

WATERJET WORK SAFETY

¹ Ján KMEC, ² Ľuba BIČEJOVÁ

¹ Wating Prešov s.r.o., SLOVAKIA

² Technical University of Košice, Faculty of Manufacturing Technologies
Department of Technological Systems Operation, Presov, SLOVAKIA

ABSTRACT:

Waterjet cutting technology presents new accesses of shape cutting and various material separation at cold cut without heat influence to material on cutting edge.

KEYWORDS:

Waterjet cutting technology, cold cut, all materials

1. WATERJET TECHNOLOGY

Waterjet cutting technology represents unique, for the future orientated, possibility of high automation introduction at high-speed cutting really all material types.

In 30-thy year's American and Russian engineers first time tried to use water stream in mining, demarcating by high speed and that for coal, stone and rock mining.

In the end of 60-thy year's one American airplane producer decided, that he use waterjet cutting for processing of fleeced bonded textiles, plastic materials and materials folded from more layers.

High-pressure cutting with water stream, which is named also Waterjet-Cutting, was afterwards continuously developed. Important impulse for waterjet using in production technique like tool has come from aircraft designing and cosmonautics. The waterjet cutting principle is visible on following figure (fig. 1).

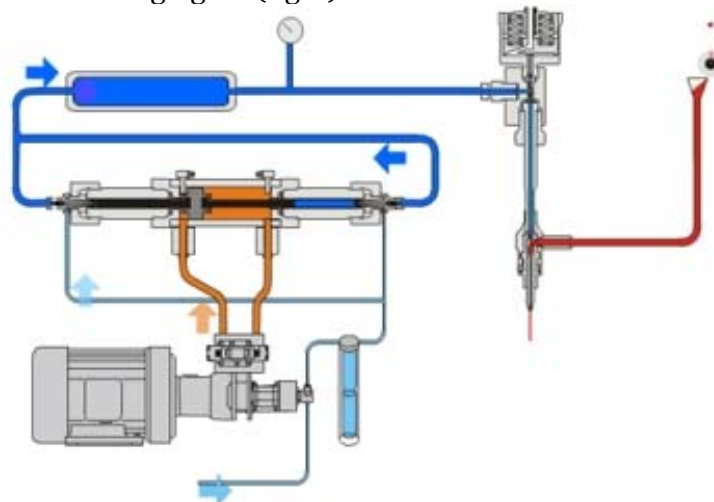


Fig. 1 The waterjet cutting principle - hydroabrasive method

2. TABLES AND ABBREVIATIONS FOR SAFETY AT WORK WITH WATERJET

Safety processes and safety practices must be monitored during introducing to the operation, during lonely operation and maintenance of high pressure pumps. In this area has created tabled and symbolic descriptions used in real practice, which is needed to follow at operation of workplaces for water jet material separation - table 1.

Table 1. Tables and abbreviations for safety at work with waterjet

	Show on dangerous, which can cause personal injuries or property damage, if care instructions are ignored.
	Show on dangerous, which can cause serious personal injuries, death or substantial property damage, if warning is ignored.
	High pressure of water stream can cause eyes injuries. Protect your eyes, when you work near the machine.
	Dangerous noise can cause hearing loss. Protect your ears, if you work near the machine.
	Dangerous electric tension can cause injury or death. Before opening the case unplug and disconnect main electric supply.
	Wrong function
	Hydraulic multipliers
	Pressure control
	High pressure
	Low pressure
	Start/Initialization
	Stop
	Running



3. SAFETY PROCESSES

Safety procedures must be following while it is worked with high pressure pump, with some its high pressure part. Such pump can operate only qualified person.

It is concerned at following safety procedures:

- ✚ High pressure of water 3800 to 4150 bar (55 to 60000psi) at waterjet cutting systems should not be reason for disconcertment. User must have respect before that pressure and use current safety processes and safety working practices.
- ✚ Everyone, who is connected with waterjet cutting system must realize, that power of waterjet cutting stream can penetrate into many hard and strong materials.
- ✚ Not qualified personal must not move in waterjet cutting area.
- ✚ In waterjet cutting area must be all time used safety glasses and earmuffs.
- ✚ All emergency STOP buttons must be regularly checked. During normal operation are pulled out.
- ✚ Check: Turn on electric supply and activate emergency SOP button so, that are pushed and you see, if energy exploding. Every device should be checked according special table. All the time, when device is checked, must function or must be returned into the original status before the start of operation.
- ✚ Use high clean lubricating wax for all threaded high-pressure connections. All piping, assembled and screwed connections should be tightened into the recommended moment values. If the circuit is under high pressure, do not try tight or install any high pressure parts, see safety of high pressure tubing.
- ✚ All high pressure leakages must be immediately repaired.
- ✚ Check all equipment according tables.

Before maintenance starting, turn off the main stop and ensure that high pressure is released.



Never perform any work on device without that you have guarantee that electric panel is unplugged.



Never work on any part with high pressure or released high pressure connections without that you firstly released the system and ensure that there is not high pressure.



Ensure that safety devices are in the operation. At dangerous stop the pump and unplugged high pressure. Emergency STOP buttons must be pushed. Pressure valve system must be opened.



Do not try to touch or be exposed to high pressure water. High pressure water penetrates into all parts of human body without exceptions.



Dropping water or material produced by this extreme pressure can injury or kill.

4. SAFETY OF THE HIGHT PRESSURE TUBING

Tubing with high pressure must be installed without stress in torsion. Suitable support and direction must be ensured. 9/16“ external diameter of high pressure pipes and armatures are recommended between the pump and the cutting head. Tubes of these big dimensions will decrease vibration, tension and bend between pump tubing and cutting area. Bigger tubing diameter also decreases the pressure and pressure pulsation.



If accessories is overcharged by high pressure of water, do not try repair the infiltration. All the time shut releasing of high pressure water before starting the maintenance on high-pressure parts. Outgoing holes are ensured to releasing of high pressure water, if infiltration happens on sealing surface. If armature is unfastened by high pressure water, flow with high pressure goes out from the nearest outgoing hole with possible dangerous results.



Be very careful, if touch device with high pressure. Possible failure from fatigue tearing or oversize pressure can result from dangerous high-pressure infiltration or parts failure.



Bendable 1/4“ pipe is regularly use at cutting for permitting of head cutting moving. Support and directions must be ensured anti-vibrating for prevention before failure of external load (load not regarding to water).



If high-pressure connections are tightened or unfastened, always use support jerk for avoiding to bending forces and stress at connection. Do not get over torque values.



High-pressure piping and devices designed to 4 150 bar (60 000 psi) must be always use only standardized. Underestimated can lead to catastrophic parts failure, which can cause device devaluation, injury or death.

5. GENERAL MAINTENANCE FROM WORK SAFETY POINT OF VIEW

Suitable maintenance is important for reliable and rigorous performance. Preventive maintenance reduces stoppage time for repairing, provides bigger operating life of parts and increases work safety.

High-pressure water will cut almost all what touches. Every infiltration must be immediately repaired to prevent damage or serious personal injury.

Maintenance directions:

- ✚ Regular equipment checking is recommended
- ✚ Keep equipment and surroundings clear
- ✚ Check pressures, temperatures and seal tightness
- ✚ Immediately execute repairing
- ✚ Maintenance record should be saved

Working environment:

- ✚ Keep clear working environment for repair and maintenance waterjet pump.
- ✚ Use clear working table for repairs and clear working environment.
- ✚ Use not woolen materials for wiping.
- ✚ If parts with compressed air are released, use only clear, dry air. If parts are wash solvent, use only clear filtrated liquid.
- ✚ Always use original spare parts from producer for original version, reliability, safety and guarantee protection.

Safety recommendations:

- ✚ Carefully read the safety instructions.
- ✚ Turn off all electric power.
- ✚ Shut all incoming delivery valves and open all unwatering valves.
- ✚ Shut injection and transfer valves, if energy is closed, safety exiting valve will open and release water high pressure hidden in releasing tubing.
- ✚ Ensure suitable drawer, bowl, tanks, etc. For fixation and detention liquid to avoid of hazardous working environment.
- ✚ Abide double control for ensuring, that all pressure is removed from system before you continue in work.
- ✚ Especially medical treatment is required always at treatment of wounding by waterjet according to card for emergency rescue. This card is part of technology delivery.
- ✚ Avoid of leaking, sharpen abrasions or bend loads, if work with expensive technology parts.
- ✚ Ensure, that all parts are clean, without sharpen edges, particulates, dirt, etc.
- ✚ Use high clean lubricant wax, if assemble some high pressure part or set.
- ✚ After repair any high-pressure part, check all high pressure connections for releasing of pressure.

Work safety with waterjet in various production Technologies must make provision for not only safety work with waterjet technology, but also safety work with all devices, which are on that workplace situated and also material manipulation.

In case of other workplace devices, manipulation with material, interoperable transport, storage, control and overall work environment, i.e. production logistic, safety regulations valid for technology operation are applied and followed, in accordance with law, in terms of Inspectorate of work safety and State health authority.

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