

PATTERN

A Pattern may be defined as a model or replica of desired casting which when moulded in sand forms an impression called "Mould". The mould when filled with molten metal forms casting after solidification of the poured metal. The quality and accuracy depends upon the pattern making.

PATTERN MATERIALS:-

There are several materials commonly used in the construction of patterns. The material used for pattern making should be durable and can be easily shaped. The type of pattern material chosen depends upon the following factors:-

- (i) The design of castings.
- (ii) The number of castings to be produced.
- (iii) The type of casting and moulding processes used in foundry.
- (iv) The degree of accuracy and surface finish required.

Following are the commonly used materials for pattern making:-

1) WOOD:-

It is widely used material for pattern making. It is used when small number of castings are to be produced. The wood as a pattern material has the following advantages and disadvantages:-

ADVANTAGES:-

- a) It is cheap and light
- b) It can be easily worked and shaped as desired.

- c) It can be cut and fabricated into numerous forms by gluing, bending.
- d) It is easily planed and sanded to smooth surface and can be preserved fairly for a long time with Shellac.

DISADVANTAGES:-

- a) It is readily affected by moisture. It changes its shape when the moisture dries out of it and when it picks up moisture from the damp moulding sand.
- b) It wears out quickly as a result of sand abrasion. It is unsuitable for repetition work.
- Pine, deodar, teak, kail, shiram are most commonly used for patterns making but mahogany is more durable for heavy duties of repetition moulding. The wood selected for pattern making should be free from knots and it should be properly seasoned before use.

METALS:-

When large number of castings are required, the pattern is made of a metal. The metal patterns are more durable, have longer life and produce moulds to a close dimensional accuracy. Metallic patterns are suited to machine moulding because of the accuracy, durability and strength.

There are some drawbacks with metallic patterns:-

- (i) Expensive than wood.
- (ii) Less tendency to shape and work.
- (iii) Tendency to get rusted.
- (iv) Excessive weight.

Following Metals are commonly used for pattern making:

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(i) CAST IRON:-

It is cheap, easy to file and fit. It is strong, gives a good smooth mould surface with sharp edge and is resistant to abrasive action of the sand. and can be easily cast to obtain any desired shape. The main drawbacks with Cast iron are its excessive weight, is easily broken being brittle, get rusted too much and hence require dry storage.

(ii) BRASS:- It is strong, tough, rust proof and takes a better surface finish than Cast Iron. It has the ability to withstand wear of the moulding sand. The small patterns can be easily rectified, built up or fitted by soldering. Since the brass patterns are heavier and costlier than Cast Iron, therefore it is used only for small patterns.

(iii) Aluminium:- Aluminium melts at a relatively low temperature, soft and easy to work, light in weight, and resistant to corrosion rust and abrasive action of sand. It provides strength and good surface finish.

(iv) White metal:- It is an alloy of lead, copper and antimony and has low melting point about 260°C . The white metal patterns are soft and easily worn away by the moulding sand. It is commonly used for die casting and hence called as die casting alloy.

3. PLASTER :-

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The plaster of Paris or gypsum cement is successfully used as a pattern material because it can be easily casted into intricate shapes and can be easily worked. It has a high compressive strength (upto 30 MPa) and controlled expansion. It is used for making small patterns and core boxes of intricate shape.

4. PLASTICS :-

The thermo-setting resins, usually phenolic resin plastics, are now gaining popularity as a plastic material for patterns. The plastics are light in weight, have high strength, high wear resistance, high corrosion resistance, low solid shrinkage and have very smooth surface finish.

In order to make plastic pattern, first of all a master pattern from wood is made and then a plaster of Paris mould is prepared from this master pattern. The plastic resin is now poured in the mould and heated to some specific temperature. After solidification, it produces a plastic pattern.

5. WAX :-

It is used for "investment casting Process". It helps in imparting a high degree of surface finish and dimensional accuracy to castings. The wax pattern is prepared by pouring heated wax into the split mould or a pair of dies while the latter are kept water cooled. The dies after having being cooled down are parted off. The wax pattern is now taken out and used for moulding.

Selection of Pattern Material :-

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- (i) Service requirements eg quantity, quality of castings, minimum thickness desired, degree of accuracy and finish required.
- (ii) Possibility of design changes.
- (iii) Type of prodⁿ of castings and type of moulding methods and Equipments to be used.
- (iv) Possibility of repetition.

CHARACTERISTICS OF GOOD PATTERN :-

- (i) Easily worked, shaped and joined.
- (ii) Light in weight for facility in handling or working.
- (iii) Strong, hard and durable.
- (iv) Resistant to wear, corrosion and chemical reaction.
- (v) Dimensionally stable and unaffected by variation in temperature and humidity.
- (vi) Available at low cost.
- (vii) Having ability to take a good surface finish.

A pattern is always made larger than the required size of the casting in order to allow various factors such as shrinkage, machining, distortion etc. The following allowances are usually provided in a pattern.

1 SHRINKAGE ALLOWANCE:-

Shrinkage allowance is also known as contraction allowance. The various metals used for casting contract after solidification in the mould. Since the contraction is different for different metals, therefore their corresponding allowance also differ and there is a shrink or contraction scale for each type of metal used in a casting.

Shrinkage or contraction allowance:-

<u>Type of Material</u>	<u>Contraction Allowance.</u>
Cast Iron	10.5 mm/metre.
Copper, Brass & Aluminium	16 mm/metre
Steel	20 mm/metre
Lead and zinc	24 mm/metre.

2 Draft Allowance:-

It is a taper which is given to all the vertical walls of the pattern for easy and clean withdrawal of the pattern from the sand without damaging the mould cavity. It may be expressed in mm/metre on a side or in degrees. The amount of taper varies with the type of pattern. The wooden patterns require more taper than metal patterns because of the greater friction resistance of the wooden surface. The taper on the

- inner surface must be greater than on the outside
- ~~60~~ taper. The amount of taper varies from $\frac{1}{2}$ to $1\frac{1}{2}$ degrees. Taper on external surface may be 16-25 mm/metre and for internal surface 40-50 mm/metre.

3. Finish or Machining Allowance :-

This allowance is provided on the pattern if the casting is to be machined. This allowance is given in addition to shrinkage Allowance. The amount of this allowance varies from 1.6 to 12.5mm which depends upon the type of casting metal, size and shape of casting, method of casting used, method of machining to be employed. and the degree of Finish required. The ferrous metals require more machining allowance than non-ferrous metals.

4. Distortion Allowance :-

This allowance is provided on pattern used for castings of such design in which the distortion is not uniform throughout.

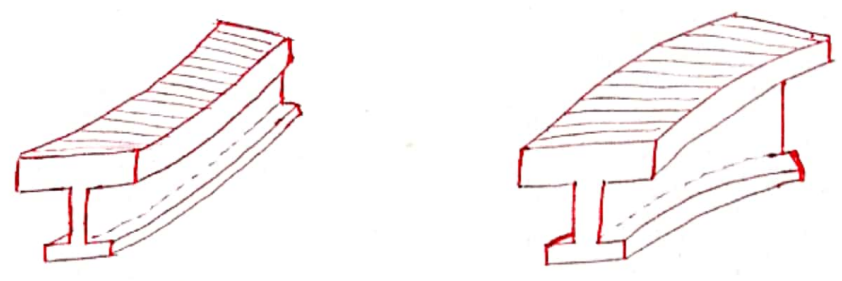
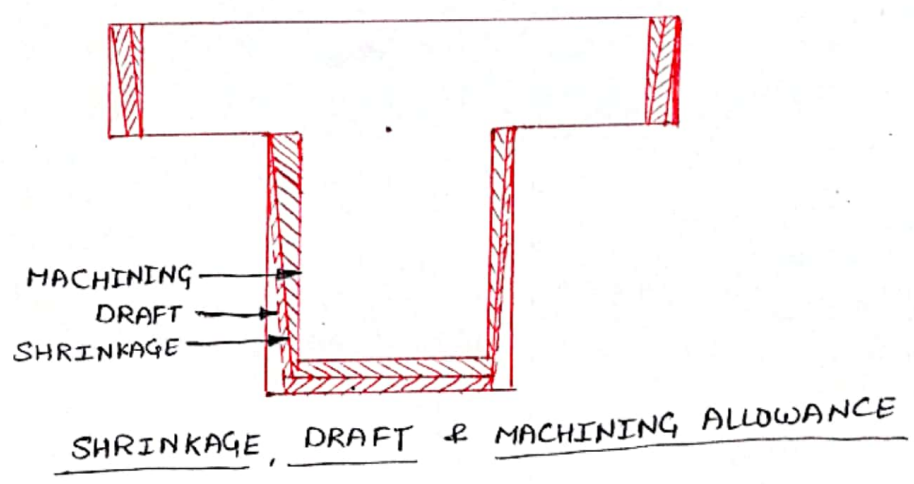
For eg:- Consider a long I section beam having the top flange much thicker than the bottom one. The thinner flange will freeze and contract first & when the top flange freeze it contracts more than the thin flange because the rate of cooling of this thin flange is retarded by the transmitted heat from the thick section. Due to this unequal contraction, the I-section will be distorted or cambered. The thicker flange will be concave and thinner flange convex.

To compensate this, the distortion allowance is provided in the opposite direction.

5. Rapping or shaking Allowance :-

When a pattern is to be withdrawn from the mould. It is first shaken, by striking over it from side to side, so that its surface may be free from the adjoining sand wall of the mould. As a result, of this the size of the mould cavity increases a little and negative allowance is to be provided in the pattern to compensate the same.

In small and medium-sized casting, this allowance can be neglected. But in larger casting this allowance is considered by making the pattern slightly smaller than the casting.



DISTORTION OR CAMBER ALLOWANCE

● The type of pattern selected for a particular casting depends upon the following conditions:-

1. The shape and size of casting.
2. The number of casting required.
3. The method of moulding employed.

The following types of patterns are commonly used:-

1. Solid or single piece pattern:-

A solid or single piece pattern is the simplest of all the patterns, is made in compact form, it has no joints, Parting or loose pieces in its construction. This type of pattern is used for a limited number of castings because its moulding involves a large number of manual operations like gate cutting, providing runners and risers, withdrawal of pattern etc.

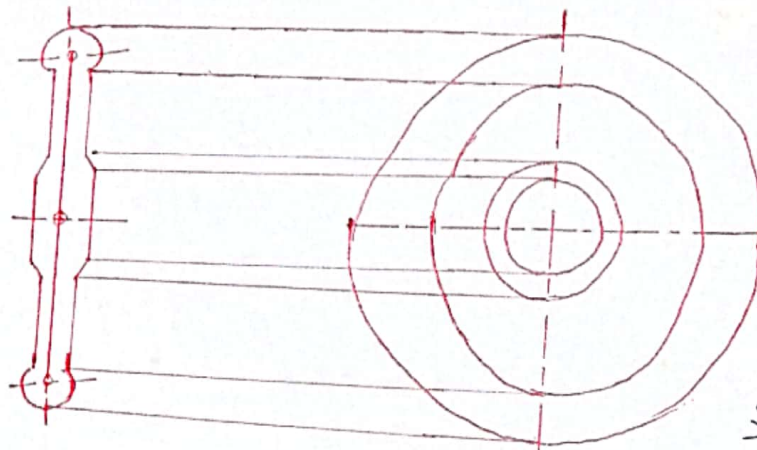


SOLID PATTERN

2. Split Pattern:-

Most of the patterns are not made in a single piece because of the difficulties encountered in moulding them. In order to eliminate this difficulty, some patterns are made into two or more pieces. A pattern consisting of two pieces is called a two piece split pattern. One half of the pattern sets in the lower part of moulding box known as drag and the other half in the

Upper part of the moulding box known as cope 27
 the line of separation of the parts is called
 Parting line. or parting surface.

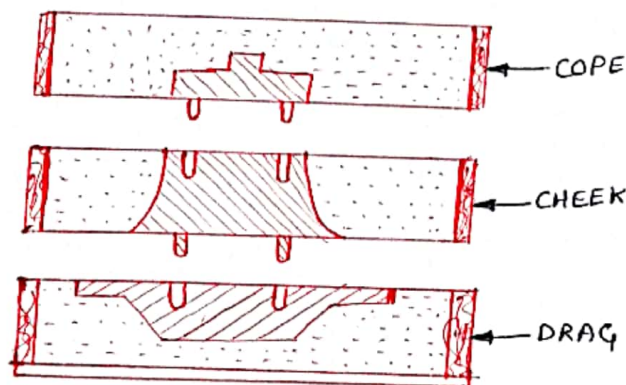


SPLIT PATTERN

3. Multipiece Pattern:-

Castings having a more complicated design require the pattern in more than two parts in order to facilitate an easy moulding and withdrawal of pattern. Such pattern is called multipiece pattern.

A three piece pattern requires a moulding box with three parts, upper part - cope
 middle part - cheek
 lower part - Drag.



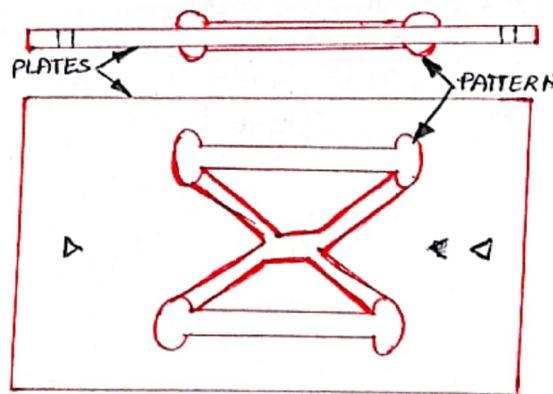
MULTI PIECE PATTERN

4. Match plate pattern:-

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Match plate patterns are used when a rapid production of small and accurate castings is desired on a large scale. A single pattern or a number of patterns may be mounted on a match plate when the cope and drag portions of the split pattern are mounted on the opposite sides of the wooden or metal plate (usually aluminium plate), the pattern is called "match plate pattern".

The gates and runners are permanently fastened to the drag side of the plate in their correct positions in order to form a complete match plate. When the match plate is lifted off the mould, all patterns are withdrawn and the gates and risers are completed in one operation.

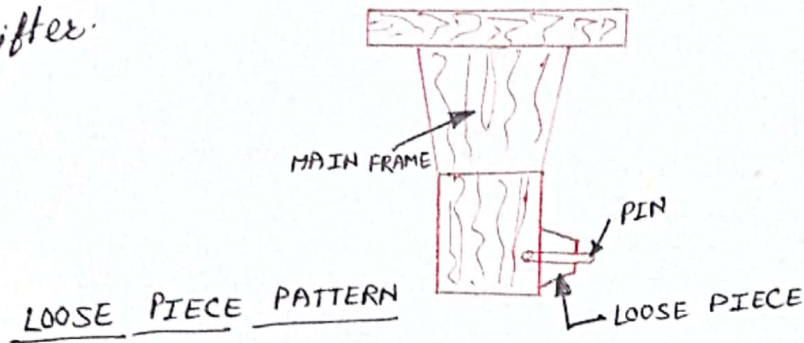


MATCH PLATE PATTERN

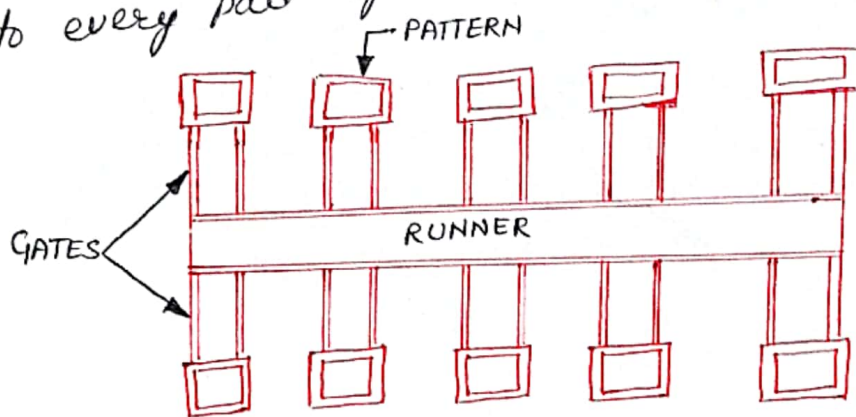
5. Loose piece pattern:-

Sometimes, a pattern has to be made with projections or overhanging parts. These projections make the removal of the pattern difficult. Therefore, such projections are made in loose pieces and are fastened loosely to the main pattern by means of wooden or wire dowel pins. These pins are taken out during the moulding operation.

After moulding, the main pattern is withdrawn first and then the loose piece is removed with the help of a lifter.

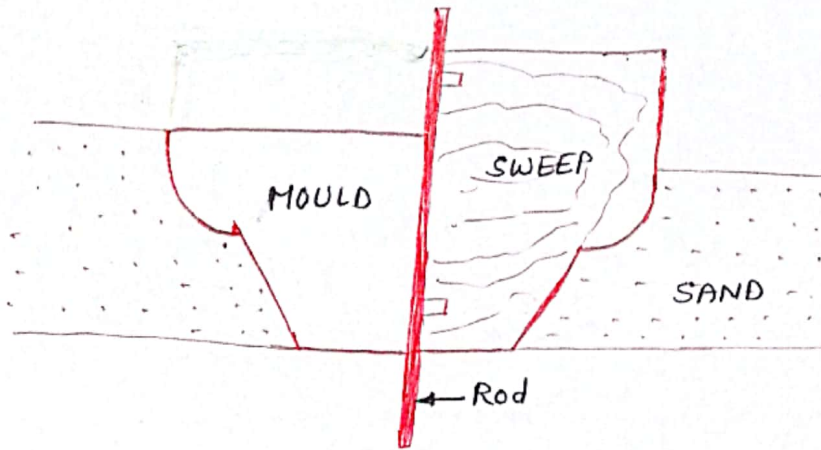


6. Gated Pattern:- The gated pattern is used for mass production of small castings. When a number of small patterns are placed in a single mould, then each pattern may be provided with a gate pattern with it. It consists of pieces of wood or metal fixed to the patterns to form the runner and rising channels in the mould, so that full supply of the molten metal flows into every part of the mould.



7. Sweep pattern:- The sweep patterns are used to prepare moulds of symmetrical and regular shapes particularly in large sizes. A sweep pattern consists of a wooden board fixed to metal rod. A sweep is a template of wood or other material which has the shape corresponding to the shape of

• Casting. the rod is fixed in position in the sand and the sweep is rotated about the axis of rod. the ramming of sand and sweeping of board is done continuously till the mould is complete. This method is economical for preparing mould because no actual pattern is needed, only a sweep board is required to prepare the mould.



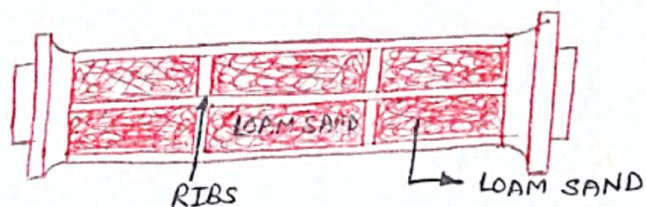
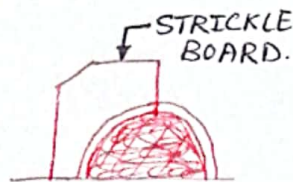
SWEEP PATTERN

8. Skeleton pattern :-

When a few and large sized castings are required, it is not advisable to use a large solid pattern of that size, as it will require a lot of wood or material and time to make a full pattern. In such cases, a skeleton pattern in the hollow form, consisting of wooden frame and strips is used.

The frame work is filled and rammed with lean sand and a strickle board, is used to scrap the excess sand out of the spaces b/w the ribs.

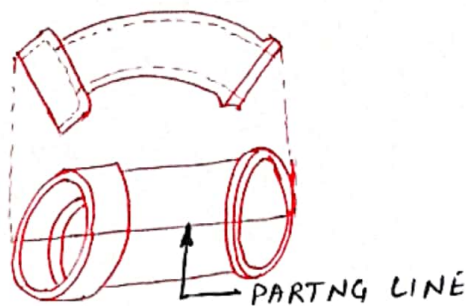
skeleton pattern are used for castings of hollow cast iron pipes, valve bodies etc.



SKELETON PATTERN

9. SHELL PATTERN:-

The shell pattern, is used largely for drainage fittings and pipe work. This type of pattern is usually made of metal mounted on a plate and parted along the centre line, the two sections being accurately doweled together. The shell pattern is a hollow construction like shell. The outside shape is used as a pattern to make the mould.



SHELL PATTERN

10. COPE AND DRAG PATTERN:-

When very large castings are to be made, the complete moulds become too heavy to be handled by single operators. In order to ease this problem, the cope and drag pattern is used. It is a two-piece pattern split on a joint line. One part is moulded in a cope and the other part in a drag of moulding box.