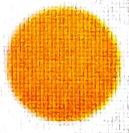
INGREDIENTS OF MOLDING SANDS

Molding sands are actually mixtures of three or more ingredients. Green sand -- clay, water, sand (SiO_2).

Also a number of other ingredients/materials are added.

- **SAND:** Molding sand contains 50 to 95 % of the total material in a molding sand. These sand particles may differ in the following ways:
- Average grain size, grain size distribution and grain shape.
- Chemical composition.
- Refractoriness and thermal stability.

- Generally the purest silica sand, 99.8+ percent SiO_2 is considered the most refractory and thermally stable.
- Excessive amounts of iron oxide, alkali oxides and lime can cause objectionable lowering of the fusion point in some sands.
- The shape of sand grains may be rounded, angular, or sub-angular depending on their geologic history.



- **Clay**: 2 to 50 percent
- With a suitable water content, it is the principal source of the strength and plasticity of the molding sand.
- Binder
- Natural molding sand ------ sand + clay in minerals
- Synthetic molding sands

- "Essentially aggregates of extremely minute crystalline, usually flake-shaped particles that can be classified on the basis of their structure and composition into a few groups which are known as clay minerals.
- Single clay minerals
- Mixtures of clay minerals
- Clay minerals : bentonites, fire clays (kaolinites) and special clays (halloysite, illite)

- **Water:** 1.5 to 8 percent
- Activate the clay ---------- develop plasticity and strength.
- Water in molding sand is often referred as "tempering" water.
- Water in excess -------- free water
- The rigid clay coatings of the sand grains may be forced together ---------- develop strength.
- Free water ----- lubricant --- makes the sand more plastic and more moldable though the strength may be lowered.
- Control of water in sand (clay) is very important.

SPECIAL ADDITIVES

- **Cereals:** finely ground corn flour or gelatinized and ground starch from corn.

  0.25 to 2.00 percent

  Increase green or dry strength and collapsibility.
- **Ground Pitch:** by-product of coke making.

  up to 2.0 percent

  improve hot strength and casting finish on ferrous castings
- **Sea Coal:** 2 to 8 percent.

  A finally ground soft coal.

  Grey and malleable iron molding sands.

  Improve the surface finish & Improve ease of cleaning the castings.
- **Gilsonite:** About 0.4 to 0.8 percent.

  A mineral

  Improve casting finish
- **Fuel Oil:** A little fuel oil is sometimes used as a replacement for a small percentage of water, thus lowering the total percentage of moisture present .

SPECIAL ADDITIVES

Wood Flour: 0.5 to 2.0 percent

Enhance thermal stability.

Control the expansion of sand by burning out at elevated temperature

Silica Flour: Pulverized silica, finer than 200 mesh, is called silica flour.

Up to 35 percent

Increase hot strength

Iron Oxide: 0.25 to 1.0 percent

To obtain added hot strength.

Perlite: An aluminum silicate mineral

0.5 to 1.5 percent

Better thermal stability of the sand

Riser insulator

Molasses, Dextrin: Cane or blackstrap molasses, unrefined, and containing 60 to 70 percent sugar solids, may be used for increased dry strength.

Dextrins may also be used for the same purpose

PROPERTIES OF GREEN SANDS

Properties depends on several factors.

i) The sand ingredients.

ii) The methods of preparing the sand for molding.

iii) The method of molding employed in using the sand.

iv) Variables related to the casting such as weight, shape, kind of casting alloy and gating design.

Effect of the ingredients:

- Each of the ingredients can have important effects on the properties. Principal ingredient ----- Silica Sand Grains

Effects of the Sand Grains:

- Casting surface finish, mold permeability, sand strength, refractoriness, and expansion characteristics are all influenced by the sand grain portion of the mixture.
- Sand-grain contour of the mold cavity.
- Fine grains ------ smooth wall at the metal interface.

- **Sand grains and permeability:**

  Coarser sand ---- greater permeability

  Finer sand ---- lower permeability The grain size distribution has a pronounced effect on permeability.

- **Sand grains and strength:**

  Strength ..... surface area of sand grains available for binding.

  Fine sands present more surface area and can develop high strength, but of course more clay is required.

  Wide size distributions favor strength, while narrow distributions reduce strength.

  Angular sand grains ----- more strength.

- **Sand grains and refractoriness:** High refractoriness --sand grains of maximum purity and size.

  Impurities which discolor silica lower its fusion point. Finer grains appear to be more easily fused than coarser ones.

- **Sand grains and Expansion:**

  Wide size distribution --- dense packing of the grains --- cause expansion problems.

  Fine sands also expands more.

- **Effects of Clay:** *Water is necessary to activate the clay.*

Clay and Sand Strength: For a given clay type and content, there is an optimum water content.

The effects of the clay on dry and hot strengths are quite important.

Too low a dry strength permits washing of the sand by the metal, and dirt in the castings.

Too low or too high a hot strength is also undesirable.

Clay Content and Permeability: Permeability is reduced by fine material in the sand.

Increasing clay content ------ lowers permeability.

Higher clay content also require more tempering water, and hence more steam is formed when the metal is poured .

Clay Content & Bulk Density: Clay content also influences the bulk density achieved by the sand during ramming.

A sand having minimum bulk density has much void space and will have a good permeability commensurate with its sand grain characteristics.

Clay Content & Expansion:

Clay content of 10 to 14 per cent in the sand mixture are accompanied by minimum confined-expansion value, 0.03 to 0.04 in. per in. as measured at 2500 F.

High clay contents together with the proper amount of water and ramming of the sand thus favor thermal stability.

Clay Content & Other Properties:

High hot and dry strengths are developed by bentonite and bentonite-fire clay mixtures ----- less collapsibility.

Combustible materials may be added to promote collapsibilty.

Excess clay ----- clay balls Good mixing is required.

- **Effects of water:** Close control of the moisture content of molding sand.

  Optimum tempering water.

  Water causes ------- the clay to develop higher dry strength.

  The bonding action is attributed to adsorbed water rigidly held by the clay.

  With its adsorbed water, the clay coatings on the sand grains can be wedged together if sufficient force (ramming) is applied.

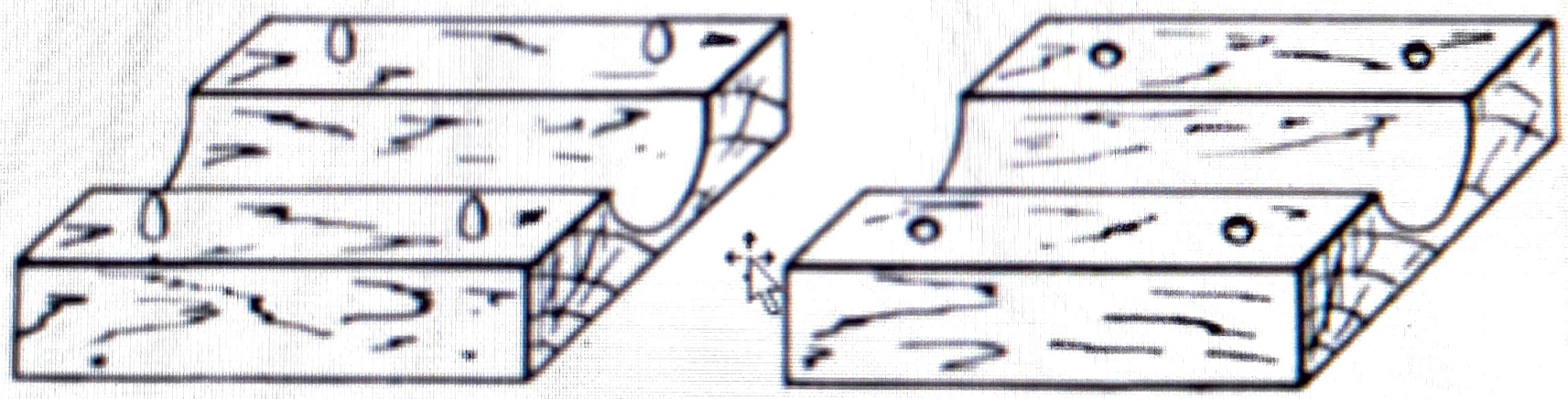
  Free water, un-adsorbed, can lubricate the coated sand grains and permit a greater bulk density to be reached.

CORE MAKING IN THE PROCESS OF CASTING

INTRODUCTION

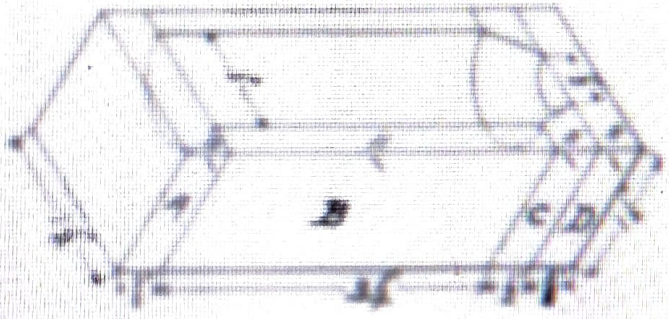
A core is a device used in casting process to produce internal cavities and reentrant angles. The core is normally a disposable item that is destroyed to get it out of the piece. They are most commonly used in sand casting.

CORE BOX

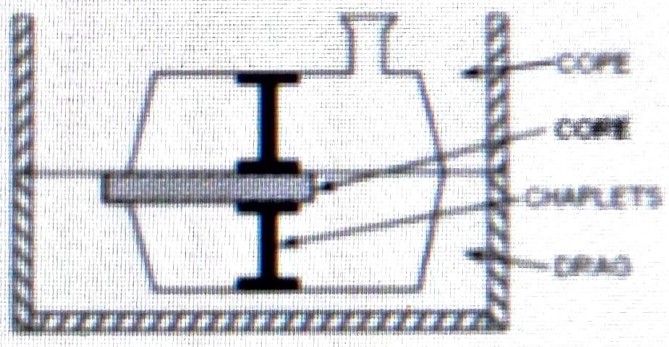


TYPES OF CORE BOXES

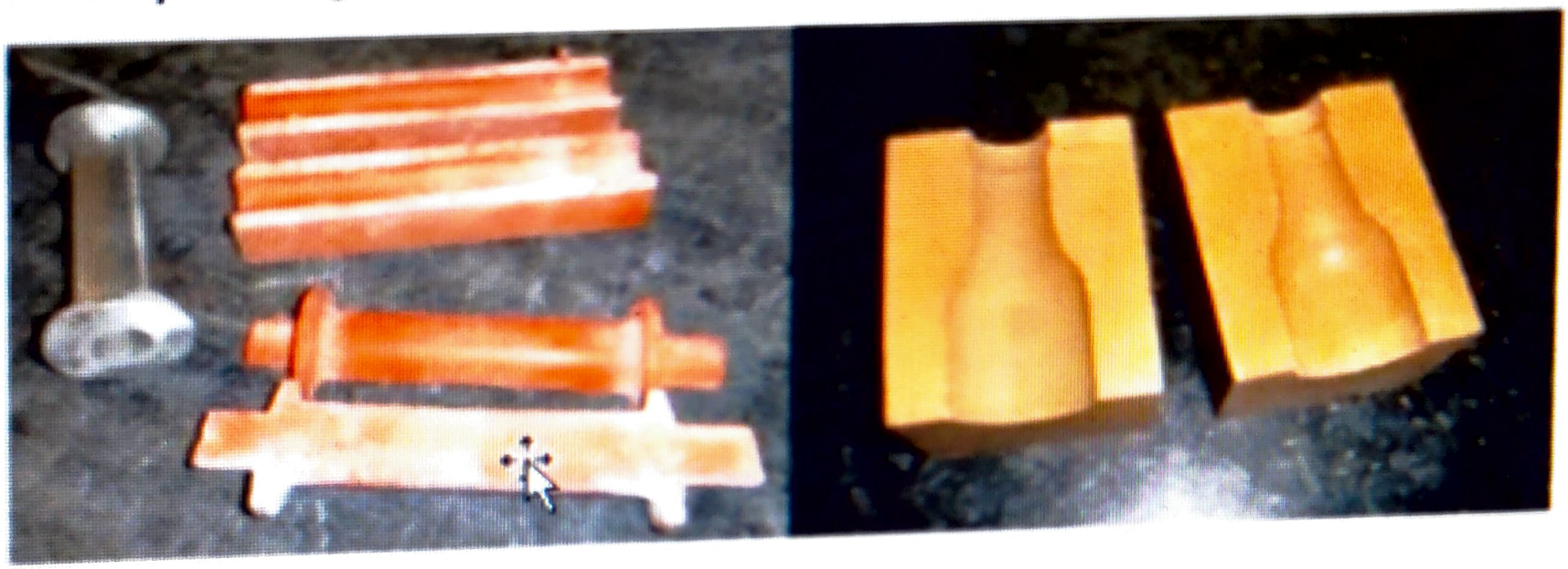
Half core box: When the shape of the core required is such that it can be prepared in identical halves, a half core box should be used.



Dump core box : If the core produced by the core box does not require any pasting and is complete in it, the box designed is referred to as a dump core box.



Split core box: When the core box is in two parts and complete cores results in single ramming, the box is split core box. For alignment of two parts, dowel pins are fixed in one part and corresponding holes are made in the other.



- Left and right core box: When the core is required in two parts and they are not identical, two different core boxes of the half core type have to be provided for each part of the core. Such boxes are called right handed and left handed core boxes.

Strickle core box: This is used when the core is required to have an irregular shape, which cannot be rammed by other methods. In this case, the desired irregular shape is achieved by striking off the core sand from the top of the core box with a piece of wood called strickle board. The strickle is cut to correspond exactly to the contour of the required core.

Loose piece core box: In case where two parts of the core are not identical they can be prepared from a single core box with the help of loose pieces. One part of the core is processed by placing the loose piece in the left-hand recess, and the other part by shifting the loose piece to the right-hand recess

CORE MAKING PROCESES

In Hinduja Foundries, they are using three processes. They are

1. Cold box process
2. Carbon dioxide (CO2) core making process
3. Shell process