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Introduction to wood-based panel products

Wood-based panel products are sheet materials that contain a significant amount of wood in the form of strips, veneers, chips, strands or fibres. The categories described in this Wood Information Sheet (WIS) are:

- plywoods
- particleboards
- oriented strand board (OSB)
- fibre building boards.

Within each of the above categories are a number of specific panel types and grades. Some of these are defined in BS EN product standards while others are made to commercial specifications.

The 'Choose and use' sheet *Wood-based sheet materials* [1] provides up-to-date information for builders, including uses.

PanelGuide [2] is a comprehensive source of information on wood-based panels that is available from the TRADA, Wood Panel Industries Federation and Timber Trade Federation websites.

BM TRADA recommends *Eurocode 5* [3] for structural design of timber. PD 6693-1:2019 *Recommendations for the design of timber structures to Eurocode 5: Design of timber structures* [4] incorporates common rules and rules for building.

This WIS is an overview of wood-based panels with signposts to more detailed information sources that are listed at the end. It outlines the manufacture and characteristics of the basic types and also indicates some of the speciality products derived from them.

Contents

Figure 1: Softwood plywood is usually made from European grown spruce or pine, while birch is a common hardwood plywood
Photo: Wood for Good

Key points

- CE marked wood-based panels for use in construction must comply with the harmonised standard BS EN 13986. From January 2021, UKCA marking will become an alternative to CE marking for construction products placed on the UK market.
- Design using Eurocode 5 relies on characteristic design values supplied by the manufacturer or from BS EN 12369.
- Veneer plywood may be specified for a range of exposure conditions. The suitability of the plywood depends on the moisture resistance of the glue bond and the durability of the veneer, which for exterior use may be enhanced by preservative treatment or surface and edge coatings.
- Oriented strand board (OSB) is made from large overlapping flakes and provides structural performance for dry and humid construction applications. Some coated panels are suitable for specific exterior applications such as hoardings.
- Wood particleboard (commonly known as chipboard) may be specified for a range of interior uses, including dry and humid exposures as well as non-loadbearing and loadbearing applications, but is not suitable for exterior use.
- Cement-bonded particleboard is considerably denser than particleboard. It is resistant to fire, insects, weathering and moisture and has good sound absorbance.
- Of the fibre building boards, the most common is medium density fibreboard (MDF) with standard products available for dry and humid exposures, as well as non-loadbearing and loadbearing applications. A specialist MDF variant is also now available for exterior applications.

Types of wood-based panels

Plywood was developed to provide panels with dimensional stability and good strength properties, both along and across the sheet. Plywood consists of an assembly of layers glued together, with the direction of the grain in adjacent layers usually at right angles. There are two types:

- veneer plywood that has all the plies made of veneers orientated with their plane parallel to the surface of the panel
- core plywoods, such as blockboard and laminboard, which have a central core of wood strips or other materials, with two or more outer wood veneers.

Veneer plywoods are subdivided into four main types:

- EN 636-1 for use in dry conditions
- EN 636-2 for use in humid conditions
- EN 636-3 for use in exterior conditions
- BS 1088 for use in marine conditions.

Wood particleboard and fibre building boards were developed to provide utility sheet materials with uniform properties. Historically they used mainly forest thinnings and sawmill waste as the feedstock. In recent years the manufacture of particleboard in particular has utilised increasing levels of recycled wood fibre. From the original utility panels, a whole family of panel products has evolved, catering for a wide variety of end uses.

Plywood, particleboards and fibre building boards all include both general purpose or utility boards and special purpose products.

OSB is made up of thin, resin-bonded strands of wood, compressed into layers to form a mat. There are four main types covered by BS EN 300:

- OSB/1 general purpose boards, and boards for interior fitments (including furniture) for use in dry conditions
- OSB/2 loadbearing boards for use in dry conditions
- OSB/3 loadbearing boards for use in humid conditions
- OSB/4 heavy duty loadbearing boards for use in humid conditions.

CE marking and harmonised standards

There is a comprehensive series of BS EN product standards presenting requirements for a range of wood-based panels. Unlike the previous British Standards, which were largely prescriptive and based on manufacturing requirements, BS ENs specify performance. Each category of board material has its own product standards. These are supported by other standards dealing with, for example, test methods, quality control procedures and guidance on use.

With the UK leaving the EU, the requirements of the CPR will be transferred into UK law so the obligation on panel manufacturers to comply with BS EN 13986 will continue for products placed on the UK market. During 2021, products that comply may be CE marked as before or marked with the new UKCA (conformity assessment) mark, but from 2022 only the UKCA mark will be accepted. In the longer term, the requirements for UKCA marking may deviate from those for CE marking. Differing requirements will apply to products being placed on the market in Northern Ireland

At a higher level in the standardisation hierarchy is the so-called 'Harmonised Standard' for wood-based panels: BS EN 13986 *Wood-based panels for use in construction. Characteristics, evaluation of conformity and marking* [5]. This defines the requirements for CE marking of panels for all kinds of use in construction. Since July 2013, CE marking of panels to be used in construction has been mandatory in all EU countries under the Construction Products Regulation (CPR). The CPR imposes obligations on the whole supply chain to ensure that materials comply with the applicable standards and that relevant technical information is passed on to all that need it. Harmonised standards must be cited in the Official Journal of the EU before they are used for CE marking. The version of EN 13986 currently cited is dated 2005 + A1 2015.

TRADA's WIS 2/3-56 *CE marking: implications for timber products* [6] describes the process under the CPR and includes an example using wood-based panels.

Panels for non-construction use may be made to other specifications, sometimes agreed between the supplier and customer.

Structural panels

Within BS EN 13986, structural panels are subject to what is called 'Assessment and Verification of Constancy of Performance (AVCP) Level 2+'. This requires that the manufacturer has its Factory Production Control (FPC) System certified by a European Notified Body, such as BM TRADA. This demonstrates that the manufacturer has a suitable FPC in place to ensure production meets the requirements of the standard. By affixing the CE mark to a product, the manufacturer is claiming that particular batch meets the standard and the performance level stated on the Declaration of Performance (DOP).

Structural design

Design to *Eurocode 5* requires characteristic design values for the product, based on testing. For structural wood-based panels, these values are declared in the manufacturer's DOP that should be prepared before placing the product on the market. There is an obligation for all parties in the supply chain to ensure this technical information is passed along the chain by referring to the DOP in the

CE documentation. Where a specific strength property is required, purchasers should include this requirement within the purchase specification and check the CE documentation for the goods received at delivery to ensure that it meets the correct specification.

See TRADA's WIS 2/3-57 *Specifying wood-based panels for structural use* [7] for further information.

The panels must be manufactured to a suitable specification and have design characteristic values available. These may be taken from:

- BS EN 12369-1 *Wood-based panels. Characteristic values for structural design. OSB, particleboards and fibreboards* [8]
- BS EN 12369-2 *Wood-based panels. Characteristic values for structural design. Plywood* [9]
- BS EN 12369-3 *Wood-based panels. Characteristic values for structural design. Solid-wood panels* [10]

or derived in accordance with:

- BS EN 789 *Timber structures. Test methods. Determination of mechanical properties of wood-based panels* [11]
- BS EN 1058 *Wood-based panels. Determination of characteristic 5-percentile values and characteristic mean values* [12].

Veneer plywood

The practice of cross-laminating veneers for special end uses can be traced back to the Egyptian Empire. Their crude forms of plywood used sliced veneers bonded with natural adhesives such as animal glue and blood albumen. Techniques changed little until the late 19th Century when the rotary peeling machine (lathe) was invented. Standard plywood veneer is still produced using a lathe, which peels a log to a continuous strip (like unwinding a roll of paper). Most decorative veneer is sliced from flitches after the log is cut into quarters.

Production

Production depends on factors such as the size and species of log, the type of plywood to be produced and the scale of operation.

The following sequence is typical:

1. Conditioning – soaking the log in cold or hot water or steaming. This ensures that the log is at a high and consistent moisture content throughout, which facilitates peeling and helps yield smooth veneer with less tendency to split or tear.
2. Peeling – rotating the log against the lathe blade which lies against the full length of the log, producing veneer of consistent thickness. Logs for peeling should be reasonably straight to minimise waste.
3. Clipping – passing the ribbon of veneer from the lathe through manual or automatic clipping machines which cut the veneer to size, or into smaller strips if defective material has to be removed. In some mills, clipping is done after continuous ribbons of veneer have been dried.
4. Drying – feeding the wet veneer through a dryer to reduce its moisture content to about 4%–8%. This facilitates bonding of veneers and minimises warping of the finished plywood. Dryers may be continuous or batch process according to the age of the plant and whether ribbons or clipped veneer are being dried.
5. Jointing or veneer repair – joining small strips of veneer into full-size sheets by edge gluing, stitching or using perforated paper adhesive tape. Open defects, such as knot holes, may be repaired using plugs or filler to upgrade the veneer in accordance with grading rules.
6. Grading – sorting the dried, clipped or reconstituted veneers into grades, usually by visual inspection.
7. Glueing – applying synthetic resin adhesive by roller spreader, spray, extrusion or curtain coating. Veneers are assembled normally with the grain of each at 90° to the adjacent veneer. (Plywood with special characteristics is produced when this rule of bonding at right angles is not followed.) The assembly is known as a lay-up.
8. Pressing – cold pre-pressing to consolidate the lay-ups. This prevents veneers slipping while the lay-up is handled and encourages the transfer of wet adhesive. The lay-ups are then subjected to pressure and heat in batches, typically in a multi-daylight press.
9. Trimming, filling and sanding – after cooling, surface defects may be filled or repaired, if required and permitted in the specification. Most plywood is then sanded.

Standards

Veneer plywood for use in construction should comply with BS EN 13986 and BS EN 636 *Plywood. Specifications* [13] and be appropriately CE marked. Specifiers should satisfy themselves that construction plywood complies with the relevant ENs and that the level of performance is suitable for their application.

BS EN 636 may also be applied to plywood that is not intended for construction.

These standards are usually supplemented by national or industry plywood specifications covering, for example, grading of veneers particularly for the face and back. This is different to other panel products where the applicable standards classify the boards into specific types.

Performance

Plywood is a versatile product that can combine attractive surface appearance with resistance to high moisture conditions while retaining comparatively high strength-to-weight properties.

Plywoods are produced with glue bonds that range from those suitable only for dry conditions through humid conditions to those that will withstand the significantly higher moisture contents of external exposure. TRADA's WIS 2/3-11 *Specification and use of wood-based panels in high humidities and exterior situations* [14] explains the specification for external exposure.

Three use categories are established in BS EN 636 for plywood, which are referred to by BS EN 13986 as Technical Classes. These classes are:

- Dry (EN 636-1) – suitable for interior use. Contains adhesives such as urea formaldehyde (UF).
- Humid (EN 636-2) – suitable for use in humid conditions. Contains adhesives such as melamine urea-formaldehyde (MUF).
- Exterior (EN 636-3) – suitable for use in humid or in exterior conditions. Contains adhesives such as phenol formaldehyde (PF).

To comply with the marking requirements of BS EN 636, the class should be marked on each board or package followed by the letters S or NS, e.g EN 636-2 S. The letters show if the product is intended for Structural (S) or Non-Structural (NS) applications. The marking should also include the wood species.

The durability of plywood depends on the type of adhesive and the natural durability of the wood species of which it is made. The durability of the wood species may be enhanced by treatment with preservatives. Guidance on assessing the biological durability of plywood can be found in DD CEN/TS 1099 *Plywood. Biological durability. Guidance for the assessment of plywood for use in different use classes* [15].

Common types of veneer plywood in the UK

Construction plywood – structural

Plywood for use in construction must be CE marked as described above. If the plywood is for structural (S) applications, i.e. it is capable of carrying structural loads; the technical class will be modified with the letter S (e.g. EN 636-2 S); and the manufacturer must provide characteristic values for use in design on the DOP, either based on testing or by reference to BS EN 12369-2.

Construction plywood – non-structural

Plywood for use in construction must be CE marked as described above. If the plywood is for non-structural (NS) applications the values for 'strength and stiffness for structural use' will be absent from the DOP.

Utility plywoods

Utility plywoods comprise non-structural plywoods that are available in a surface appearance grade suitable for joinery, furniture and limited exterior uses.

Decorative/overlaid plywoods

Special end-use plywoods are commonly available. An example of a common overlay is a phenolic film, which gives enhanced resistance to abrasion and water penetration.

Marine plywood

Marine plywood should comply with BS 1088 *Marine plywood. Requirements* [16].

BS 1088 specifies two types of marine plywood:

- standard marine plywood
- lightweight marine plywood.

BS 1088 does not specify the species to be used; instead it gives requirements for a minimum level of durability and a limit on nominal density (in accordance with EN 350 *Durability of wood and wood-based products. Testing and classification of the durability to biological agents of wood and wood-based materials* [17]). BS 1088 also limits the amount of sapwood as far as practicable, since all sapwood is non-durable. The adhesive bond requirements are similar to Class 3 of BS EN 636.

BS 1088 plywoods are commonly available from UK suppliers. Material sold as marine plywood, without reference to BS 1088, may not be of the same quality. Therefore, it is advised to purchase marine plywood that has been manufactured under an independent third-party quality assurance scheme specifically for BS 1088 plywood. Marine plywood is not suitable for construction applications unless it is appropriately CE marked.

Wood core plywood

Blockboards and laminboards are composite boards with a core made up of strips of wood, each not more than 30mm wide, laid separately and glued or otherwise joined together to form a slab. One or more veneers is glued to each face with the direction of the grain of the core strips running at right angles to that of the adjacent veneers.

Production

The technique of manufacturing blockboard and laminboard developed alongside the plywood industry in the early 20th Century. Blockboard uses strips of wood about 25mm wide for its core, while laminboard cores are composed of strips of veneer on edge (or occasionally strips cut from plywood). Laminboard generally has the more stable core as the veneers of which it is made all have the same orientation. Ply mills may introduce block or laminboard manufacturing facilities to use residues and to

produce lower cost utility types of boards suitable for some interior purposes. The method of production is similar to that for plywood and the 'wet' stages of veneer manufacture are identical.

Wood particleboard

Wood particleboard (also known as chipboard in the UK) is made of small wood particles and a binder, usually a synthetic resin adhesive. Boards are available typically from 3mm to 50mm thick and may be of uniform construction through their thickness, of graded density or of distinct three- or five-layer construction.

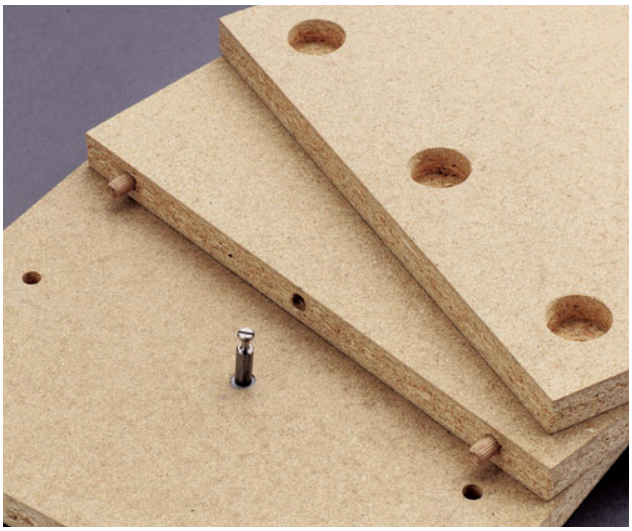

Figure 2: Wood particleboard
Photo: Wood for Good

Production

Chipboard development started before World War II, following the development of synthetic thermo-setting adhesives. It is not as demanding in terms of raw materials and skilled labour as plywood, and wood particleboard mills are now located in most countries of the world.

Production involves mechanically breaking up wood and reconstituting it using synthetic resin adhesives. The proportion of adhesive in the finished product amounts to only a few percent by weight, although its cost is much more significant. The process is highly automated and most woody parts of a tree are usable. Chips are often produced from green logs, but increasing levels of recycled timber are now being used, such as end-of-life pallets. The proportion of recycled timber used in UK-manufactured panels is typically 65% to 70%.

When produced from green logs, the basic stages of production are:

1. Debarking – removing bark from logs.
2. Chipping or milling – cutting solid wood raw material such as forest thinnings and sawmill slabs to predetermined lengths and feeding into a chipper. Sawmill products such as chips and sawdust are also milled/chipped to the required particle size. Surface and core chips are often prepared in different ways and held in separate silos.
3. Drying – passing wood chips through a dryer to reduce their moisture content to about 2.5% to facilitate gluing and hot pressing. Core and surface chips may be dried to slightly different moisture contents.
4. Sifting/particle classification – grading particles to produce a 'furnish' with a specified mix of particle sizes. Oversize chips are re-milled. Fine dust is removed and this may remove much of the remaining bark.
5. Glue blending – mixing dry chips with synthetic resin, often UF or MUF, and with other appropriate additives such as hardener or wax emulsion. Proportioning of glue and chips has to be very exact and may be deliberately varied, surface chips often having higher glue contents.
6. Mat forming – creating a mattress of wood chips with adhesive by dropping them on to caul plates or belts. Depending on the type of mat-forming machinery this will produce either homogeneous, graded-density or layered mats.
7. Pressing – compressing (sometimes with pre-compressing) to a predetermined thickness in a high pressure and temperature press, which may be multi-daylight, single daylight or continuous. With multi- and single-daylight presses, the mat is cut into discrete sections that are pressed between platens. In the case of a continuous press, a continuous ribbon of mat is compressed between two moving, heated belts, the gap between them tapering down to the final board thickness. The continuous panel is cut to size after pressing.
8. Trimming and sanding – after cooling, trimming each panel and then sanding to a constant thickness.

Extruded particleboard – most wood particleboard is produced by processes similar to those described above, but there are also boards formed by extrusion. Extruded boards are made by forcing the particle and resin mix through a wide heated die, which may also form tubular voids in the board to reduce weight. The particles align themselves with their longer dimension at right angles to the direction of extrusion. These boards are only suitable as core material for certain products such as doors.

Standards

Wood particleboards should comply with BS EN 312 *Particleboards. Specifications* [18].

Performance

BS EN 312 defines seven types of wood particleboard designated from P1 through to P7. They range from boards suitable for general purposes, interior fitments and furniture, to loadbearing types for use in interior and humid conditions.

Types P4 to P7 are loadbearing boards and are suitable for construction applications. P4 and P5 are frequently specified for floor decking and are available with tongued and grooved (T&G) profiles in sizes suitable for flooring applications. P5 is suitable for humid conditions and is often described by the trade term 'moisture resistant', but no particleboard is suitable for exterior use. Specialist flooring panels have been developed with a protective film that provides the surface with some resistance to wetting and contamination during the construction phase.

Other particleboards

The technology of manufacturing particleboards, with raw materials other than wood chips, such as flax shives and bagasse, evolved from that used for wood particleboard.

Flaxboard is manufactured from shives obtained from the flax plant and is frequently complementary to linen fibre manufacture. Bagasse is the fibrous residue left after extraction of sugar from sugar cane. Its production is seasonal, coinciding with the cane harvest. Other agricultural residues have also been used.

Cement-bonded particleboard

Cement-bonded particleboard is made from small particles of wood, bonded with either Portland or magnesite cement, formed and cured into panels.

Production

The first plant was set up to produce dense wood cementboard in Switzerland in the early 1970s, and since then there has been a gradual increase of plants around the world. Cement-bonded particleboard production differs from other particleboards because the wood content of the product is low (about 20%–30% by weight), and the pressing does not use high temperatures. The process is as follows:

1. Raw materials – storing logs for about two months to neutralise extractives in the wood that may retard cement curing. Bark is removed from all logs.
2. Flaking and milling – feeding logs into a flaker. The flakes are then refined to suitable dimensions in an attrition mill and stored in silos.
3. Sifting/screening – separating core material (larger particles) from the surface material (smaller, finer particles). Also, at this stage, oversize particles are recycled back to the attrition mill and excessive fine dust is drawn off.
4. Blending and forming – blending wood particles, cement, water and chemicals together; then the wet mix is spread on to caul plates.
5. Pressing and curing – stacking the formed mats and caul plates in a clamping device to form a package where initial setting of the cement occurs; then the clamp is released. The stacks remain in setting chambers for about eight hours to control final curing.
6. Trimming, maturing/conditioning – trimming boards to size. They remain in a curing warehouse for up to 18 days and are then conditioned to an equilibrium moisture content.

Standards

Cement-bonded particle boards comply with BS EN 634, which is in two parts:

- BS EN 634-1 *Cement-bonded particle boards. Specification. General requirements* [19]
- BS EN 634-2 *Cement-bonded particleboards. Specifications. Requirements for OPC bonded particleboards for use in dry, humid and external conditions* [20].

Performance

Cement-bonded particleboard has a density in the range 1000kg/m^3 to 1200kg/m^3, approximately twice that of plywood and about 1.75 times the density of standard grade wood particleboard. This imposes restrictions on its end use. There can be difficulties encountered in cutting and machining due to abrasion of the cutters and it can be brittle, but claimed advantages over other wood-based panel products are:

- superior dimensional stability in wet conditions and retention of smooth surface
- superior behaviour in fire
- high resistance to fungi, insects and weathering
- good sound absorbance.

Oriented strand board

Oriented strand board (OSB) is made from wood strands having a length at least twice their width, which are orientated in predetermined directions in each layer to simulate some of the characteristics of plywood.

Figure 3: OSB panels used as flooring
Photo: Wood for Good

Production

Early manufacture was based on waferboard production (using rectangular wafers), starting in 1962. During the 1970s a German company, Bahre-Bison, developed a process of producing wood strands and of aligning these strands either along the length of the board or at right angles to it. This board product was termed oriented strand board and has now largely replaced waferboard. OSB production has many similarities with standard particleboard manufacture. The process is as follows:

1. Debarking – removing bark from logs if the proportion is above that allowable.
2. Waferising, strand cutting and drying – cutting logs to length and putting into a waferiser that reduces them to strands that are cut parallel to the grain and dried in a rotary dryer.
3. Blending – mixing an adhesive with the wood furnish, sometimes with a proportion of wax emulsion in a rotary blender. PMDI, which is inherently free of formaldehyde, has become the dominant adhesive type in the European OSB industry.
4. Mat forming – forming the board in layers. The former for the first layer orientates the strands of the first surface predominantly in one direction. The second (core) layer is then formed on top with the strands either randomly orientated or orientated at right angles to those in the surface layer. The other surface is then formed with strands aligned parallel to those in the first layer. Physical or electrostatic methods of orientation can be used. The orientation is not always immediately apparent from a visual inspection of the surface.
5. Pressing – curing and pressing the resinated mat to a required density and thickness, usually in a multi-daylight press or a continuous press.
6. Trimming, conditioning and sanding – after cooling, trimming boards to size, conditioning and sanding, according to requirement.

Standards

OSB should comply with BS EN 300 *Oriented strand boards (OSB). Definitions, classification and specifications* [21].

Performance

OSB is widely used for wall sheathing, flooring underlays, roof sheathing and decking, and as the web material for I-joists. It is not recognised in BS EN standards as being suitable for exterior use but coated boards are often used in applications such as hoarding, where a long service life is not required. Boards are available in four grades from general purpose boards to heavy duty loadbearing boards for use in humid conditions. Specialist boards not specifically covered by BS EN 300 are available, including pre-primed, fire retardant and airtight boards.

Types OSB2 to OSB4 are loadbearing boards and are suitable for construction applications. OSB3 is frequently specified for structural applications such as sheathing and is suitable for humid conditions. OSB3 is available with T&G profiles in sizes suitable for flooring applications

Fibre building boards

Fibre building boards, usually exceeding 1.5mm in thickness, are manufactured from fibres of ligno-cellulosic material. There are two basic types:

- wet process – the primary bond derives from the felting of the fibres and their inherent adhesive properties
- dry process – an adhesive is added to the fibres and they are dried to below 20% moisture content before mat forming and pressing.

Production

The earliest fibre building boards, produced in the late 19th Century, contained large amounts of repulped newsprint and were of relatively low density. Somewhat later, insulating boards were produced from ground wood pulp. During the 1920s and early 1930s further techniques were developed to break solid wood down into fibres and reconstitute these under heat and pressure as a strong and durable panel, hardboard.

Wet process manufacture

This is the most common technique for manufacturing hardboards, medium boards and softboards, sometimes referred to as insulating boards. The initial stages of production are the same for each type, but the later stages, after mat forming, differ.
The production process is as follows:

1. Chipping – cutting up the raw material, such as forest thinnings, sawmill waste, plywood peeler log cores.
2. Reduction to fibres – softening the chips by pre-heating in low-pressure steam and then feeding by Archimedean screw between segmented grinding discs, one of which rotates at great speed. This is usually performed by the 'defibrator' method.
3. Board (wet lap) forming – laying pulp stock onto a moving wire

mesh and removing water by gravity, suction and the action of 'thicknessing' rollers to produce what is termed a 'wet lap' in which the fibres are interlocked or 'felted'.

4. Pressing and curing hardboards and medium boards – cutting the wet lap to press lengths and transferring onto wire mesh plates before being pressed in a heated multi-daylight press. Press closure drives the remaining water out through the mesh and compresses the mats, while the heat promotes fibre-to-fibre bonding. After pressing, the boards are further cured and conditioned to a suitable moisture content in heat treatment and humidifying chambers. The greater the press closure pressure, the higher the density of the finished board. The wire mesh leaves an imprint on one face of higher density boards.
5. Curing – conveying lengths of wet lap through ovens to dry out moisture and re-establish the natural bonding.
6. Finishing – cutting boards to size and further processing, such as painting or machining into ceiling tiles or acoustic boards.

Dry process manufacture

The most common dry process board is medium density fibreboard (MDF).

The dry process was developed from the traditional wet process and the fibre is produced in the same way. Differences in the production process are:

- Resin application – adhesive (UF, MUF or PMDI) and wax emulsion are applied to the fibre within the inlet pipe to the drying tube. Other agents may be added during or after manufacture to modify particular properties of the board.
- Drying/storage – drying of the fibre/adhesive mix is performed in a long drying tube (blowline). The dry fibre is stored in silos to await further processing.
- Mat-forming – a mattress is dry-formed on caul plates. This is gradually compressed by steel belts. For thick boards, more than one mat may be overlaid on another.
- Pressing – the dry mattress is pre-pressed to consolidate it and then cut and formed to press sizes, finally to be cured with heat and pressure in a multi-daylight press. Continuous presses are also common.
- Trimming and sanding – after cooling, each panel is trimmed and sanded to precise dimensions.

Standards

Fibreboards comply with BS EN 622, which is in five parts:

- BS EN 622-1 *Fibreboards. Specifications. General requirements* [22]
- BS EN 622-2 *Fibreboards. Specifications. Requirements for hardboards* [23]
- BS EN 622-3 *Fibreboards. Specifications. Requirements for medium boards* [24]
- BS EN 622-4 *Fibreboards. Specifications. Requirements for softboards* [25]
- BS EN 622-5 *Fibreboards. Specifications. Requirements for dry process boards (MDF)* [26].

Performance

Hardboards – fibre building board with a density exceeding 900kg/m^3 and defined minimum properties of strength and dimensional stability. Part 2 of BS EN 622 defines a range of board types for different applications, both structural and non-structural. Tempered hardboard is available from suppliers, but is not defined in the standard. It has a higher resistance to water absorption than standard hardboard, and the density usually exceeds 960kg/m^3.

Hardboard is usually smooth on one side with a fine mesh pattern on the other, but duo-faced hardboards, with two smooth surfaces, are also available. It has multiple uses in furniture, door facings, shop fitting and display work, and has been used in composite structural beams.

Mediumboards – there are two types of mediumboard:

- low density – 400kg/m^3 to 560kg/m^3
- high density – 560kg/m^3 to 900kg/m^3.

Low density mediumboards have particular application as pinboard and as components of partitioning systems. They generally have one smooth surface and one surface with a fine mesh pattern. They can also be found in shopfitting and display applications and as a floor underlay material.

High density mediumboards usually have a hard shiny surface. They have been used as wall and ceiling lining panels and as a sheathing material in timber frame construction.

MDF – the density of MDF generally exceeds 450kg/m^3 and it has two smooth surfaces. It is available in a wide range of thicknesses and is commonly used in many furniture and construction applications. It has a good face and edge surfaces for painting, veneering or laminating and can be accurately cut and profiled.

Softboards have a density of less than 400kg/m^3 and have an open, fibrous surface. They can also be obtained with paper facing. They are used as pinboards, underlay materials and as an acoustic absorbent. Impregnated softboards have been used as a sheathing material in timber frame construction and as a protective overlay in some forms of flat roofing. In pitched roof construction in Scotland,

impregnated softboards are used as a sarking material and heavily impregnated brands find application as joint fillers.

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Further reading

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About TRADA

The Timber Research and Development Association (TRADA) is an internationally recognised centre of excellence on the specification and use of timber and wood products.

TRADA is a company limited by guarantee and not-for-profit membership-based organisation. TRADA's origins go back over 80 years and its name is synonymous with independence and authority. Its position in the industry is unique with a diverse membership encompassing companies and individuals from around the world and across the entire wood supply chain, from producers, merchants and manufacturers, to architects, engineers and end users.

Our aim

To provide members with the highest quality information on timber and wood products to enable them to maximise the benefits that timber can provide.

What we do

We seek to achieve this aim through active and on-going programmes of information and research. Information is provided through our website, an extensive collection of printed materials and our training courses.

Research is largely driven by the desire to update and improve our information so that it continues to meet our members' needs in the future.

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