

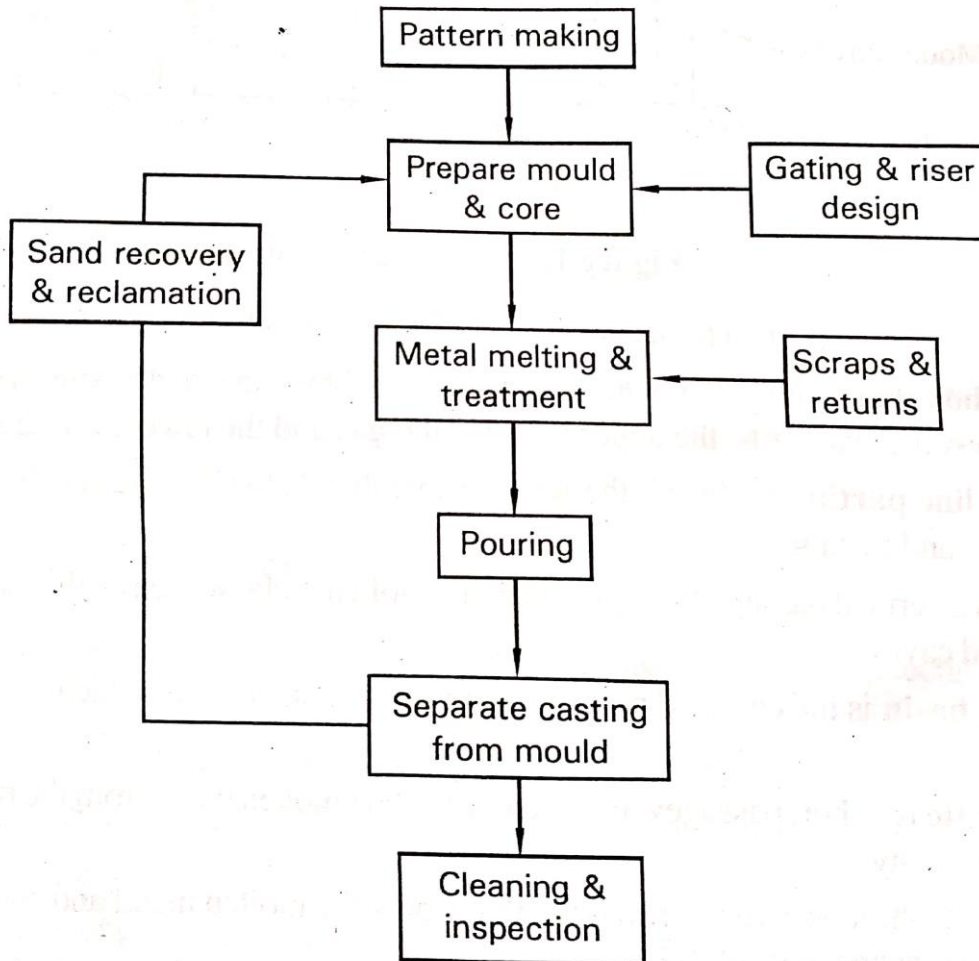
Metal Casting and Welding

Even Sem 2021-22 VTU Solution

1.a.

(i) Casting

Casting is a manufacturing process which involves pouring molten metal (ferrous or non-ferrous) into a mould cavity whose shape resembles the shape of the desired product, and allowing the molten metal to solidify in the cavity. The solidified part is then taken out of the mould cavity to finish the final product.



1.b.

A pattern is the replica of the object to be cast. It is used to prepare a cavity into which the molten metal is poured. Pattern making is a highly skilled trade translating the 2D (Two dimensional) design plan to a 3D (Three dimensional) object. A skilled *pattern maker* builds the pattern from wood, metal, plastic or other materials with the help of machines and special tools.

1.9 PATTERN ALLOWANCES

Although a pattern is the replica of the object to be cast, it is slightly enlarged in size for a few reasons. This increase in size of the pattern is called *allowance*, and is essential to all patterns,

* *Loam sand* – Contains more clay

which helps to produce a good quality mould, and hence a casting. The various allowances provided on the pattern include:

- (a) Shrinkage allowance
- (b) Machining allowance
- (c) Draft allowance, and
- (d) Distortion allowance.

(a) Shrinkage allowance

Shrinkage allowance or contraction allowance is provided to the pattern to compensate for shrinkage or contraction (decrease in volume) of metal during solidification.

All metals shrink or contract during solidification, and hence, the dimensions of casting become smaller than the desired. To avoid this, the pattern must be made slightly larger in size to compensate for the contraction of the metal. Different metals shrink at different rates and hence, allowance should be selected based on the individual type of metal to be cast. Typical shrinkage allowances for a few commonly used metals are given in table 1.1.

(b) Machining allowance

During pouring of molten metal, non-metallic inclusions which are lighter than metal floats up the

mould top, and upon solidification forms a layer of faultless surface leading to imperfections in castings. Also, in some cases, castings have to be produced with exact dimensions and tolerances. Machining or finish allowance is provided to the pattern so that the extra material on the casting thus produced can be machined or finished to the desired size and accuracy and also helps to remove imperfections. Typical machining allowances for sand castings vary from 3 mm – 12 mm. The amount of machining allowance provided depends on:

- Method of moulding: Hand/machine moulding and sand/metal moulds.
- Degree of accuracy and surface finish required.
- Ferrous or non-ferrous metal etc.

(c) Draft allowance

Draft or taper allowance is a small amount of taper added on all the vertical long faces of the pattern to facilitate its easy removal from the mould without damage to it. Figure 1.11 shows a pattern with and without draft allowance.

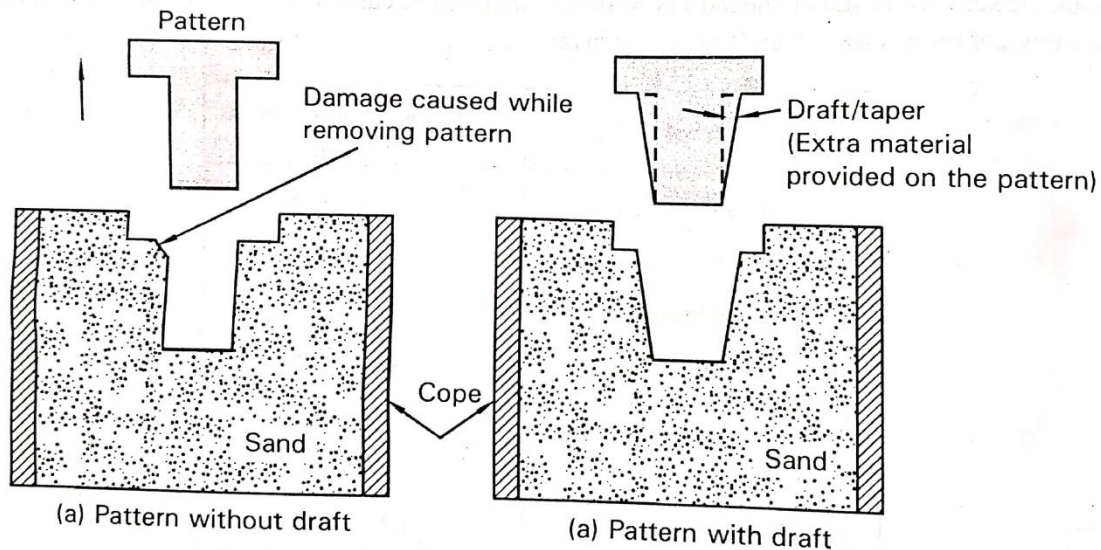


Figure 1.11 Draft allowance in pattern

When the pattern is lifted from the mould as shown in figure 1.11 (a), the vertical face of the pattern remain in contact with the mould surface tending to damage it. But, when a draft is provided as shown in figure 1.11 (b), the moment the pattern lifting commences, its faces are free from the mould surface thereby avoiding damage to the mould. The amount of draft usually expressed in degrees, depends on:

- The length of the vertical sides of the pattern that is in contact with the mould.
- Method of moulding.
- Pattern material etc.

The extra material thus obtained on the casting is machined to obtain the desired shape and size.

(iv) Distortion allowance

Distortion allowance is provided to those patterns from which the castings produced may have the tendency to distort during cooling due to the thermal stresses developed. For example, a casting in the form of 'U' shape (refer figure 1.12 (a)) will contract at the closed end on cooling while the open end remain fixed in position. Distortion for such castings can be eliminated by providing an allowance and constructing the pattern initially distorted so that the casting after cooling neutralizes the initial distortion given on the pattern. Refer figure 1.12 (b).

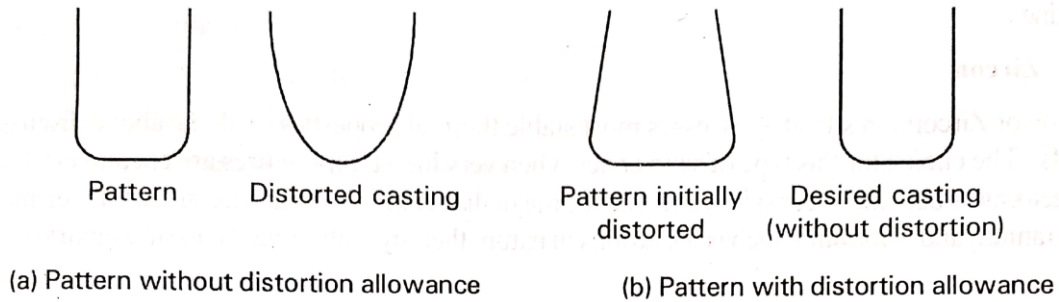


Figure 1.12 Distortion allowance
