Lecture 10

4-d. **Vacuum Sealed Molding Process**

It is a process of making molds utilizing dry sand, plastic film and a physical means of binding using negative pressure or vacuum. V-process was developed in Japan in 1971. Since then it has gained considerable importance due to its capability to produce dimensionally accurate and smooth castings. The basic difference between the V-process and other sand molding processes is the manner in which sand is bounded to form the mold cavity. In V-process vacuum, of the order of 250 – 450 mm Hg, is imposed to bind the dry free flowing sand encapsulated in between two plastic films. The technique involves the formation of a mold cavity by vacuum forming of a plastic film over the pattern, backed by unbounded sand, which is compacted by vibration and held rigidly in place by applying vacuum. When the metal is poured into the molds, the plastic film first melts and then gets sucked just inside the sand voids due to imposed vacuum where it condenses and forms a shell-like layer. The vacuum must be maintained until the metal solidifies, after which the vacuum is released allowing the sand to drop away leaving a casting with a smooth surface. No shakeout equipment is required and the same sand can be cooled and reused without further treatment.

Sequence of Producing V-Process Molds

- The Pattern is set on the Pattern Plate of Pattern Box. The Pattern as well as the Pattern Plate has Numerous Small Holes. These Holes Help the Plastic Film to Adhere Closely on Pattern When Vacuum is Applied.
- A Heater is used to Soften the Plastic Film
- The Softened Plastic Film Drapes over the Pattern. The Vacuum Suction Acts through the Vents (Pattern and Pattern Plate) to draw it so that it adheres closely to the Pattern.
- The Molding Box is Set on the Film Coated Pattern
- The Molding Box is filled with Dry Sand. Slight Vibration Compacts the Sand
- Level the Mold. Cover the Top of Molding Box with Plastic Film. Vacuum Suction Stiffens the Mold.
- Release the Vacuum on the Pattern Box and Mold Strips Easily.
- Cope and Drag are assembled and Metal is poured. During Pouring the Mold is Kept under Vacuum
- After Cooling, the Vacuum is released. Free Flowing Sand Drops Away, Leaving a Clean Casting

Advantages

- Exceptionally Good Dimensional Accuracy
- Good Surface Finish
- Longer Pattern Life
- Consistent Reproducibility
- Low Cleaning / Finishing Cost

4-e. Centrifugal Casting

In this process, the mold is rotated rapidly about its central axis as the metal is poured into it. Because of the centrifugal force, a continuous pressure will be acting on the metal as it solidifies. The slag, oxides and other inclusions being lighter, get separated from the metal and segregate towards the center. This process is normally used for the making of hollow pipes, tubes, hollow bushes, etc., which are axisymmetric with a concentric hole. Since the metal is always pushed outward because of the centrifugal force, no core needs to be used for making the concentric hole. The mold can be rotated about a vertical, horizontal or an inclined axis or about its horizontal and vertical axes simultaneously. The length and outside diameter are fixed by the mold cavity dimensions while the inside diameter is determined by the amount of molten metal poured into the mold. **Figure 10** (Vertical Centrifugal Casting), **Figure 11** (Horizontal Centrifugal Casting)

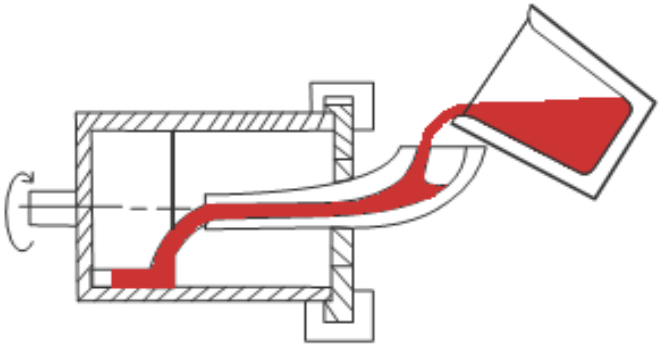

Figure 10: (Vertical Centrifugal Casting)

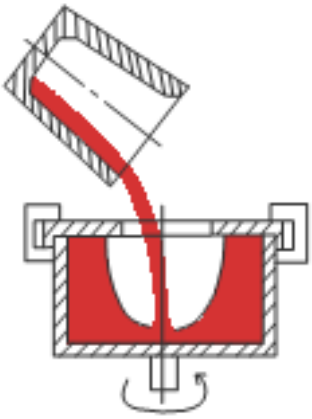

Figure 11: (Horizontal Centrifugal Casting)

Advantages

- Formation of hollow interiors in cylinders without cores
- Less material required for gate
- Fine grained structure at the outer surface of the casting free of gas and shrinkage cavities and porosity

Disadvantages

- More segregation of alloy component during pouring under the forces of rotation
- Contamination of internal surface of castings with non-metallic inclusions
- Inaccurate internal diameter