TECHNI Waterjet

A GMM Group Company

WATERJET CUTTING *VS* LASER CUTTING

WATERJET CUTTIG VS LASER CUTTING

In this brochure we will demonstrate a direct comparison between two of the most preferred cutting methods chosen by workshops around the world. We will focus on advantages and disadvantages of each cutting method by answering a series of questions relating to different applications, materials, and cost associated with each.

QUESTION 1

What materials can I cut with each type of cutting method?

WATERJET

Waterjet = Versatility

The use of pressurized water to cut material means that waterjets can cut virtually any material known to man. Abrasives such as Garnet and Aluminium Oxide are often added to mimic the natural erosion process - just at a much accelerated speed and concentration.

Waterjets are commonly used to cut the following materials.

METALS

- Aluminium
- Brass
- Carbon Steel
- Copper
- Stainless Steel
- Titanium
- Tool Steel
- Hardox

MISCELLANEOUS

- Food
- Insulation materials
- Multi layer material (ISO wall)

PLASTICS & RUBBER

- Acrylic
- Foam
- Rubber
- PVC
- Polycarbonate
- Silicone
- Aero Fiber
- Carbon Fiber
- Fiberglass
- Kevlar

NATURALS

- Ceramic Tile
- Quartz
- Granite
- Marble
- Cement board
- Reconstituted (man-made) Stone
- Glass (non-tempered, laminated)
- Paper
- Cardboard
- Leather
- Wood
- STone
- Cork

LASER CUTTING

As suggested by the name CNC laser uses a guided laser beam to cut through the material using extreme heat focused on the workpiece and a compressed gas to blast away the molten material. Modern fiber lasers work well with a veriety of materials including metals, plastics, wood, however materials with higher melting points and high energy transfer like aluminium can be difficult to cut.

The near IR wavelength at which Fiber lasers operate can cause difficulties in cutting light colored and reflective materials like aluminium, copper and brass, and the beam will try to pass through transparent materials like glass, polycarbonates, acrylics.

Specialised (usually higher powered - more expensive lasers) are required for this type of work.
Lasers excel in sheet metal applications where heat transfer into the material is not an issue, and also in marking, etching, engraving applications where the material doesn not need to be completely cut through.

CNC Lasers can cut the following materials.

METALS

- Aluminium
- Brass
- Carbon Steel
- Copper
- Stainless Steel
- Titanium

PLASTICS & RUBBER

- PVC
- Foam
- Rubber

NATURALS

- Wood
- Paper
- Leather
- Cardboard
- Cork

QUESTION 2

What thickness can each technology cut?

WATERJET

Because waterjet uses an erosion process, it can virtually cut any thickness, it is just a matter of matching the speed with the material type and the cutting head set up. This is usually all done automatically on modern waterjets. Common waterjet applications include cutting of steel and aluminium up to 6" (150mm) thick.

LASER

A laser thickness limitation is dependent on the material type and the power of the laser. A typical CNC laser that is found in a workshop will be capable of cutting up to 1/2" (12mm) thick steel and aluminium.

QUESTION 3

What are the safety factors to consider witheach cutting method? What would be a better pick for an enclosed workshop?

WATERJET

The safety benefits with Waterjet cutting are one of the main reasons why it is becoming the favored method of cutting around the world. Let's run througha few of the safety benefits below.

1 **No Heat Zones** – using a pressurised stream of water to accurately cut, means there is no heat transferred into the material and therefore no warping occurs. The additional benefit of no heat zones means finished components can be taken off the cutting table instantly without risk of injury from heat or excessive burrs. Fire extinguishers are not required in the immediate work area.

2 **No Toxic Emissions** – No material is melted during the cutting process. Plastics and rubber can be cut cleanly without toxic fumes being dispersed into the atmosphere

3 **Dust Particles Captured By Waterbed** – with every type of cutting process, dust and material particles can be a safety hazard to workers inside the workshop area. The waterbed where the material is placed acts as a natural net for particles that in a dry cutting process would be sent into the atmosphere. Raising the water level above the material (submerging) gives further protection. This has been revolutionary in the stone processing industry where airborne particles are a major concern to the health of workers

4 **Waterjet Stream Dispersed Into The Waterbed** – as mentioned above, the Waterjet cutting process takes place within a waterbed where the material is placed and submerged. Even Waterjet streams of 60,000 PSI of pressure are dispersed instantly in the waterbed, giving additional safety measures to the cutting process.

Please note that even though Waterjet cutting provides these safety features it is recommended that machine operators do wear safety glasses, gloves and implement all safety requirements to operate the machine. Safety light curtains can be fitted and are required in some jurisdictions.

LASER

Unfortunately it seems that there aren't quite as many safety benefits with CNC laser cutting compared to Waterjet. As the beam emits a high level of heat and radiation, other hazards arise because of this. Let's talk about some of the safety hazards that you might need to take into consideration when using a CNC laser machine.

1 **Toxic Emissions** – Depending on the type of material you cut will determine whether toxic emissions will be created when the high level of heat is transferred into the material. Typically, large extraction systems are required around the machine to minimise the amount of toxic fumes dispersed into the workshop atmosphere.

2 **Sparks & Hazardous Particles** – When cutting metals in particular the process causes sparks and metal filaments to be sent into the atmosphere. This is a hazard to machine operators and the workshop itself as it poses a higher chance for injury or a fire to be caused.

3 **Burns From Hot Materials** – The use of thermal cutting processes means the material stays hot for some time after the cutting finishes. This can be hazardous for those who work within the workshop, who could experience burns if they were to shift the material not knowing the cutting process had just taken place.

4 **Improper Guarding** – A laser beam is very hazardous to the eyes and skin. What you may think is a reasonably priced laser cutter could be because the manufacturer has saved cost by failing to enclose the cutting process completely.

To answer the second question, it seems as though Waterjet cutting presents itself to be the better choice to ensure a safer and more productive workshop environment.

QUESTION 4

What are the running costs associated with Waterjet and Laser cutting? Which would be more cost effective?

When researching running costs associated with each technology, we have to take into consideration what factors are used in the operation of each machine.

Waterjet machines require 3 major factors to operate.

1. Voltage Supply
2. Water Supply
3. Consumable parts

For Water Only cutting - average operating cost is approximately

US $10 PER HOUR

For an Abrasive Waterjet - average operating cost is approximately

US $20 PER HOUR

In terms of laser you also have three major expenses in order to operate the machine

1. Voltage
2. Gas Supply
3. Consumable parts

This contributes to laser costing approximately

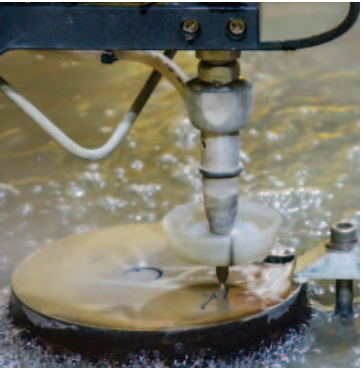
US $20 PER HOUR

to run.

If we are simply looking at operating costs then both Laser and Waterjet cutting have similar costs. However, a typical waterjet machine will cost about half what a CNC Laser will cost for a similar size and quality. Therefore, when the machine cost is also amortized into the total operating cost, the waterjet will end up being considerably less than the CNC laser.

QUESTION 5

What type of material waste (sheet utilization) am I likely to experience between both cutting methods?



WATERJET

With any cutting method you will experience offcut waste. But Waterjet is able to maximise its cost efficiency by minimising the amount of material waste produced through its ability to fit parts very closely together on the sheet of material to be cut. This is due to the following factors:

- **Advanced Nesting Software** fits the parts in the best possible way on the sheet which maximises material utilisation.
- **Cold cutting process** does not deform the sheet or cause material movement. This accuracy and finishing provided by a Waterjet makes it possible to reduce the gap (waste) between cut parts.

LASER

Over the year's laser has also used nesting software to try and maximise the number of parts on a sheet of material. Although the nesting software capabilities are the same, the accuracy and finished cuts of the laser are less accurate, inconsistent, and can have dross at the bottom of the sheet. Sheet warpage is also a consideration when nesting parts, and a larger gap may be required. This means that you will most likely experience more material wastage with a Laser than that of Waterjet cutting.

QUESTION 6

Will I need to spend additional time and resources on secondary finishing?

Getting it right the first time is the key to a productive and efficient workshop. Secondary finishing is a common issue amongst workshops and is now a factor that many company owners take into consideration before purchasing a machine. This is because secondary finishing consumes resources, requires additional cost and slows down productivity even to the point where bottlenecks within the production line are experienced. It is also a reality that every time you handle something you increase the risk of mistakes.

WATERJET

Waterjets are usually able to eliminate secondary finishing from the cutting process because of the superior edge quality with no hardened surfaces or dross, and a clean smooth cut that is created on the part. Grinding or sanding of an edge is often the final machining process, and an abrasive Waterjet part finish, straight off the machine, is akin to a smooth ground finish. A waterjet part can be welded, drilled, tapped or machined without the need to prepare the edge.

LASER

Laser does require resouces to be spent on secondary finishing because the edge quality is not as clean and smooth when compared to waterjet cutting. The high heat that is emitted onto the material during the cut often cause recast, craking, scale, dross and structural changes within the material. This requires the hard egde to be ground away before welding, drilling, or machining to avoid problems down the track.

QUESTION 7

What support am I likely to need when running either a Waterjet or Laser machine?

WATERJET

When you purchase a Techni system so begins a relationship.

Techni pride ourselves on after sales support. Our Quantum pumps have online monitoring with data retrievable from Techni's Virtual Maintenance website. Our technical staff can check pump health easily from the Techni office. Our cutting machines are Windows based so we can offer online support by remote desktop sharing. Enabling us to effectively help with issues ranging from simple application questions to detailed machine troubleshooting. We offer on-site services including preventive maintenance services, troubleshooting, staff retraining, new applications / materials assistance.

LASER

Typically quality Lasers come with a service package for the warranty period. The cost and support after this time can be considered a hidden cost and must be investigated.

QUESTION 8

What preventive maintenance costs are associated with either a Waterjet or Laser machine?

WATERJET

Typically a Waterjet operator is trained to perform preventative maintenance. Maintenance is straight forward and can be completed by anyone who is mechanically minded and has been trained. the mian . The main components are the pump and the cutting head.

A waterjet pump requires high-pressure seal changes and check valve changes approximately every 500-1000hrs. And oil/oil filter changes every 2000hrs. The cutting head requires its orifice changed every 500-1000hrs (if a diamond is used). For abrasive cutting, the focusing tube will need to be changed every 50-100hrs.

The total cost of Preventative Maintenance is approx. $4/hr on a typical waterjet setup..

LASER

Typically a laser machine requires regular attention to the mechanical, chiller, and extraction systems. These tasks fall under the scope of most factory technicians or mechanics.

If a CNC laser starts to lose efficiency that is when things become tricky. Typically, laser end-users do not service the beam delivery because of the complex process and hazards involved. Training is not offered because laser optics must be handled with extreme care and can be rendered useless if mishandled. Untrained staff can also pose a serious safety risk to themselves and others if they allow a laser beam to escape into the work area. 1mW of laser energy can cause permanent blindness and skin burns.

Therefore, the expense of bringing in a certified laser technician to service and maintain the system must be factored into the running costs.