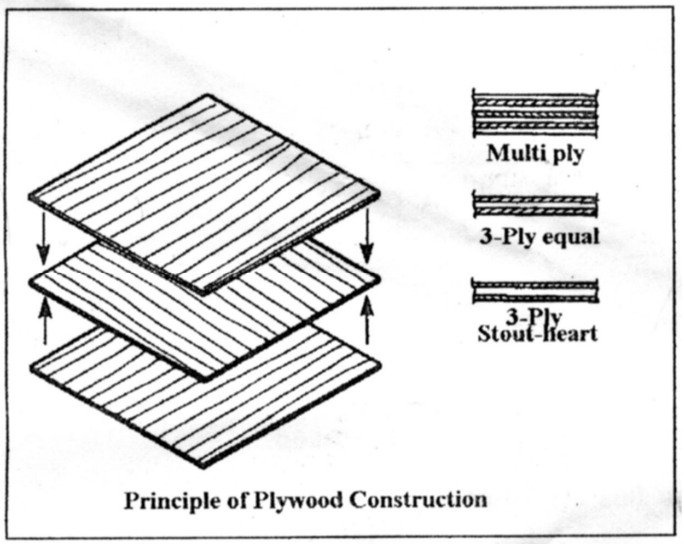
Manufactured Boards & Engineered Wood Products

Manufactured boards differ to solid timber because they are not naturally occurring materials, they are man-made. The main types of manufactured boards that we deal with are Plywood, MDF, Hardboard and Particleboard.

Plywood

Plywood usually comes in the form of large panels. These panels are formed by gluing layer upon layer of timber veneer. Each layer of veneer is set with its grain running perpendicular to the previous layer. In some cases the veneers can be placed at angles other than 90° to each other, usually to gain strength in specific directions. Most plywood panels are made up of an odd number of veneer sheets so the external sheets have the grain running in the same direction.



Principle of Plywood Construction

Plywood is different to Glue Laminated Timbers (Glulam) where the grain runs in the same direction in Glulam.

The two main grades of plywood are Construction or Industrial Grades and Hardwood or Decorative Grades.

Construction ply has traditionally been made from softwoods, although a variety of hardwoods may also be used. Construction grade plywood is again graded according to whether it is an Interior or Exterior type, the thickness and the timber used to manufacture the board.

Exterior panels can also be High Moisture Resistant (HMR) panels and are able to withstand prolonged periods of time in damp conditions. Interior construction plywood does not usually require a high resistance to moisture, so it is often graded according to the outside faces. Grade B plywood has more defects per square metre than a Grade A plywood. Generally,

construction ply is used where strength, stiffness, low cost and ease of use are more important than appearance.

Decorative plywood can be made from any number of species of timber, depending on the service conditions and finish required. This type of plywood is generally used as interior ply but it can be purchased as HMR. When decorative HMR ply is made a different adhesive is used in its construction, one that is more resistant to moisture damage. Decorative plywood is generally used in applications such as wall panelling, carcass construction and areas where appearance is important.

Plywoods must adhere to strict standards that tell us where they can be used and give us the properties of some types of ply. These standards include:

- AS/NZS 2269 Plywood Structural
- AS 2270 Plywood and Blockwood for Interior Use
- AS 2271 Plywood and Blockwood for Exterior Use
- AS/NZS 2272 Marine Plywood

Plywood has a number of advantages over natural timber panels and other manufactured boards. Due to the alternating grain direction between layers, plywood has good tensile strength in both length and width. This means that plywood will not split along the grain like a solid timber panel and can be used to span large areas. Plywood can also be easily bent to form curved shapes and is a very stable material.

Melamine Formaldehyde is the adhesive used to form most plywood. Phenol Formaldehyde is generally used for Marine (waterproof) plywood.

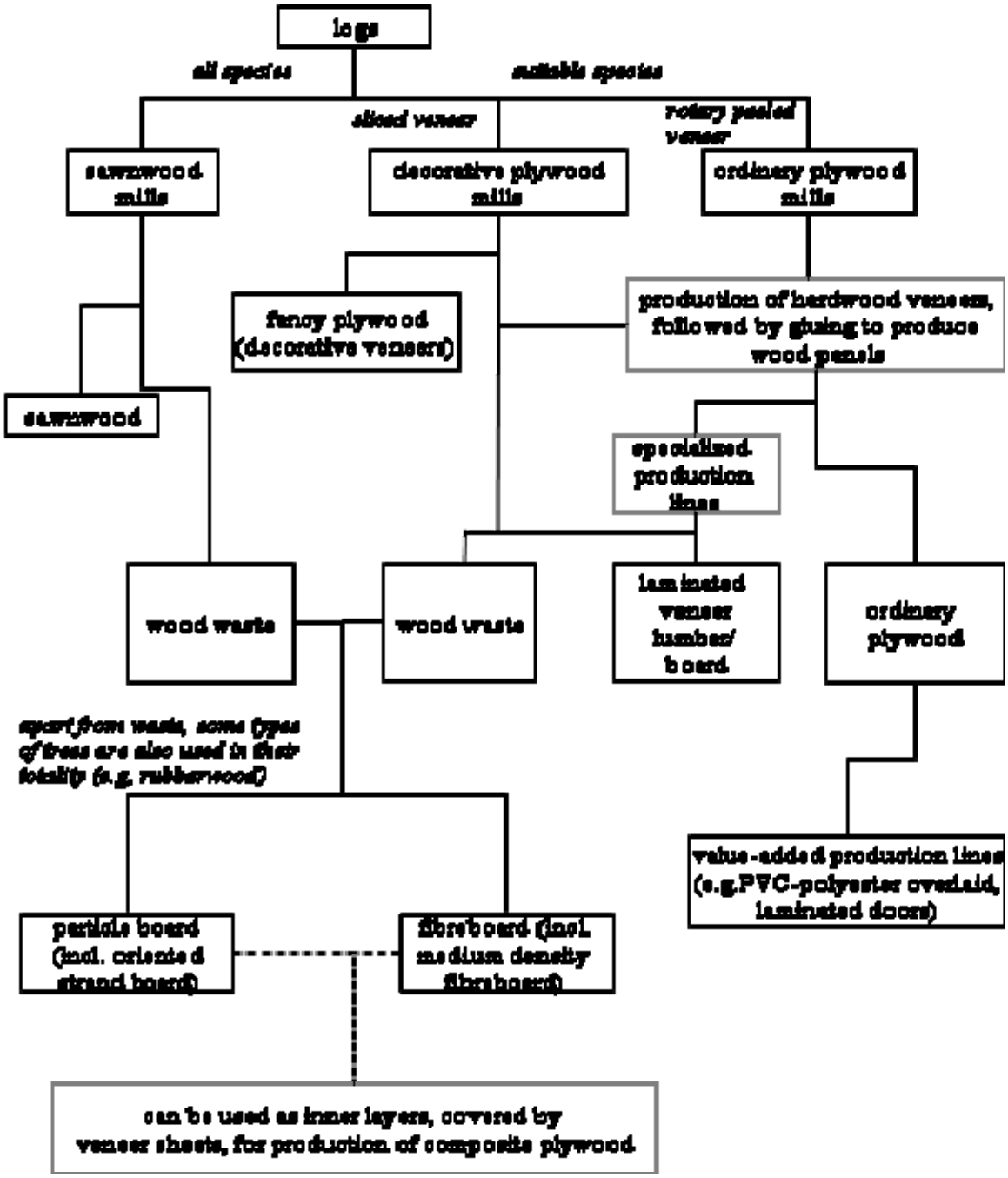
Because plywood is a manufactured board it can be made using materials other than timber. Variations are available with a honeycomb core, paper, plastic or metal layers, depending on the use of the panel.

One disadvantage of using plywood is that it is difficult to get a clean edge. A circular saw can produce a good edge, but routing and hand sawing tend to tear the end grain of perpendicular layers. It is also weak in narrow sections due to its lack of significant grain length and depth.

Nailing and screwing plywood near the edge of a panel can cause splitting. Generally, panels 7mm or less in thickness can be nailed to about 7mm of

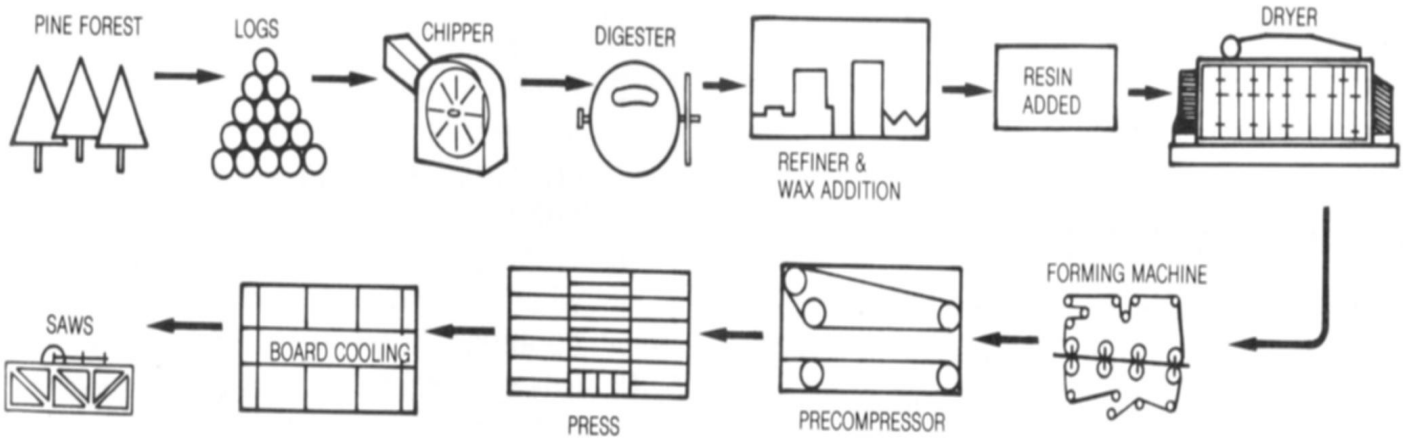
the edge. Thicker panels should be nailed at a minimum of 12mm from the edge. If necessary pilot holes should be drilled to further prevent splitting.

The production of plywood is shown below.



Medium Density Fibreboard

Medium Density Fibreboard (MDF) is manufactured using Radiata Pine. This is obtained from the chips, flakes and thinnings during the manufacture of other timber products. The pieces are machined to a specific size and then washed to remove any 'impurities'. The chips are then softened in a steam digester unit. Once softened the chips are feed into a machine (defibrator) that rubs the wood apart into fibre form. The fibres are then dried and have Urea Formaldehyde and a wax emulsion added to them. After this the fibres quickly regain their 10-12% moisture content and are sent to the forming machine. This forms the fibres into a mat that runs along a conveyor belt, through a pre-compressor, changing the mattress from 300mm to 100mm. The thickness that is going to be pressed determines the speed of the conveyor belt. The mattress is then passed into a hot press that uses not only heat but pressure to cure the resin and produce the finished sheet of MDF. The board is then trimmed to size.



MDF has been designed for internal use only. It is very stable, however there is a small degree of expansion and contraction. Because MDF has no grain it has a uniform strength in all directions. Hand and power tools can be used and it is especially good for carcass construction. A moisture resistant format is available, using a moisture resistant adhesive.

The fine particles given off when machining contain the urea formaldehyde adhesive that was used to make the sheet. This adhesive can cause cancer so all precautions should be taken to prevent the inhalation of this material. For this reason, the use of MDF in schools is prohibited.

MDF can break if the edges are being nailed or screwed. It forms an excellent base for the application of veneers and is usually very flat with little to no surface imperfections.

Hardboard

One of the most common brands of hardboard available is Masonite. W. H. Mason originally invented this product in 1924. It is made from hardwood chips, pulped with water, spread as a mattress on a travelling wire mesh screen. It is then compressed under a high-pressure hydraulic press at approximately 200°C. This forms a tough, dense, grainless sheet. After this the board is subjected to a humidifying oven that gives the board a moisture content of 5-8%.

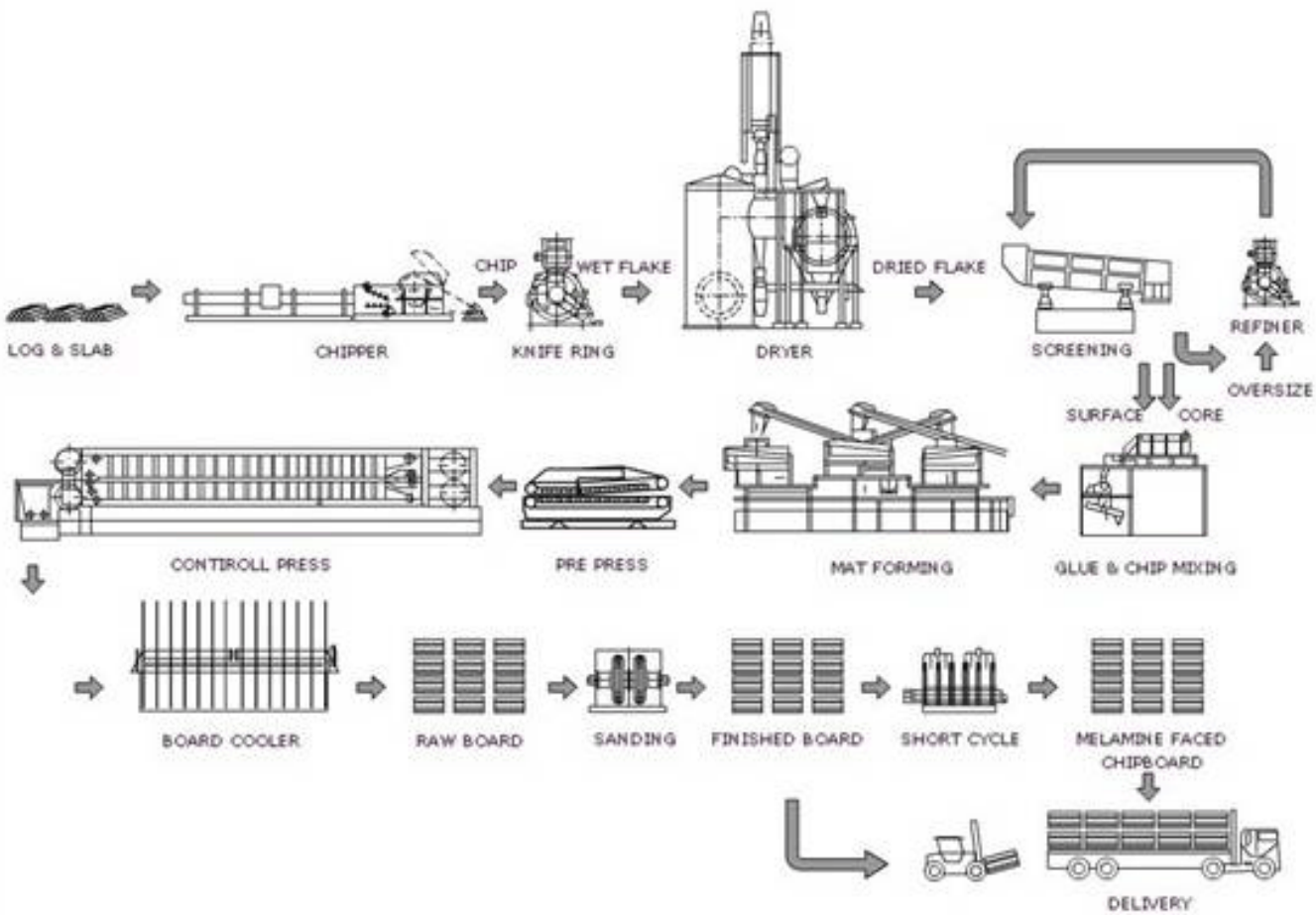
Hardboard is mainly used as a lining and facing material in building construction and furniture making. Sheets have a smooth face but a wide variety of finishes are available including different patterns and textures.
Nailing and screwing of hardboard can be done close to the edges. It can be curved or bent and is available in a tempered version that offers increased hardness and weather resistance. Most hand and machine manufacturing methods can be used on hardboard, however, cutting edges will become dull very quickly.

The standard hardboard is more absorbent than natural timber and is affected by atmospheric conditions. It breaks more readily than plywood. At school, Hardboard is used as the bench tops in our workshops.

Particle Board

Particleboard, also known as chipboard, is usually made from the chips, flakes and trimmings of pine. These pieces are collected during the manufacture of other products or during timber dressing. The pieces are put through a machine that makes them either coarse or fine in size and they are then dried. After drying the pieces are mixed with the appropriate adhesive and formed into a rough panel or mattress. This mattress contains coarse pieces sandwiched between two layers of fine pieces. The mattress is then pressed into the panel size and the particles are compacted. The veneer is applied and sanded. The particleboard is then cut to size and is ready for shipping.

The manufacturing process for particle board is described below.



Particleboard is very stable, therefore it will not change any noticeable amount due to weather changes. It has a uniform strength in all directions. It is easily worked but will dull edged tools quickly. It is also cheaper than plywood.

Disadvantages of particleboard include it being a flaky structure, making it easy to break at the corners. It is more absorbent than most timbers. This absorption means that when gluing edges together with a water or solvent based adhesive, both edges should be covered to counter the absorption of water or solvent from the adhesive. An edge treatment is required to cover the unattractive internal structure of particleboard.

When screwing into particleboard it is necessary to drill pilot holes so that the panel does not split. Self-tapping or specific particleboard screws should also be used.

Just like plywood there are Interior and HMR types of particleboard. All of these boards are manufactured using Urea Formaldehyde. HMR board includes a blue dye in the adhesive mixture to distinguish it from the other two, and a wax emulsion in the resin to dispel water.

Engineered Wood Products

Glulam is also known as Laminated Veneered Lumber (LVL). Compared to solid timber it has greater strength and less weight than the comparative timber required to achieve the same strength as this engineered wood product.

LVL also has greater stability, consistency of quality and guaranteed performance. It does not just compete with solid timbers for use but also with steel and concrete, where it I often lighter and more cost effective while offering satisfactory strength.

LVL is mainly used for structural purposes.

Review Questions – Manufactured Boards

1. What is another type of plywood that has not been mentioned in the manufactured boards notes?

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2. Where is this other plywood typically used?

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3. Describe the construction of this plywood. Use a diagram to help with your answer.

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4. What standard of plywood would we use for the construction of poolside furniture? Justify your answer.

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5. If screwing manufactured boards near the edge produces splitting how can this be overcome?

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6. What would be considered a defect on a veneered board? Use pictures to help with your answer.

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7. What care must be taken of tools used to cut or plane MDF?

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8. Name a particular piece of furniture that uses Hardboard? Where is it used on this piece of furniture?

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9. What does HMR stand for in reference to plywood?

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10. What is the difference between grades of plywood?

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11. What is particleboard made from?

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12. What percentage of the tree is wasted when producing particleboard?

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13. In which direction does MDF and particleboard have the greatest strength? Why?

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14. How is HMR particleboard distinguished from other grades of particleboard?

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