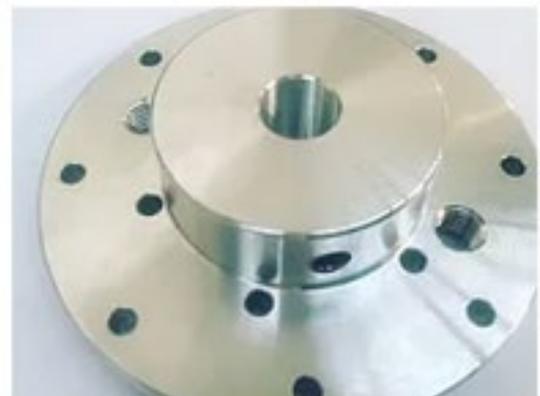
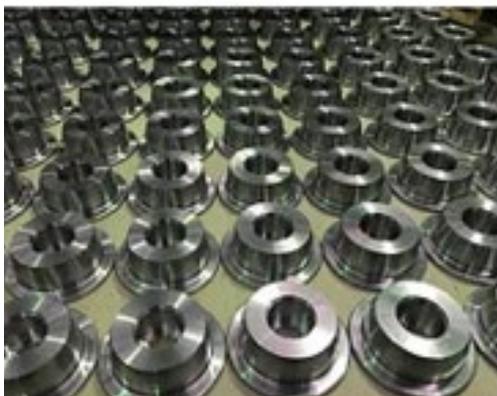
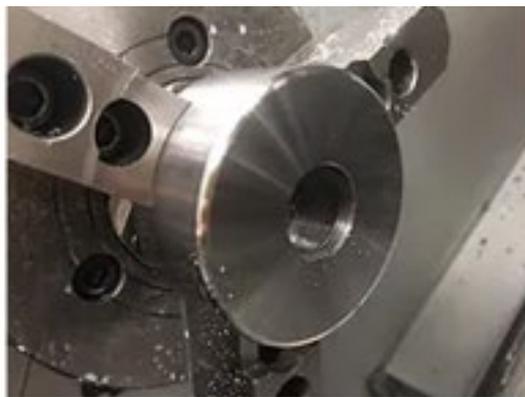


CNC / Manufacturing

Forging vs CNC Machining: which one should you choose?



CNC machining undertaken by our team at Challenge Engineering

There are some things you need to get right when deciding how to get metal parts manufactured. How should they be made? Do you go for cast, forged or machined parts?

If you're not sure, we're going to explain and compare two specific ways of making metal parts, forging and CNC machining.

Hopefully, by the end of it you should be able to decide which is going to work best for your situation and specific requirements.

What are the differences between Forging and CNC Machining?

Let's start by looking at each process.

Forging metal involves using a mould made from very tough steel. The mould comprises of two parts; the 'tool' which is the movable part, and the 'die' which is the stationary part. A press that exerts tons of force pushes the two halves of the mould onto a sheet of metal, creating the desired shape. The process can be done hot or cold, depending on the metal being forged. The part normally needs a little finishing, and that's it

CNC (Computer Numeric Control) machining, involves passing a lump of metal (or a billet as it's known in the trade) into a machine tool. The machine has sensors built in to position and guide the billet. It is fully motorised and is controlled by a computer panel. A rotating tool cuts away unwanted metal to form the part. The computer interpolates the design to give smooth curves and circles.

What are the pros and cons of forging?

Advantages

If you are making tens of thousands of replicas of the same shaped piece of metal, simple nails for example, then forging is ideal as you create a single tool and die and off you go.

Forging changes the microstructure of the metal considerably, creating a finer grain and improving the fatigue resistance.

One way to think of it is that forging compresses the metal into having a similar structure to wood, so the resulting part is very strong perpendicular to the grain. Again, for simple items like nails, this is ideal as they will stand up well to being hammered into a surface.

While setting up the press and mould aren't cheap, it can be a cost-effective process if you are mass producing similar parts. Let's say you are making 500,000 of the same basic connecting rod that requires no further machining, then forging is probably your best bet.

Disadvantages

Forged metal is generally strengthened in only specific directions, i.e. perpendicular to the grain flow. This is no good for parts that need to be tough all around such as crank shafts, for instance.

Forging cannot create parts that have acute angles (less than 90 degrees) as they are too difficult to remove from the mould, meaning sharpened points are out of the question.

Also, there are other features that cannot be made by forging, such as internal threads. You would have to have a separate machine to tap the thread when the forging process is complete.

What are the pros and cons of CNC machining?

Advantages

CNC machining is ideal if you're making parts that have complex or acute-angled shapes. For example, aerospace engineers making unique parts for a space shuttle or fighter jet would find it more convenient and cost-effective to use CNC machining.

Some forges actually use CNC machines to create the moulds to be used in their forging press.

If you have specific requirements, such as internal threads or sharpened points, and you're not looking for mass production levels of output, then CNC is the best option for you.

Surface finishes on a CNC machined part will typically be near perfect and appear very consistent and precise, whereas cast or forged parts will be a little rougher, usually requiring polishing or tumbling in an abrasive media to achieve a better surface finish.

Disadvantages

CNC machining takes time, unlike forging which bangs out simple parts quite quickly. However, it depends on volume and complexity.

However, the real cost is in the amount of waste created. Metal is cut away from each fabrication, which ends up as shavings that can only be sold for scrap, meaning production overheads can mount up quickly if you're manufacturing large numbers of intricate parts.

CNC machines are quite complicated bits of kit with various motors and moving parts. This means it needs lots of oiling and continuous maintenance, further adding to the cost of running.

If you are using the services of a CNC machine shop, however, this will all be factored into their operating costs, so you won't need to worry too much about the expense of the process. The larger the run the cheaper the cost per part.

Making a decision

In most circumstances, given the size of typical volume of runs in Australia, CNC machining is the way to go. Make sure to talk to your specialist CNC machinist, as they will be able to advise you on the best option for your specific needs.