

N4 N5

Design and Manufacture

Commercial Manufacturing

Name: Class:..... Teacher:.....

What is Commercial Manufacturing?

The term commercial manufacturing means the manufacturing, assembly and finishing processes that are used to make commercial products or their components. There are four types of commercial manufacture:

•**One-off manufacture** - This is when only one product is manufactured at a particular time. This one off product could be a prototype a one off object or a hand made object. Prototypes are made to see if a product works before it goes into large scale production. One off production takes a long time and often means it is expensive. A classic product could be a mobile phone prototype, a one off specialist product, handmade items, etc.

•**Batch manufacture** - This is when a series of products which are all identical are made jointly in either large or small numbers. Once these have products have been made more of the same products may be made using the same equipment. This equipment includes tools, moulds, machinery and labour. A classic product could be chairs, electrical products, etc.

•**Mass manufacture** - involves the product going through many stages of a production line. There are workers and machines at certain stages along the line that are responsible for making certain parts of the product. This means the product is often made over days or even weeks depending how complicated it is. This product is often quite reasonably priced due to the large scale production techniques used. However if a problem occurs it will stop the whole line of production. A classic product could be a car. The technique was first implemented by US automobile pioneer Henry Ford in 1908, for the manufacture of the Model T Ford automobile.

•**Continuous manufacture** - This is where a product is continuously produced over a period of hours, days, weeks or even years. This kind of production means the product will often be quite reasonably priced with many thousands being produced every hour. A classic product could be screws, bottles, food products, etc

Computer Aided Manufacture

Computer-aided manufacturing (CAM) means using machines that are controlled by computers. CAM is widely used across all sectors of industry, not just electronics.

All machines in CAM use computer numerical control (CNC): strings of numbers control the machine. The numbers provide all the commands needed: eg which direction to move, how fast, etc. These are normally stored in the machine as a program

The **advantages/benefits** of CAM are:

- speed**: CAM is faster than manual manufacture because machining speeds are higher therefore products are manufactured more quickly.
- greater accuracy**
- greater consistency**: every finished product is the same
- efficiency**: production can run 24 hours a day, 7 days a week
- sophistication**: CAM is able to machine difficult shapes with a high level of detail.
- cost**: due to the speed and high volumes of production, costs are reduced.

CAM is extremely quick, compared to traditional methods, and gives high quality products. It can also eliminate human error in manufacturing, reducing waste and assuring quality. The set up costs of CAM are expensive. However, the cost per product is low when thousands or millions of products are produced.

The **disadvantages/drawbacks** of CAM are:

- Machinery, maintenance and tooling costs are high.
- Machine breakdowns can lead to production stopping.

Commercial Manufacturing Processes- Plastics

The following are plastic commercial manufacturing processes which you will be required to have a knowledge of.

- Vacuum forming
- Injection Moulding
- Rotation Moulding

Vacuum forming ([You Tube Video Link](#))

In Vacuum Forming, a sheet of thermoplastic is held in a clamp and is heated until it is soft and flexible. Air is sucked out from underneath the sheet so that air pressure pulls the sheet down onto a specially made mould. This process enables thermoplastics to be formed into complicated shapes such as packaging, storage trays and seed trays.

Injection Moulding ([You Tube Video Link](#))

Injection Moulding is a process which allows large quantities of plastic components to be made quickly. Thermoplastic granules are heated until they soften. Then the material is forced under pressure into a mould. When cooled, the mould is opened and a component, which is the exact shape of the cavity is taken out. Injection Moulding is one of the most important industrial processes in the mass production of plastic goods. The cost of producing the moulds can be very high, therefore it is necessary to manufacture and sell large quantities of the product being manufactured to recover costs.

Rotational Moulding ([You Tube Video Link](#))

Rotational moulding is a method of creating medium to large sized hollow components from plastics. It involves melting plastic inside a closed mould which is rotated so the plastic coats the inside of mould. The plastic is then cooled and solidifies in the shape of the mould.

Commercial Manufacturing Processes- Metal

The following are metal commercial manufacturing processes which you will be required to have a knowledge of.

- Sand Casting
- Die-Casting

Sand Casting ([You Tube Video Link](#))

Sand casting is the process of making metal shapes (components) using pre-shaped objects and sand. A typical example of an object which has been cast is the Engineers vice which can be found on the workbench. This tool will have been cast in two separate castings. The bottom part of the casting unit which is called a **DRAG** because of the fact that the **PATTERN** is dragged from the sand. The top half of the casting unit is called the **COPE**.

Very complex shapes can be made using sand casting, but it is only economical if manufacturing a small quantity of parts.

Die Casting ([You Tube Video Link](#))

This process is the equivalent of the plastic process of 'injection moulding', where molten material is forced into a mould (die) to cool and set. The dies used are made of special alloy steel and are very expensive to produce, being made in sections for easy removal of the components. The high operating costs make this process viable for high-volume production or 'mass production' where accuracy of shape, size and surface finish is essential.

Die casting produces products with a complex shape. The tell tale signs of an item being die cast are the ejector pin marks on the surface of the product.

Commercial Manufacturing Processes- Wood

The following is the commercial manufacturing process which you will be required to have a knowledge of.

- CNC Router

CNC Router ([You Tube Video Link](#))

CNC router (Computer Numerical Control router) is a computer-controlled cutting machine related to the hand held router used for cutting various hard materials, such as wood, composites, aluminium, steel, plastics, and foams. CNC stands for *computer numerical control*. CNC routers can perform the tasks of many carpentry shop machines such as the panel saw, the spindle moulder, and the boring machine. They can also cut mortises and tenons.

A CNC router is very similar in concept to a CNC milling machine. Instead of routing by hand, tool paths are controlled via computer numerical control. The CNC router is one of many kinds of tools that have CNC variants.

A CNC router typically produces consistent and high-quality work and improves factory productivity. Unlike a jig router, the CNC router can produce a one-off as effectively as repeated identical production. Automation and precision are the key benefits of cnc router tables.

Drawing of a Tabletop DIY - CNC router. Silver: Iron, Red: Stepper Motors, Light Brown: MDF, Dark Brown: Hard Wood

A CNC router can reduce waste, frequency of errors, and the time the finished product takes to get to market