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## **ADVANTAGES OF WATER JET CUTTING**

A water jet cutter is an industrial tool capable of cutting a wide variety of materials using a very high-pressure jet of water, or a mixture of water and an abrasive substance. The term abrasive jet refers specifically to the use of a mixture of water and abrasive to cut hard materials such as metal or granite, while the terms pure water jet and water-only cutting refer to water jet cutting without the use of added abrasives, often used for softer materials such as wood or rubber [2].

Water jet cutting is often used during fabrication of machine parts. It is the preferred method when the materials being cut are sensitive to the high temperatures generated by other methods. Water jet cutting is used in various industries, including mining and aerospace, for cutting, shaping, and reaming [1].

Essentially, a water jet is an ideal, wear-free cutting tool. Such cutting is applied also when it is necessary to keep the initial properties of the processed material to prevent neither mechanical nor thermal influence.

Water jet cutting is used for production of parts from any grades of steel (tool, structural, heat-resistant), non-ferrous metals and alloys (titanium, aluminum, copper, brass, bronze) [3].

There are six main process characteristics to water jet cutting:

1. uses a high velocity stream of Ultra High Pressure Water 30,000–90,000 psi (210–620 MPa) which is produced by a high pressure pump with possible abrasive particles suspended in the stream; 2. is used for machining a large array of materials, including heat-sensitive, delicate or very hard materials; 3. produces no heat damage to workpiece surface or edges; 4. nozzles are typically made of sintered boride or composite tungsten carbide; 5. produces a taper of less than 1 degree on most cuts, which can be reduced or eliminated entirely by slowing down the cut process or tilting the jet; 6. distance of nozzle from workpiece affects the size of the kerf and the removal rate of material. Typical distance is .125 in (3.2 mm). Temperature is not as much of a factor [5].

Comparing a water jet with a machining (milling, drilling, stamping, etc.) and thermal (oxygen, plasma, laser, erosion cutting) the advantages of a water jet are:

*1. High quality of cutting.* Water jet cutting provides high precision and quality, this cutting method requires no further machining. There are no thermal changes under their influence, and this prevents deformation, slagging or mixing, as well as contamination with elements such as harmful vapors and gases inherent in other types of cutting when processing plastics, composites, etc. The jet of water does not create direct pressure on the surface of the material and mechanical action occurs only at the microscopic level. Thus, despite the large kinetic energy of the jet of water, there is no deformation of the material and precision cutting is performed without the appearance of irregularities of the edge.

Water jet cutting allows to cut details with complex profiles without additional processing of a surface of a cut and rather high productivity.

2. *Non-waste of material.* A very thin stream of water creates significantly less waste of material than traditional processes.

3. *Non-deformation.* When using a water jet cutter, non-deformation of the parts occurs and, as a consequence, the physical and mechanical properties of the material are retained. The low tangential cutting force on the workpiece causes that workpiece don't clamp.

4. *Versatility.* This technology allows to cut a variety of composite materials without creating any gaps in their structure. Water jet cutting is ideal for trimming materials with a wavy surface as well as a surface with complex contours. Sometimes a cutting machine is the only right solution, for example for cutting sheet metal laminated with plastic, copper and some other materials.

5. *Security.* When using water jet cutting there is no heating and sparking, which, in turn, provides absolute fire and explosion safety of using this method.

6. *Speed of cutting.* Water jet cutting has a high speed and allows significantly increase the amount of work performed.

7. *Automation of the process.* Ability to mechanize and automate the process of water jet cutting reduces the labor costs of the process [4].

Despite of the good indicators, the water jet cutting has several disadvantages: insufficient speed of movement of thin-walled steel; limited resource, which corresponds to the configuration and the cutting head; high value of abrasive (consumables); corrosion of metal [1].

## REFERENCES

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