

WATER JET CUTTING

STEEL, GLASS, WOOD, PLASTIC: A PROCESS FOR ALL MATERIALS.

Water jet cutting is a cold grinding or cutting process. It combines the advantages of laser – precision – with those of water: water jet cutting is thermo-neutral. In addition to laser cutting, water jet cutting is becoming increasingly important in Switzerland and Germany.

No thermal stresses occur with water jet cutting. The microstructure of the material and the material strength remain. There are no cures, distortions, dripping slag, melting or toxic gases.

In all processes, the cutting heads with the focussing nozzles are integrated in a guiding machine (robot, 2D or 3D portal). The controlled CNC axes enable 2D, 2.5D or 3D cutting processes. These processes can cut almost all materials – hard like steel and glass, but also fragile and extremely soft materials – without stress forces.

Water jet cutting has three principles: the pure water jet principle „WJ“, the abrasive water jet principle „AW“ and the suspension jet principle, which is still at development stage.



WATER JET CUTTING WITH PURE WATER.

With pure water jet cutting „WJ“, a pure water jet with a diameter of 0.1 mm cuts the material at up to three times the speed of sound (at speeds of up to 200 m / min). These materials include textiles, elastomers, fibres, thin plastics, food, paper, cardboard, leather, thermoplastic materials or food.

The water is pressurised to 1000 - 6000 bar (standard approximately 3,800 bar). After flowing through a high pressure needle valve, the water enters a 200 mm long and 3 mm in diameter wide collimation tube (calming section).

It is then pressurised by a water nozzle or a dynamic pressure nozzle and accelerated. The jet speed varies according to geometry and pressure. The small diameter of the water nozzle produces a very high local energy density, which remains constant on a relatively long section in the direction of the water jet and cuts cleanly and accurately when hitting the material.

WATER JET CUTTING WITH ABRASIVES

With abrasive water jet cutting, compact and hard materials such as metals (including steel), hard stone, glass (including bullet-proof glass) and ceramic are separated.

Before the concentrated jet of water hits the material, a cutting material of the finest grain size (abrasive) is added in the required dose in a mixing chamber, which ensures micro cutting. The water serves as an accelerator for the abrasive particles and hits the material with an impact speed of 800 m/s, thereby removing it with precision.

Until the water jet is produced, abrasive water jet cutting is identical to pure water jet cutting. The difference is that the pure water jet is no longer used just for cutting, but as a carrier material for the abrasive particles.

The pure water jet flows into a mixing chamber, into which the abrasive particles are then introduced. At the end of the mixing chamber is the focusing tube, in which the abrasive grains in the water jet are accelerated and confined to a specific cross-section.



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After the focusing tube, the abrasive water jet enters into the open end, after a few millimetres, hits the work piece. The particles knock out all the crystals and also cut hard materials such as steel and glass.

WATER JET CUTTING WITH SUSPENSION JET

With the suspension jet principle or water abrasive suspension jet cutting, a pre-prepared mixture of abrasive particles and water is discharged under high pressure from a cutting nozzle. However, the abrasive agent is not added at the nozzle but is pressurised under the exclusion of air. Therefore, a water-abrasive mixture (a suspension) is expelled from the cutting nozzle under high pressure.

This enables higher cutting performance, allows greater thicknesses and almost all materials to be cut. However, there is a delay in the start and stop of the cutting operation, since the abrasive feed cannot be switched on and off as rapidly as in injection cutting. This is one disadvantage when high-precision cutting is required.

The wear on the valves and nozzles is also much larger and attainable pressures are smaller. Therefore, this principle is only seldom used on an industrial scale.