

Metal Stamping or Metal Fabrication: Choosing the best method for production

The process of deciding how to manufacture metal parts using either metal stamping or fabrication techniques is an important decision that ultimately affects the design, quality, timing, cost and repeatable performance of the metal components to be produced. The purpose of this engineering white paper is to investigate the benefits, disadvantages and costs associated with each of these processes; and to develop a framework for deciding how to most efficiently produce parts that will best align with your design and production requirements.

Metal Stamping vs. Metal Fabrication

To consider the advantages and disadvantages of metal stamping vs. fabrication, it's helpful to review the basics of these two technologies:

- **Metal stamping** (or pressing) encompasses a variety of manufacturing processes such as punching, blanking, embossing, bending, flanging and coining using a machine press or stamping press. Metal stampings can be a single stage operation where every stroke of the press produces a metal part, or parts can be produced using a series of operations.
- **Metal fabrication** refers to creating metal parts by using cutting, bending and assembly processes. Cutting can be done by sawing or shearing parts, or via CNC cutters using a laser, mill or waterjet cutting. Bending is typically done by striking (manual or powered) or using press brakes and similar tools. Assembly joins individual pieces together by using hand or robotic welding, adhesives, riveting, threaded fasteners or even bending in the form of crimped seams.

Benefits and Disadvantages of Precision Stamping

Metal stampings are utilized throughout industry to create a wide range of precision parts. Stamping is an effective process for creating high volume production runs of parts using hard tooling to reduce costs, and increasingly incorporating secondary operations that produce unique product designs.

- *Benefits of Metal Stamping*
 - Precision stamping is a fast, cost-effective solution for manufacturing large quantities of complex products. The process is well-suited for higher-volumes because the per piece set-up and labor costs drop as production levels increase
 - Precision stamping can be highly automated and incorporate secondary operations within both the press and/or die. Value add operations including automatic stud or nut insertion, in-die tapping, even in-die welding and assembly can be incorporated to increase the value of parts
 - Complex products and innovative designs can be created using sophisticated precision stampings. Benefits include material flow or drawing as well as very tight tolerances, and repeatability not possible with fabrication techniques. This is especially evident in thicker materials and heavier parts
 - Metal stampings generally allow for lower per piece material costs through the ability to purchase in coil stock vs. sheet steel, and produce less scrap in manufacturing
 - There is a correlation between capital equipment investment by the company and their ability to perform advanced stamping techniques. Tonnage and press size are a key differentiator. Type of press and ability to run various die set-ups including: progressive dies, deep draw stampings and transfer dies
 - Stamping companies with abilities in advanced production techniques as well as prototype design services or simulation software that can prove out concepts before investing in dedicated tooling, will prove to be an additional benefit

- *Disadvantages*
 - Upfront tooling costs may render metal stamping ineffective for short production runs
 - Longer initial lead times are required primarily due to time required to develop tooling

- Difficulty and costs incurred to make design changes once tools have been created due to inflexibility of hard tooling

Benefits and Disadvantages of Precision Fabrication

Metal fabrication offers a high degree of flexibility and greater agility in prototyping and adjusting product features after a manufactured part is in production. Identifying a supplier that can also provide in-house support for a wide range of secondary operations (forming, machining, assembly and robotic welding) can reduce both total costs and production lead times.

- *Benefits of Metal Fabrication*
 - Precision fabrication offers a wide range of production techniques to create value-added metal parts that can be customized to exact customer specification
 - Initial production lead times are shortened. Rapid prototyping moves the design-to-production cycle quickly from concept and solid models to first parts
 - Flexibility is inherent in the process and enables the ability to easily and quickly implement design changes to a part. Design changes are more cost effective than with other production techniques
 - Laser Cutting/Shearing/Waterjet Cutting
 - A variety of effective techniques can be used to cut raw sheet materials to size
 - Forming
 - Continued advances in multi-axis press brakes offer CNC programmable controls, computerized back gauging and rapid set-up. Precision control and repeatability are benefiting and this is being applied to a greater range of formed metal parts. The culmination of technology, equipment and expertise are resulting in new and creative solutions using press brakes
 - Machining
 - CNC controlled machining, palletized production feed systems, and advances in machine tooling are allowing for more exacting surfaces and efficient production of tight tolerances
 - Assembly/Welding

- Formed and machined parts are assembled and joined together, then checked for accuracy. Robotic welding provides for an automated process with a high degree of accuracy
- *Disadvantages*
 - Metal fabrications are typically more labor intensive and require a higher per piece cost
 - Longer term or extended programs when incorporating service requirements may prove to be more expensive and create higher total cost over the initial die investment and lower piece price of stamping
 - Repeatability, while improving with new technologies, can still be a challenge as compared with a proven stamping die
 - Part shape may require the detail forms of a stamping die
 - Complex drawn parts are generally not possible with fabrication techniques
 - Generally the production process is slower than metal stamping
 - Material costs are typically higher than with metal stampings

Conclusion: Balancing of Priorities

As driven by today's consumer, a key trend in manufacturing is shorter product design cycles. Time to market is critical, yet cost is always a driving influence. This creates a much greater need for rapid prototyping coupled with efficient production. The concentration on TOTAL COST and increased frequency in product life cycle creates a migration to utilize hybrid design, test and production techniques.

Each decision on producing a part through use of metal stamping or metal fabrication must balance a complex set of priorities to determine the total efficiency of production. One must incorporate the initial design of the part, prototype and production planning, short and long-term costs and the ability to manage the service and complete product lifecycle.

Shorter initial lead times and rapid development from 3D models to prototype parts has become an essential priority for many companies. The current focus on TOTAL COST often spreads development costs for a program over a much shorter time period (two years vs. seven years), and the desire to limit upfront program costs is producing a need to reduce the initial capital investments required for new products.

One emerging manufacturing trend has been adoption of these hybrid design and production techniques that leverage the advantages of both metal stamping and metal

fabrications. These hybrid designs require machinery capabilities and personnel expertise with both production methods. The ability to create a production plan customized to the needs of an individual product is a huge benefit to the customer. The goal with hybrid design and production is to analyze the best method for producing a part that fits a company's design and production objectives.

Consider working with a company with experience and capabilities in both stamping and fabrication, such as P&G Steel Products (www.pgsteel.com), that can provide consultation and experience with how to most effectively utilize the benefits of both stamping and fabrication in a single source. Ultimately you will have a partner supplier that can not only deliver your requirements, but can also shorten lead times, provide the highest quality and manage total cost.

Resources:

NTMA: National Tooling & Machining Association, www.ntma.org

Tooling & Manufacturing Association (TMA): www.tmanet.com