Using No Bake Molding System to achieve a Competitive Edge

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Introduction to Nobake Casting

As the metalcasting industry's second favorite method for producing cast components (green sand molding is the first), nobake molding has proven its worth as an efficient means to produce medium and low volumes of complex castings in both ferrous and nonferrous metals

In the nobake process, sand is mixed with a chemical binder/catalyst system and then molded around the cope and drag halves of the tooling. After a specified period of time (from as little as 10 sec to as long as the foundry requires depending upon mold size), the sand mixture hardens (resembling a brick in strength) to form the mold halves and the tooling is drawn. Then, a refractory coating may be applied to both mold halves before they are brought together to form one complete mold for pouring. (Nobake molded cores also can be produced using a similar method and assembled into the mold to form more complex shapes.)

What No bake Syaytem Offers

Nobake molding, like green sand molding, is known for its versatility. Virtually all metals can be cast via nobake molding with component weights ranging from less than a pound to several hundred thousand pounds. For casting designers, nobake molding offers:

- good dimensional tolerances (±0.005-0.015) because the rigidity of the mold withstands the pressures exerted by the molten metal during casting;
- compatability with most pattern materials, including wood, plastic, metal, fiberglass and styrofoam, allowing for inexpensive tooling options for casting runs as low as one. In addition, nobake molding imparts minimal tooling wear;
- design flexibility for intricate casting shapes. The rigidity and tensile strength of nobake molds allows for thin sections of 0.1-in. to be routinely produced. In addition, mold strength allows for minimal draft and radii requirements in casting design.
- reduced opportunity for gas-related defects as the nitrogen content of most binder systems used for nobake molding minimize susceptibility to gas porosity;
- fine surface finishes that can be upgraded further with the mold and core coatings to support special finishing on the cast components such as paint or dressing. In addition, nobake casters can alter their molding media make-up from basic silica sand to higher-end media such as chromite or zircon sand for applications requiring X-ray quality and extreme pressure tightness;
- ability to work well with unique metalcasting quality enhancement tools such as metal filters, ceramic runner systems and exothermic risers to improve casting properties.
- low to medium volume production capability with runs from 1-5000 parts/yr.

Some Important questions related to No bake system

How many cast components will you require per year?

Nobake molding typically is an option for production runs from 1-5000 castings/yr . Due to the curing time required for the chemicals to harden the mold as well as the methods to distribute the molding media on the pattern, the high productions achievable with green sand, permanent mold or diecasting aren't possible with nobake. Nobake molding prefers cast components with higher complexities in low to medium volume runs.

When should you choose nobake molding vs. green sand molding?

Anything that can be cast in a green sand mold can be cast in a nobake mold, but the reverse isn't true. Besides the number of castings that need to be produced, the decision between green sand and nobake comes down to the complexity of the casting design. Since unfinished nobake molded castings (without machining) typically cost 20-30% higher than green sand, designers and purchasers sourcing to nobake molding must offset this price difference by taking advantage of what the process offers. Significant reductions in machining costs can be achieved through the process' tight tolerances and minimal dimensional variability and by designing in complex shapes and geometries, thin walls, and reduced draft, radii and machine stock.

Tooling cost also plays a factor in this comparison. Green sand molds require compaction force during the molding process, which means that the tooling must be able to withstand this force. Nobake tooling doesn't have to withstand a strong compaction force (often only light vibrations), allowing wood and plastic to be viable tooling materials. In addition, the lack of compaction force in molding also allows nobake molders to use loose pattern pieces and other innovative tooling options to increase casting complexity and add design features to the components.

What about pattern cost because you only require a few parts?

Pattern materials for nobake molding include wood, plastic, fiberglass, metal and styrofoam. This allows the tooling cost to be minimized as much as if not more than any other production casting process. In addition, with the styrofoam option for the Full Mold process (see "Nobake Meets Lost Foam in Full Mold Process" sidebar), hard tooling doesn't even have to be created for small production runs.

How do you design cast components for nobake molding?

Designing castings for traditional nobake molding follows many of the same principles used in all other casting processes. Draft is required so patterns can be drawn, sharp corners and angles should be minimized and uniform section thicknesses (especially in the same plane) should be employed as much as possible. However, the process does allow for more daring designs. Consult a nobake foundry with your ideas to determine how best to accomplish a specific casting challenge.

Cost vise comparison of No Bake system and Sodium Silicate/CO_2 Process

(A Case Study)

Detail of Operating Parameters

Part Name	Slag Pot
Material	Grey Cast Iron
Pouring Weight	5700 Kg
Mold coating	Graphitic coating (Spirit Based)
Pouring Temperature	1300 degree C
Melting Equipment	Cupola Furnace

Characteristics of ESTER hardened No-bake Alkaline Phenolic Resin

Resin

Alkaline phenolic resin is alkaline water solution of phenolic resin with very low free phenol andformeldehyde.

Appearance	*Viscosity*	*Specific gravity*	*Free Phenol*	*Free Formeldehyde*	*Remarks*
Deep red and brown liquid	*150 CmPa.s @ 25 degree C*	*1.2~1.3 g/CC @ 25 degree C*	*0.5 %*	*0.2 %*	*High strength low odour*

Hardener

Hardener is generally carboxylic ether of polyol

Density	Viscosity	Ester content	Stripping time
1.1~1.2 gm/CC @ 25 degree C	30 CmPa.s @ 25 degree C	98 %	20 minutes @ 20~25 degree C

CO2 Process				Alpha Set			
MOLDING MATERIAL COST							
Variable	**Weight**	**Rate**	**Cost**	**Variable**	**Weight**	**Rate**	**Cost**
Silica sand	14000 Kg	Rs. 4.5/ Kg	Rs.63000/-	**Silica sand**	14000 Kg	Rs.4.5/- Kg	Rs.63000/-
Sodium silicate	1120 Kg	Rs.15.2/- Kg	Rs. 17024/-	**Resin (@ 2% of wt of sand)**	280 Kg	Rs.141/- Kg	Rs.39480/-
CO2	140 Kg	Rs.48/- Kg	Rs.6720/-	**Hardener (@ 20 % of weight of Resin)**	56 Kg	Rs.249/- Kg	Rs.13944/-
Sand Reclamation	zero			**Sand reclamation (@ 70 %)**	9800 Kg	Rs.4.5/- Kg	Rs.Rs.44100/-
Total			Rs. 86744/-			Total	Rs.72324/-

CO2 Process			Alpha Set		
LABOUR COST					
Molding Time 03 days			**Molding time** 01 days		
Molders	**2 no.**	**Rs.3600/-**	**Molders**	**02 no.**	**Rs.1200/-**
Helpers	**8 no.**	**Rs.3600/-**	**Helpers**	**04 no.**	**Rs.1600/-**
Fettling Time 06 days			**Fettling Time** 1 day		
Chipper men	**03 no.**	**Rs.9000/-**	**Chipper men**	**02 no.**	**Rs.1500/-**
	Total	**Rs.16200/-**	**Total**		**Rs.4300/-**

CO2 Process	Alpha Set

MOLDING MATERIAL COST	**Rs.86744/-**	**MOLDING MATERIAL COST**	**Rs.72324/-**
LABOUR COST	**Rs.16200/-**	**LABOUR COST**	**Rs.4300/-**
Total Cost	**Rs.Rs.102944/-**	**Total Cost**	**Rs.76624/-**
Molding Cost per Kg **Rs.18.06/-**		**Molding Cost per Kg** **(with reclamation) Rs.13.44/-** **Molding cost per Kg** **(with out reclamation)Rs. 21.17/-**