Unit 4: 1 NOTES (Foundry & Casting)

Foundry & Casting: Introduction to foundry, Steps involved in making a casting. Patterns and Types of patterns, Pattern allowances. Gating system Types of casting processes

CASTING

It is a manufacturing process by which a liquid material is usually poured into a a cavity called mould. The molten metal is then allowed to solidify. The solidified part is known as a casting. The casting is ejected or broken out of the mould to complete the process. Casting is most often used for making complex shapes that would be otherwise difficult or uneconomical to make by other methods.

Sand casting process consists of the following steps;

i. Placing a pattern in sand to make a cavity or mould.
ii. Incorporating a gating system.
iii. Filling the cavity or mould with molten metal
iv. Allowing the metal to cool until it solidifies
v. Breaking the sand mould and removing the casting

Importance of sand casting

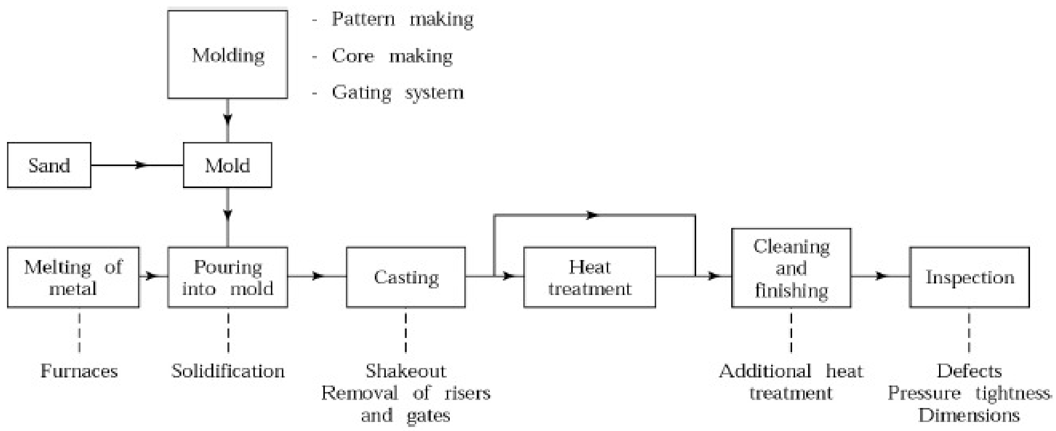
i. Complex shapes can be produced.
ii. Minimal directional properties are obtained.
iii. Hollow sections can be produced.
iv. Very large part can be produced.
v. Metals that are very difficult to machine can be used to produce an object.

Metals that can be casted are; Iron, steel, Al, brass, bronze, Magnesium etc.

Various casting processes are;

i. Sand casting
ii. Die Casting
iii. Centrifugal Casting
iv. Shell-Mould Casting
v. Investment Casting
vi. Permanent-Mould Casting etc.

Sand Casting Steps



TYPES OF MOULDING SAND

The various types of moulding sand are

1. Green sand
2. Dry sand
3. Loam sand
4. Parting sand
5. Facing sand
6. Backing sand
7. System sand
8. Core sand

1. Green Sand

- It is a mixture of silica sand and clay. It constitutes 18 % to 30 % clay and 6 % to 8 % water.
- It is slightly wet when squeezed with hand. It has the ability to retain the shape and impression given to it under pressure.
- It is easily available and has low cost.
- The mould which is prepared in this sand is called green sand mould.
- It is commonly used for producing ferrous and non-ferrous castings

2. Dry Sand

- After making the mould in green sand, when it is dried or baked is called dry sand.
- It is suitable for making large castings.
- The moulds which is prepared in dry sand is known as dry sand moulds.
- If we talk about the physical composition of the dry sand, than it is same as that of the green sand except water.

3. Loam Sand

- It is a type of moulding sand in which 50 % of clay is present.
- It is mixture of sand and clay and water is present in such a quantity, to make it a thin plastic paste.
- In loam moulding patterns are not used.
- It is used to produce large casting.

4. Parting Sand

- Parting sand is used to prevent the sticking of green sand to the pattern and also to allow the sand on the parting surface of the cope and drag to separate without clinging.
- It serves the same purpose as of parting dust.
- It is clean clay free silica sand.

5. Facing Sand

- The face of the mould is formed by facing sand.
- It is used directly next to the surface of the pattern and it comes in direct contact with the molten metal, when the molten metal is poured into the mould.
- It possesses high strength and refractoriness as it comes in contact with the molten metal.
- It is made of clay and silica sand without addition of any used sand.

6. Backing Sand

- Backing sand or flour sand is used to back up facing sand.
- Old and repeatedly used moulding sand is used for the backing purpose.
- It is also sometimes called black sand because of the addition of coal dust and burning when it comes in contact with the molten metal.

7. Core Sand

- The sand which is used to make core is called core sand.
- It is also called as oil sand.
- It is a mixture of silica sand and core oil. Core oil is mixture of linseed oil, resin, light mineral oil and other binding materials.
- For the sake of economy, pitch or flours and water may be used in making of large cores.

PROPERTIES OF MOULDING SAND

The basic properties required in the moulding sand are

1. Adhesiveness
2. Cohesiveness
3. Collapsibility
4. Flowability or plasticity
5. Permeability or porosity
6. Refractoriness

Unit 4: 1 NOTES (Foundry & Casting)

1. Adhesiveness: It is a property of moulding sand due to which it adhere or cling to the another body i.e. sides of the moulding box.

2. Cohesiveness: It is property of moulding sand due to the sand particles sticks with each other. It may be defined as the strength of the moulding sand. It may be of three types i.e. green strength, dry strength and hot strength.

3. Collapsibility: It is the property of the moulding sand due to which the sand mould breaks (collapse) automatically (or with less forces) after the solidification of the casting occurs. This property is highly required in cores.

4. Flowability or plasticity

It is the ability of the moulding sand to get compacted to a uniform density. It will flow uniformly to all portions of pattern when rammed and distribute the ramming pressure evenly all around in all directions. Generally, flowability or plasticity increases with decrease in green strength and vice versa. Flowability increases with decrease in grain size of sand. The flowability also varies with moisture and clay content in sand.

5. Permeability or porosity

Permeability is also termed as porosity of the moulding sand. It is the property of the sand due to which it allow the escape of any air, gases or moisture present or generated in the mould when the molten metal is poured into it. All these gaseous generated during pouring and solidification process must escape otherwise the casting becomes defective. The extent of ramming of the sand directly affects the permeability of the mould. Permeability of mould can be further increased by venting using vent rods.

6. Refractoriness

It is defined as the ability of moulding sand to withstand high temperature of the molten metal without breaking down. It is a highly important characteristic of moulding sands. Refractoriness can only be increased to a limited extent. Moulding sand with poor refractoriness may burn on to the casting surface and hence smooth casting surface can not be obtained.

MOULDING PROCESSES

1.**Bench moulding**: It is for small work, done on a bench of a height convenient to the moulder.

2. Floor moulding: When castings increase in size, with resultant difficulty in handling, the work is done on the foundry floor. This type of moulding is used for practically all medium and large size castings.

3. Pit moulding: Extremely large castings are frequently moulded in a pit instead of a flask. The pit acts as the drag part of the flask and a separate cope is used above it. They sides of the pit are brick kind, and on the bottom there.

4. Machine moulding: Machines have been developed to do a number of operations that the moulder ordinarily does by hand. ramming the sand, forming the gate and drawing the pattern can be done by these machines.

Desirable characteristics of Moulds

- The mould must be strong enough to hold the weight of the metal.
- The mould must resist the erosive action of the rapidly flowing molten metal during pouring.
- The mould must generate a minimum amount of gas when filled with molten metal.
- The mould must provide enough venting so that any gases formed can pass through the body of the mould itself, rather than penetrate the metal.
- The mould must be refractory enough to withstand the high temperature of the molten metal and strip away cleanly from the casting after cooling.
- The mould must permit the casting to contract after solidification.

MAIN CONSTITUENTS OF MOULDING SAND

1. Silica sand: It is themajor portion of the moulding sand (80 % approx.) silica sand contains 80 to 90% silicon dioxide. Silica sand provides refractoriness and permeability to the moulding sand.

2.Binder: The purpose of adding a binder to the moulding sand is to impart the sufficient strength and cohesiveness. However, it produces an adverse effect on the permeability of the moulding sand. It includes; linseed oil, molasses, clay, bentonite, resins, additives like sea coal, graphite, wood flour etc.
Water: The clay content added to foundry sand will not give the required strength and bond until a suitable quantity of water is added to it. The quantity of water added to sand varies from 2 to 8%.

PREPARATION OF MOULDING SAND

It includes following;

1. **Mixing of sand**: It is the process through which required materials are added to the sand to impart the required properties.

2. **Tempering of sand**: It is the process by which adequate amount of moisture is added to moulding sand to make suitable for mould making.

3. **Sand conditioning**: It means the uniform distribution of binder around the sand grains, so that it flows readly around and takes up the details of the pattern.
Sand testing: A physical test is performed for judging the suitably of the sand for casting.

PATTERN
Pattern may be defined as a model or replica of the desired product (i.e. casting), so as to produce mould or cavity.The different types of pattern materials are discussed as under;

1. Wood: It is the most common material used for pattern making because it satisfies many of the desired requirement.
Advantages :
(i) It is cheap
(ii) It is available in abundance.
(ii) It can be easily shaped into different forms and intricate designs.
(iii) It cab be easily repaired.

Disadvantages

(i) It wears out quickly due to its low resistance to sand abrasion.
(ii) It is more affected by moisture, which may lead to its warping or splitting.
(iii) It is weaker than metallic pattern.

Metals: Metals are used as pattern material, only when the number of castings to be made is very high and a closer dimensional accuracy is desired. They have a much longer life than wooden patterns.

Disadvantages :
(i) They are costlier than wood
(ii) For giving different shapes and fine surface finish they need machining. This again adds to their cost.
(iii) A large number of them have a tendency to get rusted.

Plaster :Plaster of Paris or gypsum cement is advantageously used as a pattern material since it can be easily casted into intricate shapes and can be easily worked also.

Plastics :Plastics are gradually gaining favor as pattern materials due to their following specific characteristics :
1. Lightness in weight.
2. High strength.
3. High resistance to wear.
4. High resistance to corrosion due to moisture.

5. Fine surface finish.
6. Low solid shrinkage.
7. Very reasonable cost.

The plastics used as pattern materials are thermosetting resins. For making the pattern, first the moulds are made, usually from plaster of Paris. The resin is then poured into these moulds and the two heated. At a specific temperature, the resin solidifies to give the plastic pattern.

Wax :Wax patterns are exclusively used in investment casting. For this a die or metal mould is made in two halves into which the heated wax is poured. The die is kept cool by circulating water around it. As the wax sets on cooling, the die parts are separated and the wax pattern taken out.

Pattern allowances:

Pattern is having different size as compared to casting because it carries certain allowances due to metallurgical and mechanical reasons. These allowances are considered when a pattern is designed for casting. The types of pattern allowances are discussed as under;

Shrinkage or contraction allowance:

As metal solidifies and cools, it shrinks and contracts in size. To compensate for this, a pattern is made larger than a finished casting by means of shrinkage or contraction allowances.

Draft or taper allowance: At the time of withdrawing the pattern from the mould, the vertical faces of the pattern are in continual contact with the sand, which may damage the mould cavity. This danger is greatly reduced if the vertical surfaces of a pattern are tapered inward slightly.

Machining or Finish allowance: The material is removed from the surface of the casting to give size and surface finishing. The extra metal is called machining or finish allowance.

Distortion or camber allowance: If the shape of the casting changes that is called distortion of the casting. A casting will distort or wrap if

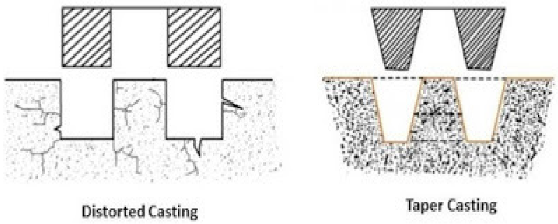
It is of irregular shape

All its parts do not shrink uniformly

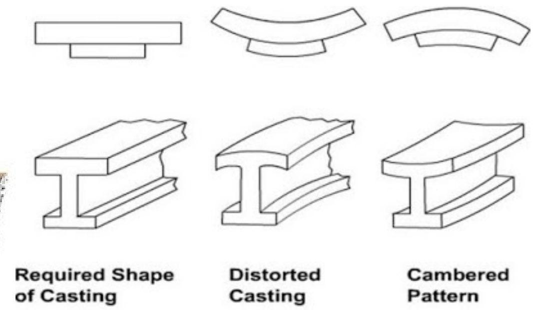
It ha long flat casting

The arms posses unequal thickness.

Shaking or rapping allowance: when a removable pattern is rapped in the mould before it is withdrawn, the cavity in the mould increases slightly. So, in order to compensate this, pattern is made slightly smaller than the actual.



Draft Allowance



Distortion Allowance

Casting defects:

- Blow holes
- Gas holes
- Seam and plate
- Misrum
- Cold shut
- Hot tear
- Shrinkage Cavities.

Blow holes: Small holes visible on the surface of the casting are called open blows where as occurring below the surface of the casting.
Causes : High moisture in sand resulting in low permeability, very hard ramming of sand and improper venting of mould.

Gas holes: These are the holes appearing on the surface when it is machined or cut into sections.
Causes: using faulty or poor quality metal, use excessive moist sand.

Cold shut: It is an interface within a casting that lacks complete fusion and is formed when two streams of liquid from two different directions come together after the leading surfaces are solidified.

Causes: Metal lacking in fluidity, too small gates, too cold molten metal.

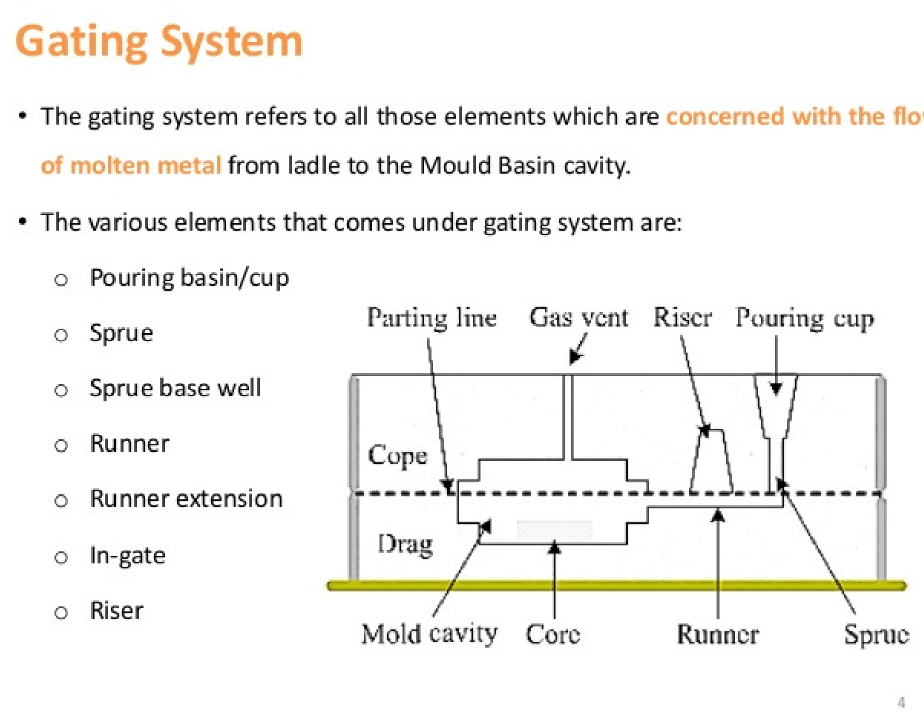
Shrinkage Cavities: An internal void in a casting from the volume contraction that occurs during solidification. It causes for any casting.

Gating System

A proper method of gating system is that it leads the pure molten metal to flow through a ladle to the casting cavity, which ensures proper and smooth filling of the cavity. It includes: pouring basin, a vertical passage known as a sprue, gate through which the metal flows from the sprue base to the mould cavity, a runner in large castings, which takes the metal from the sprue base and distributes it to several gate passage ways around the cavity.

Characteristics of good gating system:

a) Metal should enter the cavity with as little turbulence as possible at or near the bottom of the mould cavity.
b) Erosion of the passageway or cavity surfaces should be avoided by properly regulating the flow of metal.
c) Metal should enter the cavity so as to provide, directional solidification if possible. The solidification should progress from the mould surfaces to the hottest metal so that there is always hot metal available to compensate for shrinkage.
d) Clay or other foreign particles should be prevented from entering the mould cavity.
e) Skimming gates may be used to trap slag or other light particles into the second sprue hole.



The various elements of the gating system are;

Pouring basin or cup: Molten metal is poured in to a pouring basin which acts as a reservoir from which it moves smoothly in to the sprue. The pouring basin is also able to stop the slag from entering the mould cavity by means of a skimmer.

Sprue: it is the channel through which the molten metal is brought in to the parting plane where it enters the runners and then gates. Sprues are conical in shape.

Runner: It is generally located in the horizontal plane (i.e. parting plane) which connects the sprue to its gates.

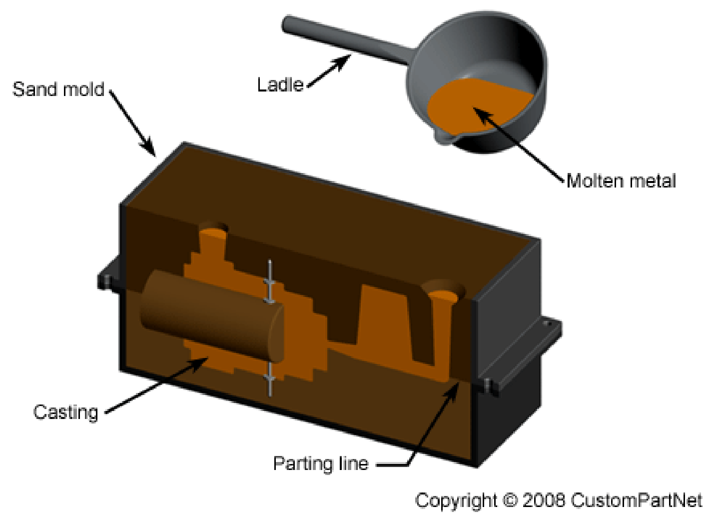
Gates: These are the openings through which the molten metal enters the mould cavity.

Riser: It acts as reservoir of the molten metal. It supply the same molten metal to the mould cavity during requirement.

Types of casting processes

SAND CASTING

Sand casting, the most widely used casting process, utilizes expendable sand moulds to form complex metal parts that can be made of nearly any alloy. It has low production rate as the mould get destroyed in order to remove the part (i,e, casting). The sand casting process involves the use of a furnace, metal, pattern, and sand mould. The metal is melted in the furnace and then poured into the cavity of the sand mould, which is formed by the pattern. The sand mould separates along a parting line and the solidified casting can be removed. The steps in this process are described in greater detail in the next section.



Sand casting is used to produce a wide variety of metal components with complex geometries. These parts can vary greatly in size and weight, ranging from a couple ounces to several tons. Some smaller sand cast parts include components as gears, pulleys, crankshafts, connecting rods, and propellers. Larger applications include housings for large equipment and heavy machine bases. Sand casting is also common in producing automobile components, such as engine blocks, engine manifolds, cylinder heads, and transmission cases.

The process cycle for sand casting consists of six main stages, which are explained below.

1. *Mould-making* - The first step in the sand casting process is to create the mould for the casting. A sand mould is formed by packing sand into each half of the mould. The sand is packed around the pattern, which is a replica of the external shape of the casting. When the pattern is removed, the cavity that will form the casting remains. Any

internal features of the casting that cannot be formed by the pattern are formed by separate cores which are made of sand prior to the formation of the mould.

2. *Clamping* - Once the mould has been made, it must be prepared for the molten metal to be poured. The surface of the mould cavity is first lubricated to facilitate the removal of the casting. Then, the cores are positioned and the mould halves are closed and securely clamped together. It is essential that the mould halves remain securely closed to prevent the loss of any material.

3. *Pouring* - The molten metal is maintained at a set temperature in a furnace. After the mould has been clamped, the molten metal can be ladled from its holding container in the furnace and poured into the mould. The pouring can be performed manually or by an automated machine. Enough molten metal must be poured to fill the entire cavity and all channels in the mould. The filling time is very short in order to prevent early solidification of any one part of the metal.

4. *Cooling* - The molten metal that is poured into the mould will begin to cool and solidify once it enters the cavity. When the entire cavity is filled and the molten metal solidifies, the final shape of the casting is formed.

5. *Removal* - The sand mould can simply be broken, and the casting removed. This step, sometimes called shakeout, is typically performed by a vibrating machine that shakes the sand and casting out of the flask. Once removed, the casting will likely have some sand and oxide layers adhered to the surface. Shot blasting is sometimes used to remove any remaining sand, especially from internal surfaces, and reduce the surface roughness.

6. *Trimming* - During cooling, the material from the channels in the mould solidifies attached to the part. This excess material must be trimmed from the casting either manually via cutting or sawing, or using a trimming press. A larger casting will require a longer trimming time. The scrap material that results from this trimming is either discarded or reused in the sand casting process. However, the scrap material may need to be reconditioned to the proper chemical composition before it can be combined with non-recycled metal and reused.

DIE CASTING

Die casting involves forcing the molten metal into the permanent cavity of steel mould, called a Die, under very high pressure of about 90 to 2000 times the atmospheric pressure. The dies are usually made in two half's, one is fixed and another is movable. They must be locked perfectly before molten metal is forced into it. The Sie casting is suitable only for low melting point metals and alloys. The ferrous alloys are not commercially die-casted due to their high melting temperature. The Die casting processes are highly accurate and have better mechanical properties then conventional sand casting process.

Advantages of Die Casing

(i) Higher production rate

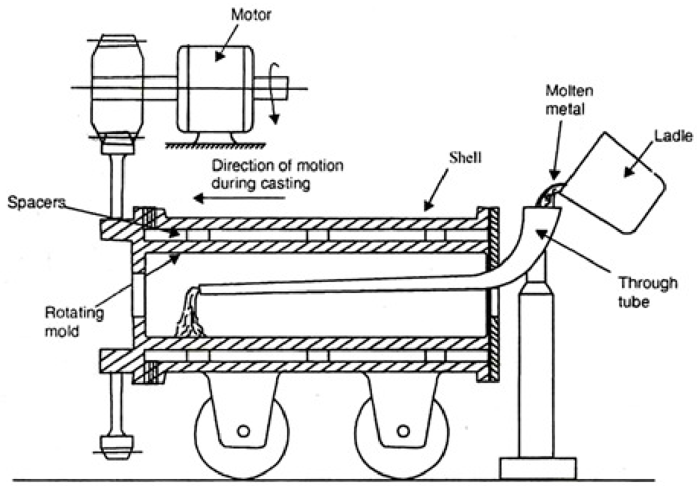
(ii) Higher accuracy of the casted part.

(iii) Intricate shapes are easily produced.
(iv) Smooth surface finish is obtained.
(v) Close dimensional tolerances may be achieved.
(vi) Die casted parts requires very little machining.
(vii) Parts having thin and complex shapes can be easily and accurately casted.
(viii) Less floor area is required.
(ix) High strength and quality parts produced because of rapid cooling rates.
(x) Die has long life.
(xi) Best suited for mass production of small castings.

Disadvantages of Die Castings
(i) Only suitable and applicable for low-melting point metals and alloys.
(ii) The ferrous alloys are not commercially die-casted due to their high melting temperature.
(iii) Cost of equipment and die is high.
(iv) Design and production cost of Die is high.
(v) Cannot be used for large castings.
(vi) Requires a high degree of skill in operation and maintenance.
(vii) Any air entrapped produces vents in the castings and they become weaker.

CENTRIFUGAL CASTING
The Centrifugal casting process involves pouring of molten metal into a rotating mould cavity, caused by centrifugal acceleration. Impurities like slag and sand being lighter travel towards the centre axis of the rotating mould keeping the main casting free from defects.
Centrifugal casting processes can be classified as:
(i) True centrifugal casting.
(ii) Semi-centrifugal casting.
(iii) Centrifuging casting.

(i) True Centrifugal Casting
The true centrifugal casting method is used for producing objects symmetrical about their axis but hollow from inside like pipes. The mould is rotated about an axis, horizontal, vertical or inclined position. The molten metal is pushed to the walls of the mould by centrifugal acceleration, where it solidifies in the form of a hollow cylinder. The quantity of poured metal decides the wall thickness of hollow castings.
The machines used to rotate the mould may have either horizontal or vertical axis of rotation. Horizontal axis machines are used for casting longer pipes, like water supply and sewer pipes, while vertical axis machines are used for short tubes casting. The basic feature of a horizontal axis, true centrifugal casting machine is shown in Fig. blow



. A true centrifugal casting machine.

Advantages of True Centrifugal Casting

(i) Higher production output.

(ii) High efficiency of metal utilization due to elimination of sprues and risers.

(iii) High density, refined fine-grained structure, and superior mechanical properties of the castings produced.

(iv) Low percentage of rejects.

(v) Small machining allowances are given to the castings produced by this method.

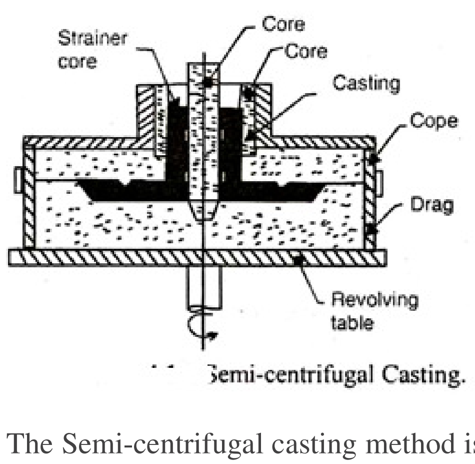
(vi) Ferrous and non-ferrous metals can be casted by this process.

(vii) Quick and economical method.

(ii) Semi-Centrifugal Casting

Semi-centrifugal casting is quite similar to that of true centrifugal casting, the difference being that the mould cavity is completely filled with the molten metal. The Semi-Centrifugal Casting method produces the parts which are Symmetrical about their axis but may not be hollow. The spinning speeds are not as high as in the true centrifugal casting. Due to lower speed, the impurities are not effectively separated from the metal.

A semi-centrifugal casting process is shown in Fig. blow



Semi-centrifugal Casting.

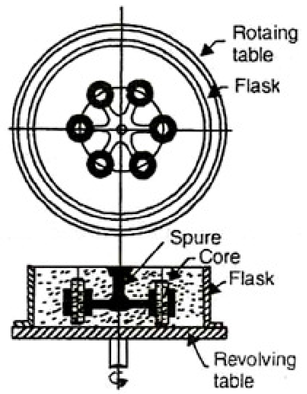
The Semi-centrifugal casting method is employed for making large size castings which are axis symmetrical. Examples include cast track wheels for tanks, tractor, and like, pulleys, spocked discs, gears, propellers, etc.

(iii) Centrifuging Casting

Centrifuging Casting method consists a number of mould cavities, arranged on the circumstances of a circle. These cavities are connected to a central down sprue through radial gates. Next, molten metal is poured, and the mould is rotated around the central axis of the sprue. In other word, each casting is rotated around an axis off (shifted from) its own centre axis. Therefore, mould cavities are filled under high pressure.

Centrifugal forces ensure the mould filling uniformly. It is usually used for producing castings with intricate shapes.

A centrifuging casting is shown in Fig. blow



Centrifuging casting.

Advantages of Centrifuging Casting

(i) It ensures the filling of the mould cavity property.

(ii) It ensures uniform thickness with smooth surface.

(iii) It eliminates impurities in the casting.

(iv) It is used for producing small intricate shapes.

(v) It is used for long castings like pipes, etc.

Limitations of Centrifuging Casting:

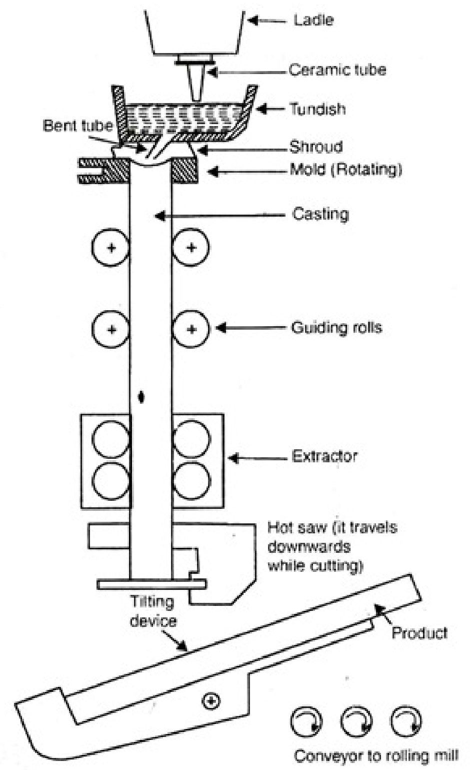
(i) Unit is quite expensive.

(ii) Costly maintenance.

(iii) Uniform speed or rotation is necessary to impart uniform thickness.

CONTINUOUS CASTING

The Continuous Casting Process basically involves controlling the flow of a stream of molten metal that comes out from a water-cooled mould or orifice in order to solidify and form a continuous rod. A modified and new version of this method is rotary continuous casting is shown in Fig. blow



The Principles of rotary continuous casting.

A Continuous casting process is shown in Fig. above. In its operation, the steel is melted and refined before transferred to the tundish. Then, the molten metal enters the rotating mould. The centrifugal force then forces the molten steel against the mould walls, and comes out from a bent tube. Impurities remain in the centre of the vortex, from where they are removed by the operator. Solidification of the metal flowing out of the mould cavity continues at a specific rate. A circular saw is used to cut the resulting solid bar into desired size. This cut part is tilted and loaded onto a conveyor and transfer it to the colling bed and then at suitable place. Continuous casting is used for the rods, squares, pipes, tubes, sheets, etc. Different shapes like triangular, circular, hexagonal, squares are easily and economically casted through this method. It can also be used to produce hollow pipes, by placing a core in the central portion of the mould.

Advantages of Continuous Casting

1. The continuous casting process is gaining wide spread industrial applications, especially for high- quality alloy steel.
2. It has possibility of casting special cross-sectional shapes.
4. It has excellent quality of cast, and controlled grain size.

CASTING DEFECTS

The following are the major defects, which are likely to occur in sand castings

- Gas defects
- Shrinkage cavities
- Moulding material defects
- Pouring metal defects
- Mould shift

Gas Defects

A condition existing in a casting caused by the trapping of gas in the molten metal or by mould gases evolved during the pouring of the casting. The defects in this category can be classified into blowholes and pinhole porosity. Blowholes are spherical or elongated cavities present in the casting on the surface or inside the casting. Pinhole porosity occurs due to the dissolution of hydrogen gas, which gets entrapped during heating of molten metal.

Causes

The lower gas-passing tendency of the mould, which may be due to lower venting, lower permeability of the mould or improper design of the casting. The lower permeability is caused by finer grain size of the sand, high percentage of clay in mould mixture, and excessive moisture present in the mould.

- Metal contains gas
- Mould is too hot
- Poor mould burnout

Shrinkage Cavities

These are caused by liquid shrinkage occurring during the solidification of the casting. To compensate for this, proper feeding of liquid metal is required. For this reason, risers are placed at the appropriate places in the mould. Sprues may be too thin, too long or not attached in the proper location, causing shrinkage cavities. It is recommended to use thick sprues to avoid shrinkage cavities.

Moulding Material Defects

The defects in this category are cuts and washes, metal penetration, fusion, and swell.

Cut and washes

These appear as rough spots and areas of excess metal, and are caused by erosion of moulding sand by the flowing metal. This is caused by the moulding sand not having enough strength and the molten metal flowing at high velocity. The former can be taken care of by the proper choice of moulding sand and the latter can be overcome by the proper design of the gating system.

Metal penetration

When molten metal enters into the gaps between sand grains, the result is a rough casting surface. This occurs because the sand is coarse or no mould wash was applied on the surface of the mould. The coarser the sand grains more the metal penetration.

Fusion

This is caused by the fusion of the sand grains with the molten metal, giving a brittle, glassy appearance on the casting surface. The main reason for this is that the clay or the sand particles are of lower refractoriness or that the pouring temperature is too high.

Swell

Under the influence of metallostatic forces, the mould wall may move back causing a swell in the dimension of the casting. A proper ramming of the mould will correct this defect.

Inclusions

Particles of slag, refractory materials, sand or de-oxidation products are trapped in the casting during pouring solidification. The provision of choke in the gating system and the pouring basin at the top of the mould can prevent this defect.

Pouring Metal Defects

The likely defects in this category are

- Mis-runs and
- Cold shuts.

A mis-run is caused when the metal is unable to fill the mould cavity completely and thus leaves unfilled cavities. A mis-run results when the metal is too cold to flow to the extremities of the mould cavity before freezing. Long, thin sections are subject to this defect and should be avoided in casting design.

A cold shut is caused when two streams while meeting in the mould cavity, do not fuse together properly thus forming a discontinuity in the casting. When the molten metal is poured into the mould cavity through more-than-one gate, multiple liquid fronts will have to flow together and become one solid. If the flowing metal fronts are too cool, they may not flow together, but will leave a seam in the part. Such a seam is called a cold shut, and can be prevented by assuring sufficient superheat in the poured metal and thick enough walls in the casting design.

The mis-run and cold shut defects are caused either by a lower fluidity of the mould or when the section thickness of the casting is very small. Fluidity can be improved by changing the composition of the metal and by increasing the pouring temperature of the metal.

Mould Shift

The mould shift defect occurs when cope and drag or moulding boxes have not been properly aligned.

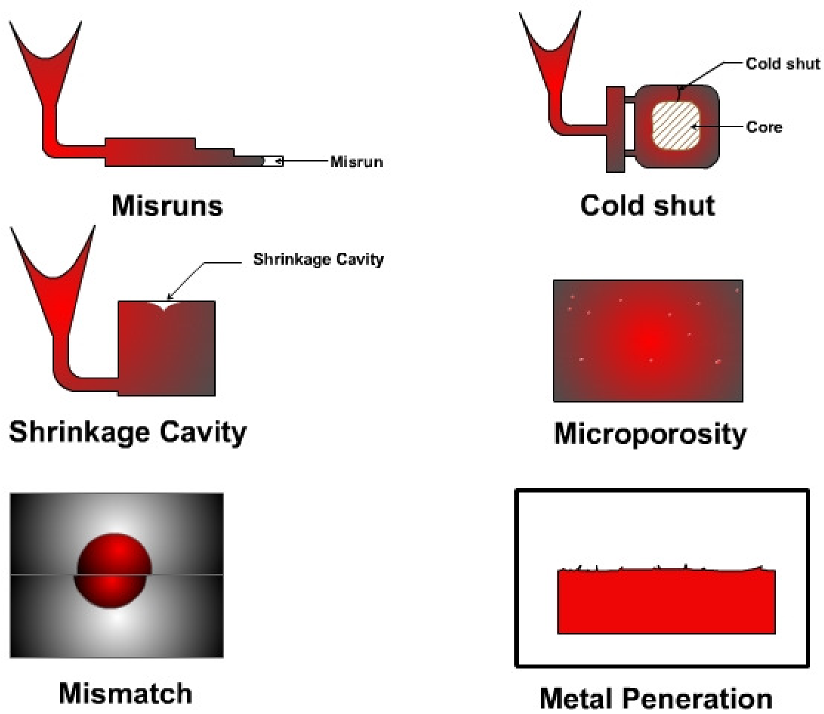


Figure: Casting Defects