

Tech Brief

Laser, Water-jet, or Mechanical Cutting—Which Method is Right for You?



INTRODUCTION

Laser Cutting vs. Water Jet and Mechanical Cutting

Each method has its relative pluses and minuses and no one method fits every situation. The thickness of the stock to be cut, hardness of the stock, whether or not the stock is stacked or layered, your cost and timing requirements, and the desired condition of the material after it's been cut are among the key factors that determine which method is right for a particular job. There are also some application procedures where one process or another is most suitable.

How Each Method Works

Before we compare the three methods, let's briefly overview how they work.

Laser

The cutting action is the result of light from a laser (typically a CO₂ laser with an energy of up to 2600 watts) passing through a lens and being directed at the material to be cut.

Water Jet

The cutting action occurs when water under pressure (with an energy of 4 to 7 kilowatts) is directed through a nozzle at the material. Typically an abrasive like garnet or aluminum oxide is added to increase the cutting action.

Mechanical

The cutting action occurs when a power-driven, hardened cutting blade removes excess material to create a desired shape. Three of the most common mechanical cutting methods are as follows.

Die cutting: A die (a blade made in a particular shape, like a cookie cutter) shears webs of sheet metal or other relatively low-strength stock such as rubber or plastic.

Lathe: A machine spins the stock while a hardened cutting blade removes excess material into the desired shape.

Milling: The stock is mounted on a movable table that maneuvers around a fixed cutting blade.



Cutting Methods

From the top: Laser Cutting, Water-jet Cutting, Mechanical Cutting.

Laser-Cutting vs. Water-jet

Key criteria for comparing these two methods include:

Thickness of Materials. Lasers perform better on materials three-eighths of an inch thick or less. While it's possible to cut thinner materials with a water jet by cutting multiple layers at once (i.e., stacking them), doing so reduces precision. Laser-cutting speed for these thinner materials is faster than that of a water jet. However, depending on the materials, once you get above a certain thickness lasers are no longer an option, while water jets are. Lasers can't cut through inch-thick steel, for example, but water jets can (although very slowly).

Precision. The minimum size of the laser-cutting slit is 0.006 inches versus the water-jet-cutting slit of .02 inches — so lasers can cut finer details. The tolerance of laser cutting is also better, typically +/- 0.005", while a water jet is typically +/- 0.010". And, as just noted, when materials are stacked, a water jet's precision diminishes further.

Time. Laser jets cut thinner materials faster and more precisely than water jets can. Also, water-jet jobs generally take longer to prepare, meaning you have to allow more time in your production schedule for material cutting, and alert your vendor if you plan to use an outside vendor for cutting.

Surface Abrasion and Staining. Water jets with abrasive particles may stain your materials or delaminate (abrade) the surface, while lasers won't.

Cost. It generally costs less to cut thinner materials with a laser and costs less to cut thicker materials with a water jet.

LASER CUTTING ADVANTAGES
- Less likely to delaminate or stain
- More precise cutting
- Less waste and subsequent cleanup
- Quicker for cutting thinner stock (< 3/8th inch)
- Less preparation time

WATER-JET ADVANTAGES
- Less technically challenging
- Lower energy costs
- Less expensive cutting equipment
- Better at cutting thicker stock

Laser Cutting vs. Mechanical Cutting

Key criteria for comparing these two methods include:

Hardness of Materials. Softer metals and other materials will deform more easily when die cut and milled than when cut by a laser.

Set-Up Time. This is a big differentiator when comparing laser to die cutting. That's because before you can cut with a die, you first have to make it, which can take weeks — as compared to a laser, which may only take a few minutes to program. The time difference is compounded if the shape of the part ever needs to change and a new die needs to be made.

Cost. What applies to time also applies to cost. Dies are quite expensive — typically thousands of dollars, which again is compounded if parts change and new dies need to be made. Lasers also typically use stock materials more efficiently, as discussed next. However, lasers' cost advantage tends to disappear as the number of pieces cut increases, typically above 10,000.

Material Waste. Lasers are very good at nesting, i.e., maximizing the number of parts that can be cut from one piece of stock — something that die-cutting and milling equipment are far less adept at — and that can't be done at all with lathes. That means lasers typically waste less material, a factor that also reduces the total cost of a job.

Thickness. Mechanical cutting tools typically can handle far thicker materials than lasers can.

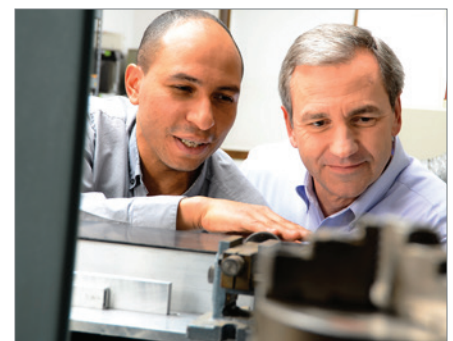
Precision. Lasers generally produce a more precise cut with more clearly defined edges than do mechanical cutting methods.

Smearing. When mechanical pressure is applied to layers of stock (as it is in die cutting or milling) any adhesive or other materials between the layers will tend to smear down the sides of the stack — something that does not occur with laser cutting.

Contamination. Laser cutting is generally a much cleaner process than mechanical methods — with no contact between the laser device and the stock — so there is less chance of accidentally marking the pieces, no contamination from cutting oils, and therefore less need for post-machining treatments (both of which add to cost).

LASER CUTTING ADVANTAGES
- Handles softer materials better
- Faster set-up time
- Lower overall cost (<10,000 pieces)
- Less materials waste
- More precise cutting
- Less smearing
- Less chance of contamination or accidental marking
- Less need for post-machining treatments

MECHANICAL CUTTING ADVANTAGES
- Handles softer materials better
- Better at thicker materials
- Lower high volume cost (>10,000 pieces)



Next Steps:

Learn more by downloading these pieces of related content: [Which Industrial Cutting Method is Right for You Brief](#) and [Top 5 Myths About Laser Cutting Blog](#).

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