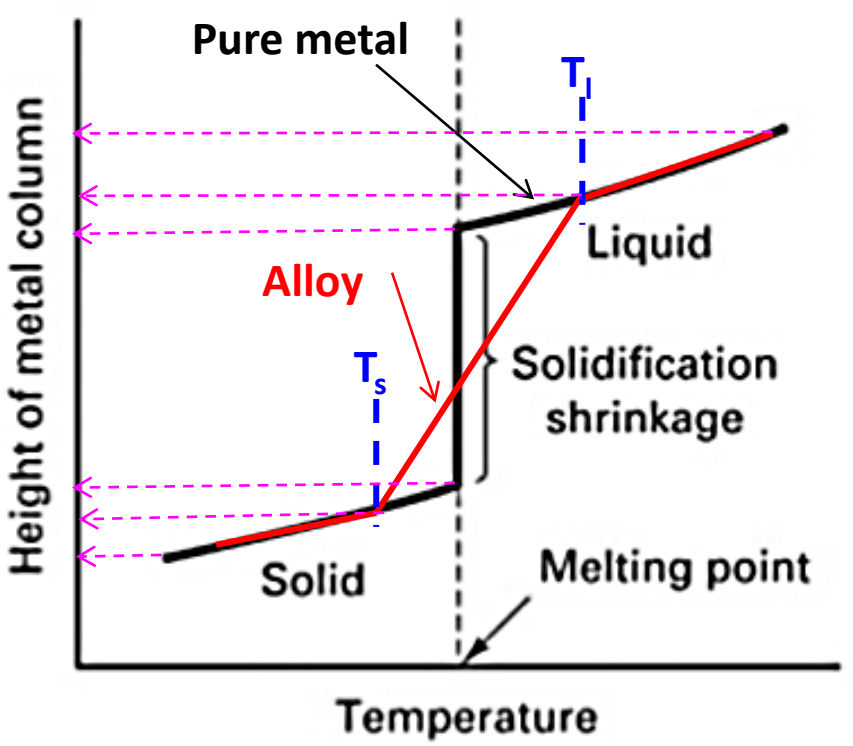
Pattern allowances

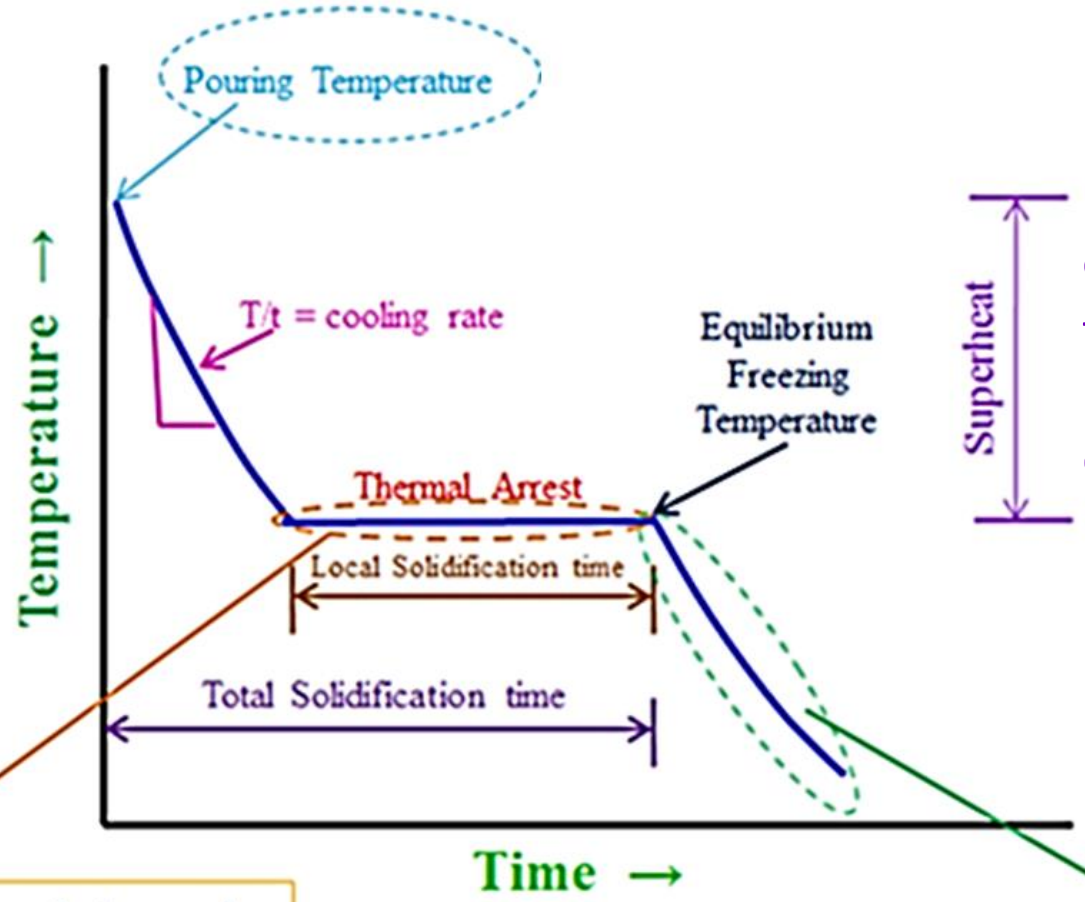
Shrinkage or contraction allowance

- Most metals undergo noticeable volumetric contraction when cooled.
  - 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.
- Liquid and solidification shrinkage is taken care of by riser in the feeder design.
- Solid shrinkage is taken care of by the shrinkage allowance by providing excess dimensions to the pattern.



Shrinkage or contraction allowance

- A pure metal solidifies at a constant temperature equal to its freezing point (same as melting point)



Superheat

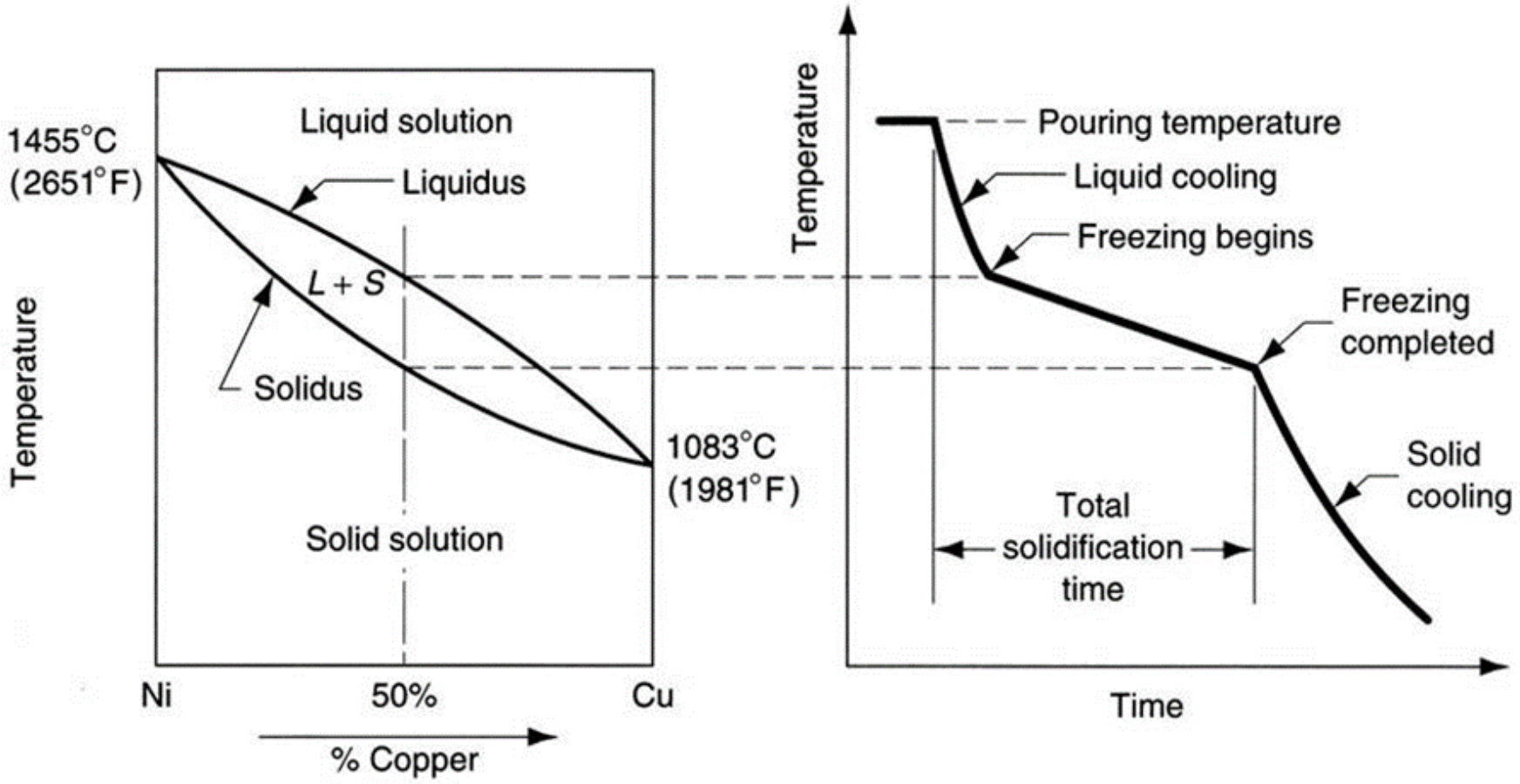
Greater the superheat the more time there is for the liquid material to flow into intricate details

It gets cooled when poured into the mould and molten metal in the liquid form will solidify. This time is called local solidification time

The solidified metal in the mould (called casting) gets cooled in the mould to the temperature of the surroundings

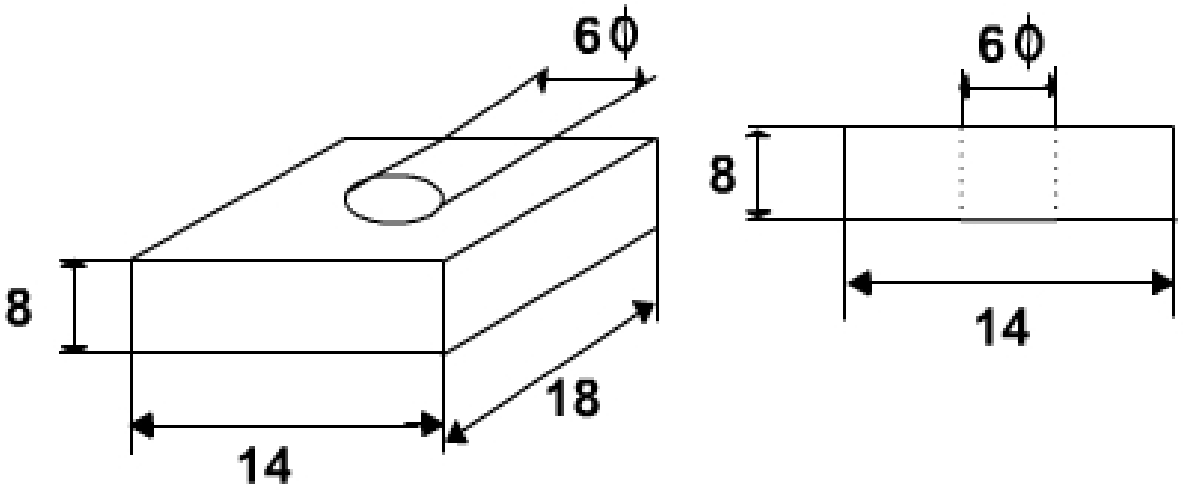
Shrinkage or contraction allowance

- In alloys → No thermal arrest, instead there is a freezing range.
- The freezing range corresponds directly to the liquidus, and solidus found on the phase diagram for the specific alloy



Problem on shrinkage allowance

- The casting shown is to be made in cast iron using a wooden pattern. Assuming only shrinkage allowance, calculate the dimension of the pattern. All dimensions are in inches.



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

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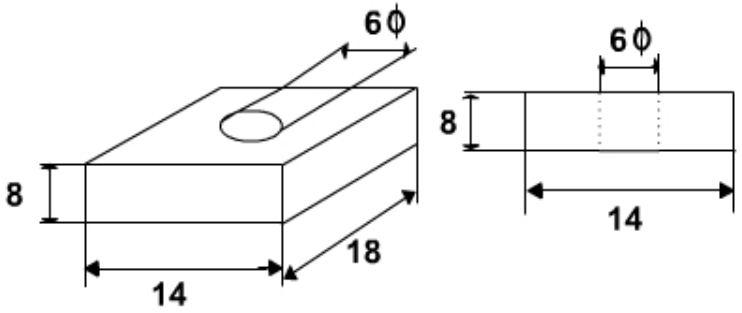

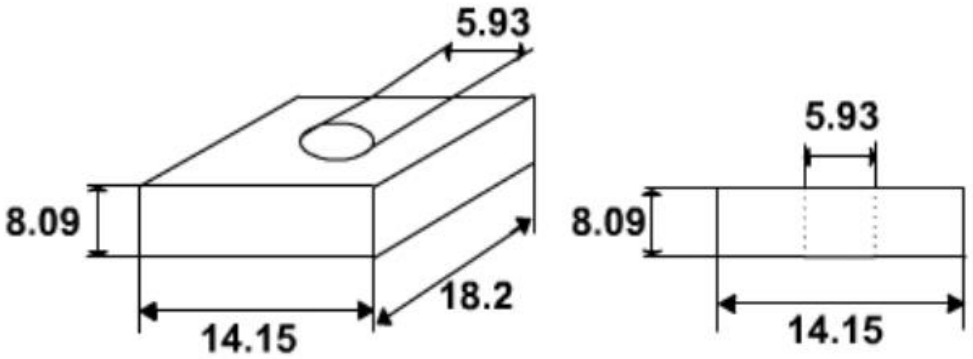

8 x (0.125/12) = 0.0833 ~ 0.09 inch

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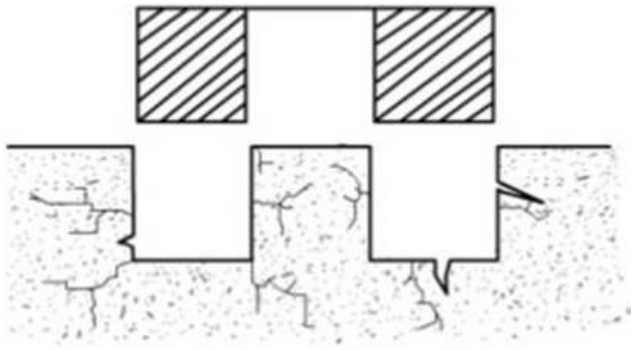
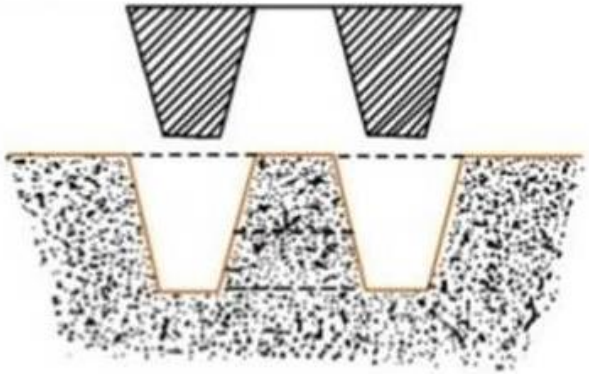
Draft allowance

- Draft is the taper provided by the pattern maker on all vertical surfaces of the pattern so that it can be removed from the sand without tearing away the sides of the sand mold.



Distorted Casting

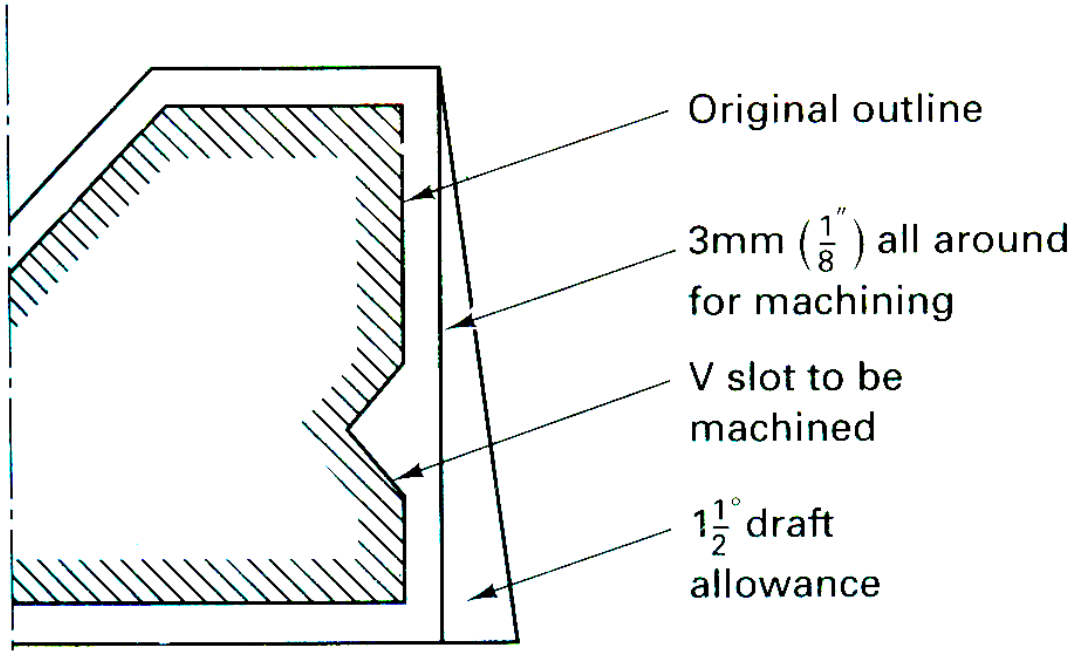


Taper Casting

Height of pattern (mm)	Metallic patern (machined mould)	Wooden pattern (manual mould)
Up to 20	1^0 30’	3^0
20-50	1^0	1^0 30’
50-100	0^0 45’	1^0 15’
100-200	0^0 30’	0^0 45’
200-300	0^0 30’	0^0 30’
300-800	0^0 20’	0^0 30’
800-2000	-	0^0 30’
More than 2000	-	0^0 30’

Machining / finishing allowance

- Thickness of metallic layer to be removed from the casting to get desired surface finish, dimensional accuracy and intricate shape.
- The amount of machining allowance is also affected by the size and shape of the casting; the casting orientation; the metal; and the degree of accuracy and finish required.

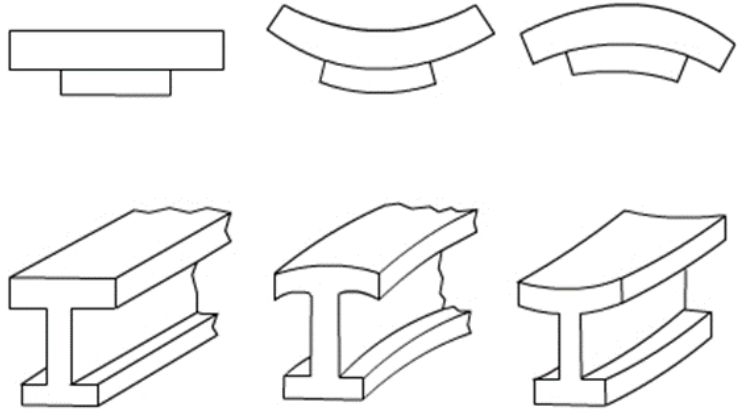


Distortion or camber allowance

- The distortion in casting may occur due to internal stresses.
- These internal stresses are caused on account of unequal cooling of different section of the casting.
- It depends on types of metal, shape, thickness.

(a) U-shaped Casting

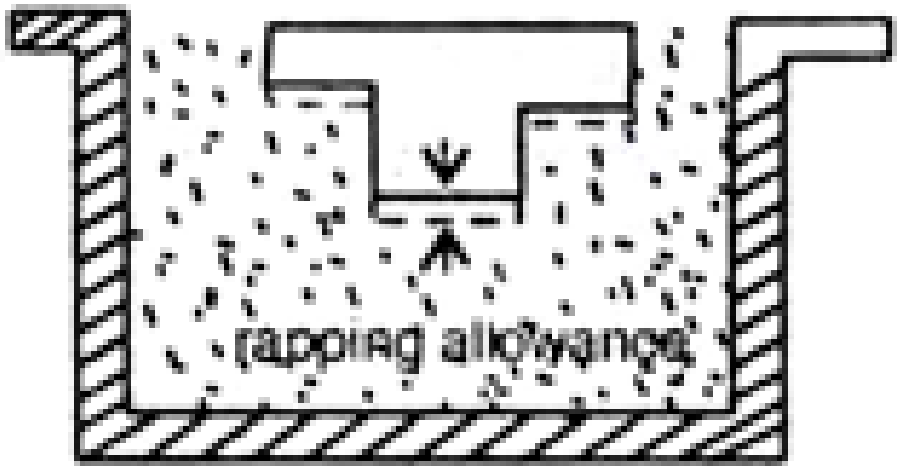
(i) Required shape of casting
(ii) Casting produced with distortion
(iii) Pattern provided with Camber allowance



Required Shape of Casting | Distorted Casting | Cambered Pattern

Rapping allowance or Shake allowance

- When pattern is withdrawn from the mould, it distorts the sides and shape of the cavity.
- To avoid this, the pattern is shaked to create a small void or gap between the mould and pattern surface for easy removal.
- This increases the size of cavity → The size of the pattern is slightly smaller than castings.
- Shake allowance is considered as negative allowance
- There is no sure way of quantifying this allowance.



Thank you