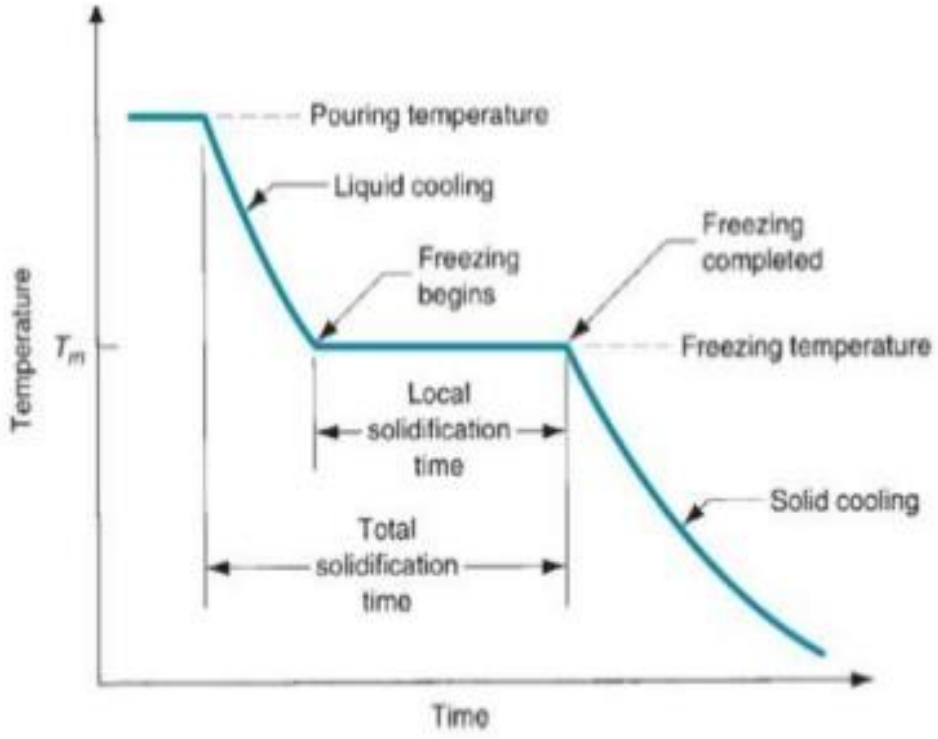
Pattern Allowances

By. Rahul Singh Yadav

Cooling and Solidification

Solidification of pure metals

- Change of molten metal to solid state
- The cooling curve of pure metals is shown in figure. Here solidification occurs at constant temperature equal to its freezing point.



PATTERN ALLOWANCES

1. Shrinkage or contraction allowance.
2. Machining or finish allowance.
3. Draft of tapper allowances.
4. Distortion or chamber allowance.
5. Shake or rapping allowance.

SHRINKAGE ALLOWANCE

Most metals undergo noticeable volumetric contraction when cooled.

Three principle stages of shrinkage:

- **Shrinkage of liquid** as it cools from the solidification temperature
- **Solidification shrinkage** as the liquid turns into solid
- **Solid metal contraction** as the solidified metal cools to room temperature

SHRINKAGE ALLOWANCE

- Liquid Shrinkage:

- It refers to the reduction in volume when the metal changes from liquid state to solid state at the solidus temperature.

- To account for this shrinkage; riser,which feed the liquid metal to the casting,are provided in the mold.

Solid Shrinkage:

It refers to the reduction in volume caused when metal loses temperature in solid state.

To account for this, shrinkage allowance is provided on the patterns.

SHRINKAGE ALLOWANCE

Different metals shrink at different rates because shrinkage is the property of the cast metal/alloy.

The metal shrinkage depends upon:

- 1. The cast metal or alloy.
- 2. Solidification temp. of the metal/alloy.
- 3. Casted dimensions(size).
- 4. Casting design aspects.
- 5. Moulding conditions(i.e., mould materials and moulding methods employed)

MACHINING ALLOWANCE

It is required because of,

- Castings get oxidized in the mold and during heat treatment; scales etc., thus formed need to be removed.
- It is the intended to remove surface roughness and other imperfections from the castings.
- It is required to achieve exact casting dimensions.
- Surface finish is required on the casting.

MACHINING ALLOWANCE

Typical allowances

- **Cast iron** 0.8-1.0%
- **Steel** 1.5-2.0%
- **Aluminium** 1.0-1.3%
- **Magnesium** 1.0-1.3%
- **Brass** 1.5%

Shrinkage allowances are incorporated into the pattern using shrink rules.

Thermal contraction might not be the only factor for determining pattern size.

Surface finishing operations (machining, etc.) should be taken into consideration.

DRAFT ALLOWANCE

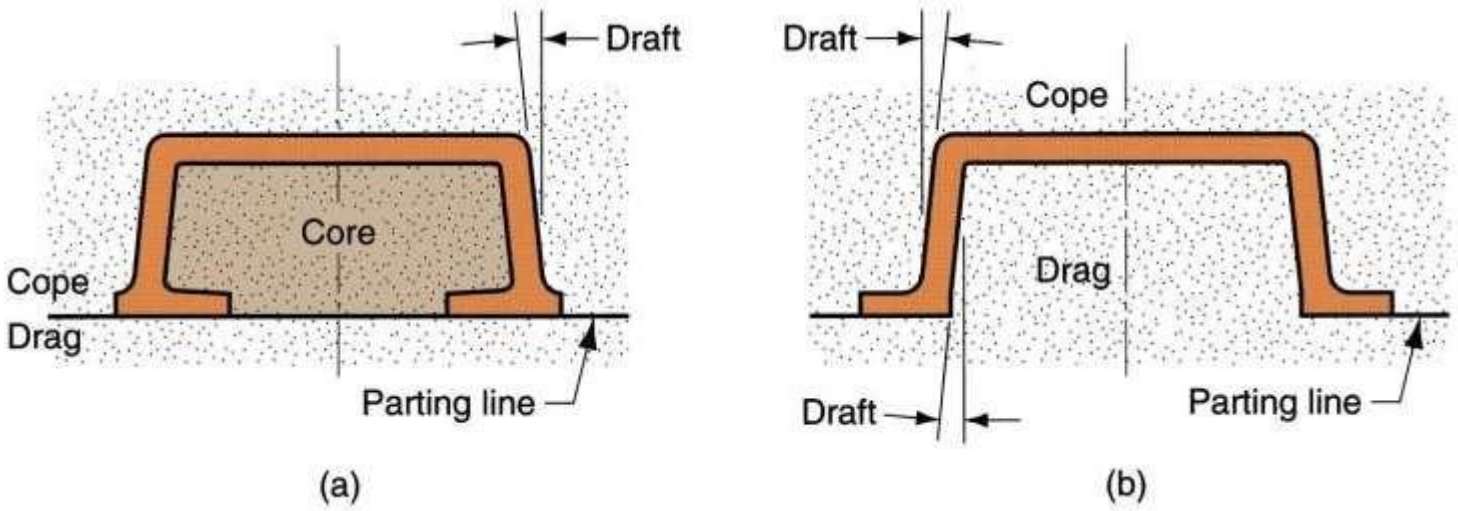
It is given to all surfaces perpendicular to parting line.

Draft allowance is given so that the pattern can be easily removed from the moulding material tightly packed around it with out damaging the mould cavity.

The amount of taper depends upon:

- Shape and size of pattern in the depth direction in
  contact with the mould cavity.
- Moulding methods.
- Mould materials.
- Draft allowance is imparted on internal as well as external surfaces; of course it is more on internal

WHAT IS DRAFT?

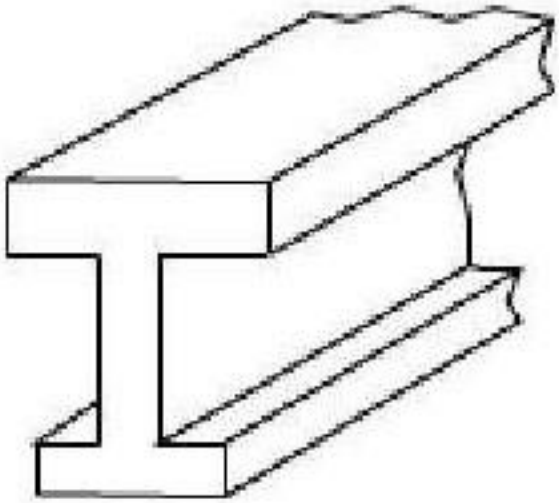


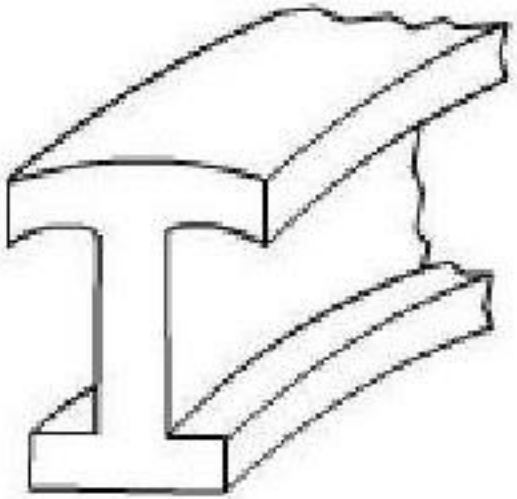
Minor changes in part design can reduce need for coring

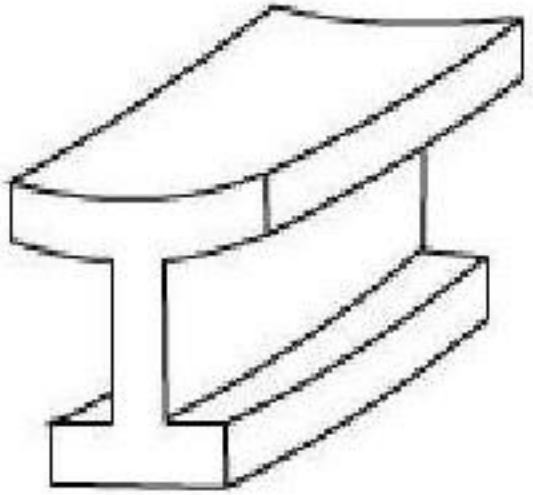
DISTORTION ALLOWANCE

A CASTING WILL DISTORT OR WRAP IF :

- It is of irregular shape,
- All it parts do not shrink uniformly i.e.,some parts
  shrinks while others are restricted from during so,
- It is u or v-shape,
- The arms possess unequal thickness,
- It has long, rangy arms as those of propeller strut for the ship.
- It is a long flat casting,
- One portion of the casting cools at a faster rate







Required Shape of Casting

Distorted Casting

Cambered Pattern

SHAKE ALLOWANCE

A patter is shaken or rapped by striking the same with a wooden piece from side to side.

This is done so that the pattern a little is loosened in the mold cavity and can be easily removed.

In turn, therefore,rapping enlarges the mould cavity which results in a bigger sized casting.

Hence, a allowance is provided on the pattern i.e.,the pattern dimensions are kept smaller in order to compensate the enlargement of mould cavity due to rapping.

The magnitude of shake allowance can be reduced by increasing the tapper.

THANK YOU...