

The Sand Casting Process

Sand casting is a gravity pour process, in which molten metal is poured into a sand mold to create a metal part or object. Sand castings can be made from any air melt alloy, but typically are made from aluminum, copper based alloys, grey iron and ductile iron. This process is used for volumes from one to thousands, and for small, simple parts to large, complex shapes. Holes and internal details can be cast using removable sand cores, made from core boxes.

The first step in the sand cast process is patternmaking. Patterns are made from wood, metal, composite materials or a combination of more than one material. The type of material used to make the pattern is usually dependent upon shape, features and quantity of the casting to be poured. Patterns are a replica of the external shape of the part, allowing for shrinkage. When cores are needed to create interior features, they are made from core boxes. Core boxes are an additional piece of tooling, and can be made from cast iron, or machined from metal or wood. Large, heavy cores can be made hollow, to reduce weight, and are referred to as shell cores. Cores are made from sand that is mixed with a binder and baked.

The next step is molding, a multi-step process resulting in a mold, into which the molten metal is poured. The mold is contained in a flask, which consists of a top portion, called a cope, and a lower portion, called a drag. First, sand is packed into the flask around the pattern. When the pattern is removed, the metal distribution system (gates, runners and sprues) are assembled into the mold. When cores are required, they are installed in the drag portion of the mold. There are many different methods and types of equipment used to manufacture molds, depending upon quantity, size, and internal features. These range from low volume, manual mold making, to high volume, completely automated mold making machines.

Once the molds are prepared, molten metal is poured by ladle into the mold. The casting is allowed to cool, and the mold is broken apart in a process called shakeout. If used, cores are removed using high-pressure water or chemicals. The mold sand is typically reclaimed, and with the addition of new sand and binders, is re-used.

Once the castings clear shakeout, the metal distribution system is cut off, and the castings can be completed by tumbling, vibrating and/or blasting.

Other available after cast operations include heat treat, NDT when internal integrity must be verified, pressure or leak testing in vessel or valve applications, CNC machining, painting and powder coating.

Advantages of the Sand Casting Process

- Very flexible in shape, size, material and quantity
- Inexpensive tooling costs
- Shorter lead times
- Least expensive casting process