Draft Indian Standard

CODE OF PRACTICE FOR FINISHING OF WOOD AND WOOD-BASED MATERIALS

PART I OPERATIONS AND WORKMANSHIP

0. FOREWORD

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0.1 This Indian Standard (Part I) was adopted by the Indian Standards Institution on 28 June 1967, after the draft finalized by the Painting, Varnishing and Allied Finishes Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 With a view to provide guidance with regard to the finishing work of wood and wood-based materials the Indian Standards Institution is bringing out the Indian Standard code of practice for finishing of wood and wood-based materials (IS : 2338) which is being published in two parts. This part [IS : 2338 (Part I)-1967] deals with operations and workmanship in finishing of wood and wood-based materials. The second part deals with the painting schedules.

0.3 Wood and wood-based materials are finished for decoration and for protection. The finishes used are of two types, namely, opaque and transparent. Opaque (pigmented) coatings or paints conceal the grain and colour of the substrate and substitute in their place a surface of an entirely different colour and texture. Transparent finishes, on the other hand, bring out the grain and colour of the substrate, thereby enhancing its inherent beauty.

0.3.1 Protection furnished by wood finishes is mainly a matter of retarding the absorption and subsequent drying out of moisture from the finished surfaces. By retarding the passage of moisture into the wood, the finish minimizes changes in dimensions and often in shape. The durable film of a surface finish may also provide protection against spotting and discolouration caused by dust, gases, grease or handling. To a limited extent it take up abrasion resulting from hard usage.

0.3.2 Finishes as a rule do not protect wood from biological decay. Oviposition by some wood boring insects is prevented by a continuous film of the finish.

0.4 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country. This has been met by deriving assistance from the following publications:

N.Z.: S.S.CP 5 Code of practice for painting. New Zealand Standards Institute.

B.S. CP 231: 1952 Painting. British Standards Institution.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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CODE OF PRACTICE FOR FINISHING OF WOOD AND WOOD-BASED MATERIALS

PART I OPERATIONS AND WORKMANSHIP

1 SCOPE

1.1 This standard (Part I) deals with operations -and workmanship for the finishing of wood and wood-based materials with the pigmented and clear finishes.

1.1.1 In this .standard clear finishes, such as nitro-cellulose, polyester, polyurethene, acid catalysed cold cure amino-plast and similar type of finishes are not covered.

2 TERMINOLOGY

2.1 For terms relating to paints and allied materials reference may be made to IS : 1303-~~1963~~1983.

2.2 For terms relating to wood and wood-based materials reference may be made to IS : 707-~~1958~~2011.

3 NECESSARY INFORMATION

3.1 For the efficient application of finishes on wood and wood-based materials the following information is necessary and shall be furnished to the person in-charge of the work:

a) The type of wood and wood-based materials; the nature of their pretreatment, namely, preservation, seasoning, etc;

b) The location of the member to give an idea of the extent of exposure to weather;

c) The type of wood finish to be applied, surface pigmented, clear, penetrating etc;

d) Information on the nature of previous finish would be **desirable** for re-decoration; and

e) Atmospheric conditions in the locality, namely, temperature, humidity, incidence of sunlight, etc.

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f) Factors to consider when choosing a wood finish i.e. project type, exposure to sunlight and humidity, skill level, ease of use, colour, tools required, durability, safety, sustainability, appearance, drying time etc.

g) Wood finishing process i.e. remove existing finish.

3.3 Arrangement shall be made for proper exchange of information between those engaged in wood finishing work and those whose work will affect or will be affected.

4. GENERAL CHARACT~~FJ~~ERISTICS~~USTICS~~ OF WOOD AND WOOD-BASED MATERIALS

4.1 The decorative and protective value of a finish may be influenced by the nature of the surface on which it is applied. There are several species of wood and an increasingly large number of wood-based panel products often differing from each other in surface characteristics. They may be hard, soft, resinous or porous in varying degrees.

4.1.1 Wood is a hygroscopic, heterogeneous, cellular and anisotropic (orthotropic) material and tries to reach a state of equilibrium with the atmosphere in so far as its moisture content is concerned. Changes in moisture content are accompanied by swelling and shrinkage, which is most pronounced across the grain of the wood. Due to moisture movement the summerwoods swell to a greater extent than spring woods and this sets up stress-concentration at the sharply defined junctions between one year's summer growth and the next year's spring and the failure commences about this region. The resulting stresses on the film of finishing material are such as to cause fissures to develop along the grain under adverse circumstances.

4.1.2 Before painting, wood shall be properly seasoned and the moisture content 'shall be brought as near as possible to the equilibrium moisture content as given in IS : 287-~~1960~~1993 so as to prevent uneven shrinkage during drying which may result in distortion or even in cracks in the paint finish. It is also advisable not to finish excessively dry wood.

4.1.3 The cellular structure of wood has a strong influence on the absorption of liquid components of finishes. Non-uniform absorption of vehicle by the wood upsets pigment-binder ratio, impairing the appearance and life of the coating.

4.1.4 Plywood, blockboard, hardboard and particle board have greater dimensional stability than solid wood and provide more uniform surface for finishing.

4.1.5 The trade and botanical names of different Indian timbers are given in IS :399 1963 t. The painting characteristics of some of the soft and hardwoods are given in Appendix A.

5. DESIGN CONSIDERATIONS

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5.1 Design and Detailing of Joinery Timber –Since water can find access through unpainted surface or joints and may encourage decay, in all cases where the wood surface is in contact with surfaces which are likely to get wet, such as brickwork or concrete, one or two priming coats shall be applied to wood surfaces before fixing to minimize absorption of water. Special attention is drawn to the following:

a) Window and door frames, flush with the wall face may allow ingress of moisture between the structural walling and the woodwork, and the paint is then likely to fail unless two prime coats are applied to the surface and allowed to dry before fixing.

b) The rails of gates shall preferably be bevelled to shed water and help to prevent it from entering the joints between vertical and horizontal members.

c) Door posts and sash frames resting on steps or sills are liable to absorb water unless the steps or sills are so designed and built as to drain away water. Door posts, sash frames and similar joinery shall be adequately primed all ***over,*** taking special care to prime any cut surfaces before fixing.

d) Wherever required, in joinery exposed to weather, tenons and other concealed surfaces shall be primed before assembly. Members shall be assembled while the paint is wet. When surfaces are to be glued, priming/may not be possible and hence the use of waterproof glue is recommended. Any painted beads or stops shall be primed on the underside and fixed in position while the paint is wet.

e) In design, consideration shall always be given to the grain direction and the effects of shrinkage, swelling and warping which may tend to open joints and break the paint film. Wide boards shall be fixed centrally or at one edge only, bearing in mind that movement may be sufficient to rupture the paint film or may cause the board, and with it the paint to split if the movement is unduly restrained in fixing. End grain shall receive special care in painting.

5.2 Selection of Coating Materials

5.2.1 *Prime Coat*

5.2.1.1~~A~~ Prime coat is a preparatory coating applied to materials before painting and it allows finishing paint to adhere evenly and better to surfaces. Paint primer typically consists of 20-30% synthetic resin, 60-80% solvent and 2-5% additive. This layer serves multiple purposes. This process improves paint adhesion, enhances its longevity and offers extra protection for the underlying material. Primer are used to seal up porous surface, prevent stains and previous colors from showing up underneath paint. Priming ensures better adhesion of paint to the surface, increases paint durability and provides additional protection for the material being painted.It adheres to the timber surface and contain stain inhibiting tannin blockers.

Uses of Primer : Overall function of primer is to smooth the surface. In addition it is also used to cover, seal and finish the surface.

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The selection of primer depends on the following:

- What type of priming must be done.
- The amount of priming coats that needs to be used.
- Essential steps for priming wood.

Types of primer:

- Oil- based primer: Oil based primer is best for outdoor, raw wood and dry wall, painted or stained surfaces, rough surfaces. This primer can adhere to any type of surface. This primer is great for blocking stains and is preferred for porous surfaces like wood. This primer is harder to clean and require the use of solvents to clean the brushes. It is usually slow drying and have higher VOCs (Volatile organic compounds) and have a stronger smell.

- Water/Latex based primer: These primers are water based and are most commonly used for indoor. They are fast drying and are less likely to peel or crack. A latex based primer can be cleaned in water and has lower VOCs which means they do not smell as strong as the oil based or shellac primers.

- Shellac primer: Shellac primer can be used with both oil based and latex paints and may be best at blocking stains and can even seal in smells that may be coming from the surface. They are fast drying and can adhere to almost any surface. This primer has very strong smell and require the use of denatured alcohol to clean the brushes.

suitable wood primer shall adhere firmly to the surface, form a sound foundation for further coating and fulfil special functions, such as acting as a sealer on porous wood and hardboard.

5.2.1.2 Wherever the timber has large pores, a preliminary priming with a quick drying varnish of the gold size type conforming to IS : 198-19~~52~~78 is desirable. The varnish shall be forced with a brush well into the pores so that the pores are completely filled. This filling of the pores shall not be regarded as a substitute for normal priming and shall be followed by a coat of the primer.

5.2.1.3 Pink wood primer (*see* IS : 3536 -~~1966~~2016~~)~~ or the mixture of white and red lead primer may be used in painting structures containing a slight excess of moisture as they allow minute quantities of moisture to pass through without disrupting it. Pink wood primer creates a protective barrier that seals the wood, preventing moisture and other elements from causing damage. This primer is perfect for use on interior and exterior timber surfaces including doors, windows, furnitures, and more. It is made from a blend of linseed oil and alkyd resin. It is oil based primer and has excellent filling and sealing properties.

- Outstanding barrier protection on for both exterior and interior use on new or bare timber.

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- Ideal for brush or roller application.
- Can be used as a sealer on naturally oily timber.
- Solvent borne blend of high grade aluminium and high quality resin
- Seals weathered creosote and smoke damage stains and no bleeding
- Also suitable to seal surfaces with a moderate coat of bituminous material applied.

5.2.2 *Stoppers and Fillers***–**For deep holes, plastic wood conforming to IS : 423-~~19617~~ 1961shall be used. Stopping may be generally confined to large holes or cavities. Shallow indentations shall be made up with the paste filler conforming to IS : ~~426-1961~~. ~~For high class work filling operationshall be done over the whole surface by using the filler conforming toIS :110-1950s. For clear finishes, filler conforming to IS : 345-195211shall be used~~.

Stopping: After filling all the pores of the wooden surface in priming, fill up nail holes, dents, cracks etc. Putty is used as the fill material. When putty is dried, then the whole surface is rubbed with glass paper or pumice stone. This process of rubbing down the wooden surface is called stopping.

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Wood filler: It is a mixture of wood fibres such as raw dust and a binder that hardens. The binder is either water or petroleum based. Water based filler is dry and it may need to add a bit of water to achieve the desired consistency. A chemical based filler will require a chemical solvent for clean up whereas water based filler clean up with soap and water. Fillers are fine particulate materials adds to a substance to modify or enhance its physical properties or to extend more costly or scarce materials. Fillers do not dissolve or react with the host compound. Fillers are substances added to paint. They do not change the colour at all but give it a grainy, slightly coarse appearance. Some common types of paint fillers include calcium carbonate, talc, silica and silicates, clay, barium sulphate, mica, aluminum silicate, glass microspheres, polymeric fillers, cellulose derivatives etc.

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Wood filler is used for:

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- Repair dents, gashes and gouges in unfinished furniture.
- Fix holes in wood flooring.
- Cover scratches or cracks in unfinished trim brfore installing.

The pros and cons of wood filler:

Pros:

- Wood filler is sandable
- It hardens as it cures
- It dries quickly

Cons:

- Wood filler is not suitable for exterior use

- Difficult to adhere to stained or painted finishes.

Wood putty: Wood putty is an oil based compound with other natural or plastic ingredients. It remains pliable, making it preferred for woodwork that expands and contracts when subject to humidity. It is recommended for wood already stained or varnished. Wood putty based on petroleum materials require mineral spirits, acetone, or some other chemical for mixing and cleaning. Water cannot be used. Wood putty has a sharp odor and takes a long time to dry. Wood putty is difficult to sand and it is exceedingly tough and durable.

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Uses:

- Repair dents and cracks or fill small holes in finished wood furniture, flooring or interior trim.
- Patch cracks and holes in woodwork that may be expand or contract due to exposure to humidity.

Pros:

- It's more cost effective than wood filler because it lasts longer. Also, if it dries in the container, a few drops of acetone will soften it and make it usable again.
- It comes in various colors to easily match the wood's finish.
- It's ideal for applications where the wood expands and contracts along with changes in the temperature and humidity.

Cons:

- Most paints won't adhere to it and stains will not color properly.
- It takes a long time to dry.
- It's not sandable.

5.2.3 *Undercoat and Finishing Coat Materials*–

Undercoat: An undercoat is used to create a neutral base for colour to develop. They work to cover surface imperfections and they are often sanded before recoating. Undercoats exist to be used on primed or painted surfaces, particularly wood. When applied over a sealer or primer, it work to reinforce and strengthen its function. Undercoat creates a tough, resistant barrier to moisture and forms a perfect base for further product. Before considering the application of undercoat and finishing coat it shall be made sure that those selected are compatible with each other. If a non-elastic finishing coat is applied over an elastic primer coat it may lead to cracking or alligatoring of the finishing and the primer coat may become visible through cracks in the finishing coat. Similarly, if the finishing coat contains a strong solvent, it may attack the primer coat and lead to shrivelling (wrinkling) of the entire paint structure. It is, therefore, essential to specify and ensure that the various types of paints to be used are compatible with each other, and as Indian Standard specifications on paints

allow enough latitude for the manufacturer to adjust his materials, it is advisable to consult the paint manufacturer and obtain his guarantee that the paints purchased not only satisfy the specified requirements but are also compatible with each other. As a general rule, it is safer to use primer and finishing paints made by the same manufacturer.

6. PAINTING NEW WOOD WORK

6.1 Surface Preparation: Surface preparation includes the following process:

- Clean the surface: Before priming, it's important to make sure the surface is clean and free of any dirt, dust or debris. Use a mild detergent and water to ease the surface and let it dry completely before proceedings.
- Sand the surface: Sanding can help smooth out imperfections and generate a better bonding surface for paint and primer. Use the fine-grit sandpaper and work in the direction of the wood.
- Fill any type of holes or imperfections: If there are any holes, cracks or other imperfections on the surface, use a wood filler to fill them. Once dry, sand again for a smooth finish.
- Apply a coat of primer: After preparing the wood surface, apply a coat of primer using a brush or roller. Ensure to cover the entire surface evenly and allow it to dry moving on to the next move.

Tips for applying primer:

- Use quality tools: Invest in high-quality brushes and rollers to ensure a smooth and even application of primer.
- Work in small sections: For best results, work in small sections at a time to avoid the paint drying too quickly or becoming uneven.
- Ensure to apply multiple coats: Depending on the type of paint and the desired finish, apply multiple coats for full coverage.
- Use even strokes: When using a brush, use long, even strokes in the same direction to create a smooth finish. For rollers, use a W-pattern or zig-zag pattern for best results.

Trouble shooting common issues:

- Paint drips: To avoid paint drips, make sure to remove all the excess paint from the brush or roller before applying. If a drip does occur, wait for it to dry fully and sand it down before applying the next coat.
- Uneven coverage: This can be caused by not using enough paint or not applying it evenly for best results.
- Bleeding: If painting is done over a dark surface with light-coloured paint, the dark colour may show through. To avoid this, make sure to use a tinted primer or multiple coats of paint for full coverage.

Finishing touches:

- Sand and touch up: After the final coat of paint has dried, lightly sand any imperfections and touch up any areas that may need it.

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- Apply a top coat: For added protection and durability, apply a top coat to the painted surface. This will also add a glossy or matte finish, depending on the preference.
- Clean up: Once the painting is finished, make sure to clean up any spills or drips with soap and water. Disposed off any used material properly.

6.1.1 Wood that is to be painted should be well seasoned and free from discoloured sapwood and from large resinous or loose knots. If the wood is not properly seasoned, the surface may become uneven on drying and cracks may also develop. Paint applied over discoloured sapwood is liable to become discoloured; resin from knots tends to exude through the paint. Any **such** unsound portions should, therefore, be cut out and replaced with sound wood.

6.1.2 Nails should be punched well below the surface to provide a firmkey for stopping.

6.1.3 Mouldings should be carefully smoothed with abrasive paper and projecting fibres left after machining should be removed. Quirks need particular attention since paint collects on any rough projections and the finished appearance is then marred.

6.1.4 Flat portions should be smoothed off with abrasive paper used across the grain prior to painting and with the grain prior to staining or if the wood is to be left in its natural colour. Woodwork which is to be stained is sometimes smoothed by scraping instead of by glass papering.

6.1.5 Any knots, resinous streaks or bluish sapwood that are not large enough to justify cutting out should be treated with two coats of pure shellac knotting, applied thinly and extended about 25 mm beyond the actual area requiring treatment. Aluminium primer may be used in the place of shellac knotting. If the area is small and the wood is not highly resinous, it is permissible instead of applying two coats of knotting, to apply one coat slightly pigmented with aluminium powder.

6.2 Priming

6.2.1 If there is dirt or any other extraneous material this shall be removed. If the wood work is not already primed, a priming coat shall be applied. In case there is already a primer coat but an unsatisfactory one, it shall be rubbed down to bare wood and the surface re-primed. Primer shall be applied by brushing.

6.2.2 Care shall be taken to prime not only the surface of the wood that will be visible after fixing but also any surface which will be in contact with materials, such as brickwork or concrete from which the wood may absorb moisture. It would be an advantage to give such surfaces a further coat of primer, before fixing.

6.2.3 Unless specified otherwise, all joinery work which is intended to be painted shall receive at least two priming coats. It is particularly important that end grains be so treated and, if it is necessary to cut the joinery before fitting, all cut ends shall be painted with two priming coats.

6.3 Stopping and Filling– Stopping and filling should be done after priming. Ifthe surface is not first primed, the filler or stopping may shrink and fall away, owing to absorption of some of the binder.

6.3.1 Stopping is made to the consistency of stiff paste and is used to fill holes and cracks, while the function of the filler is to level up slight irregularities of surface. Filler is usually applied with a putty knife and is subsequently rubbed down to a level surface with abrasive paper, pumice stone or other suitable abrasive. For certain work, fillers are mixed to the consistency of thick paint and applied with a brush.

6.3.2 The filler coat should be of an optimum thickness and should be allowed to fully harden and flatten before subsequent coat is applied. Apply as many layers as necessary allowing the coats to harden and flatten between coats.

6.4 Application of Undercoat – Undercoat shall be applied after the surface has been primed, stopped, filled and rubbed down to a smooth surface. Undercoat may be brushed or sprayed. After drying the coat shall be carefully rubbed down and wiped clean before the next coat is applied.

6.3 Finishing –The application of finishing paint varies according to the type of paint employed. Cleanliness is essential and as far as possible the application should be carried out in normal dry conditions. The finishing coat may be applied either with the brush or sprayed.

7. APPLICATION OF CLEAR FINISHES

7.0 General –Clear finishes for wood are generally used for interior surfaces as their durability when used on external surfaces is less than that of pigmented coating. This is mainly because of the destructive action on the clear finishes by the ultraviolet rays present in the sunlight. The ultraviolet radiation is to a great extent absorbed by the pigments present in the coatings while it may cause considerable damage to clear finishes.

7.1 For the application of clear finishes the following procedure shall generally be adopted:

a) Filling,
b) Staining,
c) Sealing, and
d) Finishing.

7.2 Filling

7.2.1 The primary function of fillers is to fill the opened cells of the wood inthe surface layer. This is necessary to prevent the excessive penetration of the finish, that is, subsequently applied and to level off the surface of a porous wood to make a smooth top finish possible. Wood filler covers seams, cracks or nail holes in wood. It is a lightweight, mostly odour free water solvent filler material. Water based wood filler should be painted or sealed.

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7.2.2 On hardwood with large open vessels a suitable filler conforming to IS : ~~345-1959~~ may be used.

7.2.3 For special stain effects coloured fillers shall be used.

7.2.4 A combination of filler and stain may be used for reasons of cost, that is, to eliminate a separate staining operation. However, the result lacks the grain and colour contrast characteristic of wood stains.

7.2.5 On fine-textured woods having minute pores that do not require filling, unfilled drying oils, thin varnishes, lacquer or shellac may be used.

7.2.6 Filler or stain filler shall be heavily applied to the wood surface by hand, using hessian or jute rag across the grain. It may be rubbed when still wet to get better penetration. After 5 to 10 minutes it shall be wiped off by hand across the grain followed by a light wipe with the grain. Picking out of corners and carvings may be done with a rag wrapped around the end of a sharpened wood dowel. The filled surface shall be dried preferably overnight, and smoothened with abrasive paper. Wipe with a clean soft rag to remove dust and nibs.

7.2.7 Application of Wood filler/ Putty:

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Equipment / Tools:

- Putty knife
- Oscillating sander
- Shop vacuum

Materials:

- Wood filler or putty
- Rags
- Mineral spirits or acetone
- Sandpaper
- Tack cloth
- Wood stain

Process of application:

i). Mix the wood filler: Stir the wood filler in its container with a putty knife. Water based wood filler may not need to be stirred but solvent based wood putties usually need a thorough stirring as components will separate. Mix the material until it is a smooth, peanut butter like consistency with a uniform colour and texture.

ii). Spread the wood filler: Press the wood filler firmly and deep into the crack then scrape off the excess making sure not to gouge the knife into the patched area. Petroleum based putty hardens quickly so it will need to work fast. Water based products are creamy and stay wet much longer.

iii). Smooth the filler: Press the wood filler deeper into the crack with finger, if necessary then wipe off the excess from the wood. To remove the filler from finger, quickly wipe it off with water or mineral spirits as the case may be. Scrape the filler from putty knife onto a scrap of wood, then remove any residue from the blade using a rag and water or mineral spirits.

iv). Sand the wood filler smooth: Sand by hand after the wood filler is completely dry and hard, using 220-grit sandpaper. Move the sandpaper in the same direction as the wood grain. For large filled areas, use an oscillating sander, starting with medium grit sandpaper and following with fine 220-grit or 320-grit paper.

v). Wipe with a tack cloth: Wipe down the wood with a tack cloth, using light pressure to remove sawdust and filler debris. Stain the wood once the area is clean.

7.3.1 Staining: Wood staining involves applying a coat of stain to a freshly sanded wood surface to transform the colour of the wood. The process of sanding and staining a piece of wood is known as refinishing. When the wood surface is refinished then first strip the wood of any pre existing stain or varnish, then apply a new coat of stain followed by a wood finish such as polyurethane.

Following materials are needed to stain the wood:

i). Pre-stain wood conditioner

ii). Stain

iii). Sandpaper

iv).Tack-cloth

v).Stain applicator

vi). Lint free cloth

vii).Drop cloth

viii). Mineral spirits

ix). Wood sealer

x). Power sander

Process of staining:

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i). Sand the wood

ii). Stir the stain

iii). Apply the stain

iv). Wipe off excess stain

v). Dry the wood before applying a sealer

vi).Clean up

7.3 Staining

7.3.1 Staining of wood may be resorted for indoor fittings and even then only for subsequent clear finishes. The object of staining wood is to darken it as part of a decorative scheme. If skilfully carried out, staining may be used with good effect to enhance the natural grain or figuring of the wood. ,

7.3.2 The depth of colour produced by staining will depend not only onthe concentration of the stain but also on the extent to which it is absorbed by the surface. Stain is readily absorbed by soft porous spring-wood but comparatively little by the harder and denser summerwood. Hardwoods, being less absorbent, will present less difficulty; the stain may be applied liberally and allowed to remain until sufficient quantity is absorbed, the excess being then wiped off, if necessary. The effects produced by knots, resinous portions and other markings may be similarly accentuated. The different types of stains as water, spirit and oil stains have different penetrating properties and, therefore, shall be selected to suit the performance required.

7.3.2.1 *Water stains*–Water stains are made with water soluble dyes. They emphasize the grain, especially that of softwoods, since they are readily absorbed by the porous portions but less readily by the denser, more resinous portions. They will raise the grain of the wood thus spoiling the smoothness of the finish if a highly polished effect is required; this difficulty can be overcome by first wetting the surface with water to raise the grain and then, after drying, smoothing it with abrasive paper before staining. Where it is necessary to provide a temporary staining treatment on wood,that is, damp or unseasoned, water stain is preferable to other types of stain.

Water based stains are easy to clean up and are fast drying. These stains use water as the binder, which makes it easy to clean up or thin with water.

- They are extremely resistant to mold and mildew and more environmentally friendly.
- Because of its quick drying time, it is perfect for small projects.
- They do not penetrate the wood as deeply as oil based stains which result in softer colours. However, darker color can be obtained with successive coats.
- They also have a tendency to raise the grain of the wood.
- This can be applied by brush or with a rag.

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- **7.3.2.2** *Spirit stains* – Spirit stains are solutions of spirit soluble dyes in industrial methylated spirit. Like water stains, spirit stains penetrate more into the softer portions of the wood and so accentuate the grain but they do not cause the fibres to swell nor raise the grain. They will dry very quickly and shall be applied quickly and skilfully to avoid patchy effects. If applied to damp wood the dyes in the stains are liable to be thrown out of solution. The surface after staining with spirit stains may be finished in the same way as after treating with water stains. Spirit stains are methanol based to make them quick drying and because of this they also will not raise the grain of the timber they are applied to. The pigments used to make this stains are of the highest quality. Spirit stains are fully inter mixable. Spirit stains are quick drying, non-grain raising and extremely fade resistant, making them ideal for all sorts of wood working, especially artistic work intended for long term display.

Process of application: To obtain a uniform colour, always wipe evenly, blending the stain over the whole surface area by exerting a degree of pressure when applying by hand. Leave to dry, and do not sand between coats. The application of additional coats will deepen the existing colour/ shade, 30-40 minutes at room temperature.

- Spirit stains can be applied by cloth, brush, or spray which includes spray diffusers, airbrush or spray gun.
- The stains blend extremely well regardless of application method. The yellow is being blended into red, giving an orange colour in the transition.
- Once the colour and effect is achieved, apply aerosol sanding sealer followed by wax.
- A gloss finish will bring out the vibrancy of the colours.
- Experiment with the different colours and effects and add liming wax and gilt cream for extra variations.

7.3.2.3 *Oil stains*–Oil stains may be solutions of oil soluble dyes in linseed oil but usually, to give a wider range of colours, they consist of insoluble, semi-transparent pigments ground in linseed oil and thinned with turpentine or other solvent. Sometimes wax is added to make the stainless penetrating. Oil stains will give a softer effect than water stains or spirit stains. Generally they may be finished with gloss or flat oil varnish. If wax polished, the stain shall first be given time to dry hard. If applied to damp wood they are likely to develop a milky effect or bloom. The application of oil stains and varnish will retard the drying of the wood. Oil stains will not take well on certain resinous or oily woods, such as teak. Sometimes, these woods are pretreated with solvents to remove the greasy matter from the surface prior to oil staining or varnishing. Oil based stains bring out the intricacies of the wood grain and are the more common choice among wood workers. This is ideal for hardwood such as oak or maple. They do have a longer dry time, a strong odor, require mode sanding and are slightly more difficult to clean up. With proper

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ventilation, the right tools and a little elbow grease, oil based stains can yield an impressive result.

- They usually have a linseed oil binder that allows plenty of time to remove the excess before the stain dries. They are typically applied with a rag or cloth instead of a brush.
- Oil based stains are the best wood stain for furniture or any large wood surface because of the slower drying time, which gives the piece a more even finish.
- Oil based stains tend to penetrate deeper, leaving behind a richer color that is easy to refresh by applying another coat.
- They have excellent surface adhesion that makes resistant to peeling, giving the wood a more durable finish.
- Before applying the stain, the existing finish should be removed.

It contains noxious chemicals and may require the use of respirator mask when working with the stain.

7.3.3 *Wash Coating* – A wash coat is a coat of thinned finish that is applied to bare wood to partially seal the surface before a stain is applied. It keeps the stain from soaking into the wood and causing blotching. It works well on woods like alder, aspen, birch, cherry and pine.

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Wash coat means a coating containing not more than one pound of solids per gallon, which is used to seal wood surfaces, prevent undesired staining and control penetration. A wash coat may also be used to provide a barrier coat when paper laminates are applied to the wood surface, or when glazes are applied during the coating operation. It is provided on wood before staining. It is a thinned finishing product that will soak into the softer grain and not into the harder grain brfore the thinner flashes off and the product dries. Once dry and lightly sanded, this results in a more consistent surface which is ready to receive the stain or dye. The wash coat prevents the stain from soaking into the softer grains and creating an uneven color.

If grain raising stains have been employed or if it is desired to reduce to a minimum the risk of stain bleeding into top coats and to prevent discolouration of wood by absorption of oil and stains from the filler, a thin coat of shellac or lacquer shall be applied on the stained surfaces before sanding.

7.3.4 The stain may also be mixed with varnish to produce the combined effect in one operation; the result will; however, not be as satisfactory as when the 'finishing' follows as a separate operation after staining. Alternatively, the stain may also be mixed with wax so that after application in one operation the wax may be polished; Here again the results will not be as satisfactory as in a two stage system.

7.3.5 *Preparation of Wood for Staining:* Surface preparation of wood for staining include the following process:

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i). Repair as needed with wood putty : This process begins with examining the surface. If the wood has damage on the surface, use wood putty or filler to fill in any

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holes or divets. Sand and clean the surface of the wood. Then, apply wood filler using a putty knife. Once filler is dry, sand the area until the surface is level and smooth. Then apply stain or other finish as desired.

ii). Sanding:

- When preparing wood for stain, firstly sand the surface. Use a sanding sponge or orbital sander. Sandpaper with a lower grit number will make wood rougher, allowing more stain to absorb and creating a darker color.
- Start with 120-grit sandpaper for pieces that already have a finish. With unfinished wood, start with 80-grit sandpaper and then treat it if it is refinished.
- When the imperfections have been removed and the entire surface has been sanded, wipe off the dust and loose sandpaper grit.
- When the imperfections has been removed and the entire surface has been sanded, wipe off the dust and loose sandpaper grit.
- Sand with 180-grit until all the marks left by the 120-grit has been removed and the surface appears level.
- Brush clean.

iii). Wet the wood:

- Wipe down the wood to raise the grain. If the grain is not raised at this point in the process, the stain will raise later. However, re-sanding to get theb wood smooth again removes much of the stain.
- Let the wood dry, then sand with 180 to 220-grit paper.
- Remove dust with a clean cloth.

iv). Apply conditioner or filler as needed:

- Some soft woods like pine and some hard woods such as cherry, turn blotchy when stained. In such a case, consider applying a pre-stain wood conditioner, which seeps into the wood fibres to seal the material and prevent the uneven absorption that causes blotching.
- If the gel stain is used than apply it without needing a conditioner.
- Some woods such as mahogany and oak have an open grain structure that needs filling to provide a smooth finish. Grain filler is a pigmented paste that comes in a variety of colours. Choose one to match the wood or stain colour and apply with paint brushes or rags to the manufacturer's instructions.
- Remove excess with a scraper and lightly sand after drying.

v). Stain the wood:

- Thoroughly stir the wood stain before applying.
- Use a rag or cloth instead of a sponge, which may absorb the stain. When applying, the cloth should be wet but not dripping. Test on a piece of scrap wood.

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- Apply stain across the grain of the wood or with the grain of the wood. Follow manufacturer's directions for the staining application instructions.
- Stain usually can not be removed after application. It is better to apply thinner coats and add more as needed, rather than apply too much and have a darker colour.

vi). Remove the excess stain:

- Remove the excess stain with paint rags by wiping with the grain.
- If the stain has dried too much, it will be difficult to remove.Loosen it by applying more stain and rubbing vigorously. If it dries hard, paint thinner will loosen it.

vii). Apply sealant as needed:

- Applying a topcoat sealer is not required, but a finish protects the stained wood from scratches and keeps it from fading over time.
- If applying a polyurethane wood fionish with a brush, apply one or two coats.
- If using a spray can hold 8 to 12 inches from the surface and apply two or three light coats.
- Be prepared for drying time to take at least a day.

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7.3.5.2 Small cracks or nail holes may be stopped with plastic wood, fine plaster of Paris or other suitable stopping, if water stain or spirit stain is to be used. The stopping shall be rubbed down with fine abrasive paper when hard and touched with a little thinned knotting before staining. Where oil stain is to be used, stopping shall preferably be done after staining, using tinted putty or wood filler.

7.3.5.3 If necessary, softwood may be treated with hot weak size before staining to prevent undue absorption of stain, but an excess of size should be avoided. To a certain extent the degree of penetration of a stain may be controlled by pretreatment of the absorbent surface with a hot weak size of thinned shellac varnish. Size shall preferably be not used where the stained surfaces are likely to come into contact with water, which may smear it. To control the depth of colour, however, diluted stain may be made to soak well into the wood. Where size is used, the surface shall be allowed to dry thoroughly before staining. In general, flat surfaces shall be treated first and mouldings and edges last, that is, reversing the order recommended when applying paint, the object being to avoid double staining along the edges.

7.3.6 *Application of Stains*

7.3.6.1 Stains may be applied by brushing, and wiping or by spraying. The stain shall be so thinned that it can be applied, fairly liberally without over-staining. Care shall be taken, especially on absorbent softwoods, to apply the stain evenly and without overlapping. Spirit stains, in particular require careful and quick application as they dry very quickly.

7.3.6.2 The stained surface shall be varnished, wax-polished or French polished as required after it has dried. For reasons of economy, the surface shall be sized before varnishing, in which case it is important to allow the size to dry thoroughly. Where a more durable finish is required two or three coats of finishing clear varnish is recommended.

7.4 Sealing – A suitable sealer shall be applied ***on*** the filled and sanded surface to prevent absorption by the wood of the succeeding coats of finish and to seal stain and filler and thus preclude their bleeding into the finish coat.

Application:

- Apply an initial coat of wood sealer evenly using a brush, in the direction of the grain. Smooth the surface to avoid an uneven texture.
- Leave to dry for ±1h, then sand lightly with 0000 steel wool. If any whitish patches appear, it is becauser some wax has remained in the wood. Sand the white patches following the grain using fine sandpaper.
- Remove the dust and apply the product to the area to obtain a smooth surface.
- Leave to dry for ±1h, then sand lightly with 0000 steel wool.
- Remove the dust and apply a second coat of wood sealer.

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7.4.1 Sealer may be sprayed on taking care not to flood the surface. It is allowed to dry hard.

7.4.2 A stain (toner) may be incorporated with the sealer for special colour effects.

7.4.3 When fully dry the surface shall be sanded taking care not to cut through at corners and edges. Dust shall be blown off and surface wiped with a clean rag.

7.5 Varnishing

7.5.1 Varnish: Varnish is a type of coating that is applied to various surfaces to protect them from damage and enhance their appearance. It is typically made up of a mixture of solvents, resins and drying agents and they come in a variety of types and colours to suit different applications. Varnish can protect against wear and tear, resist damage from ultra violet rays and water and enhance the aesthetic appeal of surfaces. Choosing the right type of varnish for a particular application can make a significant difference in the overall quality and longevity of the finished project.

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Types of varnish:

- Clear varnish: Clear varnish is transparent and does not add any colour to the wood. It is an excellent choice for protecting natural wood finishes and maintaining their natural colour and grain patterns. It is usually made from a blend of resins and oils and they offer excellent durability and protection against weat and tear.

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- Pigmented varnish: This type of varnish is tinted with pigmented to add colour to the wood. This varnish comes in the range of colours, from light to dark and can be used to achieve a variety of decorative effects.

- Oil-based varnish: Oil-based varnishs are known for their durability and protection against wear and tear. They are made from a combination of resins and oils and they penetrate the wood deeply to provide excellent protection from moisture and ultra violet rays. Oil-based varnishs take longer to dry than water-based varnishes, but they are more durable and offer better protection.

- Water-based varnish: Water based varnishes are a popular choice for their fast drying times and low odour. They are made from a blend of synthetic resins and water and they offer excellent protection against moisture and ultra violet rays. This varnish are easy to clean up with soap and water and are ideal for use in indoor areas.

- Polyurethane varnish: Polyurethane varnishes are known for their superior durability and resistance to wear and tear. They are made from a combination of resins and polyurethane and they form a hard, protective layer on the wood.This varnish is available in both oil-based and water-based formulkations and they are ideal for high-traffic areas that require maximum protection.

- Protection against wear and tear.
- Resistance to ultra violet rays and water damage.
- Enhanced aesthetic appeal
- Increased durability and longevity

Factors to be considered when choosing varnish:

- Type of surface
- Durability
- Colour and gloss
- Application method
- Environmental factors
- Health and safety

Process for carrying out varnish:

7.5.2~~1~~ Prepare the surface: Surfaces to be varnished should be prepared to produce a smooth, dry, matt surface and free of any dust or debris. Use sandpaper to smooth out any rough spots and wipe the surface with a damp cloth to remove any dust or dirt. Previous coats of paint or stain, if any, should be allowed to dry and be rubbed down lightly, wiped off and allowed to dry.

7.5.1.1 The operation of varnishing calls for careful attention to cleanliness. All dust and dirt should be removed from the surface to be varnished and also from the

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neighbourhood. If the surfaces are dampened to avoid raising of the dust, they should be allowed to dry thoroughly before varnishing is commenced. Damp atmosphere and draughts should be avoided. For exterior work, a normal dry day should be chosen. Exposure to extremes of heat or cold or to a damp atmosphere will spoil the work.

7.5.1.2 In handling and applying varnish care should be taken to avoid forming froth or air bubbles. Brushes and containers should be kept scrupulously clean.

7.5.2 *Application* –

- *Apply varnish in thin layers: Apply varnish in thin layers with a brush or a roller. This will prevent drips and ensure that the varnish dries evenly.* The varnish should be applied liberally with a brush and spread evenly over a portion of the surface with short light strokes to avoid frothing. It should be allowed to flow out while the next section is being laid-in. Excess varnish should then be scraped out of the brush and the first section be crossed, re crossed and then laid off lightly. Too much or too little varnish left on the surface will mar the appearance of the finish. The varnish, once it has begun to set, should not be retouched. If a mistake is made, the varnish should be removed and the work started afresh.
- *Sand between coats:* After each coat of varnish, use fine-grit sandpaper to lightly sand the surface. This will help the next coat of varnish adhere better and create a smoother finish.
- *Use high*-quality brushes and rollers: High quality brushes and rollers are essential for achieving a smooth, even finish. They will also help you to avoid streaks and bubbles in the varnish.
- *Work in a dust*-free environment: When applying varnish, it is important to work in a dust-free environment. Cover the floors and nearby surfaces with drop clothes to prevent dust from settling on the wet varnish.
- *Follow the drying time:* Allow each coat of varnish to dry completely before applying the next coat. Follow the manufacturer's instructions for drying time and temperature.
- *Apply enough coats:* Apply too few coats of varnish can result in a thin and easily damaged finish. To achieve a durable finish apply at least three coats of varnish.

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7.5.2.1 Where two coats of varnish are specified, the first should be a hard-drying undercoating or flatting varnish; this should be allowed to dry hard and then be flatted down before applying the finishing coat. If two coats are applied, sufficient time should be allowed between coats.

7.5.2.2 When flat varnish is used for finishing, a preparatory coat of hard drying undercoating or flatting varnish should first be applied and should be allowed to harden thoroughly. It should then be lightly rubbed down before the flat varnish is applied. Sections of the work, such as panels, should be cut in clearly, 'so as to avoid any overlapping during application, as this is likely to impart some measure of gloss to partially dried areas, worked up in lapping. On larger areas, the flat varnish should be applied rapidly, and the edges of each patch applied should not be allowed to set, but should be followed up whilst in free working condition.

8. FRENCH POLISH

French polishing is a wood finishing technique that results in a very high gloss surface, with a deep colour and chatoyancy. It consists of applying many thin coats of shellac dissolved in denatured alcohol using a rubbing pad lubricated with one of a variety of oils. The French polish technique is an excellent method to accent exotic wood grain.

8.1 Pure shellac varying from 'pale orange to lemon yellow colour, free from resin or dirt should be dissolved in methylated spirit at the rate of0.15 kg of shellac per litre of spirit (*see* IS–: 348-19~~52~~68). Suitable pigment should be added to get the required colour.

8.2 Preparation of Surface– All unevenness should be rubbed down to smoothness with sand paper and the surface should be well dusted. Fill up the pores in the wood with a filler made of a paste of whiting in water or methylated spirit (with a suitable pigment like burnt seinna or umber, if required) otherwise the French polish will get absorbed and a good gloss will be difficult to obtain.

8.3 Application of Polish –

- **Remove loose dirt, food and paint splatters**
- **Clean the surface with water and detergent**
- **Clean the surface with white (mineral) spirit**
- **Rub out blemishes**
- **Removing French polish**
- **Fixing loose veneer**
- **Appling French polish-Bodying**
- **Filling dents and gouges**
- **Grain filling**
- **Build up coats**
- **Spirting off**
- **Gloss finish**
- **Satin finish**

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A pad of woollen cloth covered by a fine cloth should be used to apply the polish. The pad should be moistened with polish and rubbed hard on the surface in a series of overlapping circles applying the polish sparingly but uniformly over the entire area to give an even surface. A trace of linseed oil on the face of the pad facilitates this operation. The surface should be allowed to dry and the remaining coats applied in the same way. To finish off, the pad should be covered with a fresh piece of clean fine cloth, slightly damped with methylated spirit and rubbed lightly and quickly with circular motions. The finished surface should have a uniform texture and high gloss.

9. FINISHING OF WOOD-BASED MATERIALS

9.1 Plywood –Plywood is similar to solid wood in its finishing characteristics.

9.2 Hard Board

9.2.1 Painting Characteristics–Hard board is made up of fibres which are capable of swelling under the influence of oil paints.Tempered hard board may be varnished or painted; if required.

9.2.2*Treatment* – A suitable treatment to prevent swelling under the influence of oil paints is necessary; one such treatment is to use plastic emulsion paint thinned with water, another is shellac varnish as the first coat and when dry rub down with fine grade glass paper and follow with required undercoating, and finishing coats as for solid wood.

9.3 Particle Board – The surface shall be filled with a thin brushable filler and finished as for solid wood.

9.4 Insulation Board – Two thin coats of water-based paints shall be applied by spraying.

9.5 Wood Treated with Preservative

Preservative-treated wood is generally either surface-coated or pressure-treated with chemicals that are chosen to help it resist damage from fungi, insects, micro organisms and decay over time.

Types of wood preservatives:

- **Water-borne preservatives**
- **Fumigants**
- **Oil-borne preservatives**

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9.5.2 *Treatment* **–** Fairly satisfactory results may be obtained on creosoted wood with rough surfaces (sawed or weather-beaten surfaces) by applying exterior water thinned paints, such as case-in paints or resin emulsion paints.

9.5.2.1 Creosote-treated wood shall not be painted with ordinary paint as discolouration of the latter may result. One or two sealing coats of aluminium paint or shellac knotting clear or pigmented with aluminium powder shall be applied before it is finished with other paints.

9.5.2.2 In the cast of wood treated with other preservatives, such as copper naphthenate, chlorophenol and zinc silica fluoride, a high quality aluminium primer is desirable.

9.5.2.3 Alternatively, advice may also be sought of the manufacturers of these preservatives for information as to the suitable primer that may be applied over these.

10. INSPECTION

10.1 While the finishing is in progress, inspection shall be made to ascertain that the right type of finishing material is being used, and the number of coats and the

sequence of operation are carried out as specified. The points as laid down in **10.1.1** to **10.1.4** shall be specially noted.

10.1.1 As the first signs of failure of paint may not appear until some time after the work has been completed, inspection of work can only be directed towards ascertaining as far as possible that the types of paints and number of coats applied are as specified, and that the standard of work is satisfactory.

10.1.2 The chief points on which the general quality of paint work should be judged by visual inspection are as follows:

a) Uniformity of finish and colour;

b) Uniform and complete obscuration of the ground;

c) Freedom from blemishes (for example, rums, sags, wrinkling, fat edges, entrained paint skins, dust, bare or starved patches and cracks) ;

d) Freedom from tackiness;

e) Freedom from brush marks and ladders; and

f) General cleanliness and neatness of finish.

10.1.3 Should the paint appear faulty during application any defects in the following properties should be noted and the matter reported to those responsible:

a) Colour,
b) Consistency,
c) Drying time, or
d) General quality of finish.

10.1.4 Since it is the final coat of paint which claims attention it is a common error to blame the paint or workmanship for any defects. These are by no means the *only* factors which may influence the final result. In attempting to diagnose a paint failure the following details should be ascertained and taken into consideration:

a) Nature, history and condition of the painted surface;
b) Materials used;
c) Climatic conditions before, during and after painting;
d) Technical correctness of work in relation to conditions; and
e) Workmanship.

10.1.5 Test methods for determining the current condition of applied paint:

- **Testing for dirt and oil contamination**
- **Testing for surface chalking or colour fade**
- **Surface cleaning**
- **Solvent testing for paint type**
- **Paint adhesion**
- **Concrete slab dry test-Plastic sheet**

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- **Testing for a concrete curing agent**

11 MAINTENANCE

11.1 The principle given in Table 3 of IS–: 2338 (Part II)-1967 shall generally be adopted for maintenance work. All unsound work should be burnt off or otherwise removed and brought forward as for new work.

11.2 The surface should be cleaned and rubbed down with pumice stone or abrasive paper. All holes and cracks should be prepared for stopping by touching them up with primer paint, with undercoat paint; when dry, the stopping should be completed with a suitable filler and the appropriate paint as given in IS : 2338 (Part II)-1967 should then be applied.

11.3 Points to be considered for regular routine maintenance to ensure the longevity of painted wood:

- Cleaning Technique: Use a mild soap and water solution to regularly clean painted wood surfaces. Avoid harsh chemicals that can damage the paint.
- Reapply Topcoat: Depending on the wear and tear, consider reapplying a topcoat every few years to maintain the wood's appearance and protect it from the element.
- Touching up imperfections: For minor scratches or chips, lightly sand area, apply a matching paint and finish with a clear topcoat to blend the repair seamlessly with the rest of the surfaces.

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APPENDIX A
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PAINTING CH-ARACTERISTICS OF #TIMBERS

A-1 Some of the soft and hard woods given in **A-1.1** and **A-1.2** are resinous or show oily exudation occasionally and hence they require special treatment. In general, hardwoods are porous and require filling. However, some of the hardwoods given in **A-1.3** do not require filling as their pores are less than about 100-microns in diameter or are filled with gum.

A-1.1 The following softwoods are resinous and may exude resin through paint films:

TRADE NAME	BOTANICAL NAME
Chir	*Pinus roxburghii Sargerlt*
Cypress	*Cupressus torulosa Don*
Deodar	*Cedurs deodara London*
Kail	*Pinus Wallichiana A. B. Jacks*
Spruce	*Picea smithiana Boiss*

A-1.2 The following hardwoods may show oily exudation occasionally:

TRADE NAME	BOTANICAL NAME
Gurjan	*Dipterocarpus sp.*
Hollong	*Dipterocarpus macrocarpusVesque*
Piney	*Kingiodendron pinnatum (Roxb.) Harms.*
White cedar	*Dysoxylum malabaricum Bedd.*

A-1.3 The following hardwoods do not require filling because their pores are less than about 100-microns in diameter or are filled with gum:

TRADE NAME	BOTANICAL NAME
Axlewood	*Anogeissus latifolia wall.*
Birch	*Betula sp.*
Boxwood	*Buzus sp.*
Gardenia	*Gardenia sp.*
Haldu	*Adina cordifolia Hook. F.*
Kaim	*Mitragyna parvifolia (Roxb.) Korth.*
Red sanders	*Pterocarpus santalinus Linn. F.*
Satinwood	*Chloroxylon swietenia DC.*