

1. SELECTING MATERIALS AND COMPONENTS

INTRODUCTION

Once tree's are **felled** and converted into **Stock Forms** they are known as **'Timber'**. Timber comes in 2 main types: **Rough Sawn** and **Planed All Round (PAR)**. Timbers are **seasoned** to reduce the moisture in them. This is done by drying them naturally or using a furnace. Uneven evaporation of the moisture causes **warping**. Timber can be a **sustainable resource** if it is **harvested responsibly and ethically**. Use this sheet for revision and for further research into timber based materials.

SOFTWOODS

**Softwoods** come from coniferous trees, a tree that usually has needles and cones rather than broad leaves. These trees are commonly referred to as **evergreens** as most of them keep their leaves all year round. Softwoods are **fast growing** and can reach full maturity within 25 years. Softwoods generally have a more **porous structure**. This means that if they are left unprotected, they can **absorb moisture** and begin to rot more quickly. Softwoods don't come in as many colour varieties as Hardwoods however, they are very **easy to stain** to make them look like their more expensive counterparts.



**PINE**  
**Properties:** Lightweight, Easy to work, Can split easily.  
**Common Uses:** Interior construction, Cheap furniture and Decking



**CEDAR**  
**Properties:** Good strength to weight, Durable and Resistant to decay.  
**Common Uses:** Construction, Boxes, Boats, Cladding and Musical Instruments.



**LARCH**  
**Properties:** Durable, Tough, Good water resistance, Good surface finish.  
**Common Uses:** Electrical fittings, casings, buttons and handles.



**SPRUCE**  
**Properties:** Easy to work, high stiffness,  
**Common Uses:** Construction (Interior/Exterior), Furniture and Musical Instruments



**FIR**  
**Properties:** Machines well, Durable, Stiff and Good strength to weight.  
**Common Uses:** Construction, Veneers.

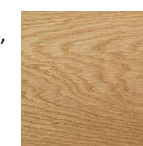


HARDWOODS

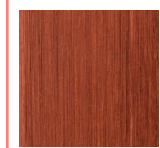
**Hardwoods** come from **deciduous trees**. These are trees which **lose their leaves** in winter. Hardwoods take a **long time to grow**. In fact, if you were to plant a hardwood tree today, you would need to wait between 80-120 years for it to grow to full maturity. Hardwoods tend to be **less porous and more dense** which makes them **less prone to wearing and rotting**. Hardwoods come in a **variety of colours** and are known for their **aesthetic appeal**.



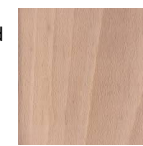
**OAK**  
**Properties:** Tough, Hard, Durable, High quality finish.  
**Common Uses:** Flooring, Furniture, Railway Sleepers and Veneers.



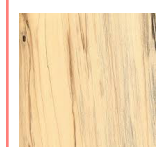
**MAHOGANY**  
**Properties:** Easy to work, Durable, Excellent finish.  
**Common Uses:** High end furniture, Joinery, Veneers.



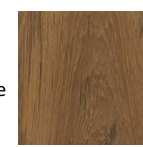
**BEECH**  
**Properties:** Fine finish, Tough and Durable.  
**Common Uses:** Children's toys, Models, Furniture and veneers



**BIRCH**  
**Properties:** Strong, Easy to work, High aesthetic qualities.  
**Common Uses:** Plywood, Veneers, Crates and Speciality wood items..



**TEAK**  
**Properties:** Strong, Tough, Hard, Excellent resistance to moisture.  
**Common Uses:** Outdoor furniture and Boats.



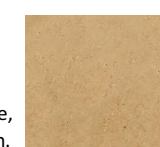
MAN-MADE BOARDS

**Manufactured Boards** are usually **sheets** made from **waste/off-cuts** and recycled timber. Manufactured Boards are usually coated with a thin layer of natural timber called a **veneer**. This adds to the aesthetic appeal of the material by making it look like a natural timber.



MDF

**Properties:** Rigid, Stable, Cheap, Easy to finish but Very absorbent which leads to rotting.  
**Common Uses:** Flat pack furniture, Toys, Kitchen Units & Construction.



BLOCK BOARD

**Properties:** Lightweight, Stable, Easy to Work, High resistance to twisting and warping.  
**Common Uses:** Construction, Low-end furniture.



CHIP BOARD

**Properties:** Good compressive strength, Not water resistant, Cheap, Easily damaged.  
**Common Uses:** Flooring, Low-end furniture, Kitchen units & tops.



PLYWOOD

**Properties:** Very stable and strong due to alternate layering at 90°. Aesthetic qualities. Thin, flexible versions are available.  
**Common Uses:** Flooring, Low-end furniture, Kitchen units and tops.



HARD BOARD

**Properties:** Fairly weak, One side smooth, the other is furry.  
**Common Uses:** Low-end furniture

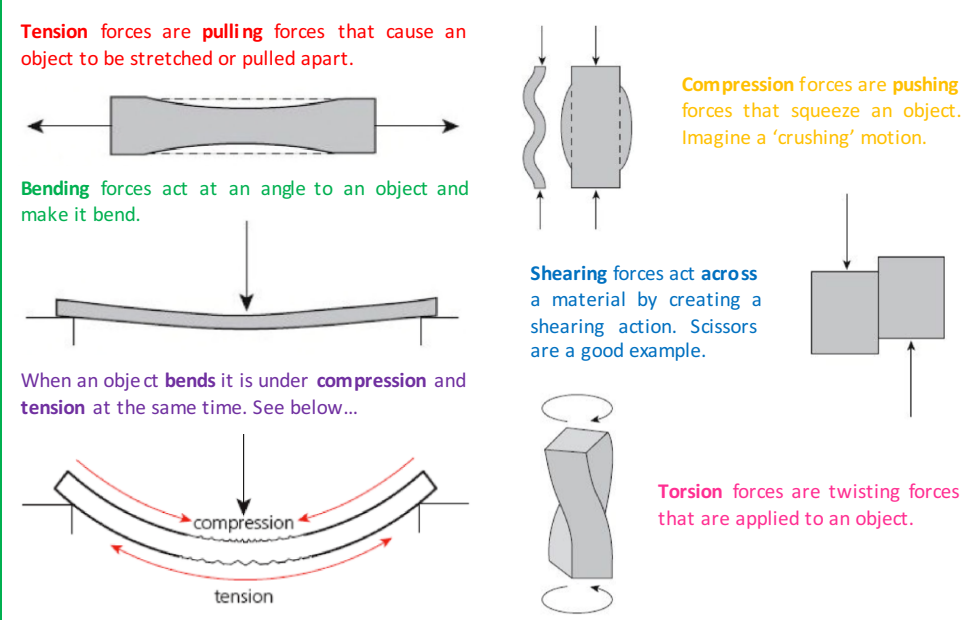


SPECIALIST TECHNICAL PRINCIPLES

2. FORCES AND STRESSES ON WOODEN PRODUCTS

Various timbers are used in a range of products.. In their everyday use, these products are regularly having forces applied to them. These forces affect the way the product operates and its overall function and safety. Designers and manufacturers need to ensure that the materials they select for their products are able to withstand the forces and stresses the product will be subjected to. If they get this wrong it could have serious consequences.

TYPES OF FORCES AND STRESSES



3. ECOLOGICAL AND SOCIAL FOOTPRINT

TIMBER LIFE CYCLE



What do the above logos and symbols mean?

The timber lifecycle shows how timbers start out as trees and end up as products which are then disposed of. Each stage of the life cycle has an impact on the environment.

Some timber based products can be stripped down and the wood can be **'reclaimed'**. These materials are usually ground down and **converted to manufactured boards**.

At the end of the products' life, the timber can be **used as fuel in power stations**. This gives off CO2, contributing to Global Warming.



Products are bought and used. Timber products don't tend to have an **impact on the environment** when they're being used.

**Waste materials from the mill**, as well as reclaimed timber from old products is used to produce **Manufactured Boards**. This allows us to create more materials without the need to cut down more trees.

Trees absorb **CO2** and give out **oxygen**. This helps to **prevent Global Warming** and provides us with oxygen to breathe.

Trees are **felled**. New seeds should be planted to ensure future generations have a **sustainable supply of timber**. If trees are not replanted and the land is used for urban development, this is known as **Deforestation**.

Trees are processed in a **mill** and cut to useful sizes known as **Stock Forms**. Machinery is commonly used for this process. The Machines require a **large amount of energy** to run, usually from fossil fuels (electricity). This gives off **CO2** which contributes to **Global Warming**.



**Deep Reading**  
 If you want to see the damage that is being caused by **Deforestation** you need look no further than the **tropical rainforests**. Today, they are being rapidly **cleared** for industries such as **oil extraction, rubber plantations, cattle grazing, soya farming, expanding cities, roads, dams and of course logging**.  
 About 12% of all man-made climate emissions come from deforestation, mostly in tropical areas. The faster the trees go, the **chance of slowing or reversing climate change becomes slimmer**. Tropical deforestation causes **carbon dioxide**, the main greenhouse gas, to linger in the atmosphere and **trap solar radiation**. This raises temperatures and leads to **climate change**. Deforestation in Latin America, Asia and Africa can affect rainfall and weather everywhere from the US Midwest, to Europe and China.

Rainforests are home to more than half of the world's animals and as the forests come down, the animals and people who live in or around them become **impoverished**. Without the forests, people migrate to cities, or move to richer countries in search of work. The world's rainforests not only **provide food, energy, security, incomes and medicinal plants for 300m people**, but they are also home to the **richest wildlife in the world**.

- **Designers and manufacturers** have an **enormous responsibility** to ensure that they consider the type of timber or manufactured board for the products they design.
- Designers and manufacturers need to consider the **environmental impact** of choosing manufactured boards that can be harmful to produce.
- Designers should ensure all timbers that they use come from **sustainable sources** such as **FSC managed forests**.

WHAT IS AFFECTED BY DEFORESTATION?

WHAT CAN YOU DO TO HELP?

## 4. SOURCES AND ORIGINS OF TIMBERS

Wood is considered to be a **sustainable material**, as new trees can be grown to replace those used for timber and fuel. The main issue facing **timber production** is that it is **being used at a far greater rate than it is being replaced** causing huge damage to the land in the countries where it is grown. Timber is also a huge culprit of **Product Miles**. Different woods have to travel thousands of miles to different countries where those tree's aren't otherwise available. That's why it's important to try and use **locally sourced timber** to help reduce **environmental impact**.

- U.K.** Willow, Ash, Beech, Birch, Fir, Larch, Oak, Pine, Spruce, Walnut
- Scandinavia** Spruce, Beech, Birch, Elm, Oak, Pine
- Europe** Fir, Ash, Oak, Walnut, Pine, Larch
- Russia** Fir, Ash, Beech, Larch, Maple, Oak, Pine, Spruce
- North America** Cedar, Fir, Larch, Hemlock, Pine, Spruce, Redwood, Sequoia, Walnut, Ash, Beech, Birch, Oak, Poplar, Elm, Maple, Sycamore, Balsa
- South America** Balsa, Laurel, Willow, Crabwood, Snakewood, Mahogany, Pine, Fir
- West Indies** Balsa, Lancewood, Rosewood, Mahogany, Cocuswood
- Africa** Mahogany, Olive, Rosewood, Teak, Walnut, Bloodwood, Ebony, Podo
- East Asia** Spruce, Walnut, Birch, Magnolia, Larch, Maple, Oak, Pine, Fir, Teak,
- Oceania** Pine, Oak, Black Walnut, Ash, White Mahogany, Cedar, Gum

## 6. STOCK FORMS

Stock Form	Description	Image
Sheet	<b>Metric</b> is the standard size for measuring sheets. Sheet starts at 3mm thick and usually increases thickness in increments of 3mm. Sheets have a variety of uses.	
Board	Boards are typically used in <b>laminating</b> to increase surface area. They are good <b>decorative</b> pieces of timber and are often used for cladding and flooring.	
Section/Length	Square Sections tend to be used for <b>frames and structures</b> . They tend to be strong and thick so that panels can be attached to them.	
Dowel	Dowel is supplied in <b>cylindrical form</b> and comes in various sizes. It is <b>measured by its diameter</b> .	
Moulds	Wood can be supplied in mouldings which have a <b>variety of shapes</b> . Commonly used for decoration.	

## 7. SCALES OF PRODUCTION

### ONE OFF PRODUCTION

In one-off production a **single product** is designed and made to a client's specification. **Labour and material costs are high**, and a high level of design and manufacturing skills are needed. Prototypes are classed as one-offs.



### BATCH PRODUCTION

In batch production **set quantities** of a product are made to order. Materials are cost-effective and manufacturing **costs are lower**. Seasonal items are usually Batch produced.



### MASS PRODUCTION

Mass production is the industrial scale manufacture of **large quantities** of products, usually on a **production line**. Standardised production methods mean it is suitable for products that are not redesigned very often.



### CONTINUOUS PRODUCTION

Continuous production is the manufacture of an item **24/7 - 365**. The system is usually completely **automated using a production line**. Due to the scale on which the items are manufactured, they are **extremely cost effective**.



## 5. USING AND WORKING WITH MATERIALS

### CUTTING/SHAPING

#### TENON SAW

Used for cutting timber in **straight lines**. Thick blade prevents the blade from deviating.



#### COPING SAW

Used for cutting **unusual and difficult shapes** with thin a blade.

#### SCROLL SAW

**Mechanically powered**. Thin blade cuts **unusual shapes**. Good for cutting sheet material.



#### WOOD PLANE

Shaves the surface of the wood to **reduce the thickness** of material. Can be adjusted to take more or less material.



#### CHISEL

Used to remove timber. Useful for **creating joints or hollowing out** areas.



#### BAND SAW

**Mechanically powered**. Adults **only**. Can cut sections, boards and sheets to specific sizes. Used for larger jobs where a more powerful saw is required.



## DRILLING

### PILLAR DRILL

Good for **accuracy** when drilling timbers. The Pillar Drill is **powerful** enough to drill large holes through thick material. Selecting the correct **drill bit and speed is very important**.



### HAND DRILL

Hand Drills are good for smaller tasks. As they are manual, they provide **better accuracy** than their powered counterparts.



### CORDLESS DRILL

**Very adaptable**. The Cordless Drill has variable speeds and a clutch which prevents over tightening fixtures and fittings. They are **ergonomically designed**.



## ABRADING

### DISC SANDER

**Mechanical machine** which removes more material than hand methods.



### RASP

A 'file like' tool with **rough teeth** for fast removal of material. Different profiles available.



### SAND PAPER

Best for 'hard to reach areas'. Different grades available. **Good for surface preparation**.



### WIRE WOOL

Used for a **high quality surface preparation** before finishing. Produces a very smooth surface.



## 8. SPECIALIST TECHNIQUES AND PROCESSES

### SPECIALIST TECHNIQUES

#### LAMINATING

Laminating is the process of 'layering' timbers to increase the surface area or thickness.

- Step One:** The various sections are marked out and planed to size.
- Step Two:** The sections are grouped and straightened while wood glue is applied.
- Step Three:** The sections are turned into one another so that the glued edges touch the next piece of timber. The pieces are then clamped into position while the glue dries.
- Step Four:** The laminated area is planed down and sanded to make sure it is flat and smooth, ready for a finish to be applied.



#### WOOD TURNING



Wood lathes are used to turn bowls and spindles. The size of the material being turned is important; the speed needs to be reduced as the diameter of the object increases. A special set of chisels are used to shape the wood as it turns. The most commonly used tools are the scraper, the gouge and the parting tool.



#### STEAM BENDING

Steam bending uses **heat and moisture** to loosen the timber and make it more flexible.

- Step One:** Steam is applied to the timber.
- Step Two:** The timber is placed around a Jig or Former which ensures that the product is accurate and makes all future products identical. The material is usually clamped to the Jig/former while it dries.
- Step Three:** The dried timber stays in its new shape and is ready for finishing.



#### BAG PRESS

The bag press uses a **vacuum system** to suck sheets around a **Former** to take a new shape. It is also commonly used when applying veneers to manufactured boards. The advantages of using a Bag Press over clamps is that it provides an **even pressure** across the surface of the material that is being worked. This means that veneers are stuck down more efficiently and timbers that are being shaped are more accurate with less likelihood of deformations.

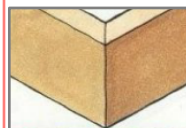
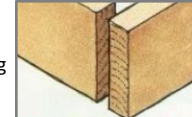
- Step One:** Apply glue to **veneers** and align.
- Step Two:** Place in large plastic bag (along with Former if applicable). Seal the edges to ensure it is air tight.
- Step Three:** Turn vacuum on to remove air from the bag and press the veneers against the Former.
- Step Four:** Wait for glue to dry before removing the item.
- Step Five:** Prepare surface and apply Finish.



## JOINING METHODS

### BUTT JOINT

Two pieces stuck together using only wood glue. **Low Strength**.

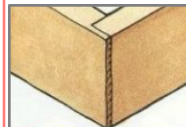
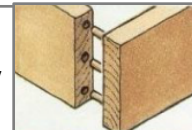


### MITRE JOINT

Pieces cut at 45°. Stuck together with wood glue. **Low Strength**.

### DOWEL JOINT

Dowel used to provide stability and strength. **High Strength**.

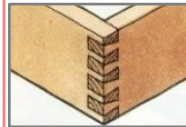
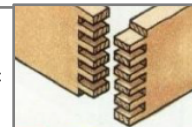


### LAP JOINT

Glued. Aesthetically pleasing. Neat. **Medium Strength**.

### COMB JOINT

Interlocking sections. Aesthetic and **High Strength**.



### DOVETAIL JOINT

Interlocking sections at angles. Aesthetic. **Strongest joint**.

## FIXINGS

### NAILS

Nails are hammered in place at angles to stop them loosening.



### SCREWS

**Pilot hole** is drilled and screw is used to attach two pieces. Screws provide a **stronger hold** than nails.

### KNOCK DOWN FITTINGS

Used in **flat pack furniture**. **Temporary joints** which are easy to assemble/disassemble with simple tools.



## ADHESIVES

### WOOD GLUE (PVA)

Wood glue **absorbs** into the surface of the 2 joining pieces and dries to form a **solid bond**.



### HOT GLUE

Hot Glue is **not very strong**. Commonly used for modelling or smaller tasks.



## 9. SURFACE TREATMENTS AND FINISHES

Name	Image	Description	Name	Image	Description
Oil (Indoor and Outdoor Products)		Soaks into timber. Protects and enhances appearance	Paint (Indoor and Outdoor Products)		Usually needs a primer. Wide range of colours
Bees Wax (Indoor Products only)		Rubbed into wood. Enhances natural grain.	Wood Stain (Indoor and Outdoor Products)		Permanently colours wood. Does not protect.
Varnish (Indoor and Outdoor Products)		Protects from moisture. Enhances appearance.	Distressing and Scorching (Indoor furnishings)		Gives a worn/vintage look. Popular in furnishings.