

# INTRODUCTION

Casting is a manufacturing process by which a liquid material is usually poured into a mould, which contains a hollow cavity of a desired shape, and then allowed to solidify. The solidified part is also known as a casting, which is ejected or broken out of the mould to complete the process.

Casting materials are usually metals or various carb setting materials that cure after mixing two or more components together for examples are epoxy, concrete, plaster and clay.

Casting is most often used for making complex shapes that would be otherwise difficult or uneconomical to make by other methods. Casting is a 6000 year old process.

## ADVANTAGES OF CASTING

- ⇒ Molten metal flows into a small section in molten cavity, hence any complex shape can be easily produced.
- ⇒ Due to small cooling rate from all directions, the properties of casting are all same in all directions.
- ⇒ Casting is often the cheapest and most direct way of producing a shape with certain desired mechanical properties.
- ⇒ Casting is best suited for composite components requiring different properties in different directions. These are made by incorporating preferable inserts in a casting.

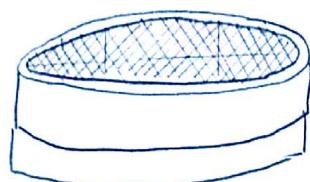
## DISADVANTAGES OF CASTING

- ⇒ With normal sand casting process, the dimensional accuracies and surface finish is less.
- ⇒ Defects are unavoidable.
- ⇒ Sand casting is labour intensive.

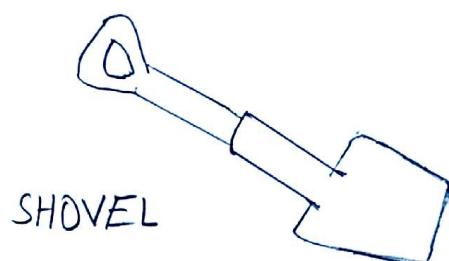
# TYPES OF PATTERN

The common types of pattern are :-

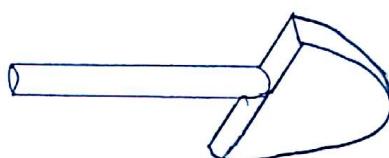
- 1) Single piece pattern
- 2) Split piece pattern
- 3) Loose piece pattern
- 4) Glated pattern
- 5) Match pattern
- 6) Sweep pattern
- 7) Cope and drag pattern
- 8) skeleton pattern
- 9) shell pattern
- 10) follow board pattern.



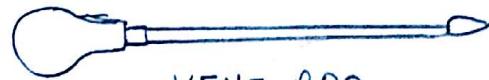
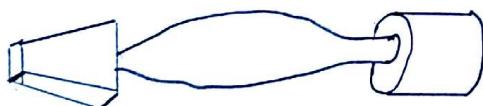
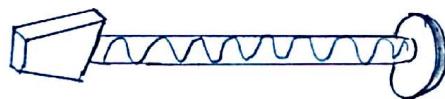
HAND RIDDLE



SHOVEL



RAMMERS



VENT ROD

# HAND TOOLS

The common hand tools are fairly numerous that are used in foundry shop. A brief description of the foundry tools is given as under.

## Hand Riddle

It consists of a screen of a standard circular wire mesh equipped with circular wooden frame. It is generally used for cleaning the sand for removing foreign material such as nails, shot metal, splinters of wood etc.

## Shovel

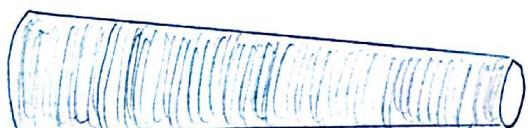
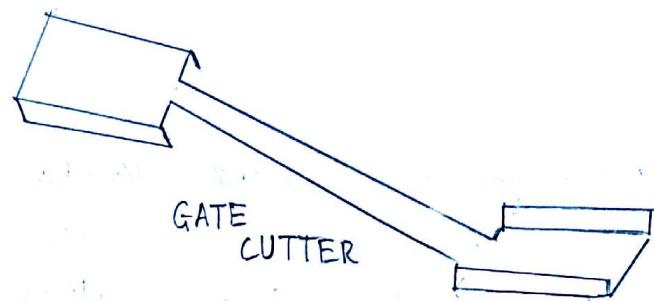
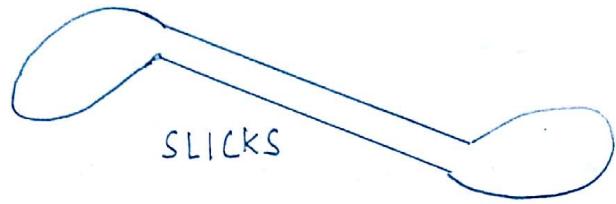
It consists of an steel pan fitted with a long wooden handle. It is used in mixing, tempering and conditioning the foundry sand by hand. It should always be kept clean.

## Rammers

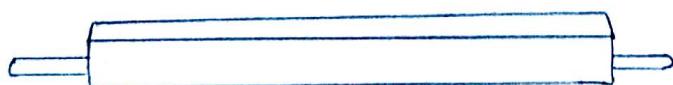
These are required for striking the moulding sand mass in the moulding box to pack or compact it uniformly all around the pattern. It is used for ramming the sand in the bench in which moulding works.

## Vent Rod

It is a thin spiced steel rod or wire carrying a pointed edge at one end and a wooden handle or a bent loop at the other. After ramming and striking off the excess sand it is utilised to pierce a series of small holes in the cope portion.



SPRUCE PIN



STRIKE OFF BAR

These holes allow the exit of steam and gases during solidifying of molten metal.

### Slicks

They are also recognised as small double ended mould finishing tool which are generally used for repairing and finishing the mold surfaces and their edges after withdrawal of the pattern.

### Gate Cutter

Gate cutter is a small shaped piece of sheet metal commonly used to cut runners and feeding gates for connecting sprue hole with mold cavity.

### Lifter

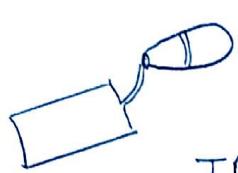
They are used for cleaning, repairing and finishing the bottom and sides of deep and narrow openings in mould cavity after withdrawal of pattern. They are also used for removing loose sand from mould cavity.

### Spruce Pin

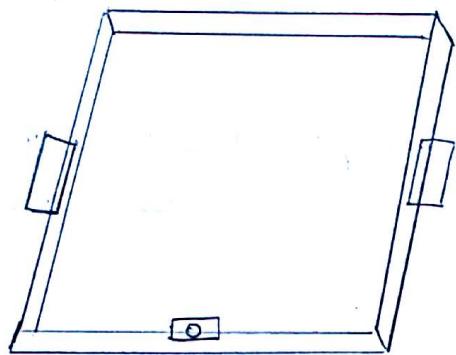
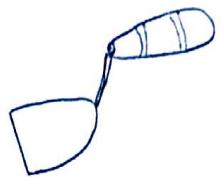
It is a tapered rod of wood or iron which is placed or pushed in cope to join mould cavity while the moulding sand in the cope is being rammed. Later its withdrawal from cope produces a vertical hole in moulding sand called sprue through which the molten metal is poured into the mould using gating system.

### Strike off Bar

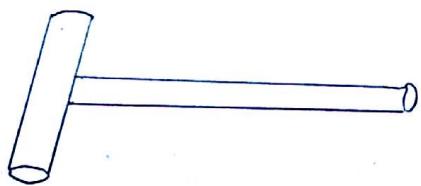
strike off bar is a flat bar having straight edge and is made from wood or iron. It is used to strike off the excess sand from the top of a moulding box after completion of ramming thereby making its surface plane and smooth. Its one edge is made bevelled and the other end is kept perfectly smooth and plane.



TROWEL



MOULDING  
BOX



MALLET

### Trowels

They are utilised for finishing flat surfaces and joints and parting lines of the mold. They consist of metal blade made of iron and are equipped with a wooden handle. The trowels are basically employed for smoothing or slicking the surface of moulds.

### Moulding Boxes

Closed moulding boxes which may be made of wood, cast iron or steel and consist of two or more parts the lower part is called the drag, the upper part the cope and all the intermediate parts, if used are called cheeks.

### Mallet

It is used for driving the draw spike into the pattern and the tapping it for separation from the mould surfaces so that pattern can be easily withdrawn leaving the mould without damaging the mould surface.

## PATTERN MATERIALS

The type of pattern depends upon:

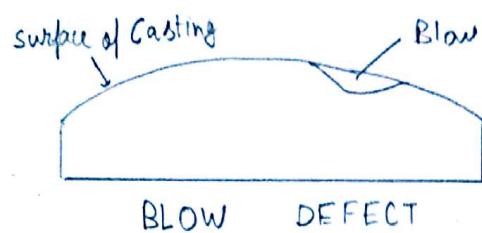
- Design of casting
- Number of casting to be produced
- Type of casting and moulded process used
- Degree of accuracy and surface finish required.

Materials used for casting are wood, metal, plastic, Plaster and wax.

## INGREDIENTS OF GREEN SAND

"Green Sand" is not a type of sand on its own, but it is a mixture of.

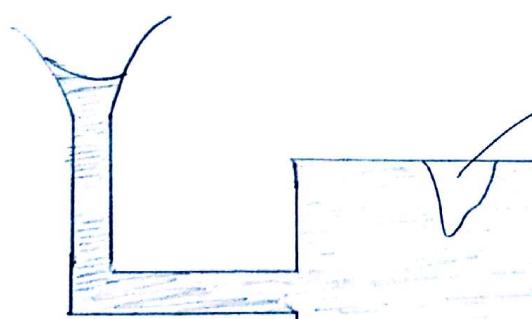
- Silica sand ( $\text{SiO}_2$ ) or chromite sand ( $\text{FeCr}_2\text{O}_4$ ) or Zircon sand ( $2\text{ZrSiO}_4$ )  
75 to 85% or olivine, or staurolite or graphite.
- Bentonite (clay) 5 to 11%
- water 2 to 4%
- insect sludge 3 to 5%
- anthracite 0 to 1%.



PENETRATION DEFECT



PIN HOLE DEFECT



SHRINKAGE DEFECT

# DEFECTS IN CASTING

## Blow

Blow is relatively large cavity produced by gases which displace the molten form of metal.

## Penetration

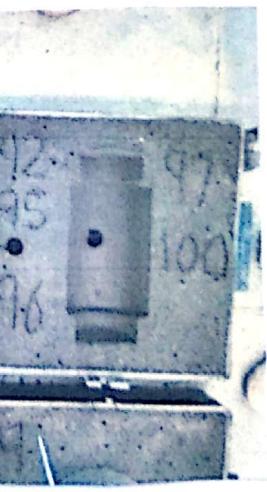
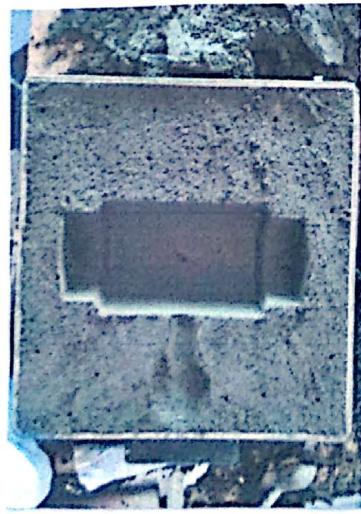
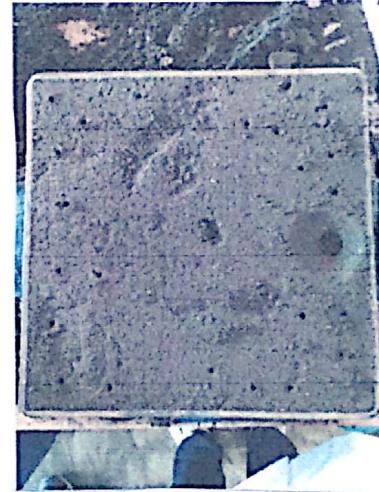
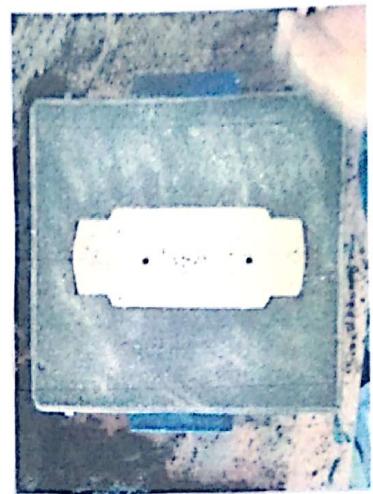
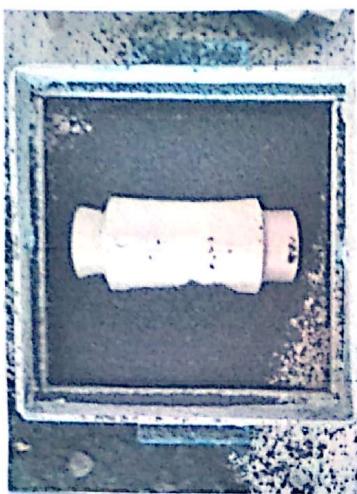
It is a strong crust of fixed sand on the surface of a casting which results from insufficient refractoriness of moulding materials, a large content of impurities, inadequate mould packing and poor quality of mould washes when the molten metal is poured into the mould wall and get solidified. cavity, at those places where sand cavity is inadequate, some metal will flow between the sand particles after a distance into the mould wall and get solidified. when the casting is removed this lump of metal remains attached to the casting. Of course it can be remove afterwards by chipping or grinding.

## Pin hole

Pin holes are small gas holes either at the surface or just below the surface, When these are present, they occur in large numbers and are fairly uniformly dispersed over the surface. This defect occurs due to gas dissolved in the alloy and the alloy not properly degassed.

## Shrinkage

A shrinkage cavity is a depression or an internal void in a casting that results from the volume contraction that occurs during solidification.



# JOB - 1

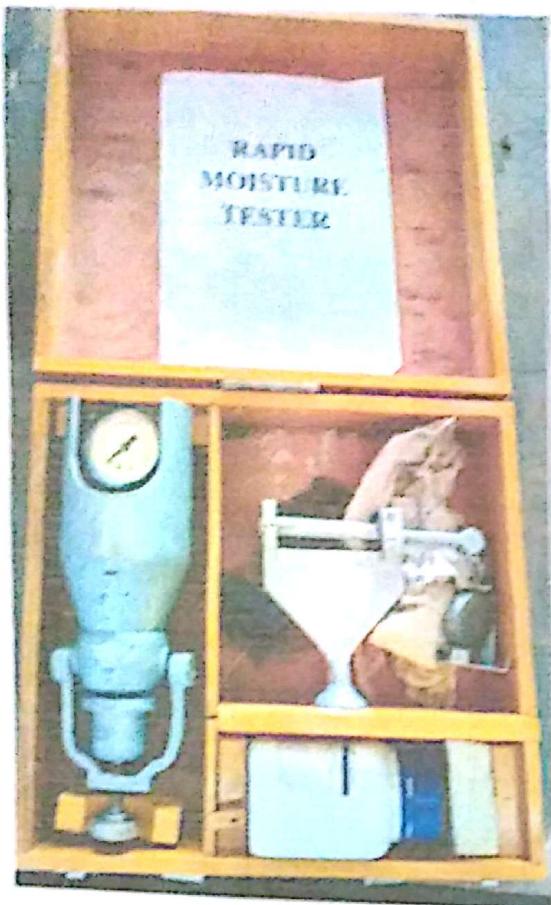
AIM - To make a sand mould with a wooden pattern

TOOLS REQUIRED - Hand riddle, shovel, Rammer, Gate cutter, lifter, Moulding Boxes, wooden pattern, Vent rod.

## PROCEDURE -

- 1) Keep the drag box inverted and put the pattern at the centre of the box
- 2) Fill the box with green sand level by ramming and using the strike off bar
- 3) Invert the drag box and fill it with sand and make the sand level plain by ramming and using strike off bar.
- 4) Sprinkle the sand on the drag and place the second part of wooden pattern and the cope box over the drag box. Join and lock two moulding boxes.
- 5) Place the spruce pins for the riser and runner respectively
- 6) Fill the cope box with green sand and keep on ramming the sand filled so that the sand particles become tightly aligned to each other.
- 7) Remove the spruce pins. With the help of lifter, carve out a bigger opening at the runner. Using a vent tool create about 15-20 holes in the cope box.
- 8) Remove the cope box using a lifter. Create a short vertical runner was kept now using a gate cutter create a gate from sink to the pattern.
- 9) Place the vent rod on the top of the pattern and using a mallet hammer the rod inside the pattern
- 10) Slowly pull out pattern, slightly twisting and pulling up taking care the mould doesn't gets disturbed.

The mould is ready now.



## JOB - 2

### → DETERMINING WATER CONTENT IN SOIL - CALCIUM CARBIDE METHOD

The test is done to determine the water content in soil by Calcium carbide method as per IS:2720 (Part-II) 1973. It is a measurement method for rapid determination of water content from the gas pressure developed by the reaction of Calcium carbide with the free water of the soil. From the calibrated gauge of the pressure gauge the percentage of water on total mass of wet soil is obtained and the same is converted to water content on dry mass of soil.

### APPARATUS REQUIRED

- a) Metallic pressure vessel, with a clamp for sealing the cup along with gauge calibrated in percentage constant.
- b) Counterpoised balance, for weighing the sample.
- c) Scrop, for measuring the absorbent (calcium carbide)
- d) Steel balls - 3 balls of about 12.5 mm diameter and steel ball of 25 mm diameter
- e) one bottle of the absorbent (calcium carbide)

### PREPARATION OF SAMPLE

#### SAND

No special preparation. Coarse powders may be grinded and pulverized cohesive and plastic soil is tested with addition of steel balls in the pressure vessel the test requires about 6gm of sample screen.



## PROCEDURE

- a) Set up the balance. Place the sample in the pan till the mark on the balance arm matches with the index mark.
- b) Check that the cup and body are clean.
- c) Hold the body horizontally and gently deposit the levelled scoop full of absorbent inside the chamber.
- d) Transfer the weighed soil from the pan to the cup.
- e) Hold cup and chamber horizontally, bringing them together without disturbing the sample and absorbent.
- f) Clamp the cup tightly into place. If the sample is bulky reverse the above placement.
- g) In case of clayey soil, place all four steel balls in the body along with the absorbent.
- h) Shake the unit up and down vigorously for about 15 seconds.
- i) Hold the unit horizontally while rotating it for 10 seconds so that the balls rolls around the inner circumference of the body.
- j) Rest for 20 seconds.

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