TIMBER QUEENSLAND
We build Queensland

TECHNICAL DATA SHEET

ISSUED BY TIMBER QUEENSLAND

TONGUE & GROOVE TIMBER FLOORING - GENERAL INFORMATION

11

RECOMMENDED PRACTICE // MARCH 2014

This data sheet outlines the product types covered in the flooring series of data sheets, including TDS 17, 18, 21 & 31. It also includes information on timbers used in flooring, the nature of timber floors over various sub-floors, characteristics of floor finishes available and aspects relating to the natural movement that occurs in timber floors after they have been finished.

MOVEMENT IN TIMBER FLOORS

Prior to discussing timber flooring products it is important to have an understanding of the relationship between timber, humidity in the air surrounding it and the dimensional changes that occur as the result of changes in humidity. During weather conditions of consistently high humidity timber will absorb moisture from the surrounding air causing it to swell or increase in size. Conversely, during drier times when humidities are low, timber will shrink, reducing in size (refer Figure 1). Unless T&G flooring is placed in a permanently controlled environment, it will always move in response to changing environmental conditions. Gaps between individual T&G boards will occur as the floor shrinks in dry weather. Similarly during either persistent wet weather or times of the year of naturally high humidity floors will tend to be tighter showing fewer and smaller gaps.

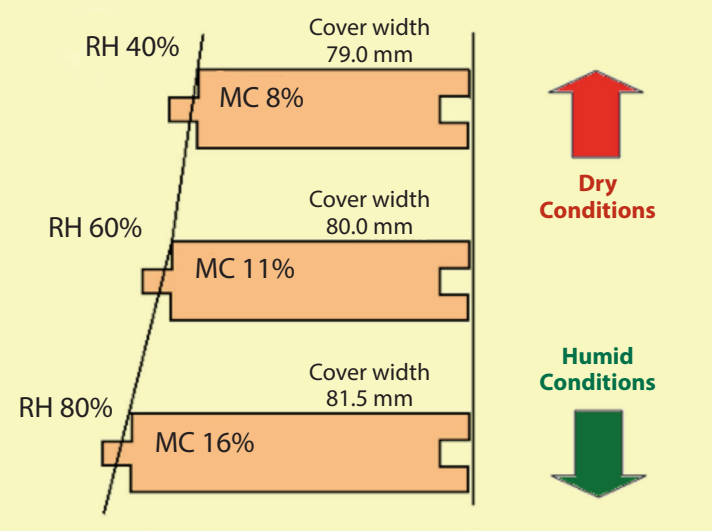

Figure 1. - Cover width variation with changing relative humidity.

Due to this, a 'continuous mirror finish' cannot be expected from floor finishes. Localised shrinkage may also occur when areas of flooring are exposed to heat sources such as fireplaces or sunlight through large doors or windows. The overall movement and rate of movement of timber varies depending on the timber species and cutting pattern of individual boards. Small moisture content variations in boards at the time of installation and differing conditions within the house (e.g. from sun exposure or fireplaces) will also cause variation in board movement.

Consequently, gapping across a floor can be expected and may be relatively even (depending on individual circumstances), but actual gap size between individual boards will vary. For the same changes in moisture content wider boards will move more than narrower boards. Therefore, gaps in wide board floors are generally wider and more noticeable. An uneven distribution of gaps can detract from the appearance of the floor and may occur if a number of boards are bonded together by the finish penetrating into the joints. Floor finishes will not prevent timber movement, but may reduce the rate of response to climatic changes. Applying a finish to the underside of a floor may further assist to reduce the impact of sudden changes in the weather.

TIMBER SPECIES AND CHARACTERISTICS

Species, Colour, Grade and Hardness

The species or species mix chosen will generally determine the overall colour of the floor. It should also be noted that species mixes may contain different species from one producer to another and may therefore appear different. Even when a single species is chosen there can be a wide variation in colour and it is also possible that a limited number of boards of a different species may be present due to similarity in appearance. As a guide, Table 1 indicates the range of colours that may be expected. The sapwood of many hardwoods can be much lighter than adjacent heartwood and some boards may contain both light and dark colours. Even within a single species and within individual trees large colour variations can occur. The age of the tree can have a significant influence on the colour with younger timber often being lighter than more mature timber. The product supplied may differ in colour to showroom samples and this should be discussed with flooring suppliers and owners. Due to this it is also preferable that flooring is supplied from one manufacturing source and that the packs are of a similar age.

Lyctid susceptible sapwood of some hardwood species (e.g. Spotted Gum) should be preservative treated in accordance with AS 1604. Some treatments may impart a brown tinge to sapwood, while boron preservative is non-colouring. LOSP treatment is also used. In this instance an H3 treatment may be used in lieu of H2 treatment to avoid the coloured dyes often used with H2 LOSP treatments.

The character of the floor is influenced by the species characteristics and therefore the grade. Grading is a process that sorts boards according to the number and size of features present (e.g.

gum veins and knots). The following table indicates the grades contained in relevant Australian Standards, but it should be noted that manufacturers often have their own grades. Often flooring that contains more feature is more moderately priced, however irrespective of the features present, there is no difference between the grades in terms of machining tolerances, permitted machining imperfections and moisture content.

It is therefore important to realise that the overall colour or blend of colour in a floor is dependent on the species or species mix chosen and the character of the floor, in terms of the features present (e.g. such as gum veins) is determined by the grade. If choosing an alternative species from the one originally considered, not only will the overall colour differ but the dominant type of feature may also change. It is important that suppliers, installers and clients work closely together to ensure that the desired look of the flooring is clearly understood by all.

Hardness indicates a species resistance to indentation and abrasion. Damage to timber floors may occur due to continual movement of furniture, heavy foot traffic and in particular "stiletto-heel" type loading. The selection of a hard timber species ensures improved resistance to indentation and abrasion. Soft timber species, if used in feature floors can be expected to indent. Floor finishes will not significantly improve the hardness of timber flooring. In some species the hardness of younger growth material can also be much lower than mature timber of the same species, but this varies from species to species.

TABLE 1 - SPECIES PROPERTIES

Species	Colour	Hardness	Common cover widths (mm)	Thicknes (mm)
Australian Hardwoods – to AS 2796 – Timber – Hardwood – Sawn and milled products Select Grade, Medium Feature Grade (Standard) and in some species High Feature Grade				
Spotted Gum	brown, dark brown, light sapwood	very hard	60, 80, 130	19, 12
Ironbark	dark brown or dark red brown	very hard	60, 80, 130	19, 12
Blackbutt	golden yellow to pale brown	very hard	60, 80, 130	19, 12
New England Blackbutt	straw to pale brown	very hard	60, 80, 130	19, 12
Forest Red Gum	dark brown or dark red brown	very hard	60, 80, 130	19, 12
Brushbox	mid brown even colour	hard	60, 80,130	19, 12
Jarrah dark	red brown	hard	67, 80, 125	19, 12
Karri	rich reddish-browns to pale pinks	hard	67, 80, 125	19, 12
Rose Gum	straw pink to light red	hard	60, 80, 130	19, 12
Sydney Blue Gum	pink to dark red	hard	60, 80, 130	19, 12
Tallowwood	pale straw to light brown	hard	60, 80, 130	19, 12
Southern Blue Gum	pale brown with some pink	hard	63, 80, 85, 108, 133	19, 12
Stringybark	yellow brown with pink tinge	hard	63, 80, 85, 108, 133	19, 12
Messmate	Pale yellow to pale brown	moderately hard	63, 80, 85, 108, 133	19, 12
Tasmanian Oak	pale straw to light brown, pink	moderately hard	85, 108, 133	19, 13
Victorian Ash	pale straw to light brown, pink	moderately hard	63, 80, 85, 108, 133	19, 12
Manna/Ribbon Gum	pale straw pinks	moderately hard	63, 80, 85, 108, 133	19, 12
Imported Hardwoods – to AS 2796 – Timber – Hardwood – Sawn and milled products Select Grade, Medium Feature Grade (Standard) and in some species High Feature Grade				
Kwila / Merbau	dark brown	hard	80, 130	19
Northern Box	mid brown even colour	hard	80, 130	19
Cypress – to AS 1810 – Timber – Seasoned Cypress – Milled products Grades No.1 and No. 2				
Cypress	straw sapwood, dark brown heartwood	moderately hard	62,85,98	20
Australian Softwoods – to AS 4785 – Timber – Softwood – Sawn and milled products except Araucaria (hoop pine) for which industry grades apply Standard Grade for AS 4785 Australian Softwoods				
Radiata	white to straw	soft	104	19, 21
Araucaria (Hoop)	straw	soft	87, 89, 102, 133, 152	19, 20, 21

Note:

1. Not all species, width and thickness combinations are available. Check with suppliers before specifying.

2. The greater the width to thickness ratio of the floor, the more problematic that issues may arise with the floor occur.

Cover Widths, Profiles, Spans and End-Matching

Typical cover widths and thicknesses for T&G strip flooring are as shown in Table 1. Actual cover widths may vary from those shown and should be checked with individual suppliers. Typical T&G profiles are shown in Figure 2. Some profiles are produced with grooves or rebates on the underside. Where the underside of a floor forms a ceiling, the board edges may be arrised to form a 'v' joint profile. The secret nail profile is used for both top (face) nailing and secret fixing. When secret fixing, the cover width should be limited to a maximum of 85 mm. The "standard profile" is used for face nailing and is the profile commonly found on wider boards. Some wider board flooring has the secret nail profile which allows temporary secret fixing prior to top (face) nailing.

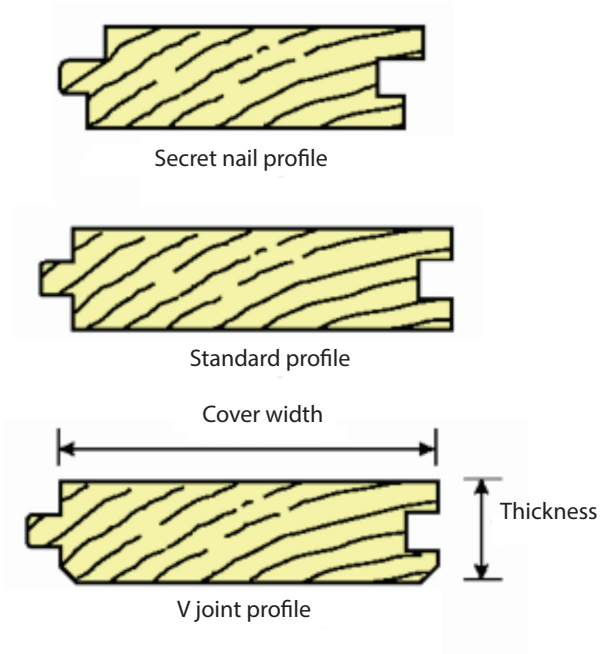

Figure 2. - Profiles

If the species or species mix contains a significant variation in colours, the appearance of the floor will differ depending on the cover width. Narrower boards tend to blend the colour variations together. Gapping between individual boards during drier times is also less with narrower boards than it is with wide boards. A board width of 100 mm or less will limit potential gap size and other movement effects such as cupping (edges of the board higher or lower than the centre). If wider flooring is used then wider gapping can be expected and under certain conditions some cupping becomes more likely.

End-matching is a process where a tongue and groove joint is provided at the ends of boards, the majority of flooring is now end-matched. For floors laid direct to joists or battens this allows joints to be placed between the joist or batten, resulting in less wastage than plain end flooring, which must have its ends fixed over the joist or batten. See Figure 3.

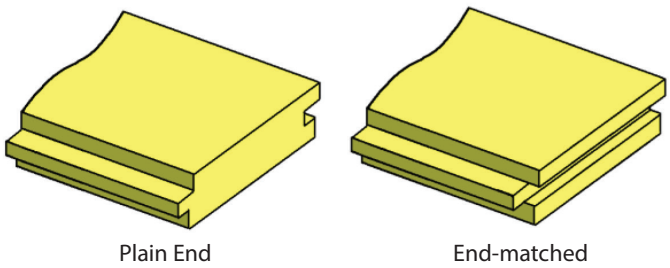

Figure 3. - Ends

Floor lengths

Flooring is generally supplied in random length packs up to 4.8m in lengths. The average length is often between 1.8m and 2.1m. Packs of shorter overall length are also available from some suppliers to facilitate floors in high rise buildings that require product to be taken to the appropriate floor by lift. The minimum length for timber being fixed to joists is 900 mm, based on a 450 mm joist spacing. In some instances, if it is known that the floor will be laid over a structural sub-floor, then lengths shorter that 900 mm may be provided.

Ordering flooring

When ordering timber flooring, the following details should be provided to the timber supplier:-

- species (or species mix)
- grade
- profile and end-joint type
- cover width
- thickness
- quantity (in linear meters)

Flooring is generally supplied within the moisture content range from 9% to 14%. For larger jobs in specific environments a different range may be specified.

To calculate the linear meters of flooring required, the following method is recommended.

$$\text{Total length of flooring required} = \frac{\text{Area of floor (m}^2\text{)} \times 1000 + \text{Wastage}}{\text{Cover width (mm)}}$$

Allowance for waste should be approximately 5% for end-matched flooring and 10% for plain end butt joined flooring.

FLOORS OVER DIFFERENT SUB-FLOORS

Depending on the T&G sub-floor supporting system (e.g. joists, plywood on slab etc.), timber floors will both feel and sound differently when walked on. Generally T&G timber floors laid over joists or battens will have more spring under foot and there is likely to be some vertical movement at board edges and end-matched joints when walked on. Some squeaks can therefore be expected from most timber floors of this type. 'Squeaks' can occur from movement of one board edge against another or from boards moving on nails. Squeaks are often more prevalent during drier weather due to loosening at the joints. Floors that are laid over plywood on a slab will have a firmer feel underfoot and some areas may sound drummy. Similarly when floors are glued directly to concrete, the feel is firmer, and again some boards may sound 'drummy' when walked on.

In cooler climates slab heating may be present and due to the direct heating effect on the timber and intermittent use of this type of heating system throughout the year, substantial seasonal movement can be expected. Although strip flooring can be used, if care is taken with appropriate product selection and installation practices, it may be preferable to use engineered timber flooring products where less dimensional changes would be expected. Even with these products care is still necessary.

FLOOR FINISH TYPES AND CHARACTERISTICS

Timber floor finishes can be grouped into four main categories. Penetrating oils and waxes, curing oils and alkyds, oil modified urethanes, and polyurethanes, the latter three categories being available in solventborne and waterborne. The polyurethanes are also available in yellowing (aromatic) and non-yellowing (aliphatic) types. All four categories are available in low to high VOC - volatile organic (solvent) content. Gloss level options can range from very high gloss to matt.

Performance parameters such as durability can vary significantly within a category as well as between categories. All categories can be recoated with refurbishment coats. The degree of surface preparation required prior to recoating will vary with time and coating type. As can be seen there is a large choice of coatings.

Penetrating Oils and Waxes

These are blends of natural oils and waxes with added chemical salt 'driers'. They are dissolved into spirit type solvents, with some of the very low volatility ones meeting the Green Building Council of Australia guidelines of 140 g/L VOC emission. This coating type can have high maintenance requirements necessitating regular application of metalised acrylic polishes. However, it is the natural look of the coated timber that is often the basis of selection. These types of coating will darken significantly on ageing and are slow to cure in cold weather. Currently they do not form a large part of the floor finish market.

Oil-Based Finishes - Curing Oils and Alkyds

Curing oils such as 'Tung' or 'linseed', dissolved in mineral turpentine or white spirits, contain added chemical curing agents called metal driers. They are usually selected because they are of low cost, are of good edge bonding resistance and produce a rich timber colour. They can be very slow curing in cold weather, darken significantly with age, some types can also yellow in the dark or when covered. Durability is low compared to the other coating types and as such they require frequent maintenance with use of metalised acrylic polishes. Gloss levels vary from high gloss to satin and they have good edge bonding resistance.

Alkyds are produced from reacting curing oils with synthetic resin and dissolving into spirit based solvents. This results in durability being improved from a low to a moderate level. Maintenance requirements are considered to be of a medium level. Again, this is a lower cost option when compared to the more durable options following, providing good edge bonding resistance and a rich timber colour. Again, these more traditional types of finishes are not as commonly used as those outlined below.

Oil Modified Urethanes (UMO's)

These spirit based solventborne coatings combine an oil with a smaller amount of a urethane. The higher the urethane proportion, the less the oil properties such as higher flexibility and resistance to edge bonding. Conversely, the higher the urethane content, the higher the durability and the less the flexible. Gloss levels vary from high gloss to satin. In recent times waterborne UMO's have appeared on the market. Although higher cost than the solventborne, the waterborne UMO's have the advantage of having low VOC emissions.

All UMO's yellow significantly with age and their slow curing in cold weather must be considered. These coatings are often selected due to their intermediate cost, being isocyanate free, having good edge bonding resistance and being of intermediate durability. Essentially they represent a coating that is reasonably durable and generally free from potential concerns such as edge bonding. As such they hold a moderate share of the market.

Polyurethane – Solventborne

This coating type provides the highest durability and film build (% solids) of all coating types as well as the highest gloss levels for the gloss options. However, there is a strong solvent smell on application and they are also of highest toxicity (isocyanate content) until the coating has cured. This is more so with two pack than the one pack moisture cure (MC) variety. With the correct use of personal protective equipment this aspect is not considered an issue. There are yellowing (aromatic) and non-yellowing (aliphatic) varieties, with further options of high solids, and gloss levels from ultra high gloss to matt.

These coatings are often selected as they provide the best wear resistance or durability resulting in lower maintenance, can be used with fast dry sealers, provide the highest gloss and film build option, are of intermediate cost and generally provide trouble free application. If requiring consideration, they do however have poorer edge bonding resistance. Currently, this type of finish is commonly used in Australia.

Polyurethane – Waterborne

This has the widest selection of sub-categories with acrylic – polyurethane blends, co-polymer urethane acrylates, 100% polyurethane resins, both yellowing and non-yellowing types, and blends of all the previous, with and without wax or silicone wear additives. As a result of this, there is a spread of properties including wear resistance from poor to arguably as good as solventborne polyurethane. Greater care is therefore necessary in selection and those without acrylic provide better wear resistance. They are available in one and two pack options, the latter utilizing either a lower toxicity hardener or a more toxic crosslinker, which is a consideration at the time of mixing. Matt through to gloss finishes are available and these finishes generally darken less with time.

These coatings are often selected based on being a healthier option for both contractor and premises occupier due to the absence of any strong solvent smells on application.

They also provide good edge bonding resistance. They are however of highest product cost, can provide a lighter timber appearance depending on the sealer and products used, and have a higher chance of tannin stain application marks. Rapid shrinkage in the floor and the associated stretching of the finish at board joints has on occasions caused the appearance of light coloured lines at board joints. These finishes have developed significantly over recent years and as such their market share is moderate and increasing.

Table 2 outlines the types of finish available and lists various properties of each.

TABLE 2 - COATING SELECTION CHART

Timber Floor Coatings							
Property	Penetrating oil / wax	Oil based finishes	OMU	Polyurethane			
				Solventborne		Waterborne	
				1 pack	2 pack	1 pack	2 pack
Wear resistance	Low	Low-Med	Medium	Very High	Very High	Med-High	Med-VH
Ability of the floor to accept careful foot traffic 3 days after coating. (Ave. Temp. 20°C)	Low	Low	Medium	Medium	High	Medium	High
Timber colour 'richness'	Low-High	High	High	High	High	Low-Med	Low-Med
Resistance of the coating to yellowing with age	Low	Low	Low	Low-High	Low-High	Med-High	Med-High
Ability to cure in cold & dry weather	Low	Low	Medium	Medium	High	Medium	High
Ability to cure in cold and damp weather	Low	Low	Low	Medium	High	Low	Low
Edge bonding resistance	High	High	Med-High	Low-Med	Low	High	Med-High
Rejection resistance	High	Medium	Medium	Low-Med	Low-Med	Medium	Medium
VOC emission at application	Low-High	High	Med-High	High	High	Low	Low-Med
Inhalation hazard when coating is applied	Low	Medium	Medium	High	Very High	Low	Medium
Odour on application	Low-Med	Medium	Medium	High	Very High	Low	Low-Med
General product cost	Med-High	Low-Med	Medium	Medium	Medium	High	Very High

SAFE WORKING

Working with timber produces dust particles. Protection of the eyes, nose and mouth when sanding, sawing and planing is highly recommended. Refer to tool manufacturers for safe working recommendations for particular items of equipment.

DISPOSAL OF OFFCUTS AND WASTE

For any treated timber, do not burn offcuts or sawdust. Preservative treated offcuts and sawdust should be disposed of by approved local authority methods.

ACKNOWLEDGEMENT

Timber Queensland gratefully acknowledge the contribution of the Australian Timber Flooring Association (ATFA) in the preparation of this Data Sheet.

TIMBER QUEENSLAND
We build Queensland

Timber Queensland Limited
ACN 092 686 756 | ABN 50 092 686 756

500 Brunswick Street, Fortitude Valley
Brisbane Queensland 4006

Phone (07) 3254 1989
Fax (07) 3358 7999
PO Box 2014, Fortitude Valley BC Qld 4006
admin@timberqueensland.com.au
www.timberqueensland.com.au