

Paper and Boards (Core)

Papers and boards

Papers and boards are generally available by the sheet, roll, or ply.

Sheets come in standard sizes, largest A0, halving in size each time, down to A10 (smallest).

Papers and boards come in different weights, measured in gsm (grams per square metre).

The thickness of paper is measured in microns.

Books, leaflets and magazines can be printed and bound in different ways. Leaflets can be printed and folded into a smaller form. Booklets are several pages bound, bonded or stitched together.

Paper and board fittings

Components used with papers and boards that are standardised include:

- drawing pins
- velcro (pads/dots) for mounting
- treasury tags
- staples
- fasteners
- book bindings.

Wastage/addition

Cutting and removing material from stock forms, such as a sheet, is called wastage.

Additive processes, like 3D printing, build up the desired shape from an additional source without waste.

Finishing processes applied to paper, card and board products

Sometimes, a finishing process when manufacturing a paper, card or board product can be:

- stamping the shape out of a sheet (die cutting)
- a specialist finishing process like UV varnishing e.g. on a business card
- a texturing process like embossing or debossing, which creates a raised or lowered surface finish e.g. in a greeting card or wedding invitation.

Papers and boards are very recyclable and made in different thicknesses, with specific surfaces depending on the intended use. They can be folded, creased, glued, easily cut, and waxed for water resistance. Finishes include printing and embossing.

Folding process

Some paper, card or board products, such as greetings cards, menus, or invitations need to be folded in order to be posted, delivered or to stand up once in use.

To fold a paper, card or board, normally a crease would be applied so that the material bends without breaking, tearing or weakening. Sometimes a perforated line or score is applied so that the material bends or folds in exactly the right place.

Binding products

When a book or pamphlet is bound, it needs to open without any of the separate pages falling out or becoming removed. Hand stitching is a skilled and time-consuming process that fixes pages together, but comb binding is a less specialist and more common method. This is when holes are punched so that a plastic bind can hold the pages in order.

Other finishing processes to bind products include stapling and using split pins.

Producing products in papers, cards and boards

Pre-press printing – creates a print layout, a digital pre-press machine then transforms electronic files onto paper.

On-press printing – a plate is covered in ink before paper is pressed against the plate then released.

Die cutting – metal cutters stamp out the desired shape from the material - like cookie cutters!

UV varnishing – parts of a graphic design can be finished with ultraviolet varnish to create a vivid, luxurious or tactile finish.

Embossing /debossing – embossing is stamping a feature into a card, paper or board to raise it above the surface. Debossing is the same but this time the feature is below the surface.

Laminating – adding layers to card or board to protect items packaged inside.

Timbers (Core)

Stock forms of timber

Natural timber is available in:

- different sectional forms
- various standard sizes (lengths)
- sawn or planed
- PSE (planed with squared edge)
- a range of shaped mouldings such as Torus skirting board.

Manufactured boards

Manufactured boards are available in sheet form and in standard sizes and thicknesses.

- Sheets are usually 2440mm x 1220mm, or sometimes half of this at 1220mm x 610mm.
- MDF is available in thicknesses typically 4mm, 6mm, 9mm, 12mm, 15mm, 18mm, 22mm, and 25mm.
- Hardboard sheet is available in 3.2mm thickness.
- Plywood sheets are typically 4mm, 6mm, 9mm, 12mm, 15mm, 18mm, and 24mm thick.

Aesthetics

Aesthetic properties are how a material or components looks.

This includes shape, colour, texture, form, reflection, gloss, style etc.

Function

Functional properties refer to how a material or component works for the intended use.

Function includes performance, efficiency, reliability and operation.

Oak is a mid-brown colour with prominent grain. Very strong and durable, it is perfect for furniture and doors, skirtings and cabinets.

Pine is a soft pale white or yellow timber with straight grain. It is quite lightweight and resists shrinking and swelling. Popular for country furniture, knotty pine is also common.

Plywood is a manufactured board of veneer layers glued at an angle of 90 degrees, for added strength and rigidity. Edges can look unsightly. Plywood is often improved with a veneer of high-quality wood.

MDF is a cheap, man-made board with no grain. It is very versatile but will require a finish. It is available in various thicknesses.

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Surface treatment of timbers

Timbers are finished with both functional and aesthetic applications, depending on the location of the product/timber and the desired outcome. Timber finishes are varied and include:

- varnishes
- wood stains
- oils
- polishes
- preservative finishes
- paints.

Applying finishes to timbers

Painting provides a colourful finish but also protects the timber. Glossy, matt or silk paints can be applied with a brush, roller or sprayer. Some include a primer too.

Wood stain is applied to enhance the appearance of the wood. Stains can also provide some protection but normally a coat of varnish is used to seal the stain.

Oil and wax soak into the timber and can enhance its appearance, whilst repelling moisture and water.

Varnish provides a shiny coat, usually applied in layers to make it more durable. Glossy and matt style varnishes are common.

Dip-treating timber protects the surface of the material, but outdoor timber fences tend to be made from pressure treated timber, which is far more long-lasting.

Timbers (Core)

Wood joining

Joining similar or different woods can be done in a temporary or permanent way. Temporary methods include screws and nuts and bolts, permanent methods include wood joints and adhesives like PVA (Polyvinyl acetate), epoxy resins and contact adhesives.

Joints

There are two categories of joints:

Box joints

Butt – a simple (but weak) join where the edges of the two pieces are glued together.

Housing – one edge slots into a groove or slot cut in the other.

Lap – a stronger joint where one piece fits into an L-shaped shoulder cut in the other.

Dovetail – very strong and looks good. A flared 'finger' fits into the same shape removed from the other piece. This is complex to achieve.

Comb – also known as a finger joint, where straight lengths on one piece slot into gaps on the other piece.

Frame joints

Dowel – a short length of round board inserted into holes in both pieces to reinforce joints.

Mortise and tenon – a very strong joint, a square 'lug' slots into a square channel and is glued.

Mitre – two 45-degree angle cuts are made to form a 90-degree angle corner.

Bridle – like a mortise and tenon joint but cut into the full width of the board.

Knockdown (KD) fittings

Standard components that are used to assemble products also come in standard forms and sizes. These include:

- screws
- nails
- nuts and bolts
- hinges
- handles
- cam lock fittings
- corner blocks
- brackets
- scan fittings
- dowels.

Screws come with different types of heads. They can be flat or round headed, with slots, crosses or square holes for different screwdriver fittings. Threads on screws vary; woodscrew threads tend to be wider than on a self-tapping screw. Machine threads are also available e.g. M3, M4, M5 etc, which are fine standard threads.

Marking out – this is a process where the required shape is marked onto the stock material. There are many tools to help mark out accurately, including a try square, tape measure, or steel rule. Materials need to be **held** or **clamped** before being cut. This could be done using a vice or clamp. **Cutting** can occur using a hand tool like a coping saw, tenon saw or hacksaw, or using machinery such as a bandsaw.

Drilling is a process used when a hole is required in a material. Drilling can be done using a **hand drill**, or **drill press/pillar drill**. **Jigs and formers** can help ensure that holes are drilled in the correct positions.

Pilot hole – a small diameter hole to guide a screw, preventing splitting.

Clearance hole – a hole large enough for a screw to fit through without the thread engaging.

Countersunk hole – the top surface of the hole is flared to receive the screwhead flush.

Counterbore hole – a flat-bottomed hole that enlarges another hole.

Calculating costs

When estimating price costs, designers and manufacturers must consider:

- the design
- the features included in the product
- the processes used to manufacture the product.

Computer aided manufacture (CAM)

CAM machines can be used to create features that allow parts to be joined to another part.

The benefit of the CAM machine is that all cuts will be accurate and exact. Laser cutters can be used to cut a variety of materials, although the correct settings are essential to avoid burning.

CAM machines can also be used to engrave materials and mark out where holes, joints and other fixings may fit.