

Production processes

Moulding – is a process involving shaping a liquid or malleable raw material using a frame, mould, former or cavity.

Extrusion – is a process used to create objects with a fixed cross-sectional shape. A hot or cold material can be pushed through a die to create complex shapes that are consistent in length.

Laminating – is a technique of manufacturing materials in multiple layers. This can create a composite material, improving strength, stability, appearance or other properties.

Milling – is a process of using rotary cutters to remove material from a workpiece. This can be done using hand or cnc input, and angles and directions of movement can vary.

Turning – involves rotating a workpiece and using a cutting tool to remove material, generally in cylindrical form. CNC lathes rely on CAD, and both wood turning lathes and metal lathes are common.

Casting – is a process where a liquid is poured into a mould or hollow cavity of the desired shape which then cools to solidify. This is then ejected or removed. Pewter casting and aluminium sand casting are done in schools.

Stamping – (also known as pressing), involves placing a flat sheet metal into a press and using a tool or die to punch, blank or remove the shape ready for further processing.

Forming – is where mechanical deformation changes the shape of a material. The shape of the material is permanently deformed without adding or removing any material. Vacuum forming is popular with a thermoplastic sheet deforming process in school settings.

Manufacturing with polymers

Injection moulding is a production process employed during the mass production or continuous flow production of parts or components made from polymers. Granular form pellets are fed into a hopper, and gravity is fed into a heater where they become molten. The molten plastic is injected into the mould cavity under pressure, until the cavity is filled. This is then cooled and ejected or removed from the mould and the process is repeated for identical items. This is a low waste and efficient system, but quite energy reliant.

Blow moulding is another popular polymer-based manufacturing process. A heater polymer tube is placed inside a cavity or mould and inflated to take the shape of the chamber, at the same time creating a hollow form with a thin wall. This is how most plastic bottles are made, again in volume using mass or continuous production systems.

Composting, combining and reforming

Composting is manufacturing by decomposing organic materials into simpler organic and inorganic compounds by the microorganisms in a process called composting.

Combining, mixing or adding materials to others can often provide opportunities for improved products.

Reforming is when materials are heated and their shape is altered.

Using jigs and fixtures during production

A jig is a device used to guide a tool to a specific position on a workpiece. Jigs can be used for drilling, cutting or joining, and will ensure accuracy and precision every time. Jigs help speed up the making process and can eliminate errors ensuring every operation is repeated exactly the same.

A fixture is a tool which holds the workpiece to a machine bed, which will allow a cutting or shaping operation to occur without the need to measure, mark or move the workpiece. The fixture can be used repeatedly to produce the same result with different workpieces.

Prototyping before full scale production

A pre-production prototype is a final version of a product or concept used for advanced testing, allowing designers, manufacturers and users to validate the final product. It also allows stakeholders to test the user experience and evaluate its performance prior to launching full scale production.

Tooling up a production line is expensive, especially if mass production or continuous flow production scales of manufacture are to be employed where computers and automation will be required. Any flaws in the design need to be corrected prior to starting production to avoid faulty products and recalls, which disappoints the end user.