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VOLUME VII ISSUE 22

MAY 30, 2012

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Custom Forging Processes



Photo Courtesy of: All Metals & Forge Group

There are several processes to produce forged parts out of metal, depending on the quantity needed and the final machining required. When the need is for thousands of parts, the processes commonly used are closed-die forging, drop forging, or casting. In each case, the forged pieces need little or no machining. When the desired quantity is in the tens or hundreds, then the forging

process used will likely be open-die forging, where each forged piece will require finish machining, usually to a design print.

Open-die forging can produce small parts that are round, square or have a step or contour to them, up to long shafts or large rings. These parts may be used in aircraft engines, turbines, drive shafts or other high-tech and heavy industry applications. The rings shown above are produced by the open-die process, in this case by [All Metals & Forge Group](#), a manufacturer of custom open-die forgings and seamless rolled rings.

The open-die forging process is often used to achieve stronger material properties that can withstand greater forces placed on the final part while in service. For example, the grain flow in a seamless forged ring runs around the ring, while the grain flow of a ring cut from plate runs across the ring in one direction.

Depending upon the application or environment where the forged part will be used, the engineers will have specified a metal family and alloy, such as a 1040 carbon steel, a 4130 alloy steel, a 718 nickel alloy or a 422 stainless steel. Each of these materials will have a different chemistry that produces different properties. In fact, the purpose for adding various small amounts of different alloys to a base metal is to produce different properties that resist some kind of wear or stress, such as corrosion from a liquid, friction from direct contact with another surface, heat, cold, or a combination of forces. In addition, the metal itself may have been either

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softened or made harder by heating and cooling processes during its manufacture, known as heat treating, which also is used to improve or control properties of the final part for its ultimate use. For a chart of metals and their alloys used in making open-die forgings, click on this link:

www.steelforge.com/forgings/forgingchart.htm

Open-Die Forged Shapes for Final Parts



Photo Courtesy of: All Metals & Forge Group

There are several shapes that can be produced by the open-die forging process to render a near-net shape for the eventual finished part. In most cases, forging creates tighter grain structure and fewer voids or inclusions that can affect the finished part. Each shape is discussed below. The Forging Chart at

www.steelforge.com/forgings/forgingchart.htm also shows the sizes each of these shapes can be produced in depending on the metal.

1) Flats: These pieces will have flat surfaces such as square blocks, rectangular blocks, or square or rectangular bars of some particular length. The advantage of these forged products are that they are produced in larger dimensions than commercially available flat bars products from mills or service centers with properties that can be controlled or altered during the manufacturing (forging) or subsequent heat treating processes.

2) Rings: Rings have three dimensions: an outside diameter (O.D.), and inside diameter (I.D. or center hole) and a "face" or thickness. This open-die forging can be produced in several shapes, including seamless rolled, contoured, or drawn over mandrel. Each can have property and chemistry differences designed for their end use, which may also be improved by heat treating. Rings can be up to 25 feet in diameter in some metal alloys but will require special overland shipping.


3) Cylinders or Sleeves: These are the same basic shape and can be compared to larger tubes. The advantage of the open-die forged cylinder or sleeve can be in thicker walls, a wider selection of metal alloys, or the ability to use the cylinder to part off several rings from the length. As with other open-die forged shapes, various properties can be altered or controlled. Cylinders and sleeves are simply long seamless rolled rings (a ring with a long "face" or thickness)

4) Discs: This shape has two dimensions, an outside diameter or O.D. and a thickness. Discs are often open-die forged to control properties or use a specific metal alloy not commercially available in a particular thickness, or with the required properties for a final part.

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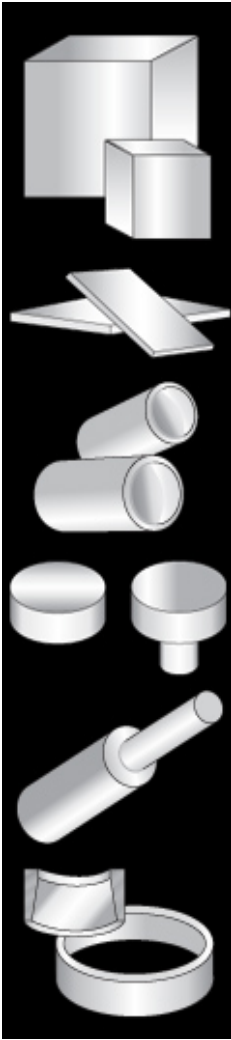
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5) Shafts: A shaft is typically a long round bar. Hex shafts can also be produced. Round shafts can be produced up to 48 feet long and are often used for drive shafts in ships or in drilling operations.

6) Step Shafts and Hubs: Step shafts are shafts that vary in length and diameter along their length. Crankshafts have steps that can be larger then smaller then larger along the length. Hubs are usually a shaft with one step and look like a disc with a shaft attached.

7) Gear Blanks: Gear blanks are basically discs that may have had the teeth rough machined into the blank to reduce material costs and final machining. They may have a step in them and often have an I.D. (center hole).

For more information on forged shapes, tolerances, lengths, or diameters, see www.steelforge.com/forgings/forgingchart.htm or visit www.steelforge.com.



Metals Outlook Newsletter is Published by All Metals & Forge Group
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