



Comparing Casting Processes

Impro



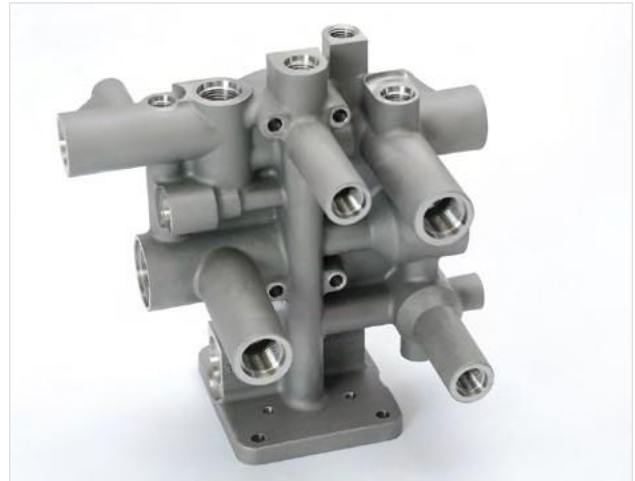
Casting is a manufacturing process that entails the pouring of molten metal into a three-dimensional mold to create a metal part. By using castings, manufacturers are able to create a wide variety of intricate solid shapes for use in various applications. For example, cast parts are often found in automotive components, aerospace parts, electronics, medical devices, and construction supplies.

Casting is one of the world's oldest manufacturing processes, with traditional forms such as sand and investment casting dating back thousands of years. Thanks to modern technology, however, sophisticated hot forming processes such as die casting have become commonplace in recent years, providing manufacturers with more options than ever.

Like any manufacturing method, all casting processes have a unique set of benefits. Any company considering casting should take the time to assess its needs before determining which process is best for them.

To help you make an informed decision, we've outlined the advantages and disadvantages of some of the most common casting processes in detail below.

Investment Casting



Investment casting involves the use of a wax pattern coated with a robust ceramic material to create a mold. The manufacturer begins by making a wax model or pattern of the desired component by injecting hot wax into a metal mold. Once the wax pattern is formed, it's coated with a ceramic material that's resistant to heat.

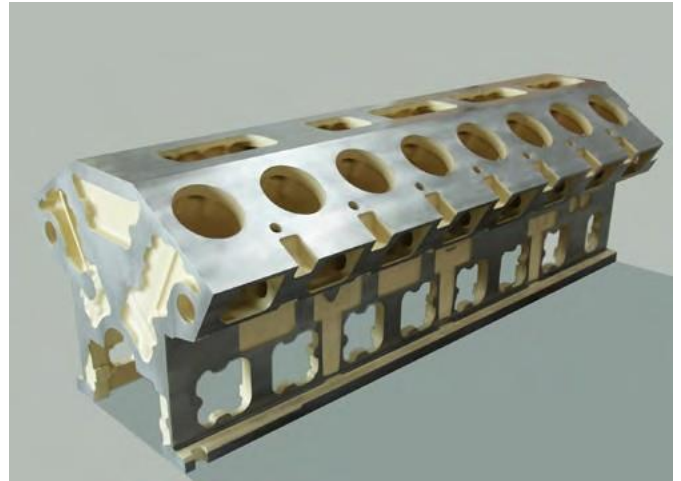
As the ceramic material hardens, its internal shape begins to mirror that of the wax pattern. After heating, the melted wax is poured out of the ceramic surrounding it. The molten metal is poured into the resulting cavity after the wax is removed. Once the metal hardens, the ceramic mold, or “investment”, is broken—freeing the newly formed metal casting.

Advantages and Disadvantages of Investment Casting

Although it typically uses stainless-steel alloys, brass, aluminum, and carbon steel, investment casting can be used with nearly any metal—both ferrous and non-ferrous materials. It also offers extreme precision and high dimensional accuracy, making it ideal for small parts that require a certain amount of fine detail. In this regard, it excels at creating thin-walled metal parts with complex shapes and sizes.

While investment casting does have many advantages, it's also a complicated process. Its complexity makes it considerably more expensive than other casting processes. However, you can defray its cost by using less machining or no machining.

Sand Casting



Sand casting is another ancient form of casting during which the caster creates a mold by compacting sand around a three-dimensional pattern or model of the final component. The compacted mold is then split apart, and the interior pattern is removed. The manufacturer then joins the two parts of the mold back together and pours molten metal into the cavity. Once the molten metal cools and solidifies, the sand is removed, revealing the newly cast metal part.

There are several distinct types of sand casting:

Green Sand Casting

Green sand casting is the more widely used form of sand casting, thanks in large part to its cost-effectiveness. Since green sand casting molds are made out of sand that's bonded with water and clay, they can be recycled. Unfortunately, because the casting is carried out by a mold box, the size of the finished part is limited by the size of the mold box itself. The cast molds also exhibit less surface strength.

Resin Sand Casting

Resin sand casting is less commonly used than green sand casting, largely because it's more expensive. It often produces superior results, however, creating more accurate castings with better surface finishes and increased strength. It also has greater flexibility in terms of the size and type of mold that it can create, since it's not limited by a mold box. Instead, it covers several mold types—all of which depend on a chemical reaction. Unlike green sand casting, it doesn't have to take a fixed volume, and even offers greater dimensional stability under molten metal pressure.

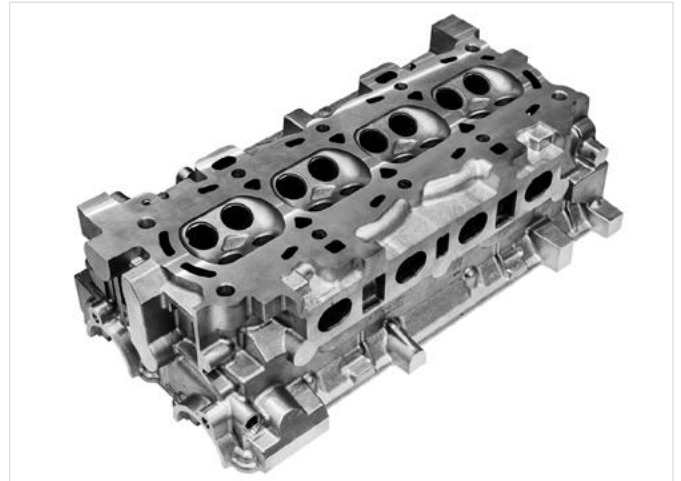
Advantages and Disadvantages of Sand Casting

Whether you choose green sand casting or resin casting, sand casting itself offers numerous benefits. Its production costs are fairly low compared to other processes—especially for small production runs. It also has the versatility needed to create fairly large metal components, and like investment casting, it can use both ferrous and non-ferrous metals. Metal castings made from sand casting can be further customized with post-casting machining to give the casting a more specialized appearance or functionality.

Additionally, sand castings that use green sand, or resin sand are capable of producing accurate castings. The flexibility of sand castings means that there are very few restrictions on the shape, size, or material of the final cast. This flexibility also extends to the production volume runs that sand casting can accommodate—from low volumes to high volumes, this process can produce parts in almost any number.

While its benefits are numerous, sand casting does have one major drawback. Though certain forms of casting are more accurate than others, in general, it often yields less accurate castings than other casting methods. The difficulty in achieving precision comes from the challenges in meeting predetermined size and weight specifications set for the final products.

Die Casting



In die casting, a molten metal is poured into steel molds, which are individually designed for each product.

Die casting consists of two processes—the hot chamber method and the cold chamber method. Hot chamber die casting is typically used with low-melting metals such as zinc or magnesium alloys. It's especially well-suited to alloys that do not easily compromise or erode metal posts, cylinders, or plungers. Cold chamber die casting, on the other hand, works better with metals that have high melting points such as aluminum.

Advantages and Disadvantages of Die Casting

Die casting is an economical process that can be used to produce a number of complex cast products. Unlike other methods, it can be fully automated and requires little to none post-machining work. Parts created from dies also feature high dimensional accuracy and close tolerances.

Compared to other casting processes, the tooling required for die casting is generally more expensive and with shorter life span. Due to the amount of tooling required to form each unique mold, it can be an expensive process for small-volume runs. Also, die casting has some geometrical limitations, and not suitable for parts with intricate internal feature.

Permanent Mold Casting

With permanent molds, a heat-resistant wash or coating is applied to the surface of a reusable metal mold that's been preheated to a temperature between 250°F and 500°F. After mechanically clamping the mold together, a molten metal alloy is poured into the mold's cavity through a gating system, which controls the rate at which the metal is poured. Once the molten metal solidifies and hardens, the manufacturer cuts the mold open to remove the newly formed cast. Any excess metal can then be trimmed away and melted down for reuse in another product.



Advantages and Disadvantages of Permanent Mold Casting

Permanent molding castings provide a good surface finish for the final casting while giving manufacturers the flexibility needed to create custom components with precise specifications. Perfect for large-volume production runs, they can accommodate nearly any shape or design while providing good dimensional accuracy. Permanent mold casting also has shorter lead times than other casting processes, and the molds that it produces are reusable.

Because permanent molding castings require high-cost tooling, however, permanent mold casting can be more expensive than other casting methods. Since it's designed to work with metals that have low melting points, it's also more limited in terms of the types of metal it can use.

Impro's Casting Solutions



Regardless of your company's needs, Impro has the expertise needed to produce your desired metal part or component with investment casting, sand casting and permanent mold casting process. As a global leader in the manufacturing of high-precision, high-complexity parts, we specialize in providing customized casting solutions for our customers throughout the world. To learn more about Impro's metal casting services or explore partnering with us, [contact us](#) today.

About Impro

Impro is a global leading manufacturer of high-precision, high-complexity and mission-critical casting and machined components for diverse end-markets. We supply customized casting and machined products and provide surface treatment services to a well-diversified global customer base. Our global leading position is underpinned by our integrated business model with comprehensive capabilities of offering one-stop solutions to our customers.

[CONTACT US](#)

[VISIT OUR RESOURCE LIBRARY](#)



Impro

21660 East Copley Drive, Suite 100, Diamond Bar, CA 91765

800-800-9756 | 877-484-6776 | sales@improusa.com

<https://www.improprecision.com>

