circumstances should the existing paint be removed by burning off.

Hardboard treated with fire-retardant salts should first be sealed with shellac varnish or a sharp primer. It should never be primed with water-borne paint.

**Painting of Particle Boards**

Particle boards have a very absorptive surface. In addition to the pores in the wood chips, voids are also present in between. This necessitates filling and sealing the surface prior to painting. Shellac varnish is a satisfactory sealer. After filling and sealing, the paint requirements of particle board become entirely a function of

**TABLE 2**

**General guidance for painting wood and wood-based materials**

| Surface to be painted       | Surface preparation                             | Sealing   | Priming  | Filling   | Undercoating and finishing                                      |
|-----------------------------|---|---|--|---|---|
| 1. New wood<br>(a) Softwood | Season, sand and rub to a smooth surface        | Seal knots and resin streaks                        | One coat of white lead primer, or aluminium wood primer, or pink primer or wood primer type B. | Fill nail holes and indentations with stopping.                                   | one coat each of undercoating and finishing paint.              |
| (b) Hardwood                | —do—  | —NIL—   | One coat of white lead primer, or aluminium wood primer or pink primer or wood primer type A.  | Fill open pores with wood filler. Fill nail holes and indentations with stopping. | —do—  |
| 2. Weathered wood           | Remove decayed wood, dry and plane the surface  | Seal with a thin coat of alkyd varnish.             | As for new wood.   | —do—  | —do—  |
| 3. Treated wood             | Dry and remove preservative on surface.         | —NIL—   | One coat of aluminium wood primer  | Fill nail holes and indentations.   | —do—  |
| 4. Plywood and blockboard   | Remove manufacturing stains of adhesive and wax | —NIL—   | As for new wood  | Fill surface checks and seal.   | —do—  |
| 5. Particle board           | —do—  | A coat of shellac varnish or other suitable sealer. | As for new wood  | As for hard wood.   | —do—  |
| 6. Hardboard                | —do—  | (i) —NIL—   | As for new wood  | —NIL—   | —do—  |
|                             |   | (ii) —NIL—  | One coat of emulsion paint thinned with water.   | —NIL—   | One or two coats of emulsion paint or chlorinated rubber paint. |
| 7. Insulation board         | —NIL—   | (i) One coat of strong size solution                | One coat of oil bound distemper  | —NIL—   | One coat of oil bound distemper.                                |
|                             |   | (ii) —NIL—  | One coat of flat oil paint.  | —NIL—   | One or two coats of flat oil paint.                             |
|                             |   | (iii) —NIL—   | One coat of emulsion paint thinned with water  | —NIL—   | One coat of emulsion paint or chlorinated rubber paint.         |



the quality desired. A coat each of undercoat and finishing paint give a good finish.

### Painting of Insulation Board

Wood-based insulation boards, are of two kinds namely fibre insulation board and low density particle board. They are soft, porous and very absorbent and are usually greyish white or cream in colour.

Flat or matt finish such as distemper, emulsion paint and flat oil paint are suitable for decorating insu-

lation boards. Spray application gives best results. Over thinning of water dilutable paint should be avoided. While repainting, the old paint should never be removed by burning off and the use of excessive amounts of water for washing should be avoided.

General guidance for painting wood and wood-based materials are given in Table 2. IS : 2338 parts I and II cover code of practice and schedules for painting wood and wood-based materials.

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*There is a demand for short notes summarising available information on selected building topics for the use of Engineers and Architects in India. To meet the need, this Institute is bringing out a series of Building Digests from time to time and the present one is the 54th in the series. Readers are requested to send to the Institute their experience of adopting the suggestion given in this Digest.*

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