



GT Casting Process Overview

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GloTech has deep experience with advanced metal casting techniques used on a variety of its product lines

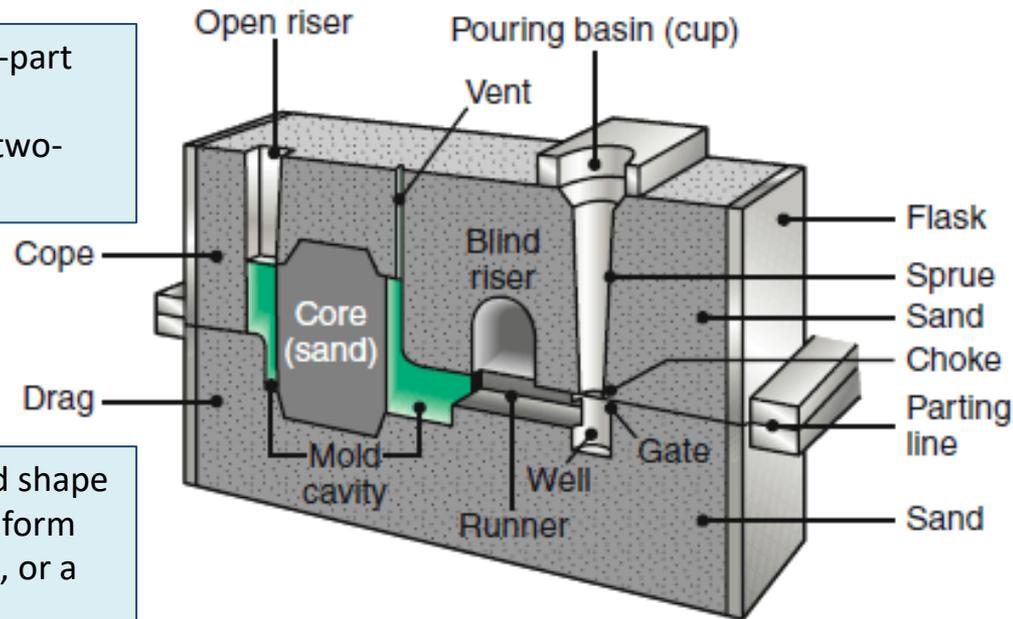
- Traditionally, sand casting has been widely used for metal castings due to cost and availability. Over 70% of the world's metal castings are produced using the sand casting process
- With the advancement of casting technology, as well as the increasing demand for better casting quality and higher production rate, casting techniques including shell cast, lost-foam, and investment (lost-wax) casting, have become increasingly popular within the industry
- GloTech has deep and focused experience developing and optimizing the following casting techniques associated with iron and steel materials:
 - Resin sand casting
 - Shell casting
 - Investment (lost wax) casting
 - Lost-foam casting

PROs and CONs of metal casting techniques commonly used for GloTech products

Casting Process	Sand Casting	Shell Mold	Investment (Lost Wax)	Lost Foam
Tolerances	Loose	Medium (size dependent)	Tight (Accurate for small parts)	Medium
Surface Finish	Fair	Very Good	Excellent	Good
Production Volume	Low	High	High	High
Other Areas of advantage	<ul style="list-style-type: none"> • Large parts • Thicker walls 	<ul style="list-style-type: none"> • Size and weight limitations 	<ul style="list-style-type: none"> • Intricate geometry • Thin wall 	<ul style="list-style-type: none"> • Large parts • Medium wall thk
Pictures				

Typical sand casting mould cross-sectional view and glossary of terms

Sand Mold Structure



Cope: Top half of a two-part casting mold

Drag: Bottom half of a two-part casting mold

Core: A preformed sand shape inserted into a mold to form the interior of a casting, or a hollow part

Riser: A reservoir to feed molten metal and control the solidification sequence

Vent: Allowing gas to escape from a mold

Sprue: The main channel through which molten metal flows before entering the mold cavity

Gate: The area of the runner system where molten metal actually enters the mold cavity

Runner: A channel through which molten metal is poured in order to reach the mold cavity

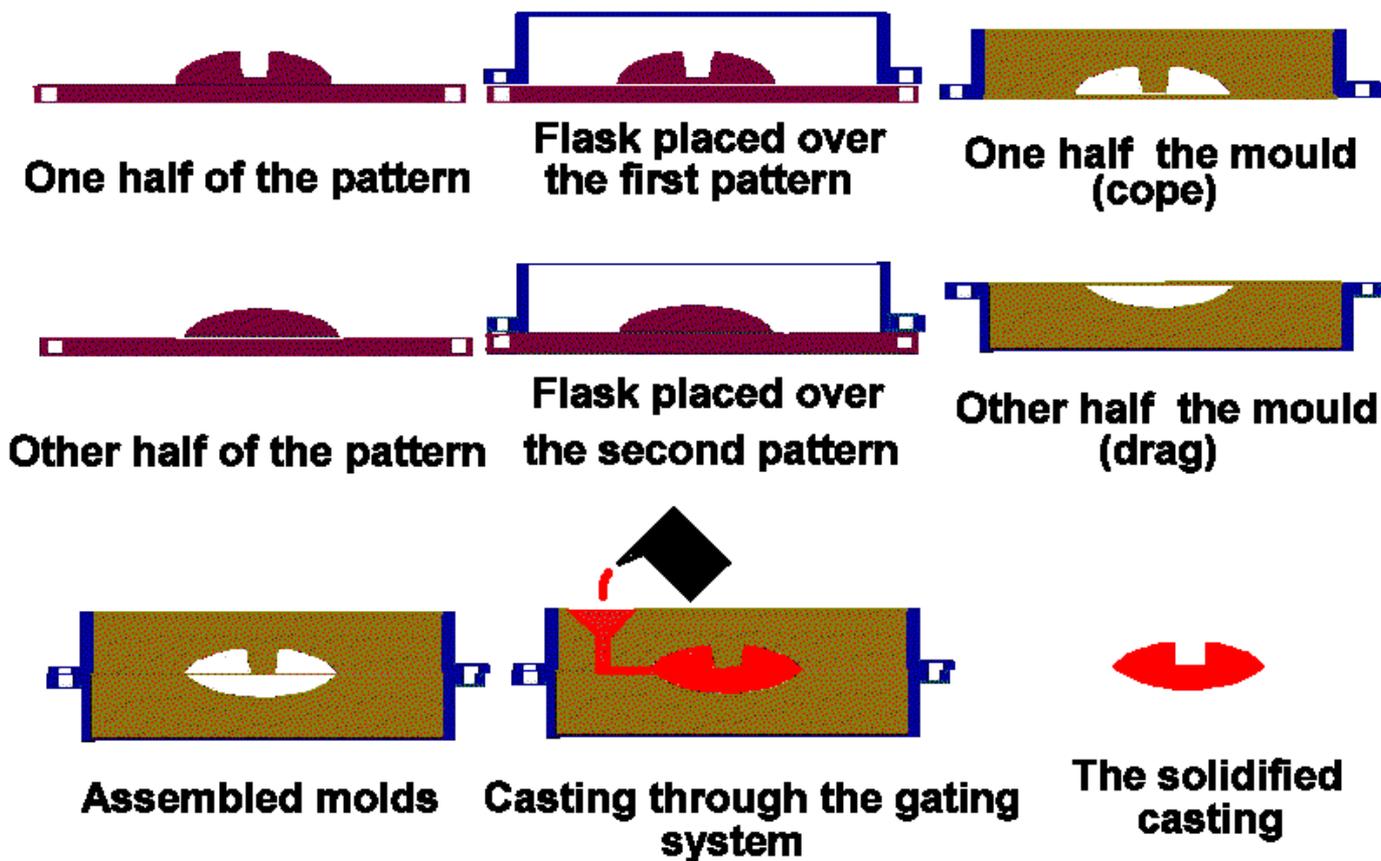
Draft: Taper on the vertical sides of a pattern or corebox allowing the core or sand mold to be removed without distorting or tearing the sand

Mold: A rigid frame into which liquid metal is poured to form a casting

Pattern: a replica of the part to be cast, used to shape the mold

One of the oldest and most economical processes for creating metal parts and structures

Sand Casting Process Overview



There are three types of sand commonly used in a sand casting process: green sand, water glass (sodium silicate) and resin sand



Green Sand

Green Sand

- A common casting process, using moist, clay-bonded molding sand
- PROs:
 - Cost effective
- CONs:
 - Rough surface
 - More casting defects (leftovers and sand holes)



Water Glass

Water Glass (Sodium Silicate)

- Another sand mold material that requires CO₂ to dehydrate
- Useful where a cavity is required in casting
- PROs:
 - Does not emit harmful or irritating gases
- CONs:
 - Can be difficult to separate / demold



Resin Sand

Resin Sand

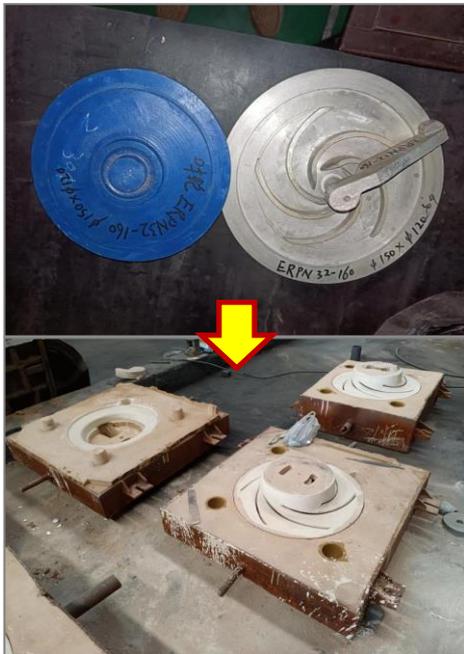
- The chemical reaction created by the resin helps to bind and stiffen the quartz sand to make solid, hard and strong molds
- PROs:
 - Less faulty castings
 - Better surface quality
- CONs:
 - More expensive
 - Lower production rate

Resin sand casting is commonly seen on larger castings with low-medium production volumes.

Resin Sand Casting Process

Mold/Core Production

Create sand mold / core using tooling / pattern



Mold/Core Assembling

Assemble core, mold, sprue, riser, etc.



Pouring/Post Processing

Pouring, shakeout, cutting, shot blast, etc.



Additional photos of resin sand casting process



Sand Core Dipping



Sand Core Coating



Sand Shell Molding



Sand Shell Molding



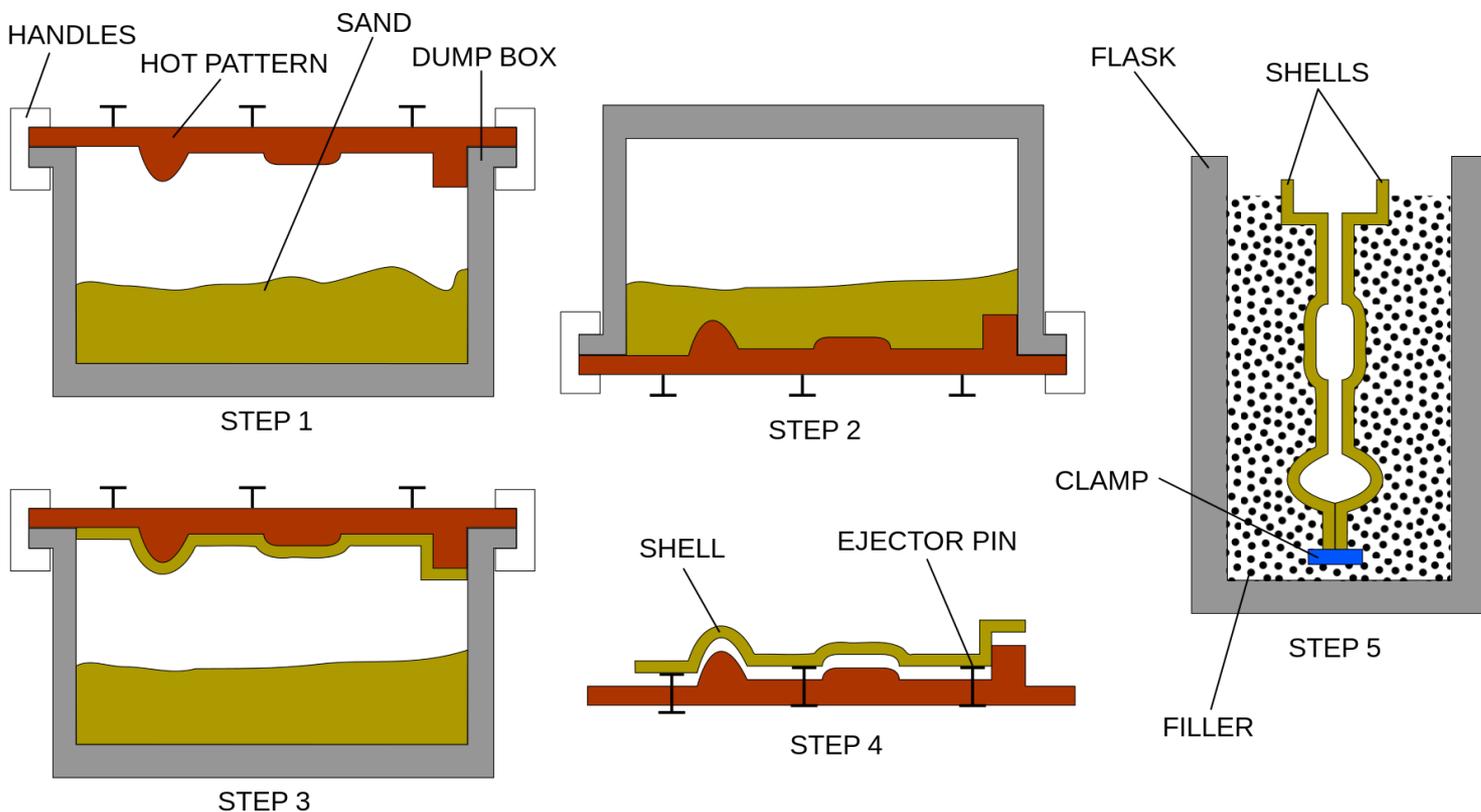
Molds Assembly



Casting with Sprue/Risers

It uses preheated metal tooling to “bake” molds and cores with a hardened shell, which allows for a smooth casting surface finish

Shell Casting Process Overview



Shell casting is mostly seen on small-medium castings where good surface finish is desired.

Shell Casting Process

Mold/Core Production

Preheat tooling
Bake coated sand into shell



Shell Assembling

Assemble core, mold, sprue, riser, etc. via glue



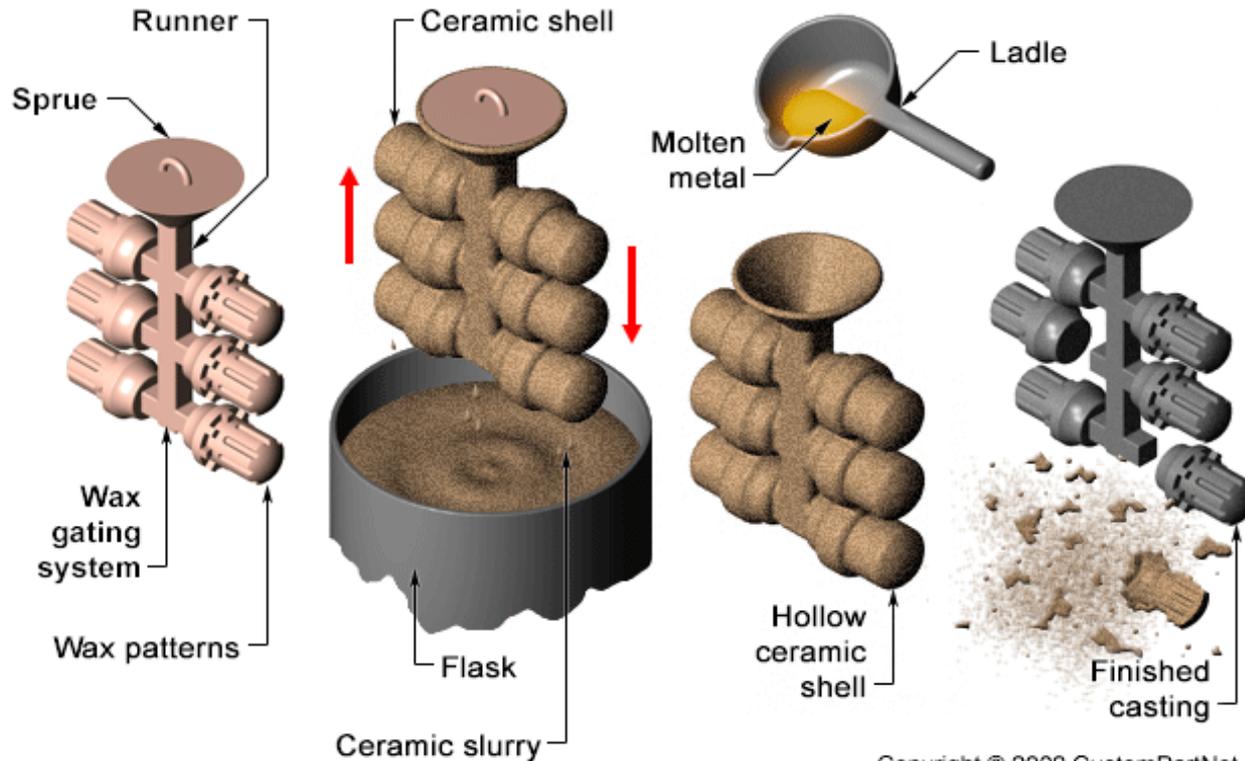
Pouring/Post Processing

Pouring, shakeout, cutting, shot blast, etc.



As one of the oldest forms of casting, investment casting allows for greater detail and smoother finish compared to other processes

Investment Casting Process Overview



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Lost wax casting is commonly seen on SS parts where appearance and hydraulic efficiency is critical.

Investment Casting Process

Wax Pattern Production & Assembly

Wax injection, cleaning and assembly



Shell Making & Dewax

Slurry dipping, sand coating, dewax in autoclave



Pouring/Post Processing

Pre-heat, pouring, shakeout, shot blast, heat treat, etc.



Additional photos of lost wax casting process



Wax Injection



Slurry/Sand Coats



Dewax



Machine Shakeout



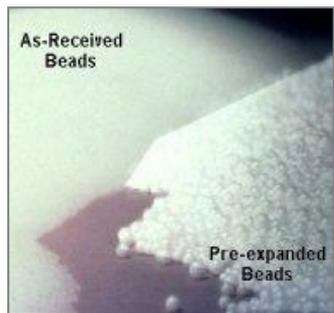
Shot Blasting (<0.5mm ball)



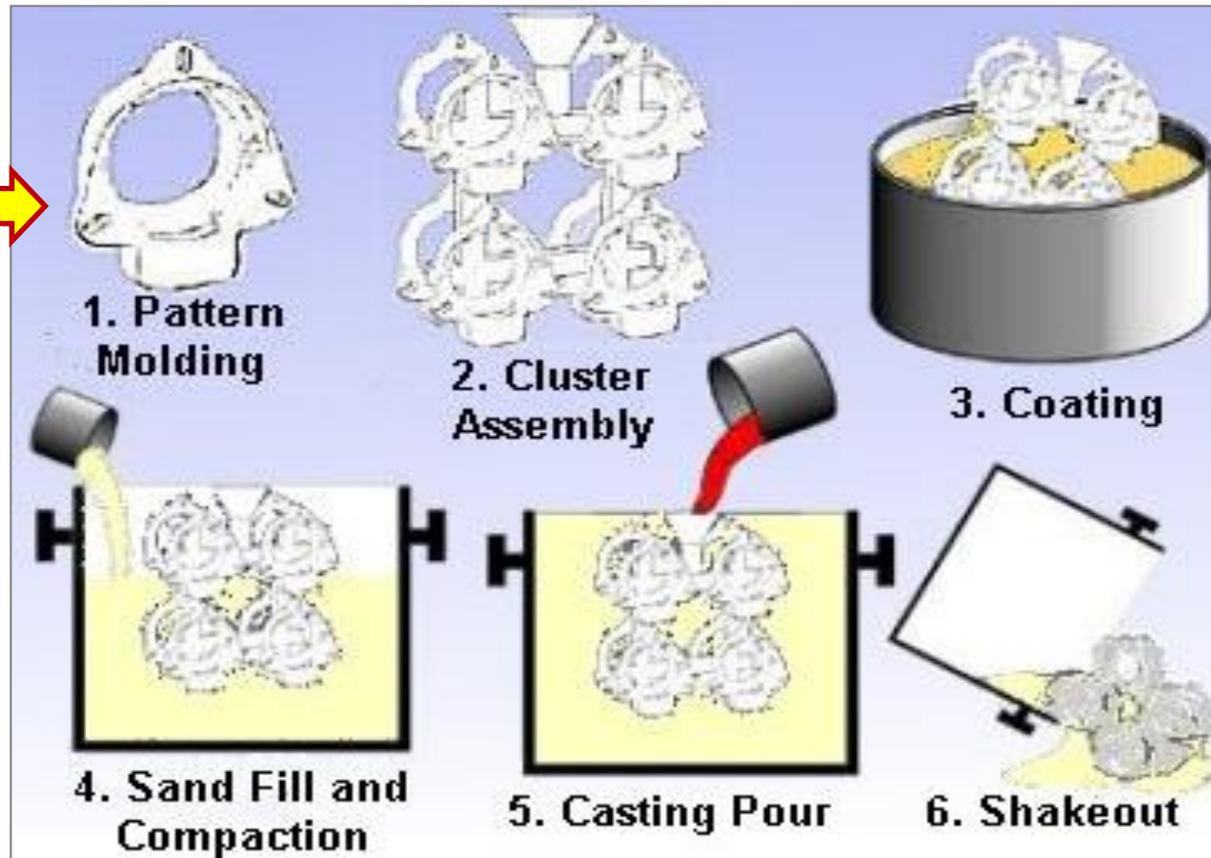
Solution Treatment

Lost foam casting is a process in which molten metal evaporates a foam mold being held still with sand

Lost Foam Casting Overview



Pre-expansion of EPB (Expandable Polystyrene Beads)



With its increasing popularity, lost foam casting is ideal for large castings with high production volumes.

Lost Foam Casting Process

Foam Pattern Production & Assembly

Foam pattern molding & pattern assembly



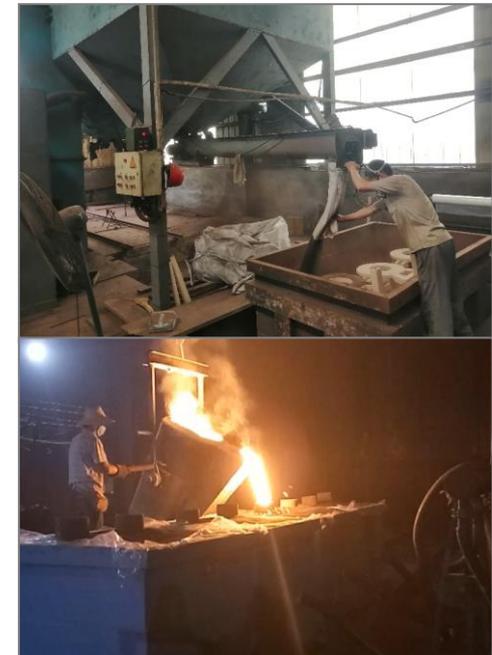
Coating & Drying

Slurry dipping & drying



Compaction, Pouring & Post Processing

Sand fill and vacuum compaction, pouring, shakeout



Additional photos of lost foam casting process



Bowl Foam Core



Tree Assembly



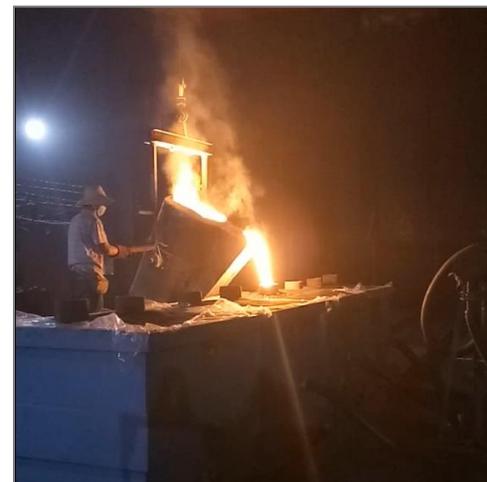
Slurry Dipping



Sand Fill and Compaction



Ready for Pouring



Pouring in Progress