

CONSIDERATIONS REGARDING THE USE OF WATER JET MACHINES IN ORDER TO REALIZE THE EXPERIMENTAL MODELS IN AGRICULTURE

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Abstract: *This paper presents the importance of using water jet machines, the principle of operation of hydraulic drive systems in order to realize experimental models in the field of research, innovation and agriculture.*

Keywords: *Industry, water jet cutting, agriculture*

1. Introduction

In the last 25 years in the research and industry of cutting machines, modern solutions have been created to optimize experimental models for agriculture.

Cutting or cutting is the technological operation by which the total or partial detachment of a part of a material is intended, for the purpose of processing it. The classification of the cutting procedures is shown in Figure 1.

Mechanical cutting (cutting) is performed by mechanical means, such as: scissors, pliers, stamps, saws, machines - tools, abrasive stones, chisels. It is particularly applicable in locksmith operations. The choice of the cutting process is made according to the precision imposed on the cut pieces, the hardness of the material, its quality and the energy consumption of the process. It can be done with or without loss of material. For the individual production, a process with low productivity can be adopted, but which requires a cheaper machine. For mass or mass production, highly competitive processes are chosen, compensating for the higher cost of the equipment or installation which is higher.

The cutting operation must ensure:

- small roughness of the separate surfaces;
- high accuracy of the volume or length of the piece;
- lack of deviations from the geometric shape of the piece;
- realization of semi-finished products larger than the cross-section;
- preservation of material characteristics in the separation zone.

According to the nature of the cutting, they are distinguished:

- cutting (cutting the ends of the bars);
- actual cutting (cutting the blank into several pieces);
- splitting (cutting, total or partial, in length, from the outside to the inside);
- excision (cutting to remove a portion from inside a semi-finished product).

In general, cutting is a preparatory work for other cutting, plastic deformation operations. For this reason, the control of the cut semi-finished products is executed from a dimensional point of view. The tools used are meter, slide rule, graded ruler, report and template. Another objective in control is the quality of the processed surfaces. In order to determine whether or not the processed surfaces have marked differences, the verification rule is used. The receipts that are recorded at the cut can be caused by the failure to comply precisely with the prescribed dimensions or process parameters (speed, temperature, electrical parameters). If the cut has been made after the drawing, the rejection may be due to the wrong drawing or the operator's inattention.

2. Material and methods

High pressure water jet cutting was first used by Dr. Norman Franz in the 1950s. He was a forest engineer who was looking for an easier way to cut wood, his experiments helped make this technology work. develop into what it is today.

Two decades later, Dr. Mohamed Hashish discovered a way to add abrasive material to the water jet. Using this a high-pressure water jet cutting machine can cut any type of material.

The high-pressure water jet cutting process is based on the erosive effect of the water on the materials, amplified effect due to the extremely high pressures and speeds with which the water jet acts on small surfaces.

It uses the kinetic energy of water particles, designed at very high speed on the surface of the cutting material. The speed is of the order of 800 - 1000 m / s depending on the working pressure, the section of the jet, the presence or absence of the abrasive.

The equipment required to obtain this jet includes: a hydraulic unit, a pressure multiplier, a battery, a workstation supply circuit and a cutting tube.

The functional principle of a water jet cutting plant is realized by the fact that high pressure water starts from the pump and is first driven to a pressure multiplier and then to the working head for pressure water jet cutting. high.

For the case of processing involving the use of abrasive particles here the system of supplying the abrasive material introduces a liquid under pressure the abrasive material necessary for the process of cutting with water jet with abrasive particles.

After the water jet comes out of the nozzle the energy is dissipated in the liquid collection tank which is usually filled with water and debris from previous cuts.

The movement of the cutting head takes place, usually in the X-Y plane. Motion control is performed using numerically controlled equipment that follows the profile of a CAD model.

The machines can also be equipped with some auxiliary systems such as: automatic cleaning tank, water recycling system, specially inclined ends, Z axis monitoring system, etc.

Ideally, you want a precise cutting in the shortest time and at the least cost. The cutting speed depends on the material to be processed, the geometry of the model, the software and the controller of the movement system, the power and efficiency of the pressure pump and other factors such as the abrasive material used.

The water used is network water, which passes through several filter floors (2 or 3), the last one by a micron, in some cases it has to be softened. To be brought under very high pressure, the water is considered to have the following maximum values:

- Dissolved materials: 500 mg/l
- Hardness (CACO₃): 25 mg/l
- Fe: 2 mg/l
- Mn: 1 mg/l
- Chloride (In Cl): 100 mg/l
- Silica (in Si): 15mg/l
- Clor biber: 1 mg/l
- Turbidity: 5 mg/l
- Acidity

3. Results

The hydraulic environment, the engine agent or the working fluid are names commonly assigned to the fluid used in hydraulic drive systems. This fluid is subjected, during the operation of the system, to very difficult working conditions for transmitting movement and effort, such as: variation in a wide range of working temperature, pressure and speeds, conditions in which it must maintain its physical properties. chemical and mechanical for a given period.

The heavy working conditions exposed raise particularly severe restrictions and require a rigorous selection of the fluid categories that correspond to most of the requirements imposed on them. Among the most important requirements that are imposed and based on which these working liquids are chosen, the following are mentioned:

- good lubricating properties and high mechanical strength of the liquid film;
- high resistance and chemical and thermal stability to prevent its oxidation, decomposition and degradation;
- minimum variation of viscosity with temperature;
- not to release vapors at normal operating temperatures and to not contain impurities that facilitate vapor release;
- not to contain, absorb or release air over the quantity allowed by the technical prescriptions;
- not to cause corrosion and deterioration of the sealing elements;
- have a high flash point and low freezing rate;
- minimum content of mechanical and technical impurities.

Mineral oils are the liquids that best meet these requirements and have a wide spread. In addition, a series of synthetic liquids are used as well as other environments, under special operating conditions.

A model of a water jet machine is presented (Figure 2) in order to obtain experimental models and the advantages of using it are presented.

The main features and advantages of a water jet cutting machine (Figure 3) are the following:

- complex abrasive cutting system with 3 or 5 axis water jet, high pressure intensifier (60,000 psi), software and a wide range of options, specially designed to optimize
- the process of cutting metal and non-metal materials, such as: stainless steel, aluminium, copper, bronze, titanium, composite material, as well as other materials such as glass, stone, granite, plastics;
- makes it possible to cut into thick materials, regardless of the type of material;
- the cutting speed management allows the work to be realized to the highest quality standards
- PLC monitoring system for monitoring the entire activity of the pump with pressure sensors, temperature monitoring and consumables life (Figure 4);
- Sand storage tank with pneumatic anti-reflux valve and low pressure required for sand pumping;
- automatic greasing of the treads and self-cleaning bearings;
- system for collecting abrasive matter and draining water from the tank;
- water filtration system and water deionization system;

Figure 5 shows a graph that shows the cutting thickness of a CNC water jet cutting machine, respectively in Figure 6 the cutting speed compared to other cutting machines such as laser and oxygen.

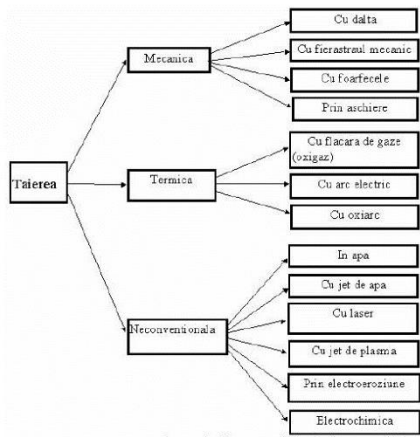


Fig. 1. Classification of cutting procedures



Fig. 2. CNC model with water jet



Fig. 3. CNC machining cutting with water jet



Fig. 4. PLC monitoring system

Metal Cutting Competing Technologies

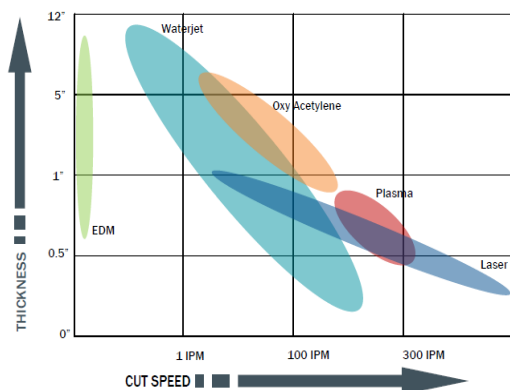


Fig. 5. Cutting thickness

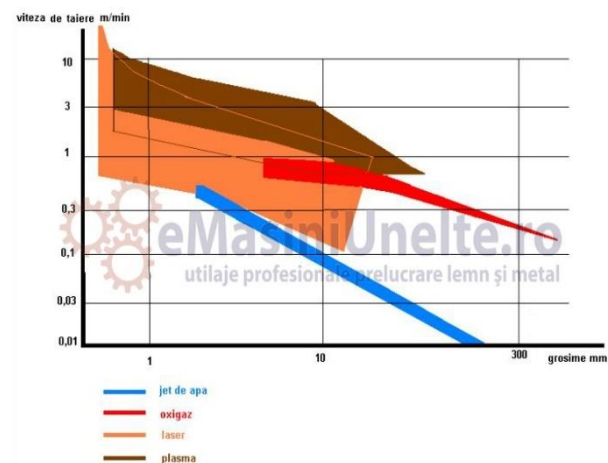


Fig. 6. Cutting speed

Conclusions

In conclusion, water jet cutting machines are an advantage for their use in the field of research because they offer great flexibility, do not generate toxic gases, UV radiation or other harmful substances for the operator, do not thermally influence the material, thus no slag is generated. The texture / quality of the surface of the material is no longer a critical factor in the cutting process and the quality of the surfaces obtained from the cutting is very high and therefore no further processing is required.

Acknowledgments

This work was supported by a grant of the Romanian Research and Innovation Ministry, through Programme 1 – Development of the national research-development system, sub-programme 1.2 – Institutional performance – Projects for financing excellence in RDI, contract no. 16PFE."

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