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The Casting Advantage

by

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Beyond the rapid emerging technologies that are keeping metal casting at the vanguard in the metal forming industry, casting process has many inherent advantages that have long been accepted by design engineers and metal part users. In terms of component design, casting offers the greatest amount of flexibility of any metal forming process. The casting process is ideal because it permits the formation of streamlined, intricate, integral parts, of strength parts and rigidity obtainable by no other method of operations. The shape and size of the part are primary considerations in design, and in this category, the possibilities of metal castings are unsurpassed.

Design Flexibility

- Rapid translation of design to finished parts
- Rapid alterations in shape
- Unlimited choice and range of sizes and shapes
- Steam-lined shapes for minimum stress concentrations
- Designs for statistically loaded parts
- Designs for dynamically loaded parts
- Shapes for attachments and assemblies
- Weight considerations
- Single, integral components
- High dimensional accuracy
- Desirable surface finish
- Few or many parts

Metallurgical Versatility

- Diversified services
- Choice of mechanical properties through heat treatment
- Uniform properties in all directions
- Weld-ability to enable assembly with other parts
- Machine-ability to obtain desired final dimensions

Economic Benefits of Castings

Economies of a one piece finished part to an assembly

- Weight reduction economies
- Short delivery periods
- Reliability

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Following list of functional advantages of castings and metal casting process illustrate why castings have been and continue to be the choice of design engineers and material specifiers worldwide.

☯ Rapid Transition to Finished Product

The casting process involves pouring molten metal/alloy into a cavity that is close to the final dimensions of the finished component; therefore, it is the most direct and simplest metal forming method available.

☯ Suiting Shape and Size to Function

Metal castings weighing from less than few grams to hundreds of tons, in almost any shape and complexity, can be produced. If a pattern can be made for the part, it can be cast. The flexibility of metal casting, particularly sand molding, is so wide that it permits the use of difficult design techniques, such as undercuts and curved reflex contours, that are not possible with other high-production processes. Tapered sections with thickened areas for bosses and generous fillets are routine.

☯ Placement of Metal for Maximum Effectiveness

With the casting process, the optimum amount of metal can be placed in the best location for maximum strength, wear resistance, or the enhancement of other properties of the finished part. This, together with the ability to core out unstressed sections, can result in appreciable weight savings.

☯ Optimal Appearance

Because shape is not restricted to the assembly of performed pieces, as in welding processes, or governed by limitations of forging or stamping, the casting encourages the development of attractive, more readily marketable designs. The smooth, graduated contours and streamlining that are essential to good design appearance usually coincide with the condition for easiest molten metal flow during casting. They also prevent stress concentrations upon solidification and minimized residual stress in the final casting. Because of the variety of casting processes available, any number of surface finishes on a part are possible. The normal cast surface of sand molded castings often provides a desired rugged appearance, while smoother surfaces, when required, can be obtained through shell molding, investment casting or other casting methods.

☯ Complex Parts as an Integral Unit

The inherent design freedom of metal casting allows the designer to combine what would otherwise be several parts of a fabrication into a single, intricate casting i.e. machinery, machine tool parts, or engine end plates and housings that carry shafts. Combined construction reduces the number of joints and the possibility of oil or water leakage besides imparting, strength to the part/component.

☯ Improved Dependability & Reliability

The use of good casting design principles, together with periodic determination of mechanical properties to test bars cast from the molten metal, ensures high degree of reproducibility and dependability in metal casting that is not as practical with other production methods. The functional advantages that metal castings offer and that are required by the designer must be balanced with the economic benefits that the customer demands.

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☯ Cost Saving

The design and production advantages described above bring with them cost savings that metalworking processes cannot offer. The savings stem from four areas

- The capability to combine a number of individual parts into a single integral casting, reducing overall fabrication costs
- The design freedom of casting minimizes machining costs and excess metal
- Patterns used in castings are lower in cost compared to other types of tooling
- Casting require a comparatively short lead time for production

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Certain advantages are inherent in the metal casting process. These often form the basis for choosing over other shaping processes such as machining, forging, welding, stamping, rolling, extruding, etc. A decided economic advantage may exist, hence, any one or a combination of points mentioned above. The price and sale factor is dominant one, which continuously weighs the advantages and limitations of process, used in a competitive enterprise.

Of course, it is true that conditions may exist where the casting process must give way to other methods of manufacture, when other processes may be more efficient, better suited and economical. For example, machining procedures smooth surfaces and dimensional accuracy not obtainable in other way; forging aids in developing the ultimate strength and toughness in steel; welding provides a convenient method of joining or fabricating wrought or cast products into more complex structures; and stamping procedures produces lightweight sheet metal parts. Thus, the engineer may select from a number of metals processing methods that one or combination, which is most suited to the needs of the work.

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