1  PRECISION CASTINGS

1.1  Casting Process

Precision casting is also known as the lost wax process. This process is one of the oldest manufacturing processes. The Egyptians used it in the time of the Pharaohs to make gold jewelry (hence the name Precision) some 5,000 years ago. Intricate shapes can be made with high accuracy. In addition, metals that are hard to machine or fabricate are good candidates for this process. It can be used to make parts that cannot be produced by normal manufacturing techniques, such as turbine blades that have complex shapes, or airplane parts that have to withstand high temperatures.

Model designing  Model manufacturing  Wax injection  Patterns assembly

The mold is made by making a pattern using wax or some other material that can be melted away.

Pattern is dipped in refractory slurry  Dry and wax removing  Casting

This wax pattern is dipped in refractory slurry, which coats the wax pattern and forms a skin. This is dried and the process of dipping in the slurry and drying is repeated until a robust thickness is achieved. After this, the entire pattern is placed in an oven and the wax is melted away. This leads to a mold that can be filled with the molten metal. Because the mold is formed around a one-piece pattern, (which does not have to be pulled out from the mold as in a traditional sand casting process), very intricate parts and undercuts can be made. The wax pattern itself is made by duplicating using a stereo lithography or similar model-which has been fabricated using a computer solid model master.

The materials used for the slurry are a mixture of plaster of Paris, a binder and powdered silica, a refractory, for low temperature melts. For higher temperature melts, sillimanite an alumina-silicate is used as a refractory, and silica is used as a binder. Depending on the fineness of the finish desired additional coatings of sillimanite and ethyl silicate may be applied. The mold thus produced can be used directly for light castings, or be reinforced by placing it in a larger container and reinforcing it more slurry.

Just before the pour, the mold is pre-heated to about 1000 °C (1832 °F) to remove any residues of wax, harden the binder. The pour in the pre-heated mold also ensures that the mold will fill completely. Pouring can be done using gravity, pressure or vacuum conditions. Attention must be paid to mold permeability when using pressure, to allow the air to escape as the pour is done. Tolerances of 0.5 % of length are routinely possible, and as low as 0.15 % is possible for small
dimensions. Castings can weigh from a few grams to 60 kg, although the normal size ranges from 200 g to about 10 kg. Normal minimum wall thicknesses are about 1 mm to about 0.5 mm for alloys that can be cast easily.

The types of materials that can be cast are Aluminum alloys, Bronzes, tool steels, stainless steels, Stellite, Hastelloys, and precious metals. Parts made with Precision castings often do not require any further machining, because of the close tolerances that can be achieved.

1.2 Advantages

Precision castings offers a combination of features which can translate to cost-saving benefits:

- **DESIGN FREEDOM** Limitations to design are very few. Precision casting process is capable of producing parts with complex holes, slots, lettering, bevels.

- **WIDE CHOICE OF ALLOY.** We can cast any different kind of ferrous air-meltable alloys (carbon and low alloy steels, tool steels, 300 and 400 series, stainless steels, precipitation hardened steels, high nickel alloys, high cobalt alloys, electrical/magnetic). Besides the steels codified by international standards, our equipments allow us to cast alloys developed on purpose for customers' special requirements.

- **REDUCE PRODUCTION COSTS.** Costly machining operations are reduced because of the high geometrical complexity and tight tolerances that can be reached with Precision casting. In many cases the casting is ready to be assembled as it is. This can lead to a significant cost reduction.

- **CLOSE TOLERANCES AND FINE DETAILS** Close dimensional tolerances are possible with Precision castings. The best tolerance range is ±0.5% of nominal dimension, with a minimum of ±0.1 mm for the dimensions less than 15 mm.

- **CUT TOOLING COSTS.** Our Precision casting tooling is usually much less expensive than tooling for other casting methods.

- **PRODUCTION VOLUMES FLEXIBILITY.** Because of the flexibility of our organization, we can produce batches which varies from few pieces to hundred thousand of pieces.
1.3 **Samples**

0.3 kg carbon steel + galvanizing clamp

9 kg stainless steel box

16 kg carbon steel reel

60 kg stainless steel and carbon steel V-shape rollers