SAWA UNIVERSITY
Technical Engineering College
Air Conditioning and Refrigeration Engineering Department

First stage

First semester

Workshops

Metal casting processes

Lecture: 2

Dr. Saleh Al-Absi

Steps in making sand castings

The six basic steps in making sand castings are:
(i) Pattern making, (ii) Core making, (iii) Moulding, (iv) Melting and pouring, (v) Cleaning

(i) Pattern making –

Pattern: Replica of the part to be cast and is used to prepare the mould cavity. It is the physical model of the casting used to make the mould. Made of either wood or metal.

-The mould is made by packing some readily formed aggregate material, such as moulding sand, surrounding the pattern. When the pattern is withdrawn, its imprint provides the mould cavity. This cavity is filled with metal to become the casting.

- If the casting is to be hollow, additional patterns called ‘cores’, are used to form these cavities.

(ii) Core making

Cores are placed into a mould cavity to form the interior surfaces of castings. Thus the void space is filled with molten metal and eventually becomes the casting.

(iii) Moulding

Moulding is nothing but the mould preparation activities for receiving molten metal. Moulding usually involves:

(i) preparing the consolidated sand mould around a pattern held within a supporting metal frame.

(ii) (ii) removing the pattern to leave the mould cavity with cores. Mould cavity is the primary cavity.

The mould cavity contains the liquid metal and it acts as a negative of the desired product.

The mould also contains secondary cavities for pouring and channeling the liquid material in to the primary cavity and will act a reservoir, if required.

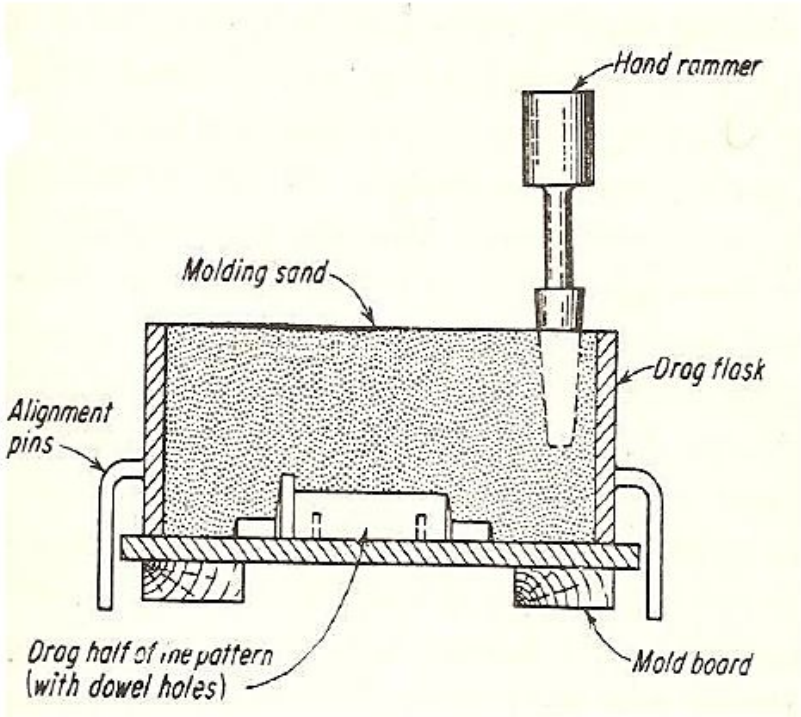
(iv) Melting and Pouring

The preparation of molten metal for casting is referred to simply as melting. The molten metal is transferred to the pouring area where the moulds are filled.

(v) Cleaning

Cleaning involves removal of sand, scale, and excess metal from the casting. Burned-on sand and scale are removed to improved the surface appearance of the casting. Excess metal, in the form of fins, wires, parting line fins, and gates, is removed. Inspection of the casting for defects and general quality is performed.

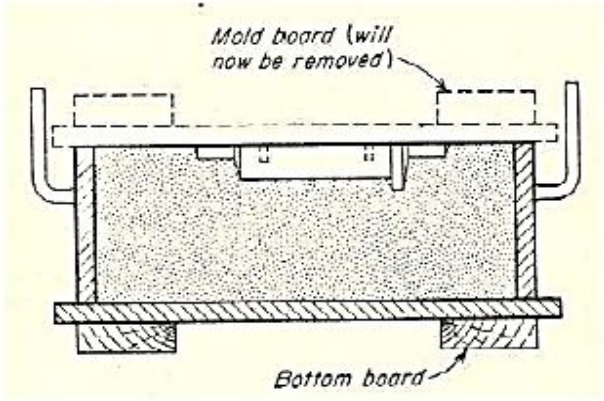
Making a simple sand mould

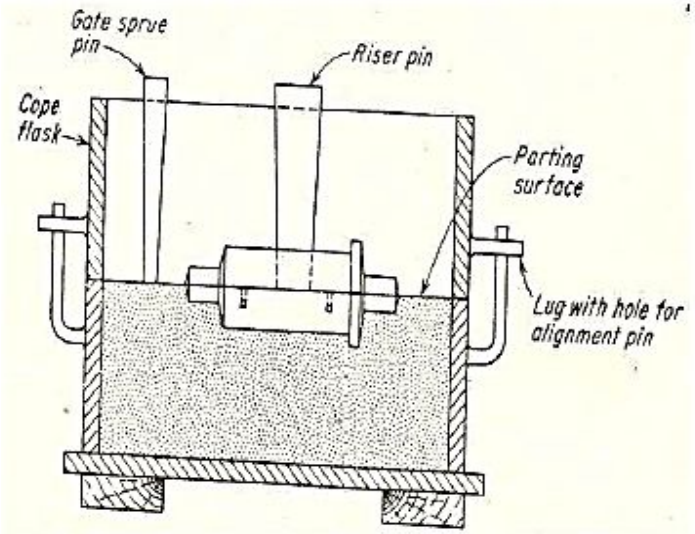


1) The drag flask is placed on the board
2) Dry facing sand is sprinkled over the board
3) Drag half of the pattern is located on the mould board. Dry facing sand will provide a non-sticky layer.
4) Molding sand is then poured in to cover the pattern with the fingers and then the drag is filled completely
5) Sand is then tightly packed in the drag by means of hand rammers. Peen hammers (used first close to drag pattern) and butt hammers (used for surface ramming) are used.

6) The ramming must be proper i.e. it must neither be too hard or soft. Too soft ramming will generate weak mould and imprint of the pattern will not be good. Too hard ramming will not allow gases/air to escape and hence bubbles are created in casting resulting in defects called ‘blows’. Moreover, the making of runners and gates will be difficult.
7) After the ramming is finished, the excess sand is leveled/removed with a straight bar known as strike rod.

Making a simple sand mould





8) Vent holes are made in the drag to the full depth of the flask as well as to the pattern to facilitate the removal of gases during pouring and solidification. Done by vent rod.

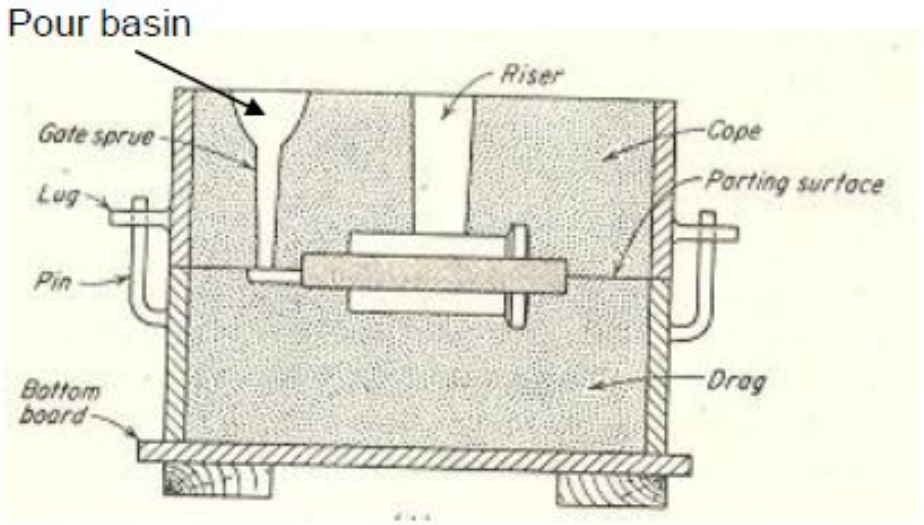
9) The finished drag flask is now made upside down exposing the pattern.

10) Cope half of the pattern is then placed on the drag pattern using locating pins. The cope flask is also located with the help of pins. The dry parting sand is sprinkled all over the drag surface and on the pattern.

11) A sprue pin for making the sprue passage is located at some distance from the pattern edge. Riser pin is placed at an appropriate place.

12) Filling, ramming and venting of the cope is done in the same manner.

Making a simple sand mould



13) The sprue and riser are removed and a pouring basin is made at the top to pour the liquid metal.

14) Pattern from the cope and drag is removed.

15) Runners and gates are made by cutting the parting surface with a gate cutter. A gate cutter is a piece of sheet metal bent to the desired radius.

16) The core for making a central hole is now placed into the mould cavity in the drag. Rests in core prints.

17) Mould is now assembled and ready for pouring.

Pattern

The pattern and the part to be made are not same. They differ in the following aspects.

1.A pattern is always made larger than the final part to be made. The excess dimension is known as Pattern allowance.

Pattern allowance => shrinkage allowance, machining allowance.

2.Shrinkage allowance: will take care of contractions of a casting which occurs as the metal cools to room temperature.

Liquid Shrinkage: Reduction in volume when the metal changes from liquid state to solid state. Riser which feed the liquid metal to the casting is provided in the mould to compensate for this. **Solid Shrinkage:** Reduction in volume caused when metal looses temperature in solid state. Shrinkage allowance is provided on the patterns to account for this.

Shrink rule is used to compensate solid shrinkage depending on the material contraction rate.

Cast iron: One foot (=12 inches) on the **1/8-in-per-foot shrink rule** actually measures 12-1/8 inches.

So, **4 inch** will be **4-1/24 inch** for considering shrinkage allowance.

Shrink rule for other materials

Material	Dimension	Shrinkage allowance (inch/ft)
Grey Cast Iron	Up to 2 feet	0.125
	2 feet to 4 feet	0.105
	over 4 feet	0.083
Cast Steel	Up to 2 feet	0.251
	2 feet to 6 feet	0.191
	over 6 feet	0.155
Aluminum	Up to 4 feet	0.155
	4 feet to 6 feet	0.143
	over 6 feet	0.125
Magnesium	Up to 4 feet	0.173
	Over 4 feet	0.155