

## CASTING IN METAL

Casting is a method of shaping metal into simple or complicated shapes without producing any waste. Removed metal can be re-melted and used again.

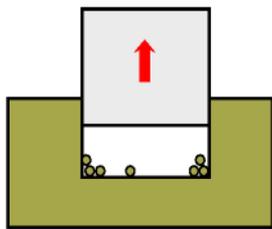
### Sand Casting

The oldest form of casting involves pouring molten metal into a shaped hole made in damp sand and letting it cool. This is the form of casting that can be done in school using low melting point metals, such as the aluminium alloy (LM4).

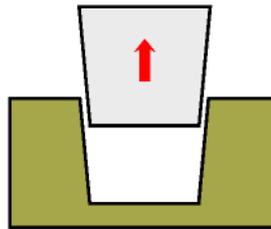
### Stages in Sand Casting

**1. Making the Pattern** The pattern is the shape to be cast, made in **wood**. It is this that is used to make the correct shape of hole in the sand. The pattern should be tapered so that it can be taken out of the sand without dislodging any sand grains. The taper is known as the **Draft**.

Pattern without draft being removed. It dislodges grains of sand into the mould as it rubs the sides.

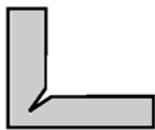


Pattern with draft being removed without touching the sides. The mould remains clear.

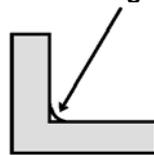


Internal corners need to have a **fillet** to stop cracks appearing during cooling.

A crack in a non filleted corner



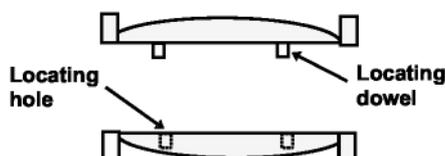
A fillet - plastic or plaster rounded filling



A pattern that because of its shape would dislodge sand when it was removed needs to be split into two or more sections.

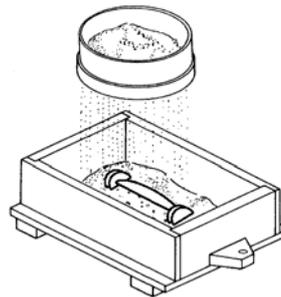
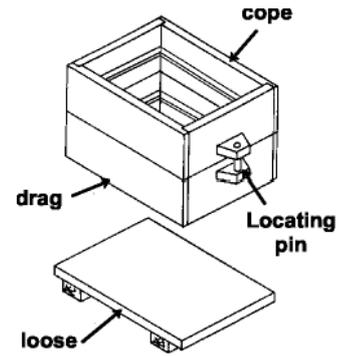
Pattern split in half with locating dowels and holes to keep the halves in line.

Pattern for cast handle



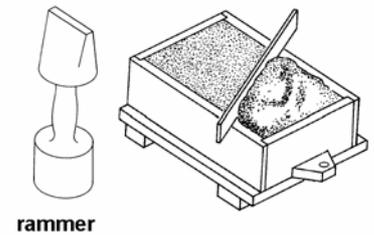
**2. Moulding** Moulding is the process of creating the hollow shape in sand.

The diagram shows the moulding box. It is in two halves; the top is called the **cope** and the bottom the **drag**. Neither has a base. They are located together by a pin and hole system at each end. On the inside of the sides is a recess to help hold the sand in place.

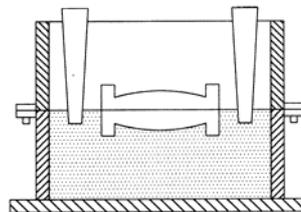


**A)** The drag is turned upside down and put on the base board. The pattern is placed in the middle. Moulding sand, made damp with oil or water, is sieved over the pattern until the pattern is covered.

**B)** The rest of the sand is shovelled in and then rammed with a rammer until it is packed tightly. The surface is then levelled by scraping a metal strip across (strickling).



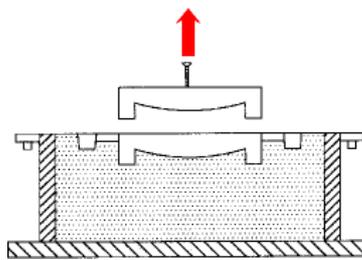
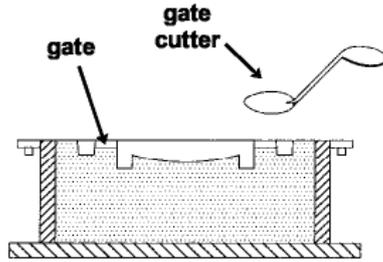
**C)** The drag is turned the right way up and the cope is then placed on top. The top half of the pattern is added and also the sprue pins are positioned. Sand is then added and rammed to fill the cope.



A **sprue pin** is a cone shape, made from wood that is used to create holes in the sand that will allow the molten metal to be poured into the mould and the excess metal to rise to the top. The holes are called **sprues**.

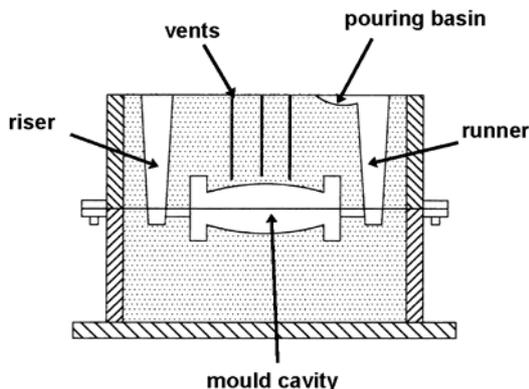
**D)** The cope is now lifted off and the top half of the pattern and the sprue pins are removed.

Channels called **gates** are cut between the sprue pin holes and the pattern to allow the molten metal to flow into the mould cavity.



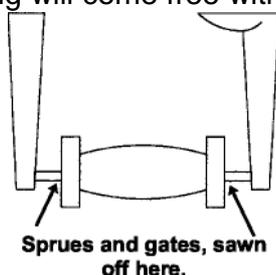
**E)** A wood screw is screwed into the pattern and it is tapped from side to side to release the pattern from the sides of the sand mould. The pattern is then carefully lifted vertically from the mould.

**F)** The cope is placed back on the drag. A hollow basin shape (pouring basin) is cut into the sprue hole that the metal will flow into (runner). A thin metal rod is pushed into the sand to create narrow holes that will allow air to escape when the metal is poured.



**3. Pouring** The mould is now ready for pouring. **This must be carried out by a teacher.** Molten metal is slowly poured into the pouring basin, the basin will overflow into the runner. The metal will then flow into the mould. Trapped air can escape up the riser or through the sand above the pattern into the vent holes. The metal should be poured until it fills the riser.

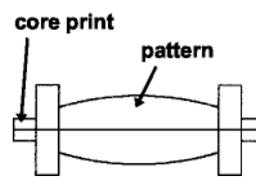
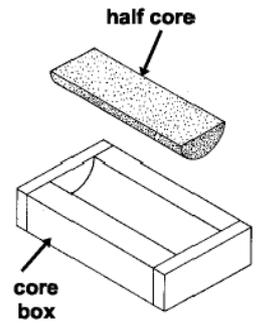
When the metal is cooled and solidified the mould can be broken open. The casting will come free with its gates and sprues attached, these will have to be removed by sawing them off and filing down the stumps. The sprues can be remelted.



**Cores**

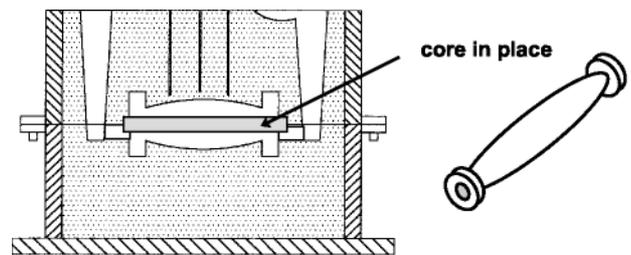
If the handle needs a hole through it so that it can swivel or slide on a bar, it can be cast with the hole in place. To have a hole in a casting a **core** needs to be used.

For a split pattern, the core needs to split as well. The core is a cylindrical shape made from sand mixed with a binder and baked in the core box. This makes it rigid so it will not break under its own weight.



The pattern needs to be altered to include extensions called core prints. These leave a depression in the sand to hold the core in place.

The core is placed in the core prints in the mould cavity. The molten metal will flow around the core.



When the casting has cooled, the core is rammed out of it with a steel rod. This leaves a hole through the centre.

**KEY WORDS** Pattern: Mould: Draft: Fillet: Sprue: Gate:

1. Explain why 'draft' is required on the sides of a pattern.
  2. What is a 'fillet' in casting and why should it be used?
  3. Why are some patterns split and how are the two halves held in place?
  4. Why is the moulding box made in two halves?
  5. Explain the mould making process using notes and diagrams.
  6. What is the purpose of the vents in a mould?
  7. What has to be done to the casting after its removal from the mould before it can be used?
  8. What is a core used for when casting?
  9. How does the pattern have to be altered if a core is required?
  10. How is a core held in place in the mould cavity?
- A** Name **five** items or parts that can be found at home or on a car or cycle, that would be made by casting.