

expertise in waterjet cutting

Waterjet cutting

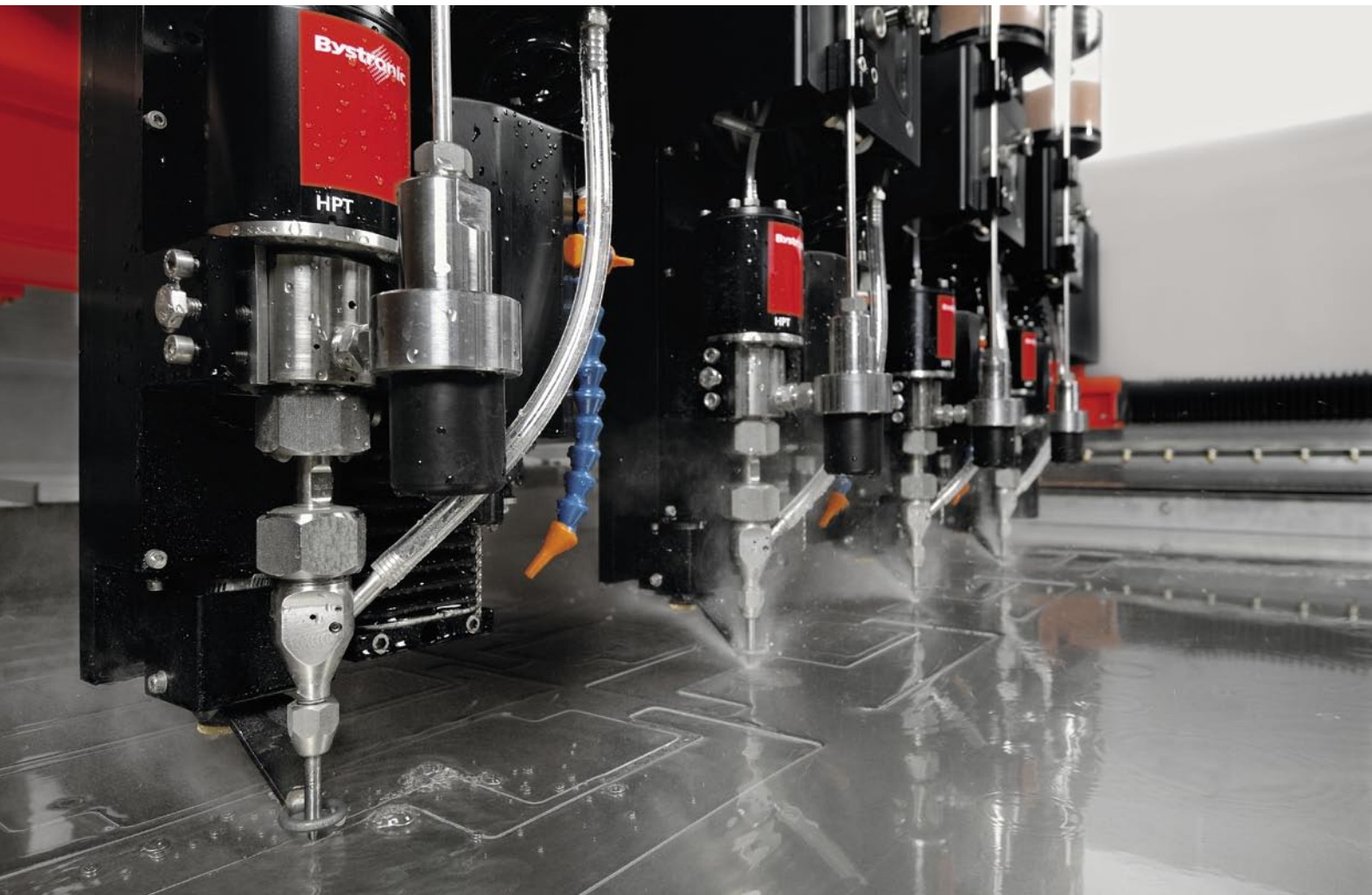
The perfect complement to milling

Bystronic

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For additional information about waterjet cutting, please visit us on the Internet at
www.bystronic.com/milling



Waterjet cutting – the perfect complement to milling with savings potential of up to 70 %

If waterjet cutting is used as preparation for milling, costs can be reduced up to 70 %. Depending on the requirements for the parts, it may even be possible to forego milling altogether. The savings are then even greater. This way, it is possible to reduce production costs drastically with this innovative production technology.

An increasing number of companies are discovering the nearly unlimited possibilities of this efficient and extremely economical process, which is also often used to supplement mechanical processing. High-pressure waterjet cutting with or without an abrasive additive is being used by contract manufacturers in nearly every industry today: from aerospace to the textile and food industries, and increasingly also in industries that process glass and composite materials. Even high-tech materials such as carbon fiber and other composite materials can be processed efficiently and precisely with waterjet cutting. Material consumption is reduced to a minimum.

The benefits of waterjet cutting speak for themselves:

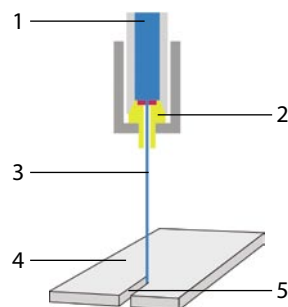
- In comparison to milling, no expensive tools are required for waterjet cutting.
- The cutting quality of the water jet is adjustable and no clamping tools are necessary.
- Thanks to the nesting of parts, less raw material is consumed.
- Up to four cutting heads on a system enable the simultaneous production of four parts.
- The low cut and reaction forces permit the processing of soft and pliable materials (e.g. foams) and the production of filigree structures.
- In contrast to milling, no tensions in the material arise during waterjet cutting.
- Nearly all materials can be processed.
- With the water jet, it is possible to make cuts in and automatically engrave the workpiece.
- It is possible to cut in nearly all directions and to generate nearly any contours.



Bystronic systems impress not just with their great precision, but also with their long useful life, which is unique on the market.

Technology and economic efficiency

The essential parameters of waterjet technology are the pressure and the water throughput. These two parameters produce the jet energy. The water is brought to a particular pressure with the pressure generator. The jet is generated in the cutting head, where the pressure energy is transformed into kinetic energy. Depending on the application, an abrasive is fed into the jet using a dosing system. The interaction between the jet and the workpiece produces the processing result.

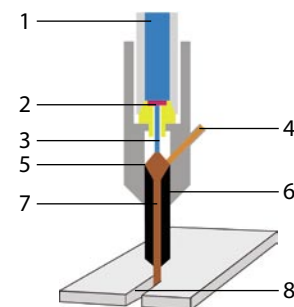


Schematic depiction of pure-water waterjet cutting

- 1 Water under pressure
- 2 Water nozzle
- 3 Pure water jet
- 4 Work piece
- 5 Cut width (kerf)

Pure-water waterjet cutting

Water compressed at very high pressure is released through a narrow opening, the so-called water nozzle or sapphire nozzle. It forms a water jet, which comes out at a speed of up to 850 m/s. Soft materials such as seals, foams, and rubber can be cut perfectly with this water jet.

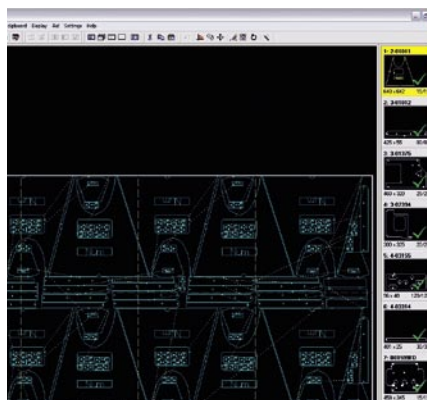


Schematic depiction of waterjet cutting with an abrasive

- 1 Water under pressure
- 2 Water nozzle
- 3 Water jet
- 4 Abrasive feed (unpressurized)
- 5 Mixing chamber (vacuum chamber)
- 6 Abrasive nozzle (focusing tube)
- 7 Water jet with abrasive
- 8 Cut width (kerf)

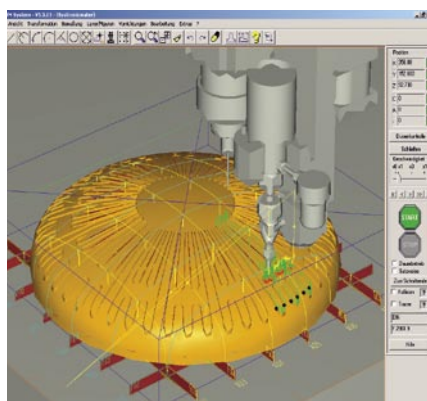
Abrasive waterjet cutting

For waterjet cutting with an abrasive, a cutting medium, the so-called abrasive (garnet sand, for example) is added to the water jet in a mixing chamber. In a second nozzle, called the focus nozzle or focusing tube, the water jet with abrasive is focused and the abrasive particles are accelerated to a high speed. They move fast enough in order to cut even very hard materials.



A technology that redefines economic efficiency – cost-effective production of prototypes and small series

A CAD file (in all common formats) of the part to be created is read in for the waterjet cutting process or created directly in the user software. The cutting plan specifies the cutting parameters for the various sections of the contour, including feed motion speed and pressure. The material to be processed is positioned on the system and cutting can begin. Thus, waterjet cutting impresses with extremely short programming and setup times as well as efficient cutting times. Waterjet cutting systems can be equipped with several cutting heads, and if necessary, several parts can be produced at the same time. Waterjet cutting systems provide users with previously unknown flexibility and economic efficiency. From individual and prototype production to small series on through to large series, all orders can be produced cost-effectively and fast, and this with a nearly unlimited range of materials. Furthermore, since waterjet cutting is a “cold” cutting process, the material is not subject to any thermal or processing forces.



3-axis CAD/CAM

The 3-axis CAD/CAM allows the cost-effective production of simple three-dimensional shaped parts. The clamping fixture required for this is constructed automatically by the software and can be produced using the same waterjet cutting system.

Process comparison and savings potential

Great savings potential – a practical example

The following comparison shows that production costs can be reduced drastically with waterjet cutting.

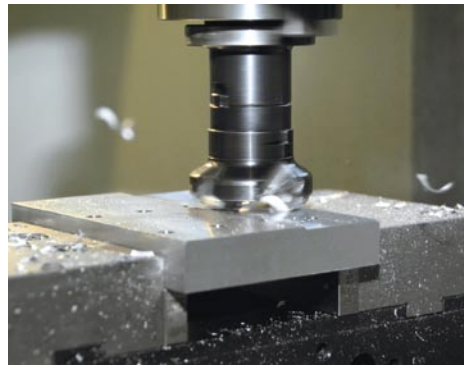


The part to be produced

Quantity:	10
Material:	Aluminum
Dimensions:	53 mm x 98 mm
Thickness:	10 mm



Waterjet cutting machine:
ByJet Pro 3015 (with 2 cutting heads)



Milling machine: 5-axis CNC

The result

Waterjet cutting

Programming:	6 minutes
Set-up of the machine:	2 minutes
Cutting time:	24 minutes*
Total:	32 minutes
Required tools:	1 tool

Milling**

Programming:	12 minutes
Set-up of the machine:	30 minutes
Milling time:	104 minutes
Total:	146 minutes
Required tools:	7 tools

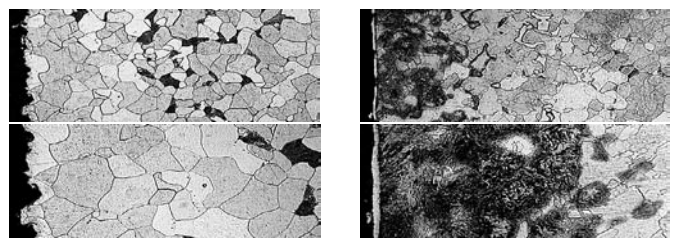
* On a waterjet cutting machine with 4 cutting heads, the cutting time would be cut in half again.

** The clamping tool required for milling was not taken into consideration in the comparison above.

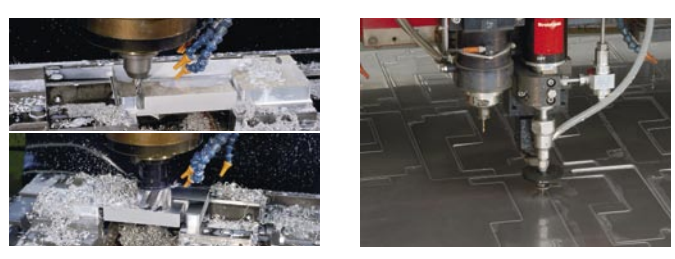
20 mm mild steel, cut with the water jet with abrasive (left) and the laser jet (right): comparison of the component surfaces and structure analysis.



Because waterjet cutting is a cold process, there is no structural influence. The heat transfer during laser, plasma, and flame cutting changes the structure.



High material loss with milling. With waterjet cutting, the parts can be nested, which reduces costs enormously.



	Waterjet cutting with abrasive	Laser cutting	Plasma cutting	Flame cutting
Material thickness	++	-	+	++
Cutting quality	++	++	-	-
Cutting speed	+	++	+	+
Universal utilization	++	-	+	-
Precision cutting	++	++	+	-
Post-processing	++	++	+	-
Slagging	+	-	-	+
Flexibility	++	+	-	-
Total processing time	+	++	-	-

Applications and flexibility

Bystronic waterjet cutting systems are used for various materials and applications. Nearly all materials, such as 110 mm-thick titanium, can be processed extremely well with waterjet cutting with abrasive. The limit is specified by the cutting tool. Garnet sand demonstrates a hardness between 7.5 and 8.5 Mohs (this corresponds approximately to a Vickers hardness of 1200 HV to 2000 HV). Therefore, all materials that demonstrate a lesser hardness can be processed with waterjet cutting with abrasive. The multitude and variety of the materials to be processed put waterjet cutting nearly in a class by itself. This flexibility together with the very short programming, setup, and processing times makes it one of the most economical production processes of all.

Even highly qualified contract manufacturers who produce high-tech materials such as carbon fiber and other composite materials for Formula 1 know how to appreciate waterjet technology. For precisely when the concern is prototypes and small series or expensive materials, it is necessary to react fast and efficiently and to optimize material usage.

Typical materials:

- Steel and stainless steel
- Aluminum and aluminum alloys
- Other metals and NF metals
- Ceramics
- Glass, bullet-resistant glass
- Stone, granite, marble
- Sandwich materials
- Structural materials
- Rubber
- Sealing materials
- Soft foams
- Soundproofing and insulating materials
- Composite materials (CFL, GRP)
- All types of plastics
- Wood
- Paper, cardboard
- Textiles, leather





Material:	Stainless steel
Thickness:	15 mm
Cutting quality:	Very high
Cutting time:	6 minutes 31 seconds
Special features:	Engraving

However, the same material cut with a lower cutting quality (separation cut).

Cutting time: 1 minute 41 seconds



Material:	Aluminum
Thickness:	30 mm
Cutting quality:	High
Cutting time:	47 minutes 15 seconds
Special features:	Very high shape precision



Material:	Alu compound
Thickness:	6 mm
Cutting quality:	High
Cutting time:	3 minutes 16 seconds
Special features:	High shape precision



Material:	Short-fiber-reinforced plastic
Thickness:	20 mm
Cutting quality:	High
Cutting time:	1 minute 55 seconds
Special features:	High surface quality



Material:	Tool steel
Thickness:	60 mm
Cutting quality:	High
Cutting time:	77 minutes
Special features:	No tolerance deviations, no heat deformation, and no hardness increase

The cutting times are based on a single cutting head machine. If a four cutting head machine is used, the production time reduces to one quarter.

The efficiency makers – waterjet cutting machines from Bystronic

ByJet Pro

The ByJet Pro impresses with its ergonomic and safe operating concept thanks to encapsulation and the safety gate as well as a low-noise work environment. The shuttle table is another highlight which contributes to the outstanding productivity of the system.



ByJet Pro L

The ByJet Pro L is available with a working area of up to 3 x 16 meters; it is thus suited for very large material sheets and round parts up to 7.7 meters.



	ByJet Pro 3015	ByJet Pro L 2030 to 16030*
Cutting heads	1, 2, 4	1, 2, 4
Maximum positioning speed parallel to the axis	60 m/min	60 m/min
Positioning accuracy	± 0.08 mm /axis	± 0.05 mm /m
Repeatability	± 0.025 mm /axis	± 0.025 mm /axis
Cutting range for flat processing	3048 x 1524 mm	2048 x 3068 mm up to 16 048 x 3068 mm
Maximum workpiece weight flat part	up to 790 kg/m ²	up to 790 kg/m ²
Maximum workpiece thickness	200 mm	200 mm

* ByJet Pro L 2030, 4030, 6030, 8030, 10030, 12030, 14030, 16030



ByJet Classic

A waterproof investment! ByJet Classic was developed for users who expect high functionality and precise cutting results and, at the same time, value an attractive price.



ByJet Classic L

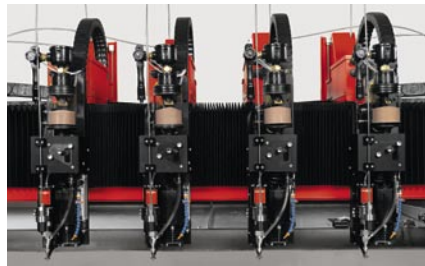
Extraordinary parts produced at an affordable price: The ByJet Classic L cuts large and special formats simply and without difficulty. A safe investment even with XXL formats!

	ByJet Classic 3015	ByJet Classic L 2030 to 10030*
Cutting heads	1, 2	1, 2
Maximum positioning speed parallel to the axis	60 m/min	60 m/min
Positioning accuracy	± 0.08 mm /axis	± 0.05 mm /m
Repeatability	± 0.025 mm /axis	± 0,025 mm /axis
Cutting range for flat processing	3048 x 1524 mm	2074 x 3068 mm up to 10 074 x 3068 mm
Maximum workpiece weight flat part	up to 790 kg/m ²	up to 790 kg/m ²
Maximum workpiece thickness	200 mm	200 mm

* ByJet Classic L 2030, 4030, 6030, 8030, 10030

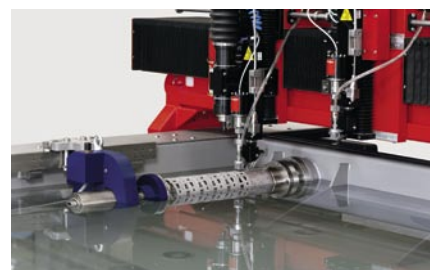
Cutting bridge

The cutting bridge with integrated tool axes and cutting head distinguishes itself through its great precision. Powerful height sensing with integrated collision protection and automatic nozzle calibration guarantees this. These features also ensure low-maintenance operation. With a drill spindle it is possible to pre-drill expensive fiber composites and other materials, which effectively prevents damage to the part (delamination, cracking).



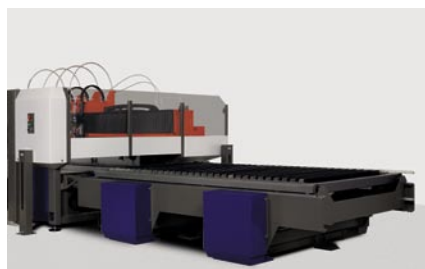
Rotary axis

Depending on how the machine is equipped, round and profile tubes can be processed fast and economically using the optional CNC-controlled rotary axis. The unit is integrated into the front part of the machine basin and thus easily accessible to the operator.



Shuttle table

The ByJet Pro can be equipped with an optional shuttle table system. Its ergonomic design enables comfortable and safe access to the cut parts, which are cleaned automatically during the table change. Non productive times are also reduced this way.



High-pressure pump Bypump 50 APC (Active Pressure Control)

Two individually-driven pressure intensifiers regulated by a micro-processor guarantee constant, linear and infinitely adjustable pressure. There is no need for an accumulator that would be subject to inspection. The intelligent and extensive diagnostic system also ensures fast and efficient maintenance and trouble-free operation of the pump for many years.



Bystronic is a worldwide active supplier of application-oriented systems and services for the laser and waterjet cutting processes, as well as bending: economical, high-performance, reliable.



Laser cutting
Laser cutting systems for the innovative processing of a wide variety of materials and geometries



Bending
3-point and air bending machines for high-precision working of sheet metals



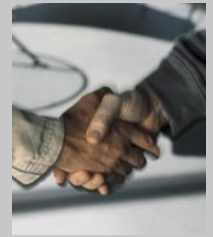
Waterjet cutting
Waterjet cutting systems for cutting metals, glass, synthetics, ceramic, and many other materials



Automation
High-performance handling and automation solutions from simple loading systems to fully automated laser production cell with integrated storage system



Software & Control
User-friendly programming and operation with requirement-oriented application programs and interfaces to CAD and ERP systems



Service & Support
Competence and customer proximity with after-sales support available worldwide: local contact persons, prompt delivery of spare parts, and professional training courses

Your contact

www.bystronic.com