

Metal casting

①

The metal casting industry plays a key role in all the major sectors of our economy. These are castings in locomotives, lorries, aircraft, office buildings, factories & homes.

Metal casting is one of the oldest materials shaping methods known. Casting means pouring molten metal into mold with a cavity of the shape to be made, and allowing it to solidify. When solidified, the desired metal object is taken out from the mold either by breaking it or taking the mold part. The solidified object is called Casting.

Advantages:-

- ① Molten material can flow into very small sections so that intricate shapes can be made by this process. As a result, many other operations such as machining, forging & welding can be minimized or eliminated.
- ② It is possible to cast practically any material that is ferrous or non-ferrous.

- As the metal can be placed exactly where it is required, large saving in weight can be achieved.
- ④ The necessary tools required for casting moulds are very simple and inexpensive. As a result, for production of small lot, it is the ideal process.
- ⑤ There are certain parts made from metals and alloys that can be produced only this way.
- ⑥ Size & weight of the product is not a limitation for casting process.

Limitations:-

- ① Dimensional accuracy and surface finish of the castings made by sand casting process are a limitation to this technique. Many new castings have been developed to overcome this such as die casting, investment casting, vacuum sealed molding process and shell molding process.
- ② The metal casting process is a labour intensive process.

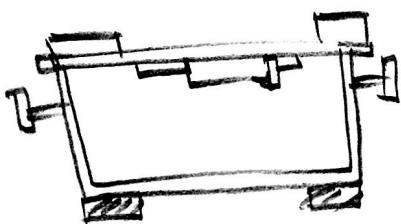
casting terms :-

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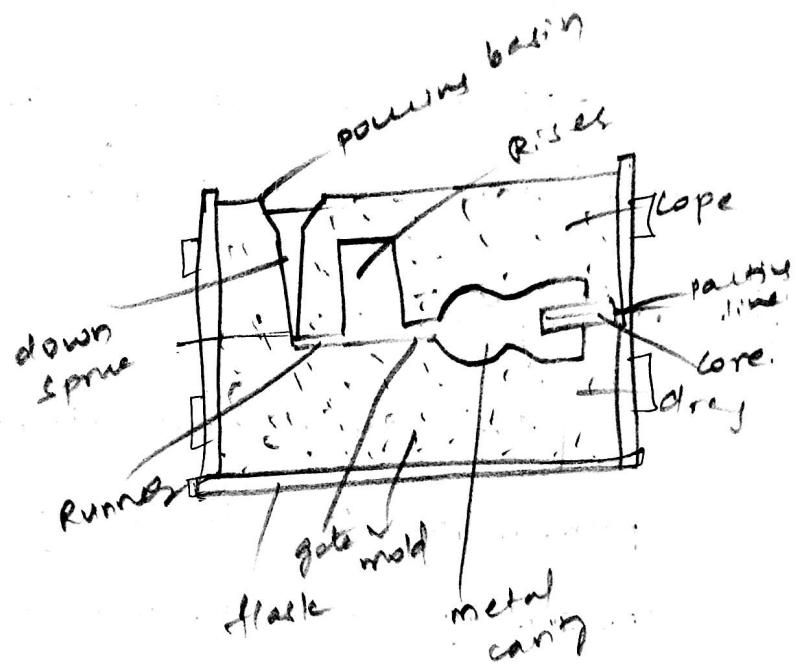


ready for
Roll over

drag completed



after roll over



① flask :-

A metal or wooden frame without traced top or bottom, in which the mold is formed. depending upon the position of the flask in the molding structure, it is metered by various names such as drag - lower molding flask, cope - upper molding flask, cheek - Intermediate molding flask used in three piece molding.

(2)

pattern :-

It is the replica of the object to be made. The mold cavity is made with the help of pattern.

(3)

parting line :

This is the dividing line between 2 molding flasks that makes up the mold.

(4)

Molding sand :

Sand which binds strongly without losing its permeability to air or gases. It is a mixture of Silicasand, clay, and moisture in appropriate proportions.

(5)

facing sand :-

The small amount of carbonaceous material sprinkled on the inner surface of the mold cavity to give a better surface finish to the castings.

(6)

core :-

A separate part of the mold, made of sand and generally baked, which is used to create openings and various shaped cavities in the castings.

winging basin:

A small tunnel shaped cavity at the top of the mold into which the molten metal is poured.

(8)

Sprue:

The passage through which molten metal, from the pouring basin reaches the mold cavity in may cases + controls the flow of metal into the mold.

(9)

Runner:-

The passage through which the molten metal is carried out from sprue to the gate.

(10)

Gate:

A channel through which the molten metal enters the mold cavity.

(11)

Chaplets:

Chaplets are used to support the core inside the mold cavity to take care of its own weight and overcome the metallostatic force.

(2)

(12)

Riser!

A column of molten metal placed in the mold to feed the casting as it shrinks and solidifies.

Also known as feed head.

(13)

Vent!

Small opening in the mold to facilitate escape of air and gases.

Steps in making land castings!-

1. pattern making

2. core making

3. Molding

4. Melting and pouring

5. cleaning

Pattern making!-

The pattern is a physical model of the casting used to make the mold. The mold is made by packing some readily formed aggregate material

(A)

as molding sand, around the pattern, when the pattern is withdrawn, its imprint provides the mold cavity which is ultimately filled with metal to become the casting. If the casting is to be hollow as in case of pipe fittings, additional patterns referred to as cores, are used to form these cavities.

Core making :-

Cores are formed, usually made of sand, which are placed into a mold cavity to form the interior surface of casting. Thus the void space between core and mold cavity surface is what eventually becomes the casting.

Molding :-

Molding consists of all the operations necessary to prepare a mold for receiving molten metal. Molding usually involves placing a molding aggregate around a pattern held with a supporting frame, withdrawing the pattern to leave the mold cavity

Setting the cores in the mold cavity and finishing and closing the mold.

Melting and pouring:

The preparation of molten metal for casting is referred simply as melting. Melting is usually done with specifically designated area of foundry, and the molding sand is transferred to the pouring basin where the molds are filled.

Cleaning:

Cleaning refers to the operations necessary to the removal of sand, scale and excess metal from the casting. Burned on sand and scale are removed to improve the surface appearance of the casting. Excess metal in the form of fins, wires, parting lines, and gates is removed. Inspection of the casting for defects and general quality is performed.

(5)

allowances :-

- ① shrinkage or contract allowance
- ② Draft or taper allowance
- ③ machining or finish allowance
- ④ Distortion or packing allowance
- ⑤ Rapping allowance

types of pattern

- ① single piece pattern
- ② split or two piece pattern
- ③ Match plate pattern

strength of the sand that is required to hold the shape of the cavity.

Collapsability :-

Should be collapseable, cheap, reusable, good &.

Molding sand composition :-

Bare sand

Silice sand - cheap.

Iron sand

Co

chromite sand

Olivine sand

Binder

(i) clay binder

(ii) organic binder

(iii) inorganic binder

Moisture :-

Clay acquires it's bonding action only in the presence of moisture.

This helps in forming clay flakker.

Clay flakker improves plasticity

Bentonite

absorbs more water & increases absorbing power!

Dry sand molding :-

① Skin drying

② complete mold drying

Permanent mold process (or) gravity die casting

for large scale production, making a mold for every casting to be produced may be difficult and expensive. therefore a permanent mold called die may be made from which a large number of castings can be produced. The molds are usually made of cast iron or steel although graphite & aluminum have been used as mold materials. The process in which we use a die to make the castings is called permanent mold casting (or) gravity die casting. Since the metal enters the mold under gravity some time in die casting we inject the molten metal with a high pressure. When we apply pressure it is called as pressure die casting.

Advantages:-

- ① sound dense casting with superior mechanical properties
- ② castings produced are quite uniform in shape have a higher degree of dimensional accuracy than castings produced in sand.
- ③ good quality of finish

Disadvantages :-

① Cost of tooling is higher than sand casting.

②

Centrifugal Casting :-

In this process, the mold is rotated rapidly about its central axis as the metal is poured into it. Because of the centrifugal force, a continuous pressure force will be acting on the metal as it solidifies. The slag, oxides and other inclusions are lighter get separated from the metal and segregate towards the centre. This process is normally used for making of hollow pipes, tubes, which are asymmetric with a concentric hole.

The mold can be rotated about vertical, horizontal or inclined axis or about its horizontal & vertical axis simultaneously. The length & outside diameter are fixed by the mold cavity dimensions while the inside diameter is determined by the amount of molten metal poured into it.

Advantages :-

① formation of hollow interiors in cylinder without cores.

- (9) less material required for gate
- (1) fine grained structure at the outer surface of the casting free of gas and shrinkage cavities and porosity

Disadvantages:-

- (1) More segregation of alloy component during pouring under the force of rotation
- (2) contamination of internal surface of casting with non-metallic inclusions
- (3) Inaccurate internal diameter