



Thapar Institute of Engineering & Technology – Patiala

Manufacturing Processes UTA026

Thapar Institute of Engineering & Technology
(Deemed to be University)

Bhadson Road, Patiala, Punjab, Pin-147004

Contact No. : +91-175-2393201

Email : info@thapar.edu

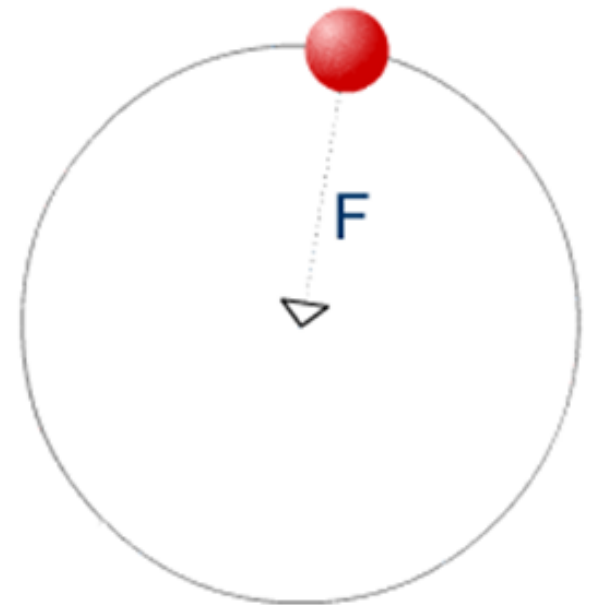
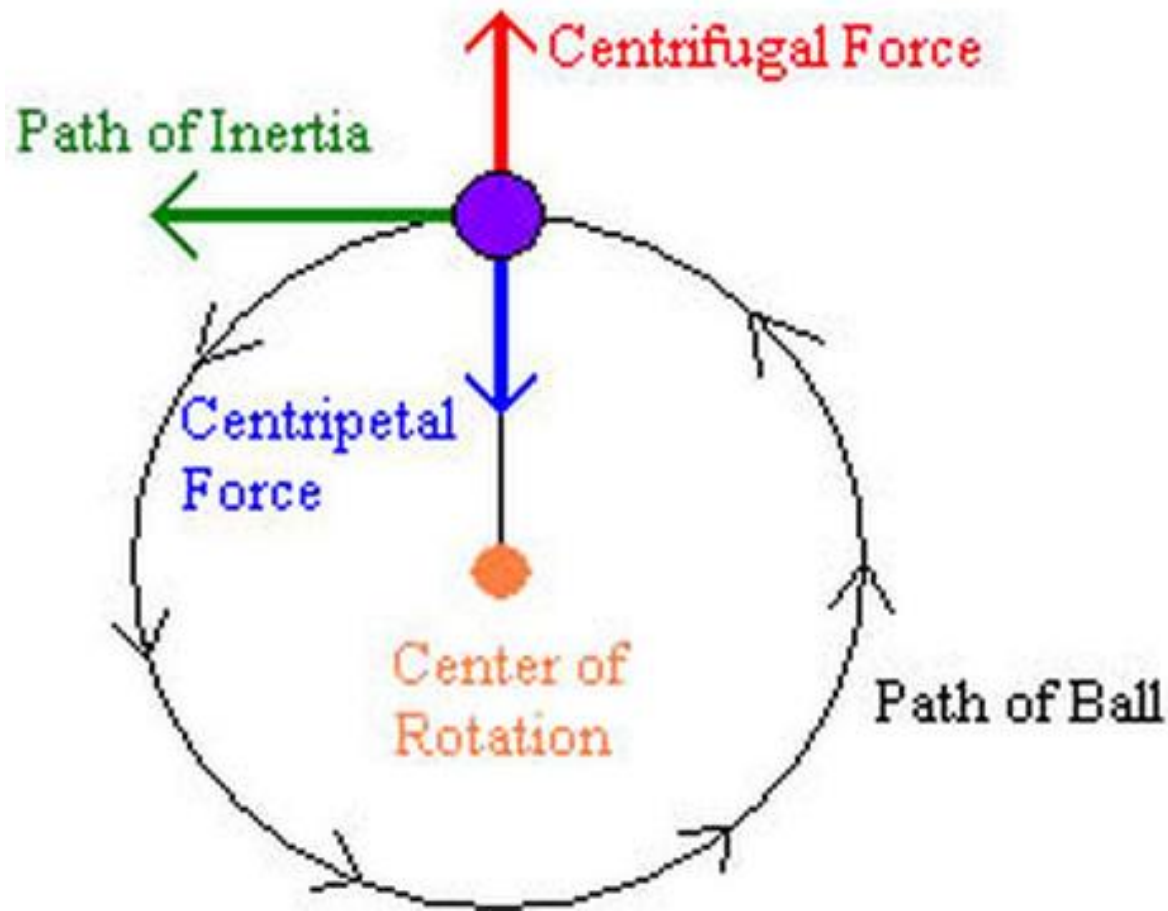


THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

MANUFACTURING PROCESSES

Centrifugal & Die Casting

Concept of centrifugal force



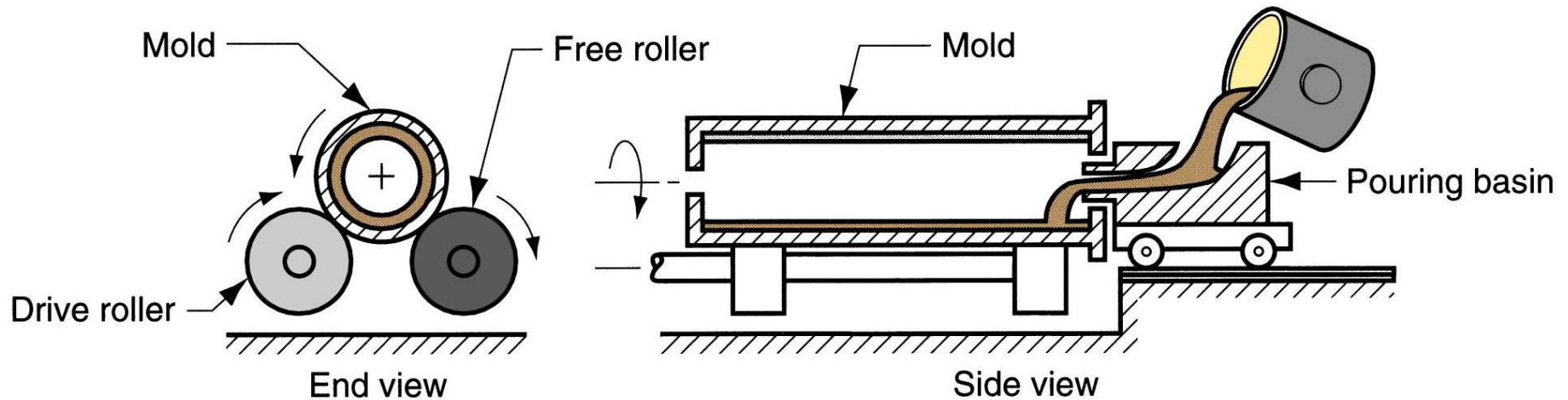
Centrifugal Casting

- As its name implies, the *centrifugal-casting* process utilizes inertial forces to distribute the molten metal into the mould cavities.
- In this process, the mould is *rotated* rapidly about its central axis as the metal is poured into it.
- Because of the *centrifugal force*, a *continuous pressure* will be acting on the metal as it solidifies.

Centrifugal Casting

- The *slag, oxides* and other *impurities* being lighter, get separated from the metal and segregate *towards the center*.
- Spinning equipment can be expensive.
- There are *three types* of centrifugal casting:
 - 1. True centrifugal casting,*
 - 2. Semi-centrifugal casting,*
 - 3. Centrifuging.*

1. True Centrifugal Casting



Source: Centrifugal Casting of Ductile Iron Pipe (<https://www.youtube.com/watch?v=3G2sBqXkRT8>)

1. True Centrifugal Casting

- In true centrifugal casting, ***hollow cylindrical parts*** (such as pipes, gun barrels, bushings, engine-cylinder liners, bearing rings with or without flanges, and street lampposts) are produced by the technique shown in Fig.
- In this process, molten metal is poured into a rotating mould (300 to 3000 rpm).
- The axis of rotation is usually horizontal, but can be vertical for short workpieces.

1. True Centrifugal Casting

- ***Moulds*** are made of steel, iron, or graphite and may be ***coated with a refractory lining*** to increase mould life.
- ***The exterior profile*** is usually round (as with gun barrels, pipes, and tubes), but hexagons and other symmetrical shapes are also possible.
- ***The inner surface*** of the casting remains cylindrical, because the molten metal is distributed uniformly by the centrifugal forces, ***therefore no core is required.***

1. True Centrifugal Casting

- However, because of density differences, *lighter elements* (such as dross, *impurities*) tend to collect on the *inner surface of the casting*.

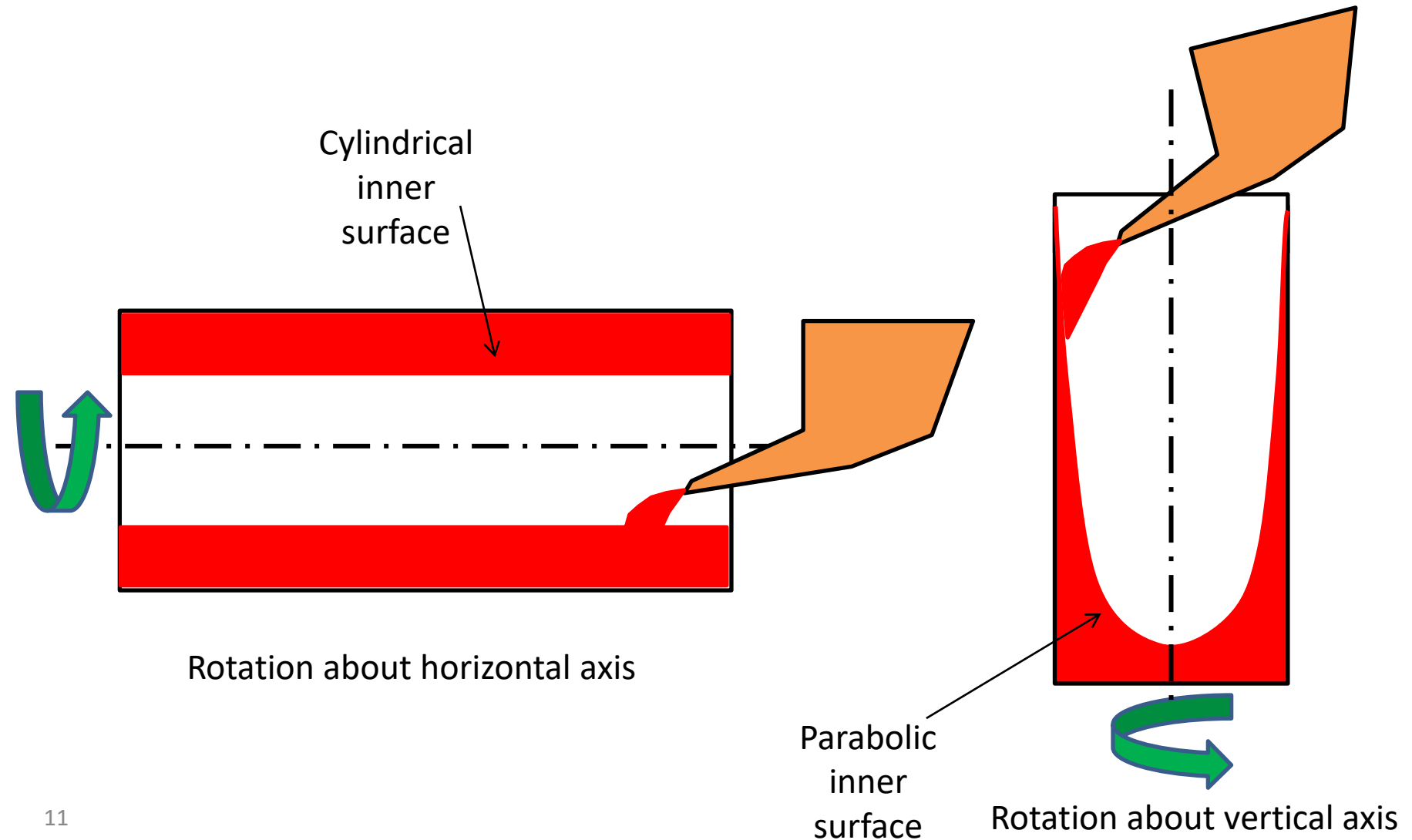


Source: Vertical and Horizontal centrifugal casting processes at UNI Abex, Dharwad plant, India. (<https://www.youtube.com/watch?v=7goyNtA5UCo>)

1. True Centrifugal Casting

- When rotation is about the **horizontal** axis, the inner surface is always cylindrical.
- If the mould is oriented **vertically**, gravitational forces cause the inner surface to become **parabolic**.
- **Wall thickness** can be controlled by varying the amount of metal that is introduced into the mould.

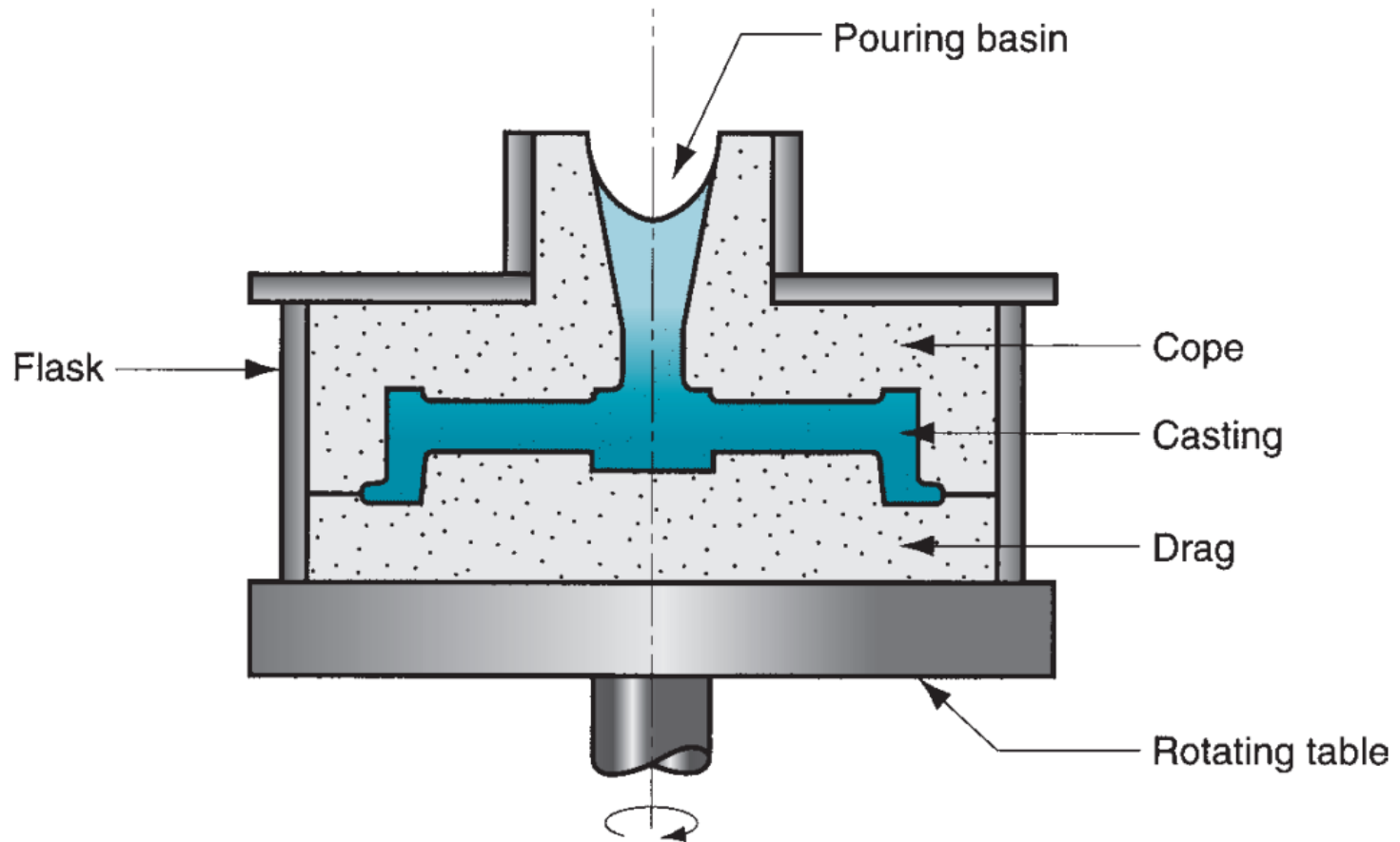
1. True Centrifugal Casting



1. True Centrifugal Casting

- During the rotation, the metal is forced against the outer walls of the mould with considerable force, and *solidification begins at the outer surface.*
- Centrifugal force continues to feed molten metal as solidification progresses inward.
- Since the process compensates for shrinkage, *no risers are required.*
- *Bi-metal castings are possible*, example: create a hard outer layer and ductile inner layer

2. Semi-Centrifugal Casting



2. Semi-Centrifugal Casting



2. Semi-Centrifugal Casting

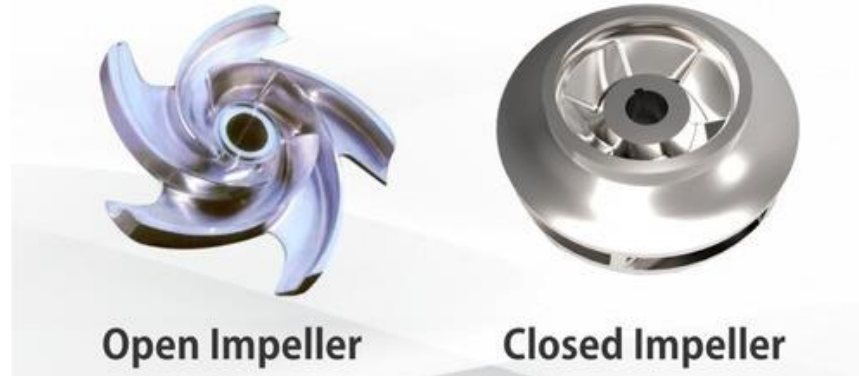
- This method is used to cast parts with *rotational symmetry, such as a wheel with spokes.*
- In this method, centrifugal force is used to produce *solid castings*, rather than tubular parts.
- The moulds are designed with *risers at the center* to supply feed metal.

2. Semi-Centrifugal Casting

- The rotational *speeds* are usually *lower* than for true centrifugal casting.
- In general, the *mould shape is more complex* than for true centrifugal casting, and cores can be placed in the mould to further increase the complexity of the product.
- *Density* of metal in the final casting is *greater in the outer sections* than at the center of rotation.

2. Semi-Centrifugal Casting

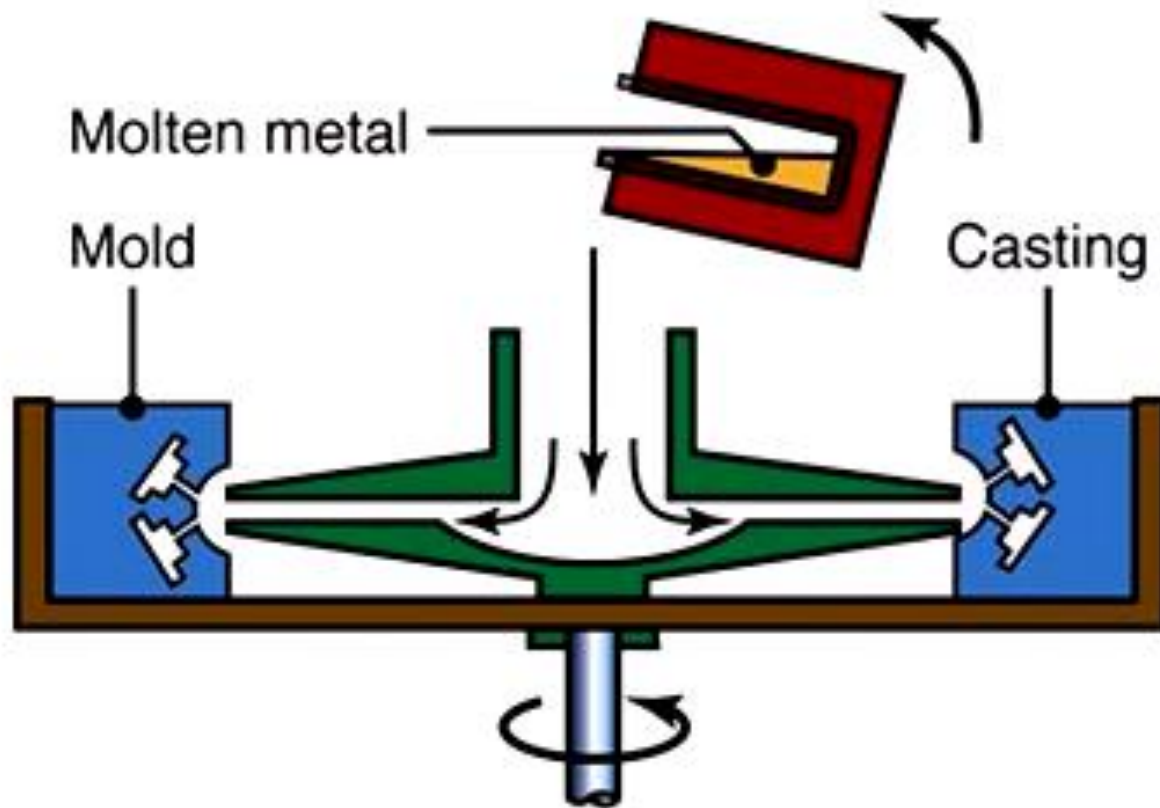
- **Common products** include gear blanks, pulley sheaves, wheels, impellers, and electric motor rotors.



Open Impeller

Closed Impeller

3. Centrifuging Casting



3. Centrifuging Casting

- In centrifuging (also called centrifuge casting), mould cavities of **any shape** are placed at a **certain distance** from the **axis** of rotation.
- Moulds are located radially about a central sprue or riser, which acts as the axis of rotation.
- The molten metal is poured from the center.
- **Centrifugal force** provides the **pressure** that ensures complete **filling** of the mould cavities.

3. Centrifuging Casting

- Relatively low rotational speeds are required to produce sound castings with *thin walls and intricate shapes*.
- Centrifuging is often used to assist in the pouring of *multiple-product investment casting trees*.