MetalTek INTERNATIONAL
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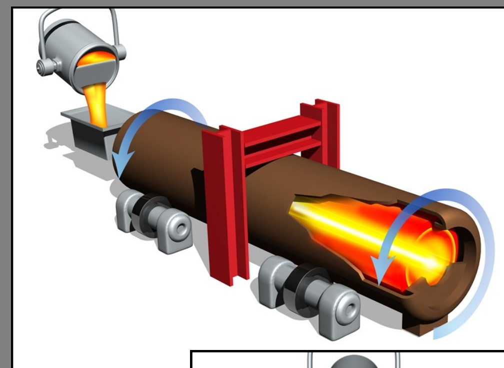
February 2009

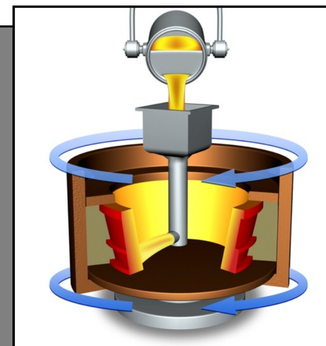
Tek Bulletin

Centrifugal shaping

Centrifugal castings are produced in a rotating die with applied forces ranging up to nearly 200 times the force of gravity, depending on the orientation and exact nature of the part being cast. Molten metal in a centrifugal casting undergoes refining during the casting process due to centrifuging of the lower density particles that may be present in the alloy (slags, gases, oxides from de-oxidation and re-oxidation products, and other exogenous materials). The centrifuging action causes the lower density particles to float to the inside diameter of the casting where they will be removed by machining after the casting is solidified.

The heat of the molten metal is extracted through the OD into the die wall, causing a unidirectional solidification from the OD to the ID. The applied g-force imparts significant pressure on the molten metal as it solidifies, which reduces the chances for shrinkage or gas voids to form, A sound casting with very low levels of inclusions or micro-shrinkage results. Centrifugal castings may thus be produced to very high radiographic levels, with excellent mechanical properties. This allows the replacement of many forged parts by centrifugals, with appropriate allowance for mechanical properties and testing.



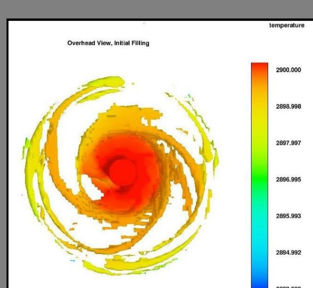


While the production of horizontal centrifugal castings allows minimal shaping, vertical centrifugal castings are often produced with complex shaping on the outside diameter through the use of permanent dies or consumable mold materials. Heat transfer and cooling rates during solidification are controlled by the use of die and mold materials and refractory coatings.

Modern computer simulation technologies allow the modeling of the casting process, with the varying shapes and material properties involved in making the casting. This has greatly reduced the risk associated with start-up of these shapes.

MODELING REDUCES RISK / OPENS OPTIONS

Solidification modeling is used in most modern foundries to simulate the physics of the process. In the last 20+ years, technology has advanced to the point that many models now take hours or less to get initial results, making it economically feasible to simulate even lower quantity casting applications.



One major advance in the technology unique to MetalTek is the ability to accurately simulate the fluid dynamics and thermal dynamics of the molten metal within the rotating centrifugal mold cavity. This allows the engineer to predict, and mitigate potential problems before the first casting is poured, and allows for early optimization of the casting process through control of turbulence and heat transfer.

The use of computer simulation as a predictive tool has greatly reduced learning time and cost on new products, particularly those with complex geometries or stringent specification requirements.

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Metals Trivia:

- Meteors have a high content of nickel and iron.
- Aluminum is the most common metal in the world.
- Bearium® leaded tin-bronze alloys have been used in many severe applications from cryogenic service to transport of the Space Shuttle. The reason? Bearium® has a proprietary process to pre-alloy the lead for better performance.

Preventing defects in static castings caused by entrapped air or dissolved gasses is a major consideration in the design of the casting gating system and control of the molding and casting processes. Not only does the molten metal have to displace the air in the mold, it also pulls additional air into the mold through aspiration as it flows into the mold cavity.

There are additional sources of gas that must also be removed; including gasses dissolved in the metal and gas related to the sand mold, such as that caused by the combustion of binders and moisture from mold washes. All of this gas rapidly expands as it heats, causing back pressure. Venting of the gas through the sand mold must be sufficient to avoid gas defects.

Have a Metals problem?
Call Us 1-262-650-7171
www.MetalTek.com