PANELEX

WATERJET CUTTING

WaterJet cutting makes precise, intricate shapes for all utility, custom, and artisan glass needs, including mirrors and decorative glass, etc. It cuts all kinds of glass and all thicknesses.There's no vibration, no heat, makes a clean, smooth edge, practically no extra work needed.

The ability to make exact, clean cuts with speed means the WaterJet cutter is very efficient for most glass cutting applications.

WaterJet cutting is fast and safe, reproducing high-quality identical cuts when necessary for multiple pieces.Fully computer controlled (CNC), your designs are vectored into the software and then exactly duplicated in cuts by the WaterJet cutter.

It readily replaces standard cutting tools and machines for glass and metal cutting. No heat is generated. As a cutting tool for steel and other metals there is no risk that excessive heat may change the properties of the material.

- WaterJet cutting is very detailed cutting which can create prototype parts very efficiently. With exact control and computer precision.
- Glass & Glazing companies will benefit greatly from access to this technology. Automated so every replication piece is exactly the same.
- Panelex expediently provides this cutting service for you.

With so many options, you have to call and inquire what water jet cutting can do for you.

PPG SICO valspar AkzoNobel TRAFICRON™

www.panelex.ca 15371 Knox Way, Richmond, BC, V6V 3A8, Canada Phone: 604.241.3173 / Fax: 604.241.3136

Waterjet Cutting Compared

	WATERJET	WIRE EDM	LASER	PLASMA	MILLING	PUNCH PRESS
ACCURACY	Average of ±0.003" (±0.08 mm) and up to 0.001" (±25 µ) [1]	±0.0001" (±2.5 µ)	±0.001" (±25 µ) [2]	±0.030 to ±0.060" (±0.75 to ±1.55 mm)	±0.0003" (±8 µ)	Fair
THICKNESS	3" (75mm) or more for some applications	12" (30 cm)	Generally less than 0.25"(6.35mm)	Cuts less than 1.25"	Able to work on 3D parts	Works well with thin sheets
CUTTING SPEED	5-10 times faster than EDM when thickness is under 1"	5-10 times slower than waterjet	Very fast cutting in thin, non-reflective materials	Fast with thin sheets	Fair	Fast batch production when initial programming and setup are done
EDGE QUALITY	Good	Excellent	Excellent	Fair	Excellent	Fair
HEAT AFFECTED ZONE (HAZ)	None	Some	Yes	Yes	None	None
MATERIAL DISTORTION	No Distortion [3]	No	Possible	Possible	No	Some
MATERIAL LIMITATION	Works in virtually all materials except really hard ceramics	Only works in conductive materials	Only non-reflective metals [4]	Generally works in metals	Not ideal for very large parts	Not good for brittle or hardened materials
PROCESS	Cold supersonic abrasive used to cut material	Spark erosion used to remove material from electrically conductive materials	Thermal process	Thermal process	Mechanical cutting tool	Shearing process
SETUP	Fast and easy set-up	Relatively easy set-up	Relatively easy set-up but may have to tune laser for different materials	Relatively easy set-up	Time consuming set-up and programming	Time consuming set-up and programming

How Does a Waterjet Work?

Basic Components and Operation:

High Pressure Pump

The pump generates a flow of pressurized water for the cutting process.

Abrasive Waterjet Nozzle

Inside the nozzle the pressurized water passes through a small-diameter orifice and forms a coherent jet of water. The jet then passes through a venturi section where a metered amount of granular abrasive is drawn into the water stream. The mixture of water and abrasive particles passes through a special ceramic mixing tube and the resulting abrasive/water slurry exits the nozzle as a coherent cutting stream of abrasive particles travelling at very high speed.

Catcher Tank

The water-filled catcher tank dissipates the energy of the abrasive jet after it has cut through the material being machined.

Abrasive Hopper

The abrasive hopper and associated abrasive flow control system provide a metered flow of granular abrasive to the nozzle.

Articulated Cutting Head

As an add-on option to OMAX waterjets, this computer-controlled multi-axis cutting head permits angled cuts and can be used to automatically minimize taper for precise vertical cuts.

X-Y Traverse System

A precision X-Y motion system is used to accurately move the nozzle to create the desired cutting path.

PC-based Controller

Advanced motion controllers for abrasive waterjet systems are PC-based and permit production of accurate parts with minimal operator experience.

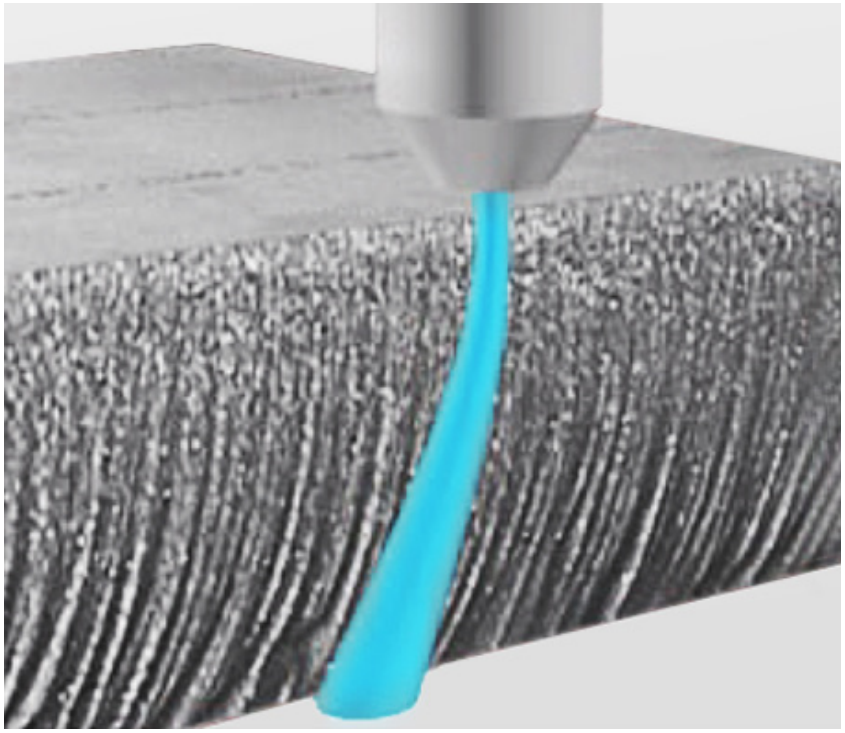
Motion Control

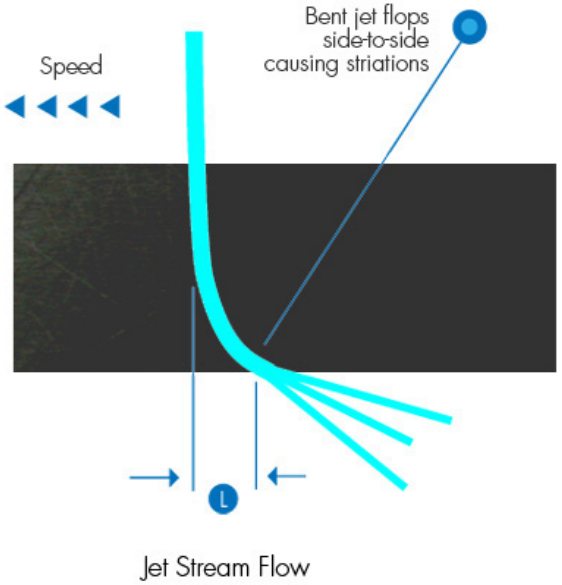
Accurate First Cut

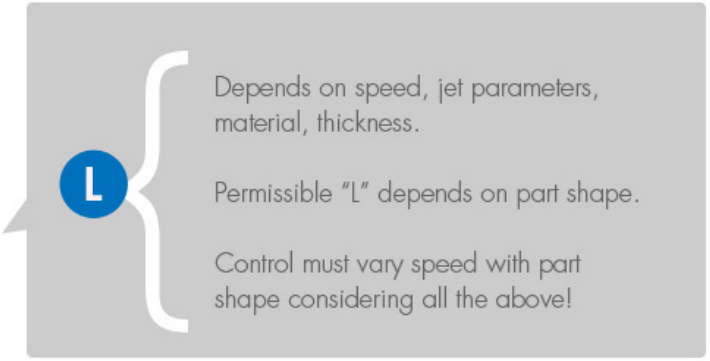
The motion control system is an essential element in an abrasive waterjet cutting system because the cutting stream bends as it cuts. This means that a waterjet tends to undercut corners and swing wide on curves when moved as one would move a traditional rigid cutting tool.

OMAX eliminates this issue by using an advanced computer model to accurately predict the motion and shape of the cutting stream and then by using a PC-based motion control system to compensate for undesired jet motion. The result is a fast, accurate part the first time.

No trial and error and no need for an experienced programmer because the experience and the knowledge is in the control software.





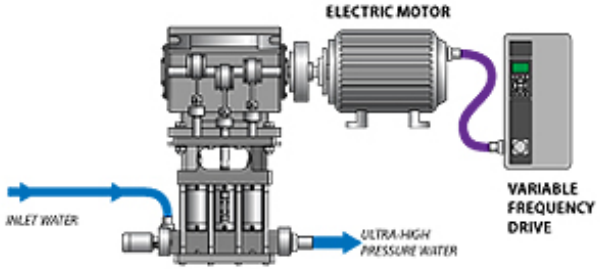


Pumps

Waterjet cutting systems utilize either the older, more complex hydraulic intensifier pump or the newer, simpler crankshaft-driven triplex plunger pump. Crankshaft pumps are inherently more efficient than intensifier pumps because they do not require a power-robbing hydraulic system. The crankshaft drive is a purely mechanical direct-drive system with minimal friction losses and so efficiencies between 85% and 90% are typical. This means that 85% or more of the electric power supplied to the drive motor can actually be delivered to the cutting nozzle, compared to the typical 65% or less of an intensifier.

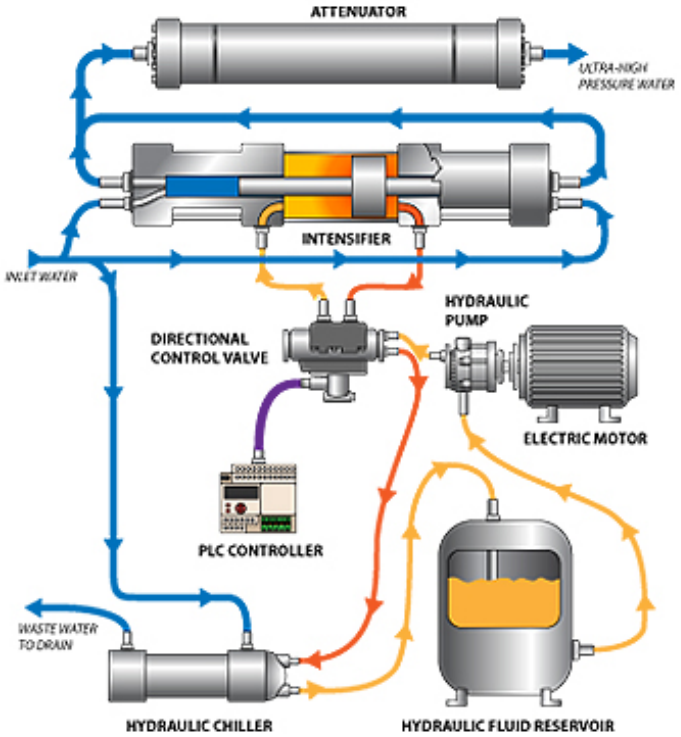
Historically intensifier pumps had an advantage of longer seal and check-valve life, but ongoing improvements in seal designs and materials and the wide availability and reduced cost of ceramic valve components now make it possible to operate a crankshaft pump in the 60,000 PSI (4,137 bar) range with long maintenance intervals and excellent reliability.

OMAX uses high-efficiency crankshaft-driven direct-drive pumps exclusively for all of its systems. A direct-drive pump is more efficient than a traditional hydraulic intensifier pump and so it can deliver more net power to the cutting nozzle, resulting in faster cutting. It is quiet and clean, with no risk of messy hydraulic leaks. In addition, a direct-drive pump is simple to understand, to troubleshoot and to maintain. The OMAX Enduromax pump features a preventative maintenance interval of 1000 hours, offering the ultimate in reliable low-cost operation.



Direct Drive Pump

VS.



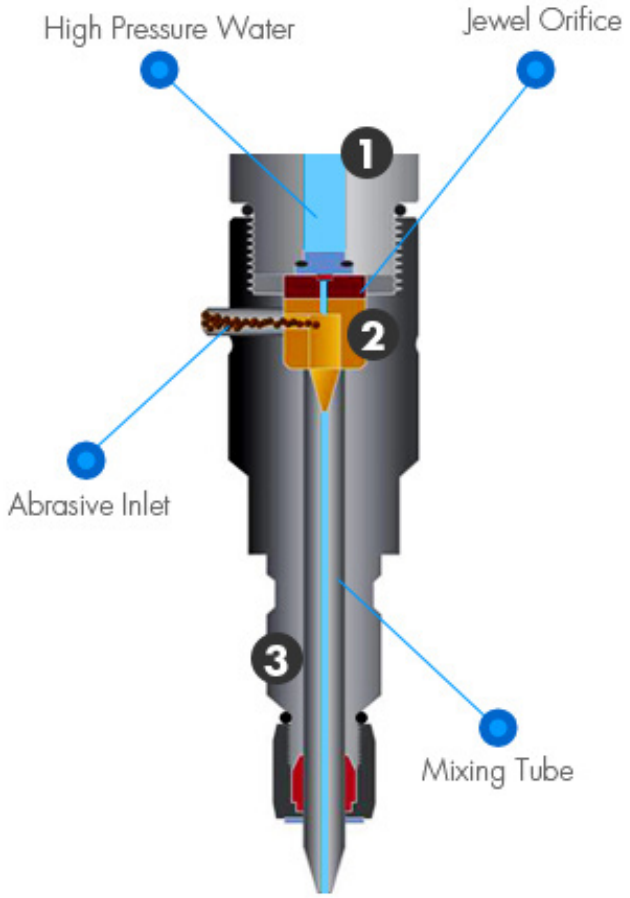
Intensifier Pump

Nozzle

All abrasive waterjet nozzles use the basic operating principle of the aspiration nozzle, first patented in 1937 (Patent 2,131,660) and shown in its modern configuration in the diagram on the right.

Note that for water-only nozzle designed for cutting of soft material, the venturi section and mixing tube are eliminated and the coherent jet of water alone cuts the material.

In order for the aspiration nozzle to cut efficiently and with long component life, it is critical that the orifice be carefully aligned with the centerline of the mixing tube. All OMAX nozzles are factory-aligned and individually tested to assure efficient cutting and long life.



Abrasive Waterjet Nozzle

What Materials Can a Waterjet Cut?

Composites:

Carbon Fiber-Reinforced Plastics

Cutting this advanced material is a major growth area for OMAX systems. The material cuts very quickly and cleanly and the OMAX abrasivejet system is now widely used in applications from aerospace components to race cars, from NASA to NASCAR.

Cutting carbon fiber-reinforced plastics with an OMAX abrasive waterjet has major advantages, such as no tool clogging or wear, no need to change tooling, no special considerations or restrictions due to heat buildup, no melting, and no hazardous fumes requiring costly air handling equipment.

Glass-Reinforced Plastics

Fiberglass can be cut quickly and cleanly without hazardous dust or fumes by simply submerging the material during cutting.

Other-Reinforced Plastics

Any fiber-reinforced material, including Kevlar reinforced personnel armor, can be quickly and cleanly cut on the OMAX without hazardous dust or fumes.

Materials continued on next page »

Carbon Steel

The OMAX® waterjet machine will cut all grades of steel. It produces a smooth cut on the edge without burn marks, cracking, excess burr, or other problems typically associated with heat-based cutting or mechanical cutting. The lack of heat affected zone from the abrasivejet means that the heat treatment of the steel is not changed by the cutting process.

Stainless Steel

All grades of stainless steel can be cut easily on the OMAX, even those such as 304 that are difficult to machine with other processes without heat or distortion. A heat affected zone can weaken integrity of a part and lead to failure. The lack of any HAZ makes the abrasivejet process particularly attractive to those producing food processing and handling equipment or the aerospace industry. Polished or reflective surfaces do not negatively affect the abrasivejet process as they might with a laser cutting system.

Hardened Tool Steel

Tool steel can be cut in a fully hardened state without any change in material properties. More and more tool and die shops are finding the OMAX system to be a valuable addition with close to EDM precision at up to 10 times the speed.

Alloys of All Types

Difficult-to-machine special superalloys, such as Inconel® and Hastelloy® are easy to cut without heat or distortion on the OMAX.

Aluminum

Probably more aluminum is cut on OMAX systems than any other metal because it cuts so quickly and cleanly, without any thermal distortion. More and more laser specialty shops are adding an OMAX system to their mix of lasers in order to accurately cut thicker aluminum.

Titanium

The OMAX system is ideal for cutting titanium, which can be a challenging material for conventional machining processes.Titanium can be cut quickly and accurately without any thermal distortion or surface embrittlement. Because titanium is so expensive, considerable cost savings can be obtained by the close nesting of parts that is possible with the abrasivejet process in order to reduce waste material.

Copper

All grades of copper cut quickly and cleanly on the OMAX without thermal distortion. The reflectivity that may be an issue for lasers is not a problem for an abrasivejet and there is no problem with “gumming” as might occur with conventional mechanical cutting systems.

Brass

Brass alloys cut quickly and cleanly with the OMAX abrasivejet process, with no thermal distortion.

Glass

The OMAX system is widely used for cutting a wide variety of glass products, from ultra-thin panels for smartphones to thick multi-layered bullet-proof panels for vehicles and buildings to panels for stained glass windows. The OMAX has the capability perform a low pressure pierce that automatically switches to high pressure mode to continue the tool path. This means that even the most brittle glass can easily be pierced to create a starting point and yet still be cut at maximum speed. The only glass that can't be cut is tempered glass.

Stone

The OMAX system can cut stone products of all types. Applications include granite countertops, quartz blanks for precision mirrors, inlaid marble flooring, decorative wall panels and stone sculptural pieces.

Concrete

Concrete cuts easily with the OMAX abrasivejet process and applications range from inlaid stepping stones to architectural features and sculptural panels.

Ceramics

Most ceramic materials can be cut with an OMAX abrasivejet. However if the hardness of the ceramic is greater than the hardness of garnet abrasive (between 7.5 and 8.5 on the Mohs scale), abrasivejet cutting will not be economically effective.

Rubber

Softer rubber and foam rubber cut easily using a water-only nozzle without abrasive. Fiber-reinforced rubber and very hard rubber can be cut cleanly using the abrasivejet process.