



**TIMBER
DEVELOPMENT
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Timber in Joinery

Joinery timber is used in the manufacture of machined and assembled timber products, which make up the second fix elements of construction distinct from structural and construction timber uses in the first fix. Both softwood and hardwood species are used in joinery.



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Timber in Joinery

Joinery is the non-structural use of timber within a building, including windows, doors, cladding, skirting boards, and door linings. It is known as “internal” for applications inside a building, and “external” when used in exterior spaces, or when it has one external face such as windows or external doors.

Joinery Product Types

There are multiple types of joinery product types, including:

- **Mouldings**

These include skirting boards, architraves, window boards, beadings, dado rails, and cornices for interior applications and barge boards, fascias and soffits for exteriors. Such products are usually manufactured from softwoods using specialised woodworking machines to produce a high-quality surface suitable for stains and finishes (but can be made from hardwood for high-end finishes). A wide range of sizes is available, from 4mm to 50mm thickness and 28mm to 275mm width.

- **Doors**

Interior panel doors are made from solid hardwood, solid softwood (typically Pine (*Pinus sylvestris*), kiln dried to 10-12% to ensure stability), or veneered particleboard. Exterior doors can be either flush or panelled, made from softwoods, hardwoods, or modified timbers e.g. Acetylated timber, which provide improved product stability. Increasingly external doors use an engineered wood core to achieve security or thermal performance standards.

- **Staircases**

Staircases are manufactured in softwoods, hardwoods, and engineered wood products, often incorporating plywoods or other sheet materials. Newel posts and balustrades are produced from softwoods and hardwoods with many including a variety of decorative elements such as metal spindles or glass panels.

- **Windows**

The earliest surviving window frames are made from Oak (*Quercus spp.*), and timber remains a material of choice for airtight and well-made window frames with excellent thermal and acoustic insulation. Timber is flexible to enable window frame construction for both standard and bespoke window sizes. Engineered and modified timbers are now widely used for window construction which provide improved product stability.

- **Flooring**

Solid timber flooring is made from both hardwoods and softwoods, with lengths available from 1,200mm to 5,700mm and thicknesses from 13mm to 30mm. Softwood timber for flooring should be specially kiln dried to 8-12% moisture content with the boards taken from the heartwood at the centre of the log for maximum stability. Boards should be stress grooved on the underside and tongued and grooved on all four sides, for increased stability and a neater fit. A number of types of engineered flooring are also available, normally with with a hardwood face veneer, and softwood or plywood core.

- **Panelling**

Interior timber panelling can improve thermal and acoustic insulation, and mask wall defects. Both Pine (*Pinus sylvestris*) and Spruce (*Picea albies*) are common choices, available in a variety of pre-finished stains and finishes. Boards come tongued and grooved in a range of sizes and thicknesses, from 7mm to 25mm. On stud walls and unplastered ceilings, panelling can be nailed direct to the studs or joists, otherwise timber battens should be used.

Moisture Content

BS EN 942 recommends moisture content ranges for external and internal joinery. It is vital to ensure joinery components are supplied and stored at the correct moisture content, in equilibrium with expected service conditions, until the final work is handed over to the client.

Category	In-Service Condition	Moisture content range
External joinery		12-19 %
Internal joinery	Unheated building	12-16 %
	Heated room, between 12°C to 21°C	9-13 %
	Heated room above 21°C	6-10 %

TABLE: Moisture content of solid timber by joinery categories

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Specification Criteria

There are multiple criteria to consider when specifying timber for joinery:

- **Aesthetics**

The colour, figure, suitability to accept finishes, and the texture of the timber (fine, medium, or coarse).

- **Commercial criteria**

The timber's availability, cost, and dimensions provided by suppliers.

- **Mechanical criteria**

The required density, hardness, rate of growth, slope of grain, and its strength (and strength-to-weight ratio).

- **Durability**

Consideration should be given to the use class and desired service class for the joinery component (defined in **BS EN 460 Durability of wood and wood-based products. Guidance on performance**).

This will include both the timber's natural durability and its treatability by preservatives (as per **BS EN 350:2016 Durability of wood and wood-based products - testing and classification of the durability to biological agents of wood and wood-based materials**).

- **Servicability**

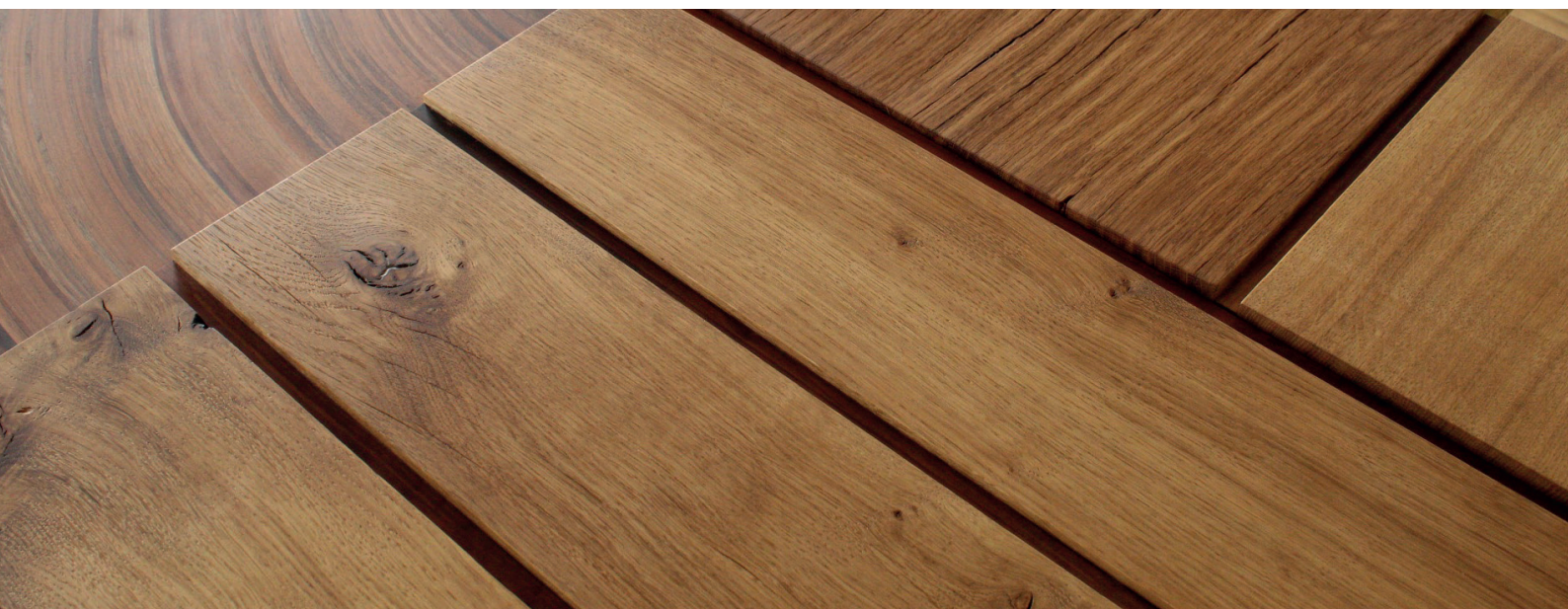
Its dimensional movement and shrinkage coefficient.

- **Workability criteria**

The ease of kilning, machining, gluing, and bending.

Some common hardwood and softwood options are detailed on the following page.

The choice of finish also informs species selection. For general purpose softwood joinery, it may not be necessary to specify a particular species, especially when an opaque finish will be applied. In this case, features made good using plugs and fillers will be covered up.



Species	Type	Average density at 15% mc	Durability	Workability	Dimensional movement	Suitability	
						External	Internal
Douglas fir (<i>Pseudotsuga menziesii</i>)	Softwood	530 kg/m ³	Moderately to slightly durable	Average	Small	No preservative	No preservative
Scots pine (Redwood) (<i>Pinus sylvestris</i>)	Softwood	510 kg/m ³	Slightly durable	Average	Medium	Preservative for sills and thresholds for doorframes	No preservative
Spruce (Whitewood) (<i>Picea albies</i>)	Softwood	470 kg/m ³	Not durable	Easily worked	Medium	Preservative for sills and thresholds for doorframes	No preservative
Ash (<i>Fraxinus excelsior</i>)	Hardwood	710 kg/m ³	Not durable	Average	Small	Not suitable	No preservative
Beech (<i>Fagus sylvatica</i>)	Hardwood	720 kg/m ³	Not durable	Average	Medium	Not suitable	No preservative
Sapele (<i>Entandrophragma cylindricum</i>)	Hardwood	640 kg/m ³	Moderately durable	Difficult to work	Medium	No preservative	No preservative
Oak (<i>Quercus robur</i>)	Hardwood	720 kg/m ³	Durable to slightly durable	Average	Medium	No preservative	No preservative
Accoya (<i>Acetylated Pinus radiata</i>)	Modified wood	510 kg/m ³ (65% RH, 20°C)	Very durable	Average	Very small	No preservative	No preservative

TABLE: Selected tree species and their suitability for use in joinery

Supply of Joinery Timber

Sawmills produce a range of sawn wood suitable to produce joinery components. These raw materials are intended for further selection, orientation, and defect removal during the joinery manufacturing process to create components which meet joinery appearance classes as defined in national standards such as **BS EN 942: 2007: Timber in joinery. General requirements.**

For example, when sawmills in Nordic countries such as Sweden, Finland, or Norway supply joinery grades of European redwood (Scots pine, *Pinus sylvestris*) or whitewood (Spruce, *Picea albies*) suitable sawn timber will be assessed using appearance grading, following the guidelines in **BS EN 1611-1:2000 Sawn timber. Appearance grading of softwoods - European spruces, firs, pines, and Douglas fir.**

The grading may be performed on the faces and the edges called G4 which is most common, or only on the faces called G2. The grading designations are followed by a number from 0–4 stating the quality of the timber, with 0 as the highest quality.

A grade can thus have the designation G4-2, which means a 4-sided visual sorting of a standard joinery raw material. Alternatively, the designation G4-0, which means a 4-sided visual sorting of a higher quality joinery raw material. Both grades can be used for production of joinery components.

Some Nordic sawmills may still use the traditional Nordic appearance grading document “*Grading of sawn timber*”. This document, previously called the Blue Book, divides timber into seven classes, with Class I representing the highest quality. Classes I–IV are usually grouped under the designation U/S, unsorted. Class V is generally referred to as fifths and Class VI is named sixths.

Grading Quality Classes	BS EN 1611-1 4-Sided Grading
I (Unsorted)	
II	
III	G4-0
IV	G4-1
V (Fifths)	G4-2
VI (Sixths)	G4-3
VII	G4-4

TABLE: Approximate relationship between different appearance grades and quality classes

Joinery Product	Grade, Class (<i>Pinus sylvestris</i> or <i>Picea albies</i>)
Small mouldings	G4-0 Class III or better
Interior cladding	G4-1 Class IV or better
Floorboards	G4-2 Class V or better

TABLE: Common joinery products with appropriate appearance grades

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Joinery Appearance Classes

The UK national standard **BS EN 942: 2007: Timber in joinery. General requirements** specifies the grading and classification of quality by appearance of joinery products or individual joinery components. It defines seven appearance classes based upon maximum allowable sizes for knots and other natural timber features, including shakes, resin pockets, discoloured sapwood, and exposed pith.

Different classes are suitable for different types of joinery:

- **Classes J2 to J30 (J2, J5, J10, J20 & J30)**

High quality or specialised joinery, with special selection of timber required (likely costing a higher price). Classes J2, J5, and J10 are seldom achieved without significant sorting and remanufacture from commercial grades of European softwood.

- **Classes J40 and J50**

General purpose joinery, likely to be readily obtainable from commercially available grades of softwood and hardwood.

Knot size is the most influential determinant of appearance class grading, and is a critical factor when specifying joinery, as small fine products like glazing bars may need to be “knot-free”.

BS EN 942 differentiates between concealed, semiconcealed, and visible faces of installed joinery, regardless of whether it is coated with an opaque finish:

- A concealed face is permanently hidden by other parts of the joinery product or by other elements
- A semi-concealed face cannot be seen when a joinery product is in the “closed” position
- A visible face is permanently on view. This timber should be able to accept a coating without any other operation than light sanding.

The appearance classes provide limits on timber for semi-concealed and visible faces, but some features are allowed on concealed faces, provided they do not interfere with product performance.

Factor	J2	J5	J10	J20	J30	J40	J50
Maximum knot size	2mm	5mm	10mm	20mm	30mm	40mm	50mm
Spiral grain	Not Permitted	Not Permitted	≤ 10 mm/m		≤ 20 mm/m		
Resin pockets, bark pockets	Not Permitted	≤ 3 mm x 30 mm per 2m length	≤ 3 mm x 75 mm per 2m length		≤ 3 mm in width, no limits applied to length		
Fissures, shakes	Not Permitted	Not Permitted	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions
Exposed pith	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions
Discoloured sapwood	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions
Ambrosia beetle damage	Not Permitted	Not Permitted	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions
Finger-jointing, butt-jointing	Not Permitted	Not Permitted	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions
Laminating sections	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions	Permitted, Subject to Conditions
Reaction wood, splits, biological attack and wane	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted

Not Permitted	Permitted, Subject to Conditions
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TABLE: Timber classes in joinery, based on appearance characteristics, derived from BS EN 942

Manufacturers can make good elements such as loose or unsound knots, shakes greater than 0.5mm in width, resin and bark products, exposed pith, and ambrosia beetle damage, depending upon the size and class of timber.

- Plugs must be from the same or similar species, and well-secured using an appropriate adhesive. They should match the hole depth, lie with grain in the same direction, and have a width up to 6mm greater than the allowable knot size. Two intersecting plugs can be used for elongated knots or defects.
- Timber filler should be compatible with the intended use of the joinery products and should completely fill the hole or shake.