MAXIEM® Gen 2

Operation Guide

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401047B-EN

OMAX Corporation believes the information described in this manual is accurate and reliable. From time to time, design improvements will be made to the OMAX equipment. Photographs, text, and sketches within the body of this manual may not exactly represent your equipment. In general, this manual contains the most up-to-date information available. However, OMAX Corporation cannot accept any responsibility, financial or otherwise, for any consequences arising out of the use of this material. The information contained herein is subject to change, and revisions may be issued to advise of such changes or additions. OMAX strives to continually improve user documentation. If you have any questions or concerns about the content of this user's guide, please e-mail us at tech_writing@omax.com, or contact us by mail at:

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OMAX Corporation is continually improving their equipment to bring you the best in abrasive waterjet machining technology. For that reason, your abrasive waterjet may differ slightly from what is described in this document. If you have any questions, please feel free to contact us at 1-800-838-0343 or e-mail us at techsupport@omax.com. You can also receive technical support on-line at: Web: http://www.omax.com (user name and password required for technical support access).

Original Instructions in English
July 2020

Contents

SAFETY

This section contains important safety information for the equipment. Careful observance of the safety information will help prevent physical injury, damage to the equipment, and extend the equipment life.

Equipment Labels

The following safety labels may appear on the equipment. If ignored, physical injury, death, or equipment damage may occur. Read the safety information in the equipment operation guides before installing, operating, or maintaining the equipment.

WARNING Electrical Shock Hazard
This symbol indicates the presence of life-threatening voltages. Never access areas labeled as such without first taking appropriate safety precautions: locking out power, verifying no voltage is present on circuits prior to maintenance activities, etc.

WARNING Flying Debris/Loud Noise
Eye and ear protection are required during operation. Removing the abrasive feed tube from the nozzle while under pressure will blow abrasive particles into the air, getting into eyes, and could contaminate tools and machines.

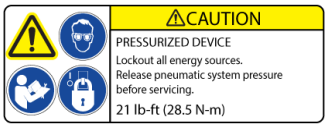
WARNING Keep Hands Away From Jet
Never place your hands in the vicinity of the nozzle while cutting.
Seek immediate medical attention in the event of a waterjet injury. Injuries caused by high-pressure abrasive waterjets are serious. Do not delay!

WARNING Watch hands and fingers
Never place your hands or fingers in areas where they are in danger of being pinched or crushed during equipment operation.

WARNING Watch Hands and Fingers
Keep the motor guards in place at all times during operation. Keep hands way from belts and pulleys when performing maintenance.

WARNING
Indicates potential health, physical, and environmental hazards which, if not avoided, can result in serious damage to the product or injury or death. Always proceed using extreme caution.

Electrostatic Discharge
Attention! Observe precautions for handling electrostatic sensitive devices.



WARNING Pressurized Device
Remove and lockout power before removing device. Release all pneumatic pressure from the system before servicing. Tighten to 21 ft-lb (28.5 N·m) when reattaching.

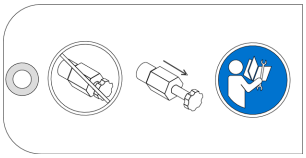
Step Hazard
Never step, stand or walk on the support slats. They are weakened with cutting and may collapse under your weight.

Do Not Oil
Oil may interfere with the operation and cause damage to the equipment.

No Open Flame
Do not allow smoking near the machine. Do not operate the equipment in an explosive atmosphere. Take care that no ignition source (such as open flame or electrostatic discharge) is nearby the equipment. Do not store flammable materials near the equipment. Do not use equipment in or around flammable gases or liquids. Do not allow explosive or flammable vapors to accumulate in the area of the equipment. Proper ventilation in your work area will assist in dissipating the accumulation of gas, vapor, and fumes. Be especially careful when cutting materials that create sparks, such as titanium—these can ignite gases in the tank.

DO NOT CUT
The cable/tube is pre-cut for optimal performance. Cutting the cable/tube will have adverse affects on equipment operation and/or cause damage.

Read Manual First/Do Not Adjust
Never make adjustments to equipment prior to reading the manual. Special instructions may be required. Adjustments may cause injury or damage equipment.



Do Not Over Tighten or Detach
NEVER over tighten the adjustment knob. Over-tightening the adjustment knob will force the stem into the seat and jam the stem into the seat, requiring disassembly to remove the jammed the components. NEVER loosen the adjustment knob until it is able to detach itself from the body. The water pressure during operation will forcibly eject the adjustment knob and tapered stem and may cause damage and/or injury.

Lock Out Power
Never do maintenance on the equipment with the main AC disconnect ON, unlocked, or with the pump in operation. Always follow standard lockout/tagout procedures.

Read Manual
Read the equipment operator's guide for specific operator instructions and additional safety requirements. Do not attempt to operate this machine until you have read and understand all safety precautions and operating instructions.

Wear Ear Protection
Always wear hearing protection while in the vicinity of the equipment. When cutting in air, noise levels can exceed 120 dB. It is quieter to cut under water. This can be achieved by adding enough water to the tank to cover both the material being cut and the nozzle tip.

Wear Eye Protection
Always wear approved safety glasses whenever cutting. Regular glasses do not provide sufficient eye protection! The garnet abrasive is not a chemical irritant, but if not quickly washed out, it can injure an eye just as any sand would. In addition, tank water could contain particles from the material or chemical irritants. Have an eyewash station located near the work area in the event abrasive spray splashes into your eyes.

Read the product labels and refer to product Safety Data Sheets (SDS) to identify properties and hazards of chemical products and materials referenced in this document. Handle in accordance with good industrial hygiene and safety practice. Use personal protective equipment as specified in the SDS.

Wear Gloves
Bacteria in the tank water can build up. A minor break in the skin can introduce harmful bacteria into a wound. Always wear protective gloves if you have cuts or open wounds on your hands. When setting up material for cutting, wear gloves that provide protection against sharp metal edges.

Read the product labels and refer to product Safety Data Sheets (SDS) to identify properties and hazards of chemical products and materials referenced in this document. Handle in accordance with good industrial hygiene and safety practice. Use personal protective equipment as specified in the SDS.

Safety Precautions

Always observe the following safety precautions while operating or servicing your equipment. Carefully operated, the abrasive waterjet is a safe tool. When operated carelessly, serious injury can result. Never make unauthorized alterations to the equipment or components.

Safety Requirements

Injuries involving contact with the water should receive immediate attention. Seek immediate medical attention in the event of an abrasive waterjet injury. Inform the physician of the cause of the injury, what type of waterjet project was being performed at the time of the accident, and the source of the water.

Treat All Injuries with Caution

Because of the stagnant water within the tank, even a seemingly minor break in the skin can introduce harmful bacteria into the wound. Any injury involving contact with the water should be immediately attended to.

Unusual infections with aerophilic microorganisms occurring at lower temperatures have been reported. These may be gram-negative pathogens, such as those found in sewage. Bacterial swabs and blood cultures may therefore be helpful in assisting a physician's diagnosis.

An injury caused by high-pressure waterjets can be serious. In the event of any waterjet injury:

- Seek medical attention immediately. Do not delay!
- Inform the doctor of the cause of the injury.
- Tell the physician what type of waterjet project was being performed at the time of the accident and the source of the water.
- Communicate the following information to the medical personnel:

> This patient may be suffering from a waterjet injury. Evaluation and management should parallel that of a gunshot injury. The external manifestations of the injury cannot be used to predict the extent of internal damage. Initial management should include stabilization and a thorough neurovascular examination. X-rays can be used to assess subcutaneous air and foreign bodies distant from the site of injury. Injuries to the extremities can involve extensive nerve, muscle, vessel damage, as well as cause a distal compartment syndrome. Injuries to the torso can involve internal organ damage. Surgical consultation should be obtained. Aggressive irrigation and debridement is recommended. Surgical decompression and exploration may also be necessary. Angiographic studies are recommended pre-operatively if arterial injury is suspected. Bandages with a hygroscopic solution (MgSO4) and hyperbaric oxygen treatment have been used as adjunctive therapy to decrease pain, edema and subcutaneous emphysema. Unusual infections with uncommon organisms in immunocompetent patients have been seen; the source of the water is important in deciding on initial, empiric antibiotic treatment, and broad-spectrum intravenous antibiotics should be administered. Cultures should be obtained.

Lockout/Tagout Procedure

OMAX recommends the implementation of practices and procedures to shut down equipment, isolate it from its energy source(s), and prevent the release of potentially hazardous energy while maintenance and servicing activities are being performed.

Do Not Operate the Equipment in an Explosive Atmosphere

Machining titanium and some other materials with the OMAX can produce sparks. Do not operate the OMAX in an explosive atmosphere. Take care; do not allow explosive or flammable vapors to accumulate in the area of the OMAX.

Disposing of Waste Materials

Dispose of cutting wastes properly and in accordance with all local and federal regulations. The abrasive waterjet produces two types of waste: the water used for cutting, and the solid material that accumulates in the catcher tank. Although the garnet abrasive itself is inert, the waste deposited from the material being cut may require special handling.

In abrasive waterjet cutting, garnet particles are accelerated with high-pressure water to strike the material creating a residue of abrasive grit and eroded particles from the cut material. Eventually, this residual sludge settles to the catcher tank bottom and accumulates until it must be removed for disposal. Depending upon the material makeup of this sludge, different disposal constraints will be imposed by the various local and federal regulations. For example, when cutting toxic materials, such as lead or radioactive metals, appropriate measures for the safe disposal of this type of contaminated water and sludge must be rigidly followed. Always consult with your local utilities company about sewage or water treatment requirements and proper sludge disposal procedures.

Adequate Shop Ventilation

Proper ventilation in your job shop will assist in dissipating the accumulation of gas, vapor, and fumes. Your machine contains a significant amount of water that will evaporate depending on the ambient temperature in your shop and the

temperature of the water in the tank itself. In order to reduce impact on other equipment in your shop you should maintain adequate ventilation in your shop. Even when cutting under water you should expect fine garnet dust to be present around the machine. Additionally some materials (esp. aluminum particles) in water are known to produce hydrogen in water.

When you cut aluminum, the fine particles in the tank react with the water to generate hydrogen gases (2Al +2H20 → 2AlOH + H2). Normally, hydrogen bubbles to the surface and escapes into the shop in harmless, low concentrations, but it might also accumulate in the air dome used for water level control. These gases in the air dome are purged when you lower and then raise the water level during normal operation, so that no large amount of gas can accumulate anyway.

We recommend that during the course of turning the machine on or off (at a shift change or between jobs), the machine user lower the water level completely to expel any gasses which might have accumulated in the air dome. And, when you periodically check on equipment operation during lengthy continuous use (e.g., checking for smooth operation during a long job), use that opportunity to also completely lower the water level. As always, take care that no ignition source (e.g., open flame, electrostatic discharge) is nearby when operating any feature on your OMAX or MAXIEM abrasivejet system.

Watch for hydrogen bubbles when machining aluminum. If you cut a lot of aluminum, you will create aluminum powder from the removed material. This powder will accumulate at the bottom of the tank along with your garnet. The aluminum then reacts with the water, releasing Hydrogen gas in the process. If you cut a lot of aluminum on a regular basis, then this is something to take into consideration. Do not allow smoking near the machine, and keep the garnet levels in your tank low to prevent bubbles from accumulating within. Be especially careful when cutting materials that create sparks such as titanium and can ignite gases in the tank. Always cut sparking materials under water to suppress the sparks and prevent ignition.

Equipment Safety Features

The abrasive waterjet provides several built-in safety features.

Emergency Stop Switch (E-stop)

The pump and table controller are equipped with emergency stop switches. The E-stop is started by pushing it in. Once pushed, it immediately shuts down the pump unit and abrasive waterjet.

Overpressure Protection

During operation, pump pressure is monitored to prevent an overpressure condition. If the pump exceeds the factory set maximum pressure limit, the control shuts down the pump unit. In addition to the software maximum pressure limit, all pumps are equipped with a factory set safety valve to provide a hard-plumbed, overpressure relief valve.

Electrical Protection

The variable frequency drive (VFD) provides electrical protection as well as speed control for the pump's main drive motor. The DIN rail-mounted contactor and circuit breaker provide short-circuit protection to the charge pump motor. Circuit breakers protect the internal transformer.

Electrical Disconnect

An electrical disconnect that cuts off and isolates the equipment from its main electrical supply is provided as standard equipment on all machines sold in countries where installation of this electrical disconnect is mandatory. This disconnect is provided as an optional accessory in other countries where installation of this device is not a requirement.

Access Control Circuit

The Access Control Circuit (ACC), if applicable, is designed to create a designated safety zone around the abrasive waterjet that protects operators from injury during use. The access control circuitry continually monitors the closure

status of two external switch contacts. The breaking of contact with either switch immediately trips the safety circuit, disabling the cutting process until the cause of the violation is corrected and the access control circuit reset.

Safety Legend

The following safety signal word panels and paragraph notifications may appear throughout this and other documentation. Each provides safety issue identification and recommended actions to avoid the hazard. Be alert! Follow the recommended safety actions and precautions to prevent injury or damage to the equipment.

⚠WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Used to address practices not related to physical injury—property damage only.

NOTE

Used to provide supplementary information, emphasize a point or give a tip for easier operation.

Sound Level Map

The diagram and table represent airborne noise emission pressure levels produced by the abrasive waterjet system while in operation. The arrows represent 1 m horizontal distance and 1.6 m vertical distance from the floor. Safety barriers are in place.

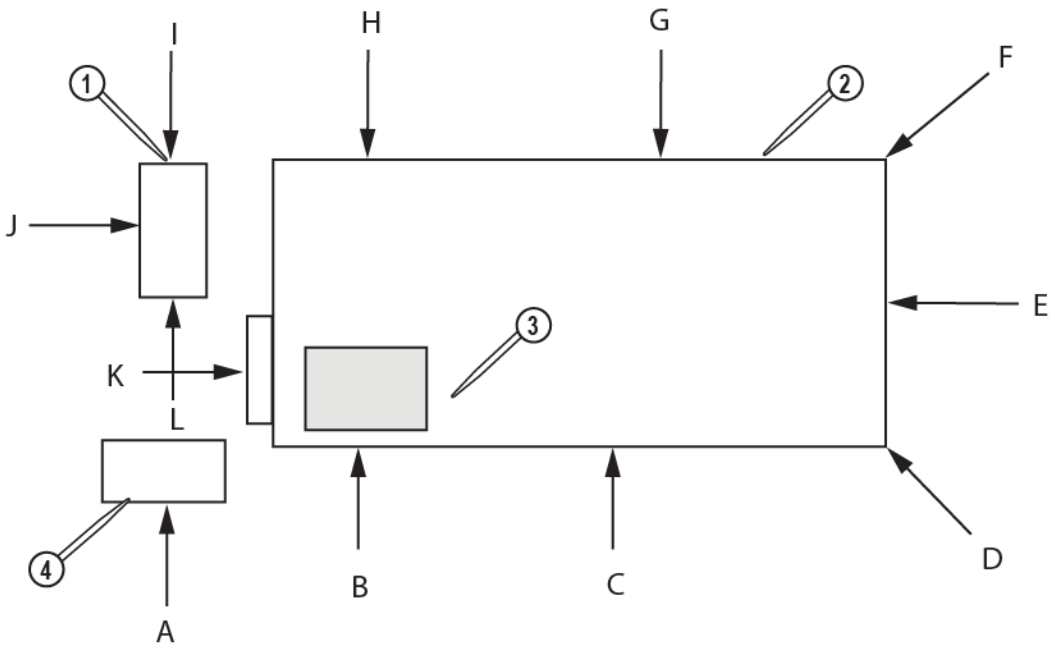


Figure 1

[1] Pump [2] Cutting table [3] Cutting area [4] Workstation

A	B	C	D	E	F	G	H	I	J	K	L
Ambient (in dbA)											
68.7	69.8	65.5	65.4	65.3	65.2	65.2	65.1	65.8	69.4	69.6	69.3
78.7	79.6	77.2	75.2	75.9	76.1	77.3	78.8	78.8	79.4	79.8	79.5
78.8	79.8	77.5	75.4	76.1	76.2	76.9	78.5	78.9	79.4	79.7	79.7
78.5	79.8	77.8	75.4	76.1	75.9	76.8	78.6	78.9	79.2	79.7	79.6

Safety Checklist

	Safety Checklist Topics
Safety Labels	
	Read this manual
	Wear Gloves
	Electrical Hazard
	Lock Out Power
	Eye Protection
	Ear Protection
	Flying Debris/Loud Noise
	Danger – Watch your hands and fingers
	Warning – Keep guards in place
	Warning – Keep hands away from jet
	Warning – Pinch points
	Warning – Worn slats
	Warning – Step Hazard
	No Magnets
	Electrostatic Discharge
	Danger - 480 volts
Safety Precautions	
	Material handling
	Hearing protection
	Approved safety goggles/eyewash station
	Treat injuries with caution- wear protective gloves
	WJTA Warning Card - medical attention for any waterjet injury
	Special handling of hazardous materials
	Prevent slipping
	Use adequate ventilation
	Use only approved work platforms
	Use a nozzle splash guard

	Safety Checklist Topics
	Use proper lifting equipment
	Remove power from equipment when not in use
	Operate equipment after reading equipment manuals and receiving qualified instruction
	Be able to quickly access the emergency stop
	Maintain protective guards and shutdown devices on/around pump
	Immediately notify repair personnel if leaks are found in pump fittings or connections
	Follow manufacturer's recommendations for servicing and use only original manufacturer replacement parts
	Follow periodic maintenance schedule to make sure that the equipment operates properly
	Following maintenance activities, clear all tools and rags from around the equipment before starting
	Be aware of trip hazards (cords, cables, etc.)
	Do not start equipment unless you know how to stop it
	Never open or do maintenance on the equipment with the primary disconnect ON or while the pump is operating. Always follow lockout/tagout procedures
	Do not make unauthorized alterations to the equipment or components
	Do not operate near an ignition source or explosive atmosphere
	Vent air dome to prevent gas buildup
	Cutting under water
Equipment Safety Features	
	Emergency (E-stop) Switch (controller and pump)
	Overpressure Protection safety valve and software shutdown
	Electrical Protection
	Disconnect switch on the equipment; equipment power cord

Date _____

Name _____Signature[1] _____

[1] *By signing this document, I acknowledge receipt and review of this Safety Checklist and understand items contained within.*

REQUIRED TOOLS

The following table contains a list of tools with the appropriate sizes needed to operate and maintain the table and components.

NOTE

Additional tools may be needed to operate or maintain equipment not addressed in this guide. See to the applicable equipment guides.

Customer Tools

These tools are not provided by OMAX or included with the equipment.

Icon	Tool	Size(s)
	Ball-end hex wrench	3/16 in.
	Empty container	1 quart
	Scale	
	Open-end wrench	2.5 in.
	Scrub brush	
	Clean, dry, compressed air	
	Clean water	

OMAX Tools

The following table contains a list of tools provided by OMAX. These tools come with the equipment.

Icon	Tool	Size(s)
	Stand-off gauge P/N 311748	

REFERENCES

Documents

The following table contains documents and diagrams associated with these instructions. These items are found in the Customer Dashboard at https://support.omax.com.

Part Number	Title
400257	Diagram, Exp Pict, Nozzle Assy, Maxjet5, English
400459	Rebuilding the High-pressure swivel
400475	Rebuilding the Dual On-Off Valve
400535	ADO Rebuild Kit Instructions
400565	Diagram, Exp Pict, MAXJET 5i Nozzle - with inlet body, MOTO-Z
400697	Rebuilding the Dual Port Swivel
400715	MAXJET 5i Installation and Maintenance
401044	High Pressure Fittings, .375 in Tubing
401055	Adjustable Dump Orifice Operators Guide
401056	Operate MAXIEM 1.5 Pump
401060	Installation and Maintenance OMAX Air Actuator
401064	Operation and Maintenance for LSRS
401081	High Pressure fittings document, .25 in tubing
401082	Maintenance, Perform Post-Maintenance Flush
401109	Operation, Variable Speed SRS, High-Pitch Propeller
401112	Operation and Maintenance Bulk Abrasive Delivery System
401240	Rebuild Dual Axis Swivel
401436	Operation, Access Control Circuit, OMAX, MAXIEM, GlobalMAX
401722	Maintenance, X, Y, and Z Components, MAXIEM

Videos

Videos associated with these instructions are located at https://elearning.omax.com.

Operation

- MAXIEM Operator Startup Training
- Software Training
- MAXIEM Help Resources

Maintenance

- General Maintenance
- High-Pressure System Maintenance
- Motion System Maintenance
- Nozzle Maintenance
- Pump Maintenance

DOCUMENT SCOPE

This document contains the operating and maintenance information for the MAXIEM abrasive waterjet cutting system, a maintenance schedule, and table maintenance tasks.

OVERVIEW

The abrasive waterjet is a precision machine tool operating under software control. It cuts complex parts out of most materials, including metal, plastic, glass, ceramics, stone, and composites using standard CAD drawing files.

COMPONENTS

The following sections describe the major components of the abrasive waterjet system.

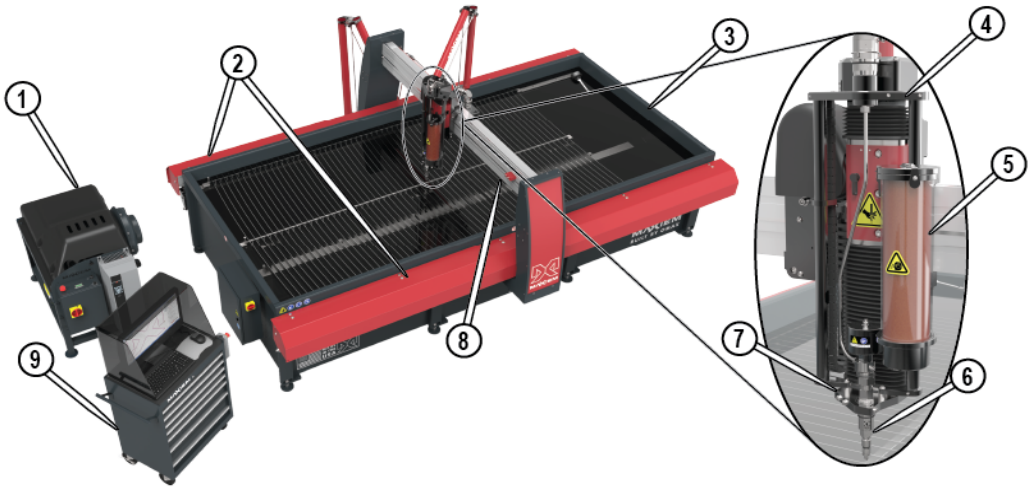


Figure 2

[1] High-pressure pump [3] Catcher tank [5] Abrasive hopper [7] Cutting head [9] Operator workstation
[2] X-axis rails [4] Z-axis [6] Nozzle [8] Y-axis bridge

Operator Workstation

Figure 3

[1] PC controller [2] Keyboard [3] Mouse [4] Toolbox (optional)

Power Controls

The power switch turns power ON or OFF to the operator workstation. The pendant controller can be placed where the operator is working.

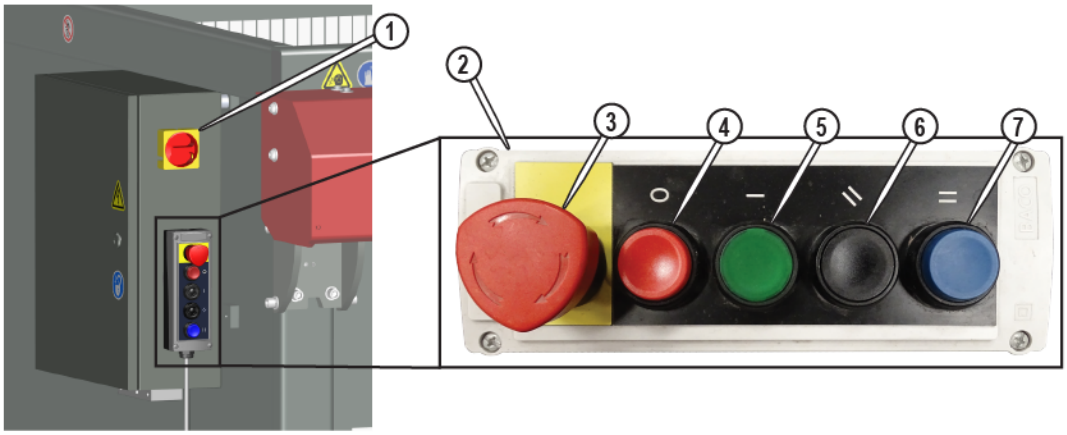


Figure 4

[1] Controller power switch [3] E-stop [5] Power ON [7] Pause
[2] Pendant controller [4] Power OFF [6] Reset

Windows PC

The PC controller is an all-in-one system containing the Windows operating system and Intelli-MAX software.

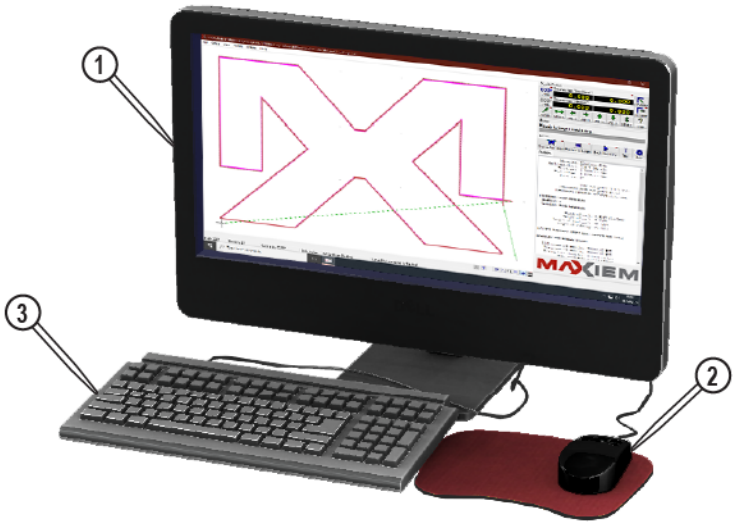


Figure 5

[1] PC controller [2] Mouse [3] Keyboard

Controller, mouse, keyboard, and power connections are located in the PC controller rear.

Figure 6

[1] Controller connection [2] Mouse connection [3] Keyboard connection [4] Power connection

X-, Y-, and Z-axis Motion System

Bridge Style

The bridge style motion systems consist of a Y-axis bridge attached to dual X-axis rails rigidly mounted to the catcher tank. The Y-beam connects to the upright that sits on the carriage that moves along the X-axis rail. X-axis movement utilizes a high-precision linear drive coupled with position feedback from magnetic encoding tape. The X-axis rails do not require lubrication and are covered and protected from abrasive contamination.

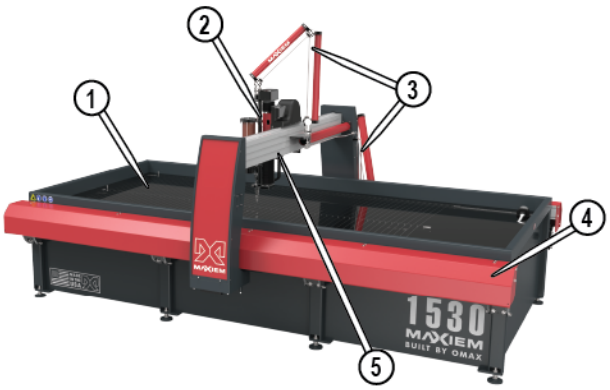


Figure 7

[1] Cutting table [2] Z-axis [3] Ultra high-pressure (UHP) plumbing [4] X-axis rail [5] Y-axis bridge

Motorized Z-axis

The Z-axis supplies the up and down movement of the nozzle using a synchronous motor. The motor, using software control, drives a lead screw to adjust the Z-axis height in increments of 0.001 in (0.0254 mm). Bellows protect the Z-axis components from moisture and abrasive contamination.

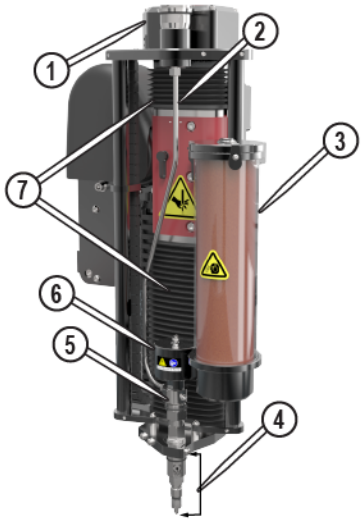


Figure 8

[1] Motor [3] Abrasive hopper [5] On/off valve assembly [7] bellows
[2] UHP plumbing [4] Nozzle assembly [6] Air actuator

Catcher Tank

The catcher tank stores the water that diffuses the jet stream that is created during the cutting process. The catcher tank is also a settling tank for spent abrasive and cut away material. Excess water drains through an adjustable water outlet filter screen that is raised or lowered to adjust the catcher tank water level as needed. Steel slats positioned in the catcher tank support the material.

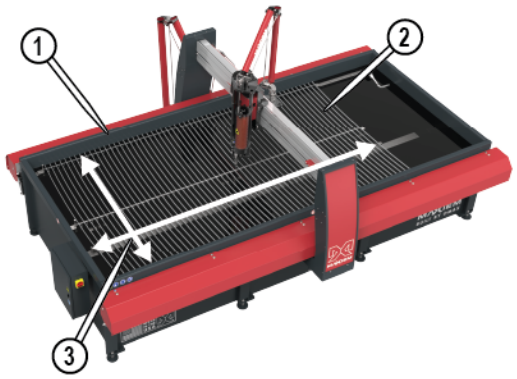


Figure 9

[1] Catcher tank [2] Slats [3] Cutting table

Ultra High-pressure Plumbing

The ultra high-pressure plumbing (UHP) supplies the water from the high-pressure pump to the nozzle. The plumbing system includes the tubes, fittings, swivels, dump on/off valve, ADO, and nozzle on/off valve. Properly connected tubes and fittings are critical in maintaining a safe and leak-free system.

Swivels

Swivels allow the nozzle to move and travel across the table surface when cutting. These are the type of swivels that can be found in the system.

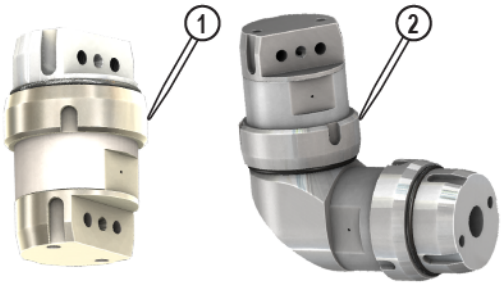


Figure 10

[1] Dual port swivel with side ports [2] Dual axis swivel with side and end ports

Dual On/off Valve

The dual on/off valves control water flow through the cutting nozzle and the pump. The orifice assembly in the nozzle operates in conjunction with the adjustable dump orifice (ADO) in the pump to control the pressure and the amount of water flowing through the nozzle and the pump dump valve. The water at the nozzle shuts off when the nozzle on/off valve closes and automatically routes the water through the pumps on/off valve and ADO until the nozzle is activated to resume cutting. The on/off dump valve then closes as the nozzle on/off valve opens. This action allows continual pump operation during times when the nozzle is not cutting.

Under software control, the pump continuously runs through the cutting cycle while the on/off valves alternate opening and closing. This process maintains consistent pressure, so starting and stopping the waterjet is done instantly during the cutting process. If dual pressure operation is desired, the pressure is switched between low and high instantly during the cutting cycle. See *401060 Installation and Maintenance OMAX Air Actuator for more information*.

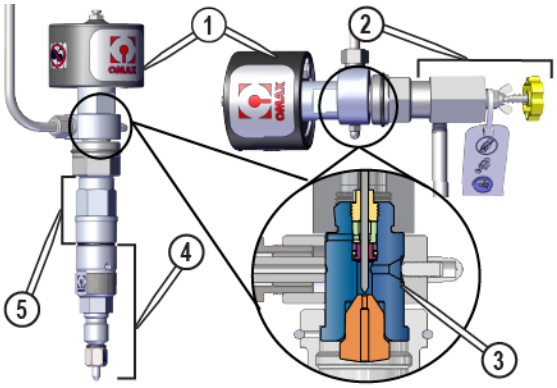


Figure 11

[1] Air actuator [2] Adjustable Dump Orifice (ADO) [3] Dual on/off valve assembly [4] Nozzle body [5] Inlet body

Adjustable Dump Orifice (ADO)

The ADO, located in the pump, assures the water pressure between the pump and the nozzle remains the same. Because it is adjustable, the opening of the orifice can be adjusted, by turning the yellow knob, to be nearly the same size as the orifice assembly contained in the nozzle. This feature allows adjustment for whatever nozzle orifice size is used. See the *401055 Adjustable Dump Orifice Operators Guide* for more information.

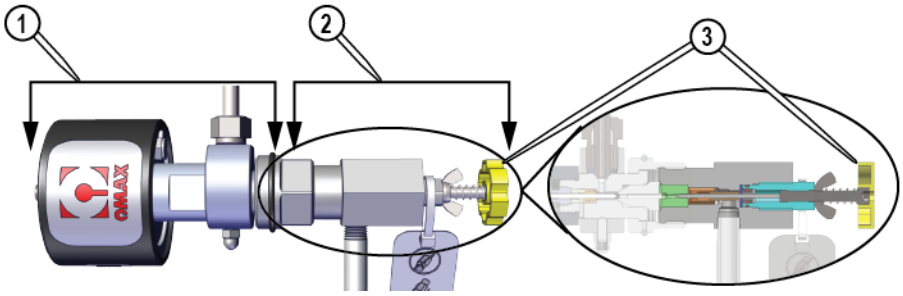


Figure 12

[1] Dump valve assembly [2] ADO assembly [3] Pressure adjustment knob

Abrasive Delivery System

The abrasive delivery system consists of a nozzle assembly, an abrasive feed system (hopper), and a feed tube.

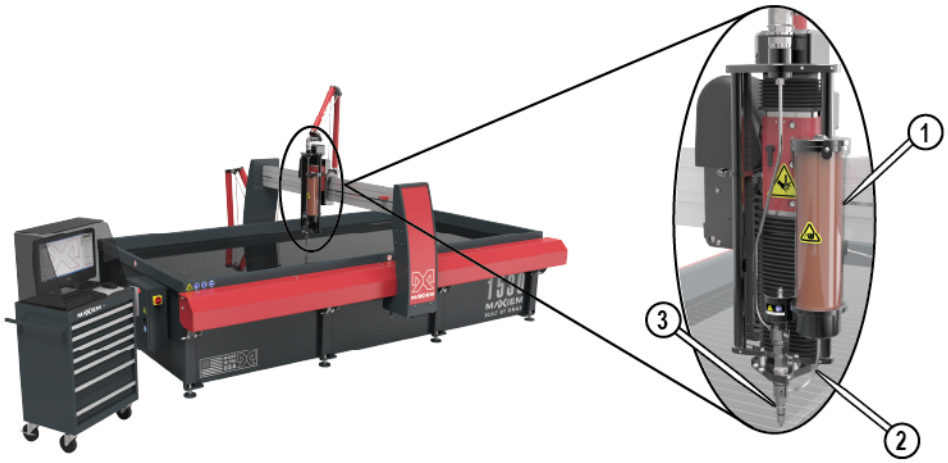


Figure 13

[1] Abrasive hopper [2] Abrasive feed tube [3] Abrasive nozzle assembly

Abrasive Waterjet Nozzle

In an abrasive waterjet nozzle, high-pressure water supplied by the on/off valve passes into the nozzle and is forced through a small hole in a jeweled orifice that is typically made of sapphire or diamond.

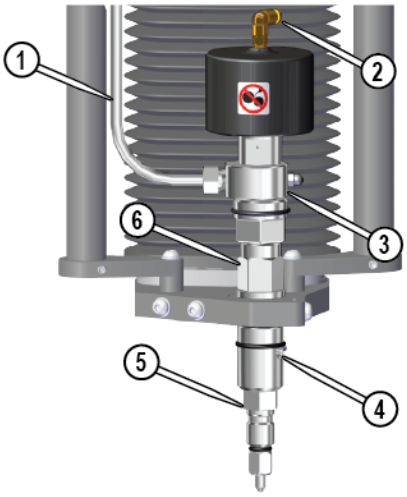


Figure 14

[1] Water from high-pressure pump [3] Dual on/off valve [5] Abrasive waterjet nozzle

[2] Air input for on/off valve [4] Abrasive feed input from hopper [6] Inlet body

Abrasive Hopper

The abrasive hopper mounted to the Y-carriage holds up to 15 lbs (7 kg) of abrasive. A hinged lid prevents dirt and other contaminants from mixing with the abrasive. Dirt and contaminants, even microscopic particles of dirt can clog the mixing tube. A PC -controlled pneumatic valve opens and closes the abrasive valve. The orifice assembly regulates the abrasive flow rate.

Follow these best practices for optimal abrasive flow.

- Always keep the abrasive material in the hopper clean and dry. If moisture enters the hopper, the abrasive material can clump and clog the feed tube.
- Always store the abrasive material in a covered, dry location protected from metal chips and other machining debris.
- Always pick a high-quality abrasive. High-quality abrasives are much more consistent in abrasive particle size. Inconsistency in particle sizes makes it difficult to maintain quality and precision when cutting and also increases the likelihood of the mixing tube becoming clogged. High-quality abrasives also contain less dust. When dust is present, static electrical charges can build up, causing the abrasive particles to clump together, hindering flow.

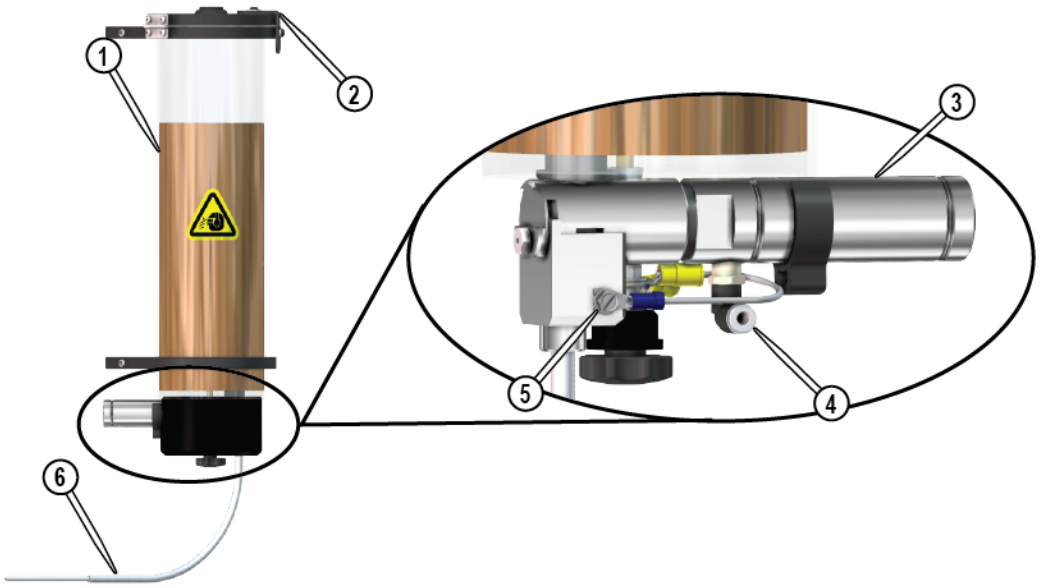


Figure 15

[1] Abrasive hopper [3] Abrasive valve assembly [5] Ground connection
[2] Hinged lid [4] Abrasive air valve connection [6] Abrasive feed tube

High-pressure Pump

See the applicable pump guide for pump characteristics, operation, and maintenance.

Intelli-MAX Software

Intelli-MAX is a software suite that controls the operation of the abrasive waterjet system. Intelli-MAX consists of two primary applications: LAYOUT and MAKE. Intelli-MAX also comes with many other useful utilities. See the software help for details.

Intelli-MAX LAYOUT

LAYOUT is the OMAX CAD program that contains a full range of drawing and editing tools, and accepts imported files from other CAD programs. LAYOUT creates the drawing exchange file (DXF), the OMAX routed data file (ORD), and OMAX Xdata file (OMX). These file types contain the drawing geometries and/or machine tool paths.

Intelli-MAX MAKE

MAKE software controls all machining operations used to cut the tool path generated by LAYOUT in the ORD or OMX file. MAKE sends motor control commands that move the nozzle and control the flow of abrasive and high-pressure water.

MAKE calculates the cutting time and the amount of abrasive required to machine the part. MAKE also provides a preview of the cutting path, statistics about the part, and tools for optimizing the cutting process.

Intelli-MAX Software Help

LAYOUT and MAKE have built-in help that provides information and tips on how to use the applications.

Options to access the built-in help while in LAYOUT or MAKE include the following.

- Select Help when using a software command, when available.
- Press the F1 key on the keyboard.
- Select Help from the main menu.

OPERATION

This section provides information for operating the abrasive waterjet system, including instructions on how to:

- Position and clamp materials.
- Identify machine limits and use auto home.
- Apply cutting tips and techniques for effective cutting.
- Create and cut a part.
- Start the system by following the startup checklist.
- Perform pre-machining tasks, such as nozzle test, measure abrasive flow, enter test data, and kerf check.
- Stop the system by following the shutdown checklist.
- Perform emergency shut-down and restart after an emergency shutdown.

Abrasive Waterjet Overview

An abrasive waterjet uses water pressurized to more than 50 ksi (thousand pounds per square inch). The **high-pressure water** [1] enters at the top of the cutting nozzle and is forced through an **orifice assembly** [2] containing a round jewel with a small hole in it. This fast-moving stream moves into a larger **mixing chamber** [4], where the speed of the water creates a suction that draws in the **flow of abrasive** [3].

This water stream plus abrasive moves into the **mixing tube** [5]. The mixing tube has a small hole through the center that contains the water and abrasive as they mix. The water and abrasive combine into a high-speed slurry at the bottom of the mixing tube, which becomes the cutting tool. The mixing tube focuses the slurry into the **high-velocity jet stream** [6] on to the material that is machined. This jet stream erodes the material, thereby cutting the part.

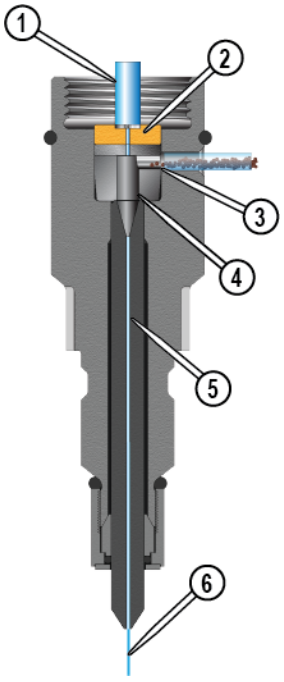


Figure 16

Machining Overview

The **software** [1] creates a machine tool path file from a CAD drawing file. The **pump** [2] generates ultra high-pressure (UHP) water, up to 50 ksi. The pressurized water travels through the **UHP system** [3] of tubing and fittings to the nozzle (cutting head).

A jewel with a tiny orifice (typically 0.014"), located in the nozzle assembly, creates backpressure and forces water through the orifice at high velocity (over 2500 ft/sec). **Abrasive** [4] is drawn into the **nozzle assembly** [5] and mixes with the water to create a cutting medium (slurry). The water and abrasive slurry exits the mixing tube (typically 0.030" internal diameter) at high velocity to cut the part.

The **nozzle (cutting head)** [6] follows the machine tool path per X, Y, and Z coordinates specified in the MAKE machining file. The nozzle speed determines the final **part edge quality** and **finish** [7].

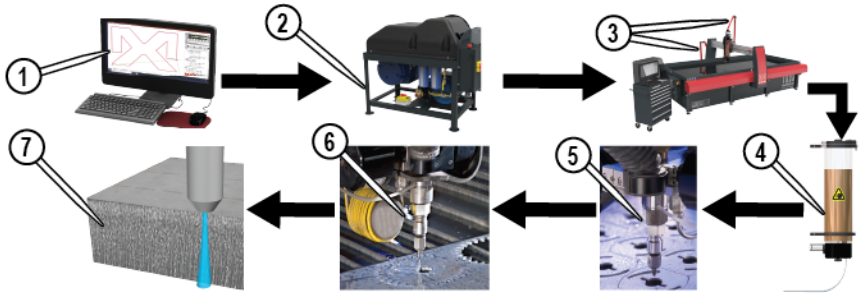


Figure 17

Steps to Make a Part

This section contains an overview of the steps required to make parts using the abrasive waterjet system. See the Intelli-MAX help files for detailed information.

See The Steps Involved in Making Parts video, located at https://elearning.omax.com.

In LAYOUT

1. **Import, open, or create a drawing file (DXF file).** The first step in making a part is to obtain or create a drawing file. Use **LAYOUT** to create and edit new and existing drawing files (DXF). Drawing files can be imported from other CAD programs.
2. **Assign the cut quality (edge finish).** The next step is to assign machining qualities (edge finish) to the drawing entities (lines and arcs) that tell the **nozzle** how fast or slow to move to obtain the necessary edge finish.
3. **Clean the drawing.** Next, clean the drawing to remove duplicate entities, extra dots, gaps, and other unwanted entities that are hard to find in the drawing. A clean drawing reduces machining issues by defining only one continuous path for the machine to follow.
4. **Add path elements to the drawing.** After cleaning, draw path elements. Path elements tell the machine where to cut, where to travel without cutting (traverse), where to pierce the material (lead in), and where to exit after cutting the part (lead out).
5. **Save the drawing file.**
6. **Create a machine tool path file (ORD or OMX).** The last step in **LAYOUT** is to convert the drawing file to a machine tool path file (ORD or OMX) using the **POST** tool. The machine tool path provides the commands the machine follows to cut the part.

In MAKE

7. **Start the machine.** After the drawing file is prepared and converted to a machine tool path file, the next step is to start the machine per the Startup Checklist.
8. **Open and configure the ORD or OMX file.** Open the tool path file and enter the material setup data, and cut and pierce settings, so the machine knows how to cut the material.
9. **Load and secure the material.** Place and secure the material on the cutting bed. Fixturing the material prevents movement in the X, Y, or Z directions and is critical in making quality parts.
10. **Position the nozzle.** Attach the **splash guard** to the **nozzle assembly** with the **cup** up. Set the **nozzle stand-off** at the highest point of the material surface, then move the **nozzle** to the location where the machine tool path should start.
11. **Prepare for machining.** Do a dry run to make sure the part fits on the material, and the **nozzle** clears any obstacles. Correct any problems found during the dry run before machining the part.
12. **Machine the part.** Flip the **splash guard cup** down. Adjust the **drain height**. Raise the water level above the material surface, and then begin machining. When finished, lower the water level, and remove and examine the part.

Draw a Part

See the Create a Drawing File video, located at https://elearning.omax.com.

LAYOUT creates part geometry using lines, arcs, and shapes such as rectangles and circles. Once drawn, assign a cutting speed (quality) to each segment of the drawing. The higher the quality chosen, the slower the cutting speed, and the smoother the edge finish of the part.

LAYOUT can import files from other drawing programs. Parts can also be created from photographs and other drawing sources using the LAYOUT tracing feature.

See the Image Tracing in LAYOUT video, located at https://elearning.omax.com.

1. Open LAYOUT, do one of the following actions.
   - Select **Start** > **OMAX LAYOUT and MAKE** > **Intelli-MAX LAYOUT Standard**.
   - Double-click the **LAYOUT** icon on the desktop.
2. Draw the part using the **Draw** and **Edit** tools.

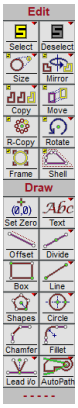


Figure 18

3. Select **Quality** on the toolbar and assign a cut quality to the drawing.

   Each entity in a drawing is assigned a cut quality value which controls how quickly the cutting nozzle moves when it cuts the entity. The slower the cutting nozzle moves, the higher the quality of the surface finish cut. The figure below shows how the surface finish changes with the quality assigned. As the quality number decreases, the cutting speed increases and the cut surface becomes less smooth.

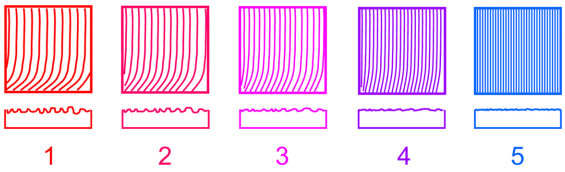


Figure 19

See the Assign Machining Qualities video, located at https://elearning.omax.com.

Figure 20

4. On the **Special** toolbar, select **Clean** to clean up the drawing.

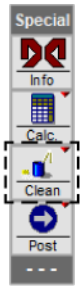


Figure 21

5. Save the drawing.

   a. Select **File** > **Save As**.

   b. Choose where to save the file.

   c. Enter the name for the DXF file.

   d. Select **Save**.

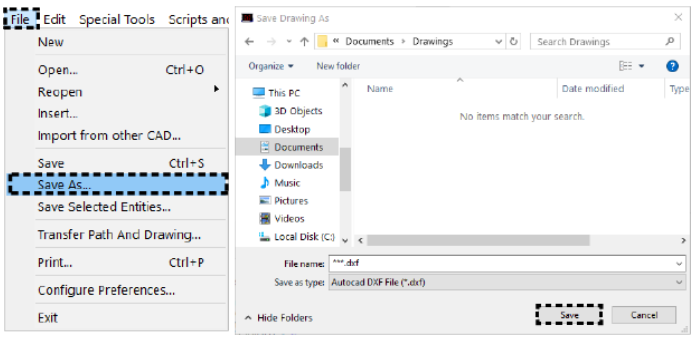


Figure 22

6. Use the **Draw** toolbar to add lead ins, lead outs, and traverses to the drawing.
   - Draw lead ins longer than lead outs.
   - Placement of the lead in/out determines whether the nozzle pierces on the inside or the outside of the geometry.
   - The nozzle travels in the direction of the least sharp turn (the widest angle) on the lead in.
   - Always make sure the lead in and lead out configurations in LAYOUT are correct.
   - Use a 90-degree lead in and lead out on square corners.
   - Use a narrow-angle on the lead in to minimize witness marks or blemishes.
   - Path the part to avoid collisions.
7. On the **Special** toolbar, select **Post** to convert the drawing file to a machine tool path.

Figure 23

8. Select the start location.

Figure 24

9. In the dialog box, select **Check for Problems** and resolve any problems found.

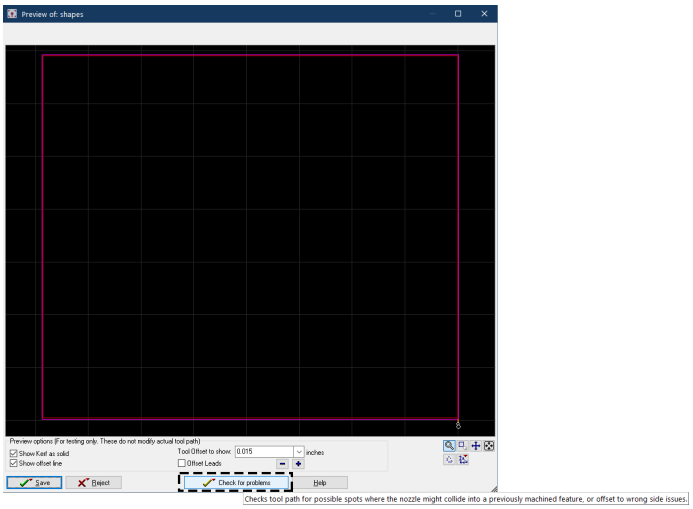


Figure 25

10. Right-click **Save** and select from the available options.

    The ORD or OMX file is saved automatically to the same location as the DXF file unless another option is selected.

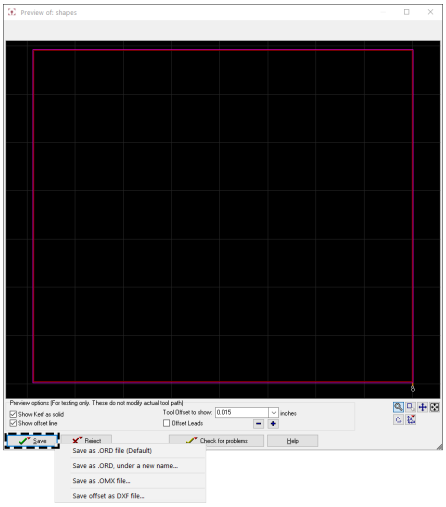


Figure 26

Make the Part

Once the tool path is defined and the ORD or OMX file is created, MAKE controls the movement of the abrasive waterjet to cut the part. Before machining, use the tools in MAKE to:

- Preview the cutting path.
- Set the material type and thickness.
- Determine the cutting time.
- Determine the amount of abrasive required.

Position and Clamp the Material

⚠CAUTION

Table slats and materials contain sharp edges that can cause injuries. Use care when handling materials on the cutting table.

NOTE

Use tabs on the material or waterjet brick to hold small parts. Tabs prevent small parts from falling through the slats into the tank.

Large clamping forces are not ordinarily needed to secure material to the cutting table, but the material must not move as it is machined. A primary cause for out-of-tolerance parts is the material moves during the cutting process.

A small downward force, about one pound (4 newtons), is exerted on the material from the jet stream; however, air forced down with the jet stream, once released, exerts a much larger upward force that pushes against the bottom of the material and can move the material.

⚠CAUTION

Always use the proper lifting equipment when handling heavy materials to prevent injury.

The best way to secure material is to use a material holding system or clamp the material against the frame or tank wall. Never clamp material to the slats. Slats can move, moving the material with them. Use the slats only for vertical support. The larger the surface area of the material, the more securely it must be held since the upward force from the jet stream's captured air has more material surface area to push.

See the Load and Clamp the Material video, located at https://elearning.omax.com.

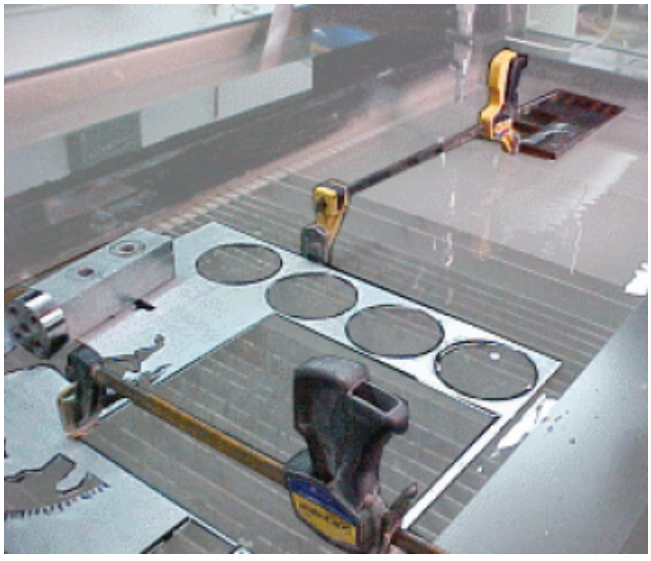


Figure 27

Machine Limits

There are two types of limits that restrict the area of nozzle movement on a table's cutting surface: absolute limits (hard stops) designed into the machine and user-defined soft limits.

Absolute Limits define the mechanical limitations where the X-axis and Y-axis can move. Hard Stops define the absolute position (X=0, Y=0 points). During machining, the Z-axis should not come in contact with the hard stops. Auto homing the table is the only time the Z-axis should touch the hard stops.

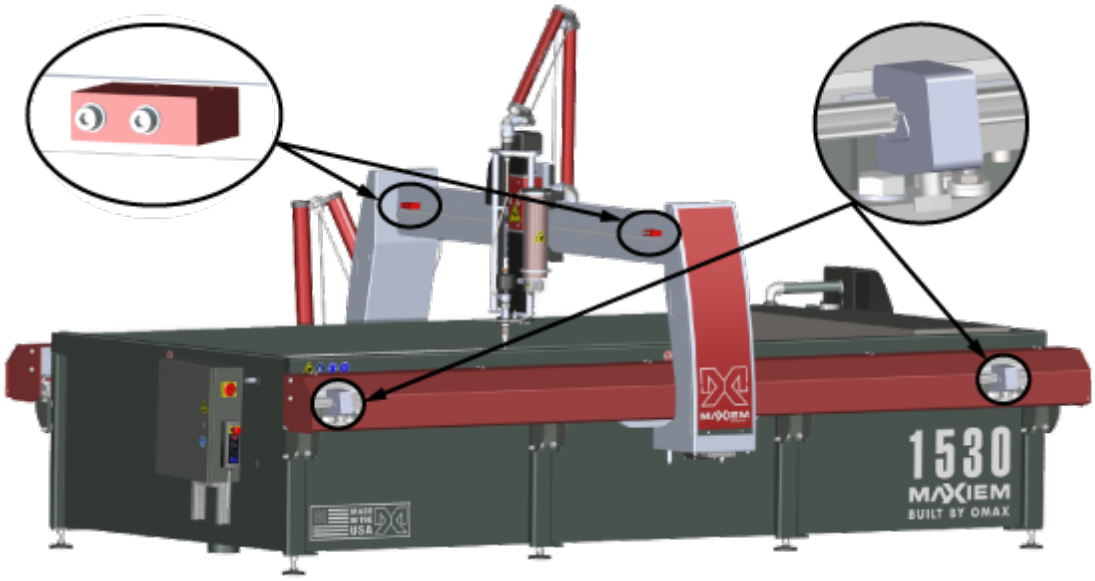


Figure 28

Soft Limits are defined in the software to prevent the cutting head from reaching the physical limits within the cutting area. These limits create a smaller working area within the maximum travel area. When reaching a soft limit, a controlled stop prevents further cutting head movement. A message warns the operator that commanded nozzle travel exceeds a soft limit. When reaching a soft limit using the keyboard to move the cutting head, the software immediately stops further movement. See the software help on how to set the soft limits.

Auto Home

Auto homing locates the table's absolute home limits. All home positions and soft limits are points relative to Absolute Home. Resetting Absolute Home resets all other homes to their correct positions. Always Auto Home the machine to re-zero Absolute Home at the beginning of each workday, when shut down for maintenance, after restarting the controller, or when the machine has faulted.

Tips for Clean and Quiet Machining

Several techniques promote clean and quiet machining with the abrasive waterjet system. Follow these best practices to make sure the machine is clean and quiet.

- **Keep the abrasive waterjet nozzle under water.** Machining underwater is significantly quieter and has less spray than machining with the nozzle above water. Keep the abrasive waterjet nozzle under 0.25–2 in. (6–51 mm) of water during machining.

NOTE

Raise the abrasive waterjet nozzle above the water when finished machining to prevent the water and abrasive mix from being drawn into the mixing tube and plugging it. When working with a highly buoyant material such as wood or paper products, it may not be possible to keep the abrasive waterjet nozzle underwater. Always wear hearing protection and prepare for additional over-spray during machining above water.

- **Place a splash guard on the abrasive waterjet nozzle.** A **nozzle splash guard** [1] comes with the system. The splash guard keeps the noise level low during machining, reduces splashing and spraying, and protects the Z-axis and cutting head components. Always place a splash guard on the abrasive waterjet nozzle when machining.

Figure 29

- **Wash heavy abrasive deposits from parts.** Abrasive may settle on the surface of a part during machining and is most noticeable when working with thick materials. When too much spent abrasive has accumulated, the abrasive waterjet nozzle may plow through it, causing the material to shift and reduce the accuracy of the cut. If too much abrasive accumulates on a part while machining, wash away the deposits with a hose while the machine cuts the part.

Startup Checklist

When starting the equipment, follow the checklist in the sequence listed.

See the MAXIEM Operator Startup Training video, located at https://elearning.omax.com.

NOTE

This checklist assumes the use of the MAXIEM pump. Always refer to the applicable pump operator guide for additional instructions.

1	Turn ON the primary breaker box power.
2	Open the air supply valve.
3	Open the water supply valve.
4	Adjust the catcher tank water outlet drain height.
5	Make sure the table control pendant E-stop is not activated.
6	Make sure the pump E-stop is not activated.
7	Open the charge pump inlet water valve.
8	Turn ON the charge pump.
9	Turn ON the MAXIEM controller primary power switch.
10	Press the green power ON switch on the controller pendant before the PC boots.
11	Turn ON the high-pressure pump primary power.
12	Make sure that cooling water flows from cooling return lines.
13	Open the charge pump flush valve to flush out warm water (as needed).
14	Let the water run for 15 minutes or until the water temperature is 70 °F (21.1 °C) or less before operating the pump at high pressure.
15	Pressurize the bulk feed hopper (if applicable).
16	Lower the catcher tank water level fully and then raise it to the slat top to purge the air dome of vapors (if needed).
17	Open MAKE.
18	Auto home the table to set the absolute home position.
19	Make sure the soft limits are enabled.

20	Make sure the nozzle orifice and mixing tube size are correct.
21	Position the nozzle between slats, 1–1.5 in. (2.5–3.8 cm) maximum above water level.
22	Do a nozzle low-pressure test.
23	Make sure the jet stream is straight and narrow.
24	Adjust the pump rpm and record the pressure for the necessary low-pressure setting.
25	Stop the low-pressure nozzle test.
26	Do a high-pressure nozzle test.
27	Make sure the jet stream is straight and narrow.
28	Adjust the pump rpm and record the pressure for the necessary high-pressure setting.
29	Make sure the pump filter pressure is adequate.
30	Examine the UHP plumbing components for leaks.
31	Stop the high-pressure nozzle test.
32	Do an ADO pressure check.
33	Adjust the ADO pressure as needed.
34	Do a water and abrasive test.
35	Listen for an increase in the sound level and stream diameter.
36	Stop the water and abrasive test.
37	Make sure the abrasive size and type are correct.
38	Measure the abrasive flow rate.
39	Make sure the carriage hopper is full of abrasive.
40	Make sure the abrasive feed tube is in good condition.
41	Make sure the pump and nozzle settings in MAKE match the operational data recorded during testing.
42	Make sure the Event & Relay Timing settings are correct for the cutting operation.
43	Cut a kerf check part and adjust the tool offset as needed.

Turn on the Power, Air, and Water Sources

⚠CAUTION

All operators must wear appropriate personal protective equipment when operating the machine to prevent injury.

NOTE

Power, air, and water sources shown are for reference only and may vary.

1. Turn **ON** the primary power breaker.

Figure 30

2. Open the **air supply valve** [1].

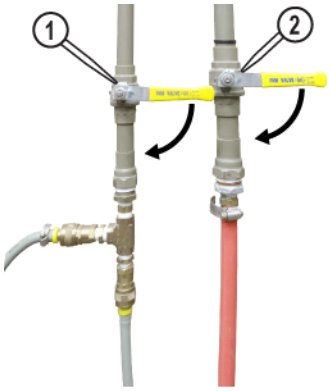


Figure 31

3. Open the **water supply valve** [2] (Figure 31).

Start the Pump

See the applicable pump operation guide for startup instructions.

NOTICE

Always operate the charge pump for at least 15 minutes, or until the cooling water temperature is between 70 °F (21 °C) and 40 °F (4 °C) before starting the high-pressure pump. This operation prevents damage to the pump wet-end components when restarting, even if the pump was shut down for a short period-of-time, for example, during a lunch break.

NOTICE

When the pump is running, pulsing water from the cooling return lines indicates the high-pressure (dynamic) seals are worn. Replace worn high-pressure seals to prevent damage to other pump components. Air bubbles in the return water indicate a leaky suction line or air displacement if pump water filters were just replaced. If there is no water flow from a line, check for a plugged orifice in the pump outlet manifold. See the applicable pump maintenance guide for repair instructions.

Start the Machine

1. Adjust the **tank water outlet** [1] height for the appropriate water level, if needed.

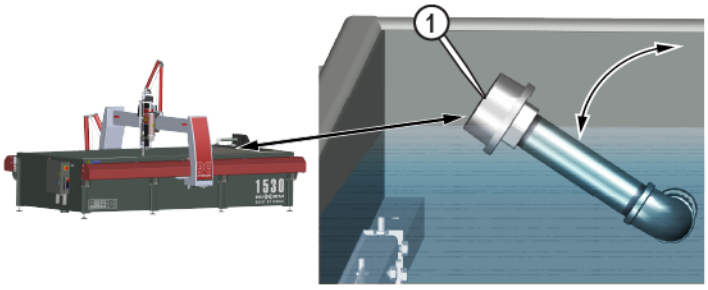


Figure 32

2. Make sure that the **E-stop** switch on the **table control pendant** and the **pump** are not engaged.

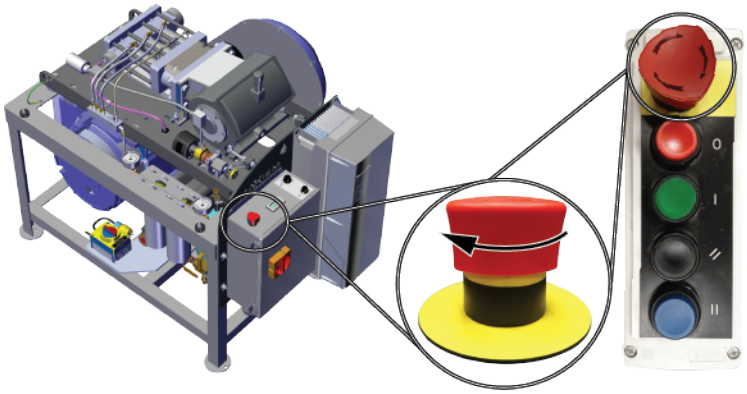


Figure 33

3. Turn **ON** the **power switch** on the **controller**.

   The power switch on the controller powers the PC.

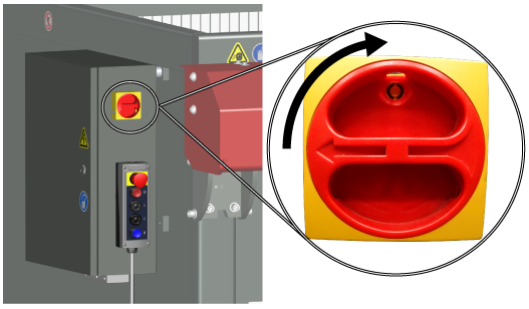


Figure 34

4. Press **power** [1] on the **controller pendant** before the **PC** starts.

   If the PC starts before pressing the power switch, press reset [2] on the pendant.

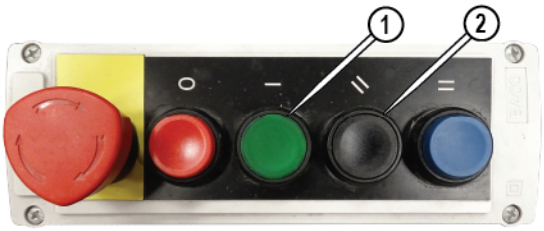


Figure 35

5. Pressurize the **bulk feed hopper**, if equipped. See *401112 Operation and Maintenance Bulk Abrasive Delivery System*.
6. If equipped with **rapid water level control**, fully lower the **tank** water level, then raise the water level to the top of the **slats** to purge the **air dome** of any vapors.
7. Open MAKE.
8. Right-click **Zero** > **Auto-Home X-Y** to auto home the **table** and set the Absolute Home position.

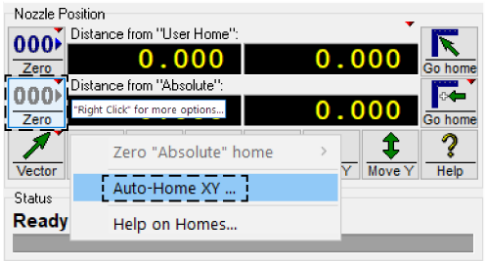


Figure 36

9. Select **Setup** > **Advanced** > **Soft Limits**, then make sure **Enable soft limits** are enabled. See the Software Help for how to set the soft limits.

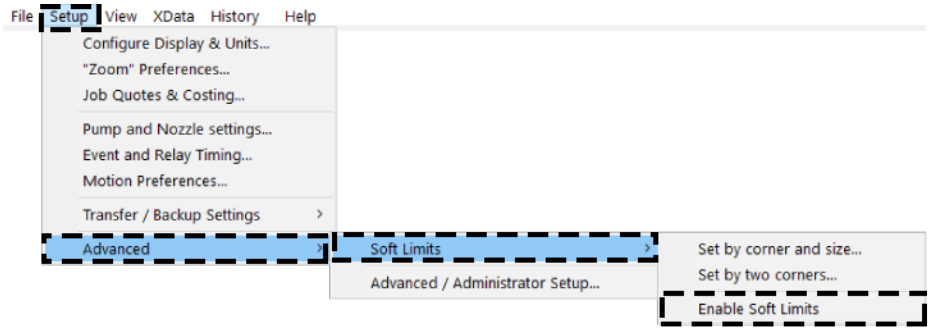


Figure 37

10. Make sure the **nozzle orifice** and **mixing tube** size are correct.

NOTICE

Changing the nozzle orifice size requires adjustment to the ADO to reduce pressure spikes. Pressure spikes can cause UHP plumbing failures and damage the equipment.

Pump Motor Power	Nozzle Orifice Size	Nozzle Mixing Tube Size	Maximum Pump Pressure
20 hp	0.011 in. (0.279 mm)	0.030 in. (0.76 mm)	50,000 psi (3448 bar)
30 hp	0.014 in. (0.356 mm)	0.030 in. (0.76 mm)	50,000 psi (3448 bar)
	0.014 in. (0.356 mm)	0.042 in. (1.07 mm)	50,000 psi (3448 bar)
	2x 0.010 in. (2x 0.254 mm)	0.021 in. (0.533 mm)	50,000 psi (3448 bar)
40 hp	0.015 in. (0.38 mm)	0.042 in. (1.07 mm)	50,000 psi (3448 bar)
	2x 0.011 in. (2x 0.279 mm)	0.030 in. (0.76 mm)	50,000 psi (3448 bar)

Do the Nozzle Tests

Do the nozzle tests to:

- Set the pump pressure and rpm.
- Make sure the orifice and the mixing tube are not damaged.
- Make sure there are no leaks in the UHP plumbing system.

Do a Low-pressure Nozzle Test

⚠CAUTION

Always use ear protection when operating the abrasive waterjet nozzle above water. Failure to wear hearing protection can lead to hearing loss.

NOTICE

Do not operate the abrasive waterjet for more than several seconds when the nozzle is above the water surface at a distance greater than 1.5 in. (3.8 cm). Air entrapment in the water increases with nozzle height, eventually allowing the jet stream to strike the tank bottom with sufficient force to cut a hole through the tank bottom; this applies to nozzle tests and cutting thick materials at a high-quality setting. Always make sure that cutting is done underwater or with the water level immediately below the material.

1. Position the **nozzle** between two **slats**, 1–1.5 in. (2.5–3.8 cm) maximum, above the water surface.
2. In MAKE, select **Test**.

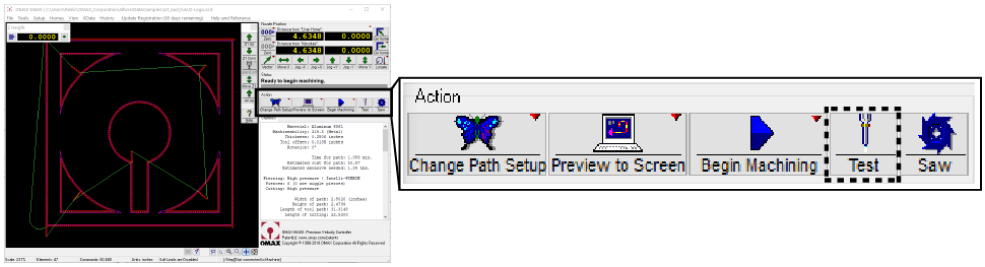


Figure 38

⚠WARNING

The cutting head is about to turn ON. To prevent serious injury, make sure the nozzle is in the correct position, and everyone is clear of the cutting area.

3. Select **Water Only (Jet is on, Main Pump is active)**, select **Low**, then select **Start Test**.

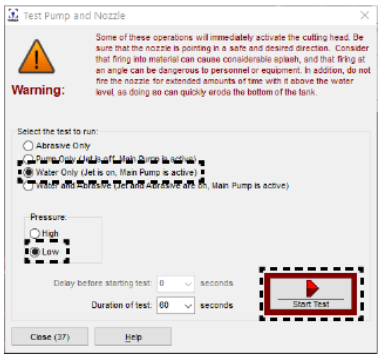


Figure 39

NOTE

The test automatically stops after 60 seconds.

4. When the jet stream begins, disconnect the feed tube from the hopper; then block the feed tube airflow.

NOTE

Always block the feed tube before examining the jet stream quality. Air from the feed tube interferes with the jet stream, making examination difficult.

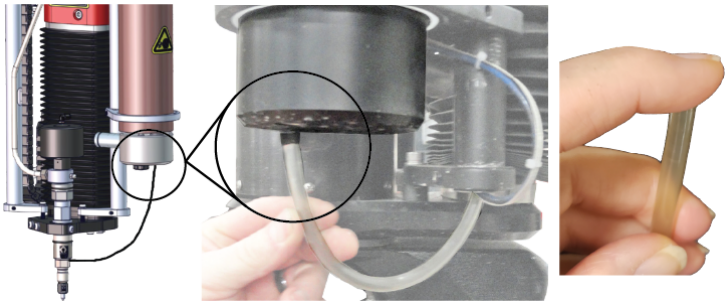


Figure 40

5. Examine the jet stream to make sure it is straight and narrow.

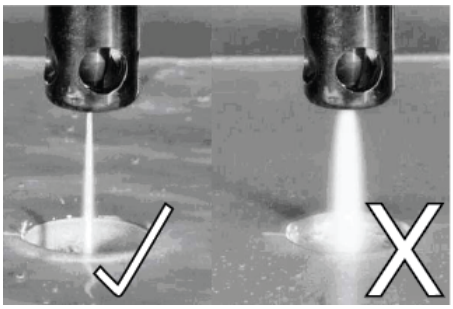


Figure 41

6. Check the **orifice** and **mixing tube** condition by examining the jet stream quality.

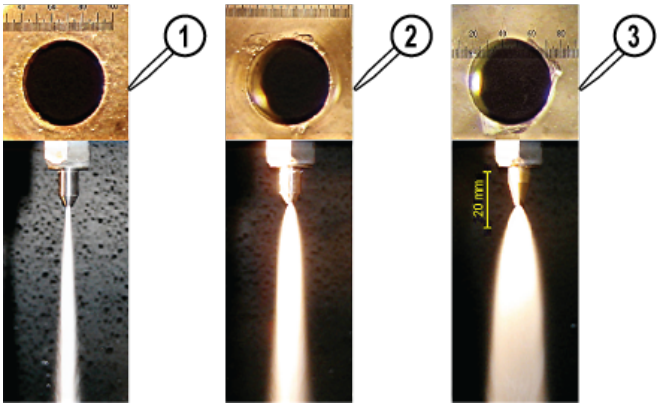


Figure 42

[1] Good orifice, good mixing tube

[2] Chipped orifice, good mixing tube

[3] Badly chipped orifice, worn mixing tube

The shape of the jet stream also indicates the cutting quality.

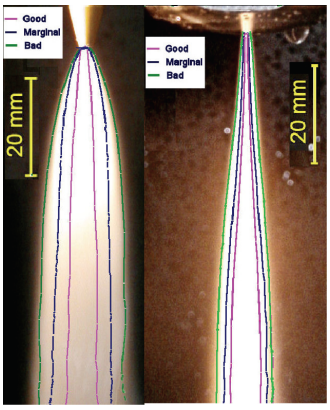


Figure 43

7. During the test, adjust the pump low-pressure rpm:

   a. Use the **low-pressure adjustment knob** to set the necessary preset low-pressure cutting pressure (default 20 ksi).

      This setting is useful for piercing brittle materials or etching and scribing materials at reduced pressure. The low-pressure mode is activated in MAKE. Record the values for rpm and pressure in low-pressure mode.

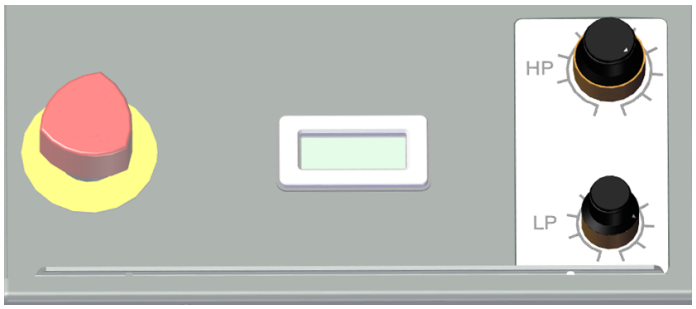


Figure 44

   b. Record the rpm and pressure values when operating in low-pressure mode for input into MAKE.

8. Select **Stop** (if needed).

Figure 45

Do a High-pressure Nozzle Test

⚠CAUTION

Always use ear protection when operating the abrasive waterjet nozzle above water. Failure to wear hearing protection can lead to hearing loss.

NOTICE

Do not operate the abrasive waterjet for more than several seconds when the nozzle is above the water surface at a distance greater than 1.5 in. (3.8 cm). Air entrapment in the water increases with nozzle height, eventually allowing the jet stream to strike the tank bottom with sufficient force to cut a hole through the tank bottom; this applies to nozzle tests and cutting thick materials at a high-quality setting. Always make sure that cutting is done underwater or with the water level immediately below the material.

1. Position the **nozzle** between the **slats**, 1–1.5 in. (2.5–3.8 cm) above the water surface.
2. In MAKE, select **Test**.
3. Select **Water Only (Jet is on, Main Pump is active)**, select **High**, then **Start Test**.

⚠WARNING

The cutting head is about to turn ON. To prevent serious injury, make sure the nozzle is in the correct position, and everyone is clear of the cutting area.

NOTE

The test automatically stops after 60 seconds.

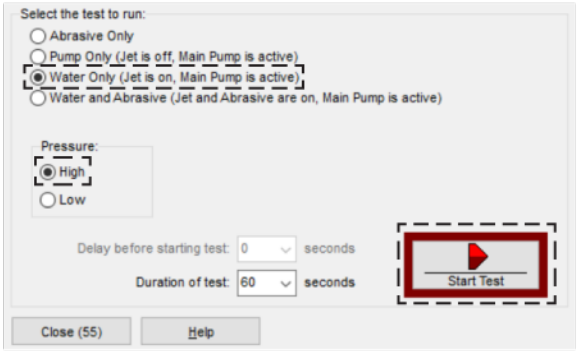


Figure 46

4. When the jet stream test begins, block the airflow through the **abrasive feed tube**.

NOTE

Always block the feed tube before examining the jet stream quality. Air from the feed tube interferes with the jet stream, making examination difficult.

Figure 47

5. Examine the jet stream to make sure it is straight and narrow.

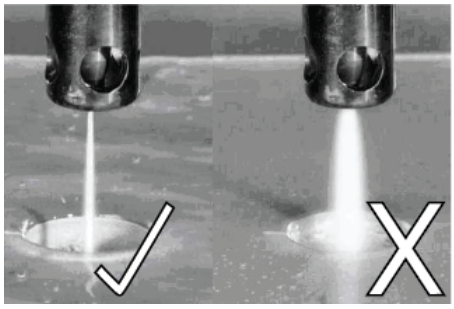


Figure 48

6. During the test, adjust the pump high-pressure rpm:
   a. Use the **high-pressure adjustment knob** on the **pump** to set the cutting high-pressure.
   b. Check the pump's **water pressure gauges** at high rpm.

      The difference between the two gauge readings must not exceed 20 psi. If more than 20 psi, replace the water filters after testing.
   c. Record the values for rpm and pressure while operating in the high-pressure mode for input into MAKE.
   d. Examine the high-pressure plumbing for leaks, see Do an Inspection of the Plumbing.

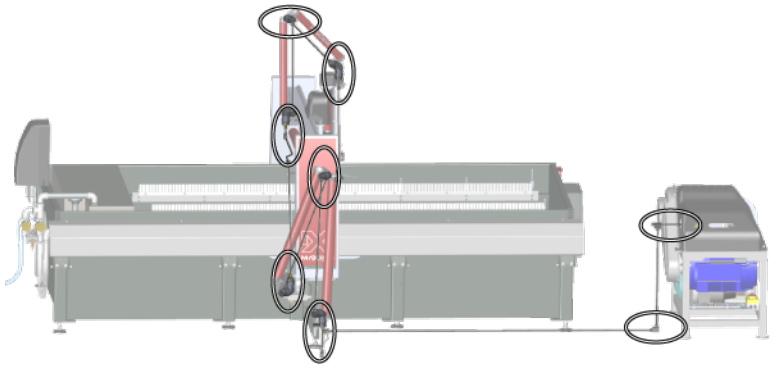


Figure 49

7. Select **Stop** when done.

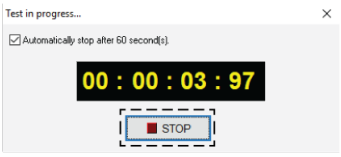


Figure 50

8. Connect the abrasive **feed tube** into the bottom of the **hopper**.

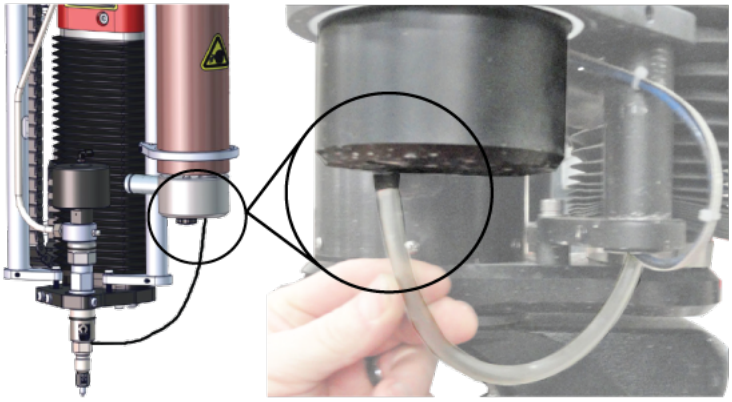


Figure 51

Adjust the ADO

The ADO pressure requires readjusting anytime a different sized orifice is installed in the nozzle, or after replacing a defective or worn jewel in the nozzle. Check the pressure at every machine start. See *401055 Adjustable Dump Orifice Operators Guide*.

NOTICE

The ADO does not close as a needle valve would. NEVER screw the adjustment knob all the way in and force the tapered stem into the tapered seat. Doing so can jam the stem into the seat, requiring disassembly of the ADO to unjam the stem.

NOTICE

Changing the nozzle orifice size requires adjustment to the ADO to reduce pressure spikes. Pressure spikes can cause UHP plumbing failures and damage the equipment.

Make sure the ADO pressure is not more than 1–2 ksi below nozzle cutting pressure, and never higher than nozzle cutting pressure.

NOTE

If the tapered pin becomes stuck in the tapered seat of the ADO, see 401055 Adjustable Dump Orifice Operators Guide.

1. Remove the **pump cover** to access the **adjustment knob** on the **ADO**.

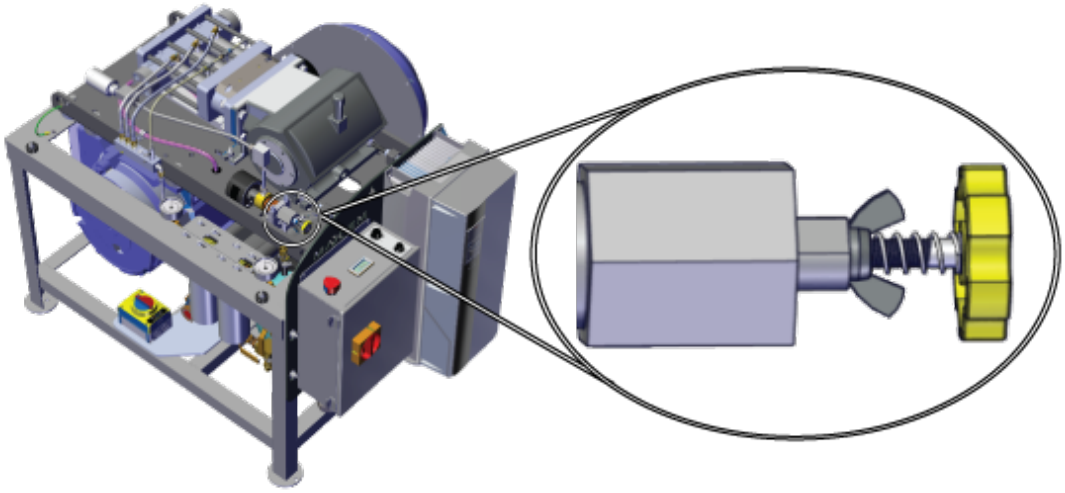


Figure 52

2. Hold the **adjustment knob** (to prevent it from turning), and screw the wing nut towards (clockwise) the **adjustment knob**, leaving approximately a 1/8–1/4 in. (3–6 mm) gap between the stem adjuster and wing nut.

   The **gap** [1] provides the necessary adjustment room for the knob. If not enough gap is available, the wing nut may contact the stem adjuster too soon, preventing the knob from being adjusted any further. If this happens, unscrew the wing nut away from the ADO body to give more adjustment travel.

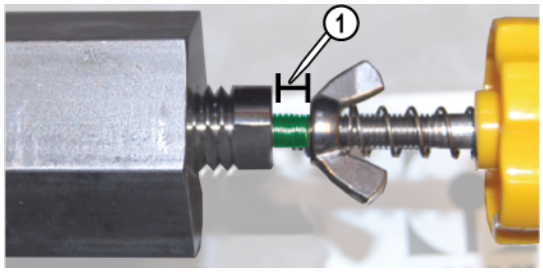


Figure 53

3. In MAKE, select **Test**.

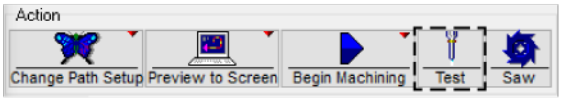


Figure 54

4. Select **Pump Only (Jet is off, Main Pump is active)**, select **High**, then **Start Test**.

NOTE

The test automatically stops after 60 seconds.

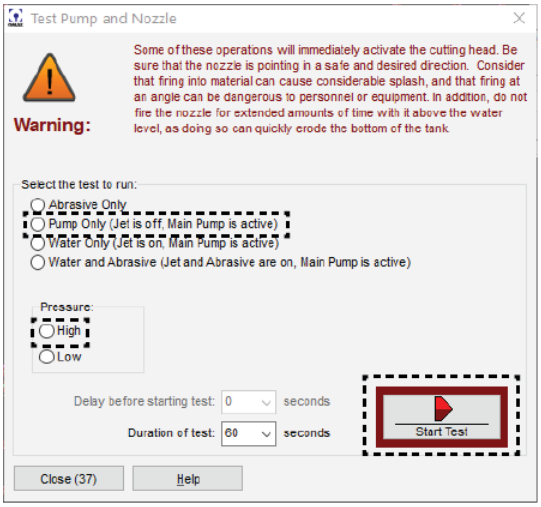


Figure 55

5. Screw the **adjustment knob** [3] toward the **ADO body** until the **wing nut** [2] makes initial contact with the **stem adjuster** [1].

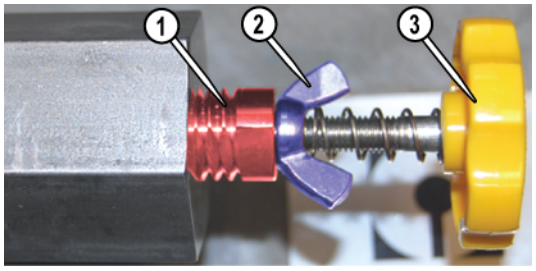


Figure 56

NOTE

If the tapered pin becomes stuck in the tapered seat of the ADO, see 401055 Adjustable Dump Orifice Operators Guide.

6. While the high-pressure test is running, turn the **ADO pressure adjustment knob** until the pressure indicated on the pump **display panel** is within 1–2 ksi of the **nozzle's** high-pressure value. An Allen wrench inserted into the end of the **knob** assists in fine-tuning the **ADO** pressure adjustment.

⚠ WARNING

Never continue unscrewing the adjustment knob until it detaches itself from the ADO body while the water is under pressure. A loose needle can shoot out of the ADO body while under pressure, which can result in physical injury.

NOTICE

The ADO pressure should not be more than 2 ksi below the nozzle pressure, or a pressure spike can occur. Pressure spikes damage the high-pressure components, which can lead to premature failure of the high-pressure components. The ADO pressure can equal the nozzle pressure, but must never exceed nozzle pressure, or a pump fault can occur.

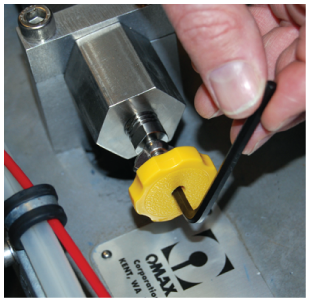


Figure 57

7. When the pressure is correct, hold the **adjustment knob** in place to prevent it from rotating, then tighten the **wing nut** to lock the **knob** in position.

   Make this adjustment while the pump is running at high pressure.

8. Select **Stop** to stop the test.

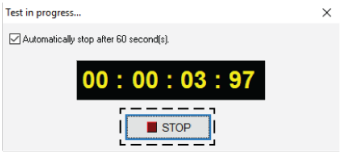


Figure 58

9. Replace the **pump cover**.

Do a Water and Abrasive Test

⚠CAUTION

Always use ear protection when operating the abrasive waterjet nozzle above water. Failure to wear hearing protection can lead to hearing loss.

1. Position the **nozzle** between the **slats**, 1–1.5 in. (2.5–3.8 cm) above the water surface.

NOTICE

Do not operate the abrasive waterjet for more than several seconds when the nozzle is above the water surface at a distance greater than 1.5 in. (3.8 cm). Air entrapment in the water increases with nozzle height, eventually allowing the jet stream to strike the tank bottom with sufficient force to cut a hole through the tank bottom; this applies to nozzle tests and cutting thick materials at a high-quality setting. Always make sure that cutting is done underwater or with the water level immediately below the material.

2. Select **Test** to display the test options.

3. Select **Water and Abrasive (Jet and Abrasive are on, Main Pump is active)**, select **High**, then **Start Test**.

⚠WARNING

The cutting head is about to turn ON. To prevent serious injury, make sure the nozzle is in the correct position, and everyone is clear of the cutting area.

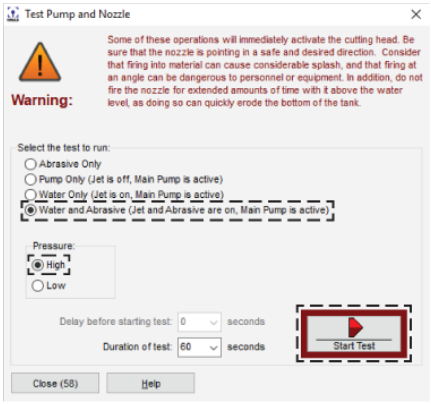


Figure 59

NOTE

The test automatically stops after 60 seconds.

4. Make sure there is an increase in the sound level and stream diameter from the abrasive flow.
5. Make sure abrasive is flowing from the **abrasive feed tube** into the **nozzle**.
6. Select **Stop**.

Figure 60

Measure the Abrasive Flow Rate

Measure the abrasive flow rate when any of the following occurs.

- If the last time the abrasive flow rate measurement was evaluated is unknown.
- When a new supply of abrasive is received.
- After cutting, the result is an edge quality that is not at the desired quality.
- If there is a significant change in humidity.

Make sure the nozzle mixing tube, orifice, and flow rate for the abrasive size are matched correctly to the size of the pump motor in use.

The table identifies the average abrasive flow rate using standard equipment.

Pump Motor Size	Nozzle Orifice Size	Nozzle Mixing Tube Size	Abrasive Flow Rate 80 Mesh
20 hp	0.011 in. (0.279 mm)	0.030 in. (0.76 mm)	0.50 lb/min (0.23 kg/min)
30 hp	0.014 in. (0.356 mm)	0.030 in. (0.76 mm)	0.75 lb/min (0.34 kg/min)
	0.014 in. (0.356 mm)	0.042 in. (1.07 mm)	1.0 lb/min (0.45 kg/min)
	2x 0.010 in. (2x 0.254 mm)	0.021 in. (0.533 mm)	0.30 lb/min (0.14 kg/min)
40 hp	0.015 in. (0.38 mm)	0.042 in. (1.07 mm)	1.0 lb/min (0.45 kb/min)
	2x 0.011 in. (2x 0.279 mm)	0.030 in. (0.76 mm)	0.50 lb/min (0.23 kb/min)

NOTE

• The 15 lb (6.8 kg) hopper comes with a -13 abrasive orifice that provides an approximate abrasive flow rate of 0.70 lb (0.32 kg) per min. with 80 mesh abrasive.
• The actual abrasive flow rate data for this and any other abrasive orifice(s) used must be measured, then the actual values (data) must be entered into MAKE in the Pump and Nozzle Settings.

To measure the abrasive flow rate, do the following:

1. Identify the abrasive type and mesh size (found on the abrasive package), then in MAKE, enter the information in the **Pump and Nozzle Configuration** tab.
2. Pressurize the **bulk feed hopper**, if equipped. See *401112 Operation and Maintenance Bulk Abrasive Delivery System*.
3. Make sure the **abrasive hopper** is **grounded** [1] to the **machine** and is full of abrasive.

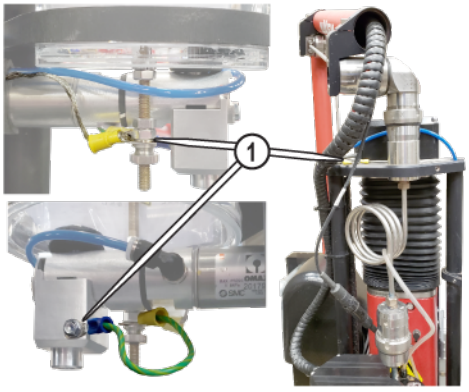


Figure 61

NOTE

If the hopper is not grounded, the abrasive does not flow properly resulting in poor cutting performance.

4. Disconnect the **abrasive tube** from the bottom of the **hopper**.

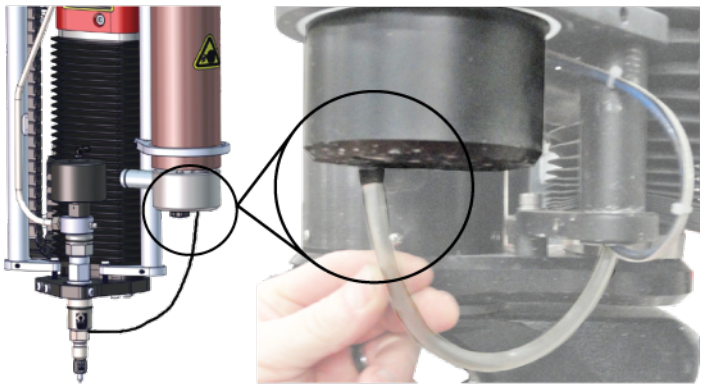


Figure 62

5. Place a container directly below the **abrasive valve** to catch the abrasive during the test.

NOTE

Weigh the empty container before the test and record the container weight.

6. In MAKE, select **Test**.

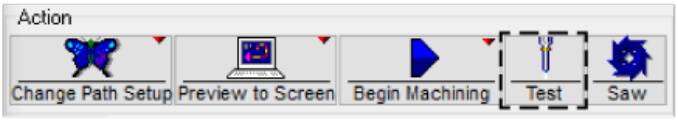


Figure 63

7. Select **Abrasive Only**, then **Start Test** to start the abrasive flow.

NOTE

By default, the abrasive flow automatically stops after one minute.

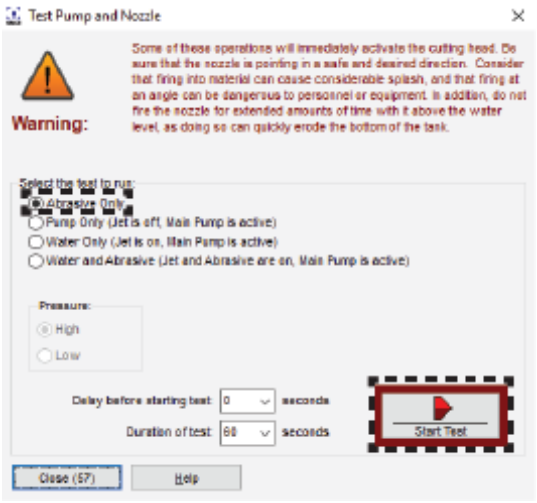


Figure 64

8. Select **OK**.

NOTE

The abrasive immediately starts flowing when OK is selected. Make sure the container is under the abrasive feed valve to collect all abrasive.

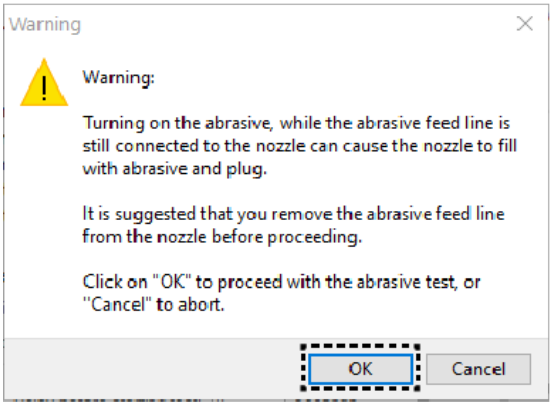


Figure 65

9. In **Test Pump and Nozzle**, select **Close**.
10. Weigh then record collected abrasive in pounds for input into the pump and nozzle settings.

NOTE

Make sure to deduct the weight of the container to prevent entering inaccurate abrasive flow that can result in poor cutting performance.

11. Connect the **abrasive tube**.
12. Fill the **abrasive hopper**, if needed.

Figure 66

13. Make sure the **abrasive feed tubes** [1] are clean, dry, not brittle, worn, and do not contain cracks, holes, or frayed ends. Replace as needed.

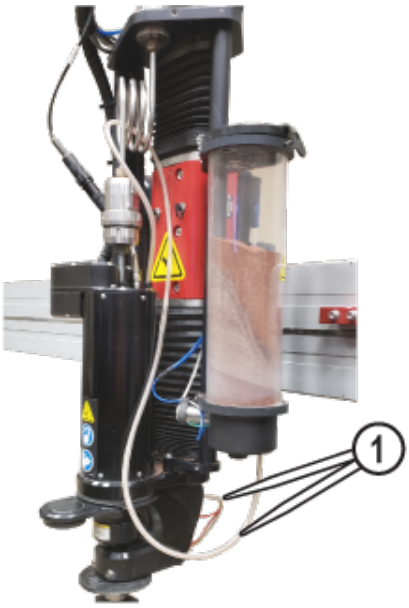


Figure 67

Enter the Pump and Nozzle Settings

Make sure the data in Pump and Nozzle Settings in Setup is equal to the actual measured values. The software settings must agree with the actual measured values for the pump pressures, and abrasive flow rate and the nozzle setup values must match the nozzle installed on the machine. If values do not match, the cutting ability of the machine is compromised.

1. In MAKE, select **Setup** > **Pump and Nozzle Settings**.

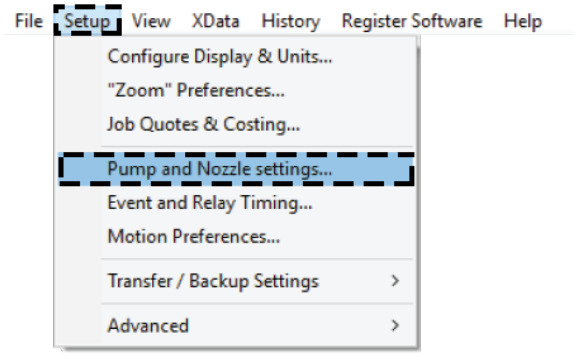


Figure 68

2. Make sure the values displayed are equal to the recorded values during the machine tests.

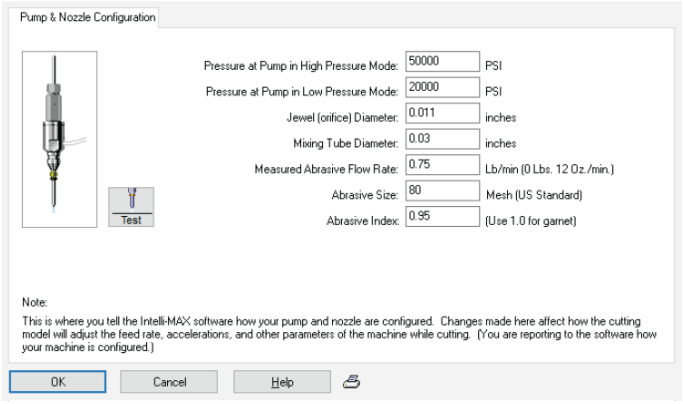


Figure 69

3. Select the **Event & Relay Timing** tab and make sure the values displayed are correct for the machine and cutting situations.

NOTE

To determine values for Event and Relay Timing, start with the default values and then adjust the values to match the requirements.

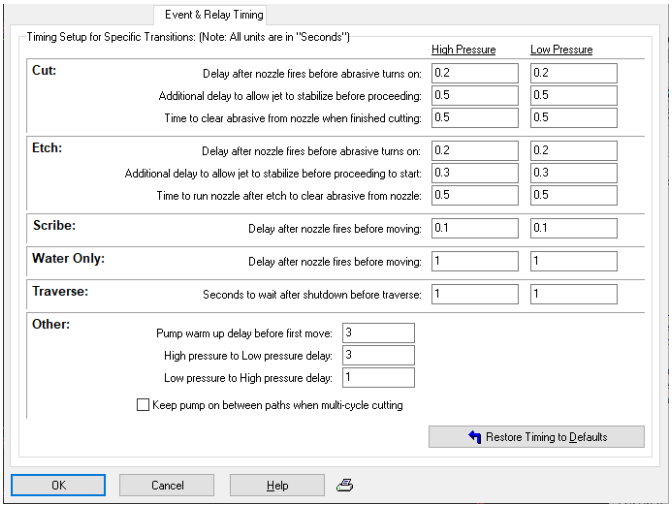


Figure 70

4. Select **OK** to save changes.

Adjust the Tool Offset using a Kerf Check

Kerf check part files are in the Sample Files, Kerf_Check_Parts folder.

NOTE

The tool offset changes as the mixing tube wears out.

See the OMAX Operator Startup Training, Steps 8-10 video, located at https://elearning.omax.com.

1. Cut a kerf check part.
2. Measure the cut part against the drawing dimensions.

3. Adjust **Tool Offset** as needed.

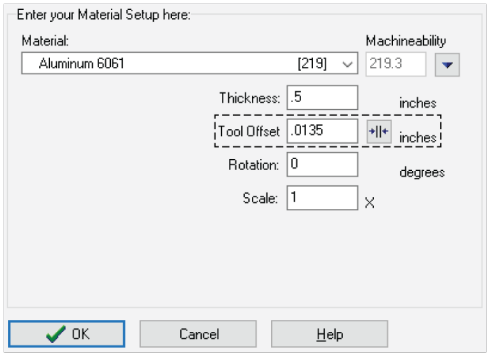


Figure 71

Configure MAKE Software

1. Open **MAKE**.
2. Select **Change Path Setup** and navigate to the ORD or OMX drawing file.

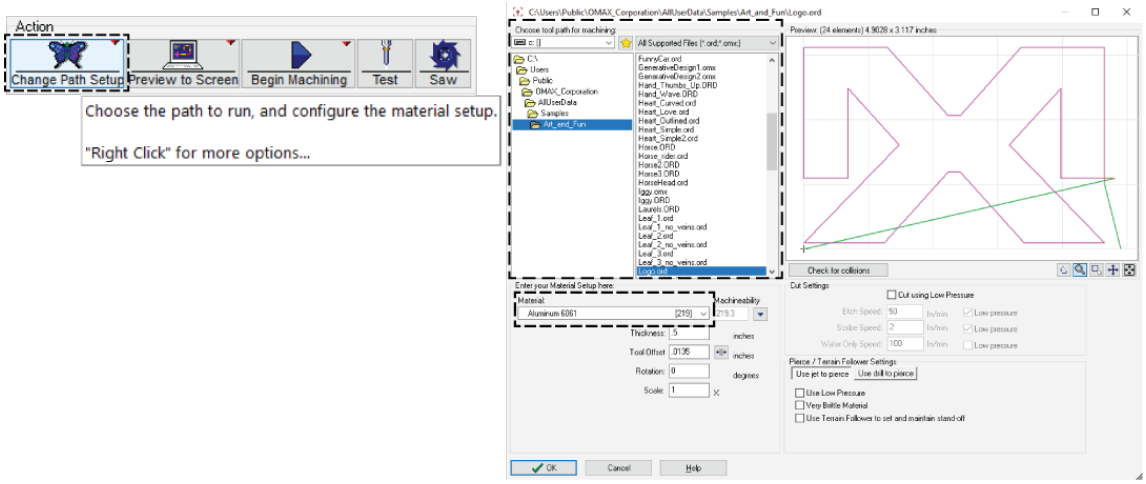


Figure 72

3. Enter the material setup values and enable applicable accessories.

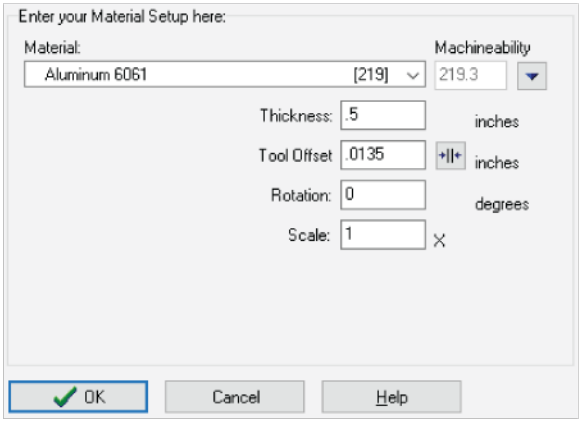


Figure 73

4. If required, configure the **Cut Settings** and **Pierce/Terrain Follower Settings**.

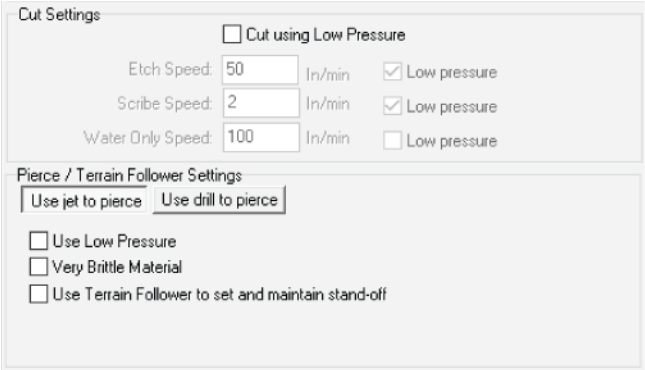


Figure 74

Cut the Material

1. Move the **nozzle** to an area on the **table** to give ample room to place and secure the material to the **table**.
2. Adjust the **tank** water level as needed.
3. Place the material on the **slats** and use adequate fixturing to keep the material flat and stable during cutting.

   See the Load and Clamp the Material video, located at https://elearning.omax.com.
4. Position the **nozzle** at the starting location for the path.
   a. Place the **nozzle** above the material, ensuring efficient use of the material.
   b. When the **nozzle** is in the correct position at the path starting point, select **Zero** to set the Distance from "Path Start."

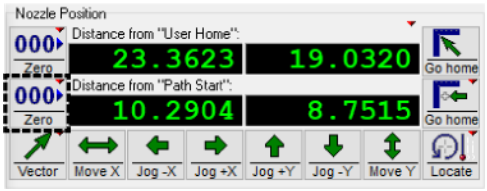


Figure 75

5. Set the **nozzle** standoff above the material. See the software help files for tips in setting the standoff.

NOTICE

To prevent damage to the mixing tube, do not lower the mixing tube directly down onto the stand-off tool.

   a. Adjust the **nozzle** above the material.
      - A distance of 0.080 in. (2 mm) is required for the **A-Jet**.

b. Use the **stand-off** tool to measure the gap between the **nozzle tip** and the material to cut, then adjust the **Z-axis** up or down.

- Press **1** to move the **nozzle** down quickly; press **7** to move it up quickly.
- Press **PageDown** to move the **nozzle** down in 0.1 in. (2.5 mm) increments; **PageUp** to move it up.

Figure 76

c. If needed, select **View** > **Show Z Coordinates** to display the **Z Height** window.

d. Select **00** to set the **Z Height** at zero.

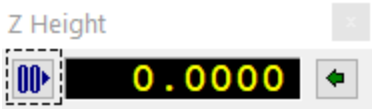


Figure 77

6. Do a dry run to make sure the cutting path is correct.

a. Select **Begin Machining**.

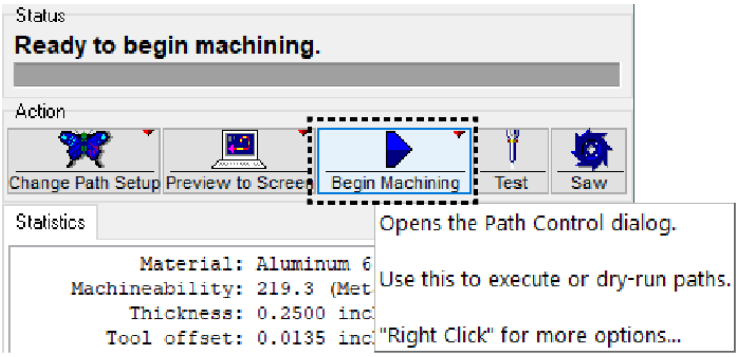


Figure 78

b. Right-click **Start**, then select **Dry run at full (Rapid transverse) speed** (or another speed of choice).

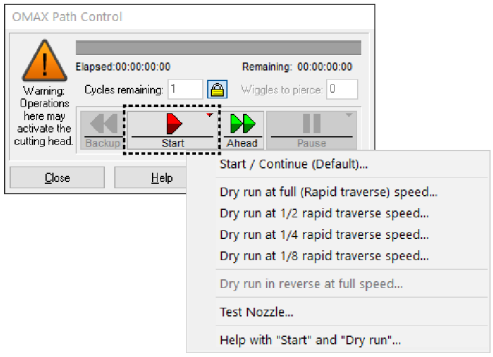


Figure 79

c. Make sure the **nozzle** travels over the material as expected.

d. If necessary, adjust the **Path Start Home** position, then do another dry run. Repeat until the cutting path is correct.

7. Raise the **nozzle** using the **Z Height** adjustment and attach the **nozzle splash guard**.

Figure 80

8. Lower the **nozzle** to its zero Z-axis coordinates (select the arrow on the right side of the **Z Height** window) (Figure 80).

9. Raise the water level in the **tank** above the cutting material.

⚠CAUTION

Always remain near the equipment during the cutting process. To prevent injury and, or equipment damage, use the E-Stop switch to stop the machine immediately. See Operate the Emergency Stop and Restart After an Emergency Stop.

10. Select **Begin Machining** > **Start** to begin cutting.

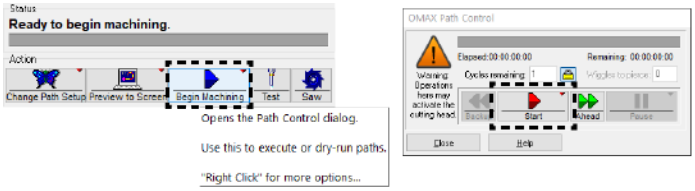


Figure 81

11. Once machining is done:

a. Raise the **nozzle** and move it away from the cut part.

b. Lower the water level.

c. Rinse the abrasive debris from the cut material.

d. Remove the cut part(s) from the **cutting table**.

Stop the High-pressure Pump

During normal cutting operation, MAKE automatically starts and stops the high-pressure pump as required.

- To stop the pump, press the **Stop button** [1], or press the **Pause button** [2] on the pendant controller.

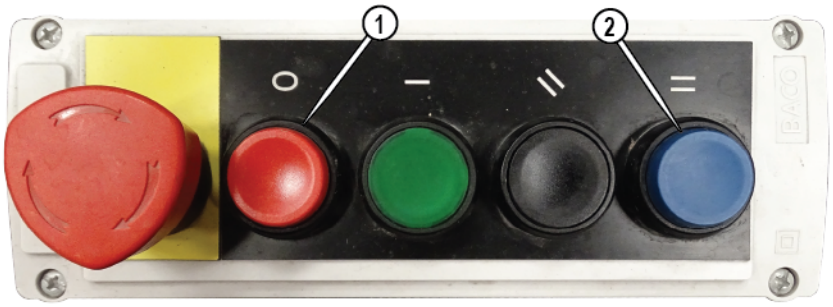


Figure 82

Pressing the E-stop (located on the high-pressure pump and any operator control panel) stops the machine immediately, see Operate the Emergency Stop.

NOTE

The E-stop switch is used only in an emergency. All nozzle position information is lost when the E-stop is pushed and requires re-homing, resetting soft limits, and other startup tasks.

Shutdown the High-Pressure Pump

These instructions apply only to MAXIEM pumps. If using a different pump, see the applicable pump operation guide.

1. Turn **OFF** the **charge pump**.

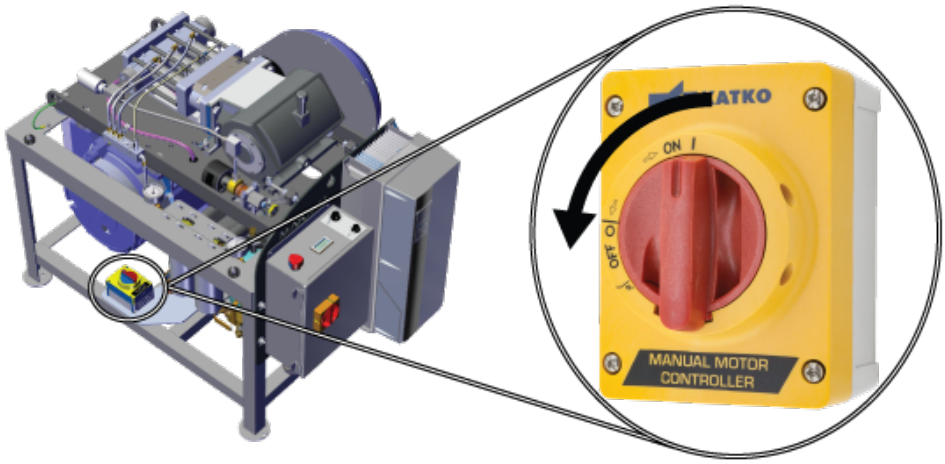


Figure 83

2. Close the **charge pump inlet water valve**, if applicable.

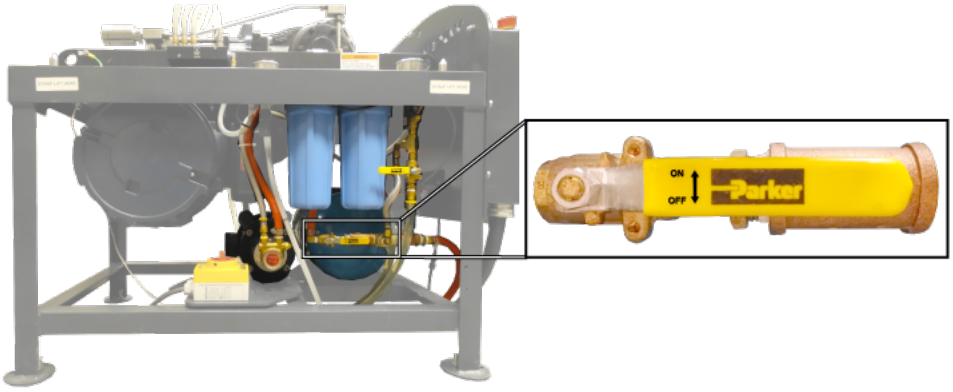


Figure 84

3. Turn **OFF** the main **pump**.

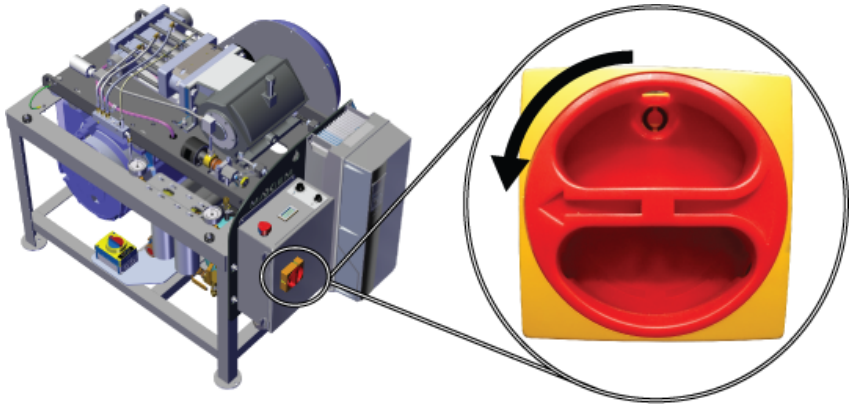


Figure 85

Tips for Effective Cutting

Use a nozzle stand-off between 0.040 in. (1.0 mm) and 0.060 in. (1.5 mm). For the A-Jet, 0.080 in. (2.032 mm) must be used. The closer the nozzle is to the material, the less the taper the final part has. Increasing the stand-off distance increases the amount of taper. Smaller stand-off distances increase the likelihood of clogging the nozzle during piercing.

Keep the abrasive free from contaminants. Contaminants in the abrasive clog the mixing tube. Contaminants include drops of water, bits of paper, metal shavings, dirt, and other debris.

Measure the tool offset regularly. The tool offset (half the width of the kerf) gradually increases as the mixing tube in the abrasive waterjet nozzle wears. Frequently measuring and adjusting the tool offset helps maintain a higher degree of accuracy of parts. Cut a kerf check part to make sure the offset is correct.

Make sure the slats have a uniform height. If the height of all slats is not uniform, the part can move up and down as it is machined, affecting part accuracy.

Avoid machining along a slat top. To minimize excessive tank spray and to extend slat life, try to place the material so that the abrasive waterjet is not cutting along a slat.

Rotate slats regularly. Most cutting is done in the same area of the machine. Slats located in this area tend to wear first. Rotating slats distribute wear and extend their useful life.

Orient the short direction of a part parallel to slats. Try to arrange drawings so that the shortest dimension runs parallel to the slats to keep the finished part from slipping between the slats.

Be careful of parts that tilt. The cutting nozzle could crash into them.

Arrange material so as many slats support cut parts as possible.

Be wary of parts with heavy ends that may tilt even when supported by many slats.

Reposition weights during a traverse or planned pause points. Insert planned pause points into the tool path using XData or MAKE, or wait until the machine does a rapid traverse to stop machining to reposition weights. Right-click Pause in MAKE, and select Pause at Start of next traverse, or Pause at the end of next traverse.

Do not precut material. Big sheets of material are easier to clamp into place and weight down. Small pieces of material can be challenging to clamp and weight correctly; there may not be enough room for both the part and the weights.

Place sensitive material between sacrificial material. When cutting parts that are sensitive to scratching, place the part between pieces of sacrificial material. The bottom of the part to be machined is especially vulnerable to splashback and frosting.

Put sacrificial material on material that may delaminate. Cover the top of material that may delaminate during piercing with sacrificial material. The sacrificial material makes sure that the abrasive is fully flowing before it reaches the cutting material.

Start at the edge of materials that are difficult to pierce. Some materials are difficult to pierce. For example, weak granites can be pierced but may chip or crack. When cutting these material types, start cuts from the edge of the material. Other materials, such as glass, can be pierced using low-pressure.

Avoid material with deep scratches. For the best possible surface finish, use stock that does not have deep scratches on the surface. Scratches on the surface can deflect the abrasive stream and cause irregularities on the bottom of the part.

Do not always make parts in the same location. Using the same location wears out slats in that area more quickly and can cut through the tank bottom. Cut parts in different table areas to even slat wear.

Shutdown Checklist

Follow these steps to make sure that all equipment shutdown tasks are completed in the required sequence.

⚠CAUTION

Safety First - to avoid physical injury, always wear eye, ear, and hand-protection devices when operating the equipment.

1	Position the nozzle between slats, 1 to 1.5 in. (2.54 - 3.8 cm) maximum above the water level.
2	Start the nozzle high-pressure test.
3	Run a water test for 20 seconds to clean and clear all abrasives, then stop the test.
4	Lower the catcher tank water to the lowest level.
5	Position the nozzle at the necessary location for shut down.
6	Remove all USB/other media.
7	Close MAKE.
8	Shut down Windows.

9	Make sure the PC is shutdown (black monitor screen).
10	Turn OFF the motors by pressing the red stop button on the pendant.
11	Turn OFF the table controller by rotating the red switch on the controller box.
12	Depressurize the bulk feed hopper (if applicable).
13	Turn OFF any other accessories (if applicable).
14	Turn OFF the charge pump.
15	Turn OFF the high-pressure pump.
16	Turn OFF the primary electrical breaker box.
17	Clean the machine.
18	Close the primary water supply valve.
19	Close the primary air supply valve.

The equipment is now correctly shut down.

Shut Down the Abrasive Waterjet

⚠CAUTION

Always use ear protection when operating the abrasive waterjet nozzle above water. Failure to wear hearing protection can lead to hearing loss.

1. Position the **nozzle** between two table **slats** at 1–1.5 in. (2.5–3.8 cm) maximum above the water surface.

NOTICE

Do not operate the abrasive waterjet for more than several seconds when the nozzle is above the water surface at a distance greater than 1.5 inches (3.8 cm). Air entrapment in the water increases with nozzle height, eventually allowing the jet stream to strike the tank at full force and possibly cut a hole through the tank bottom.

2. Allow the **pump** to run for approximately 20 seconds with **Water Only** to clear all abrasive from the **nozzle**.
   a. Select **Test** to display the **Test Pump and Nozzle** options.

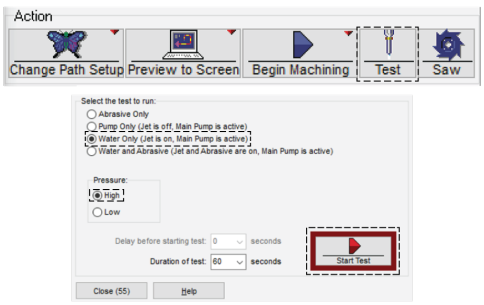


Figure 86

b. Select **Water Only (Jet is on, Main Pump is active)** and **High**.

c. Select **Start Test**.

⚠WARNING

The cutting head is about to turn ON. To prevent serious injury, make sure the nozzle is in the correct position, and everyone is clear of the cutting area.

d. After 20 seconds, select **STOP**.

Figure 87

3. Lower the **catcher tank** water to the lowest level (if applicable).
4. Position the **nozzle** at the necessary location for shut down.
5. Remove any USB stick or other media from the **PC** (if applicable).
6. Close **MAKE**, then close all other software applications running on the **PC**.

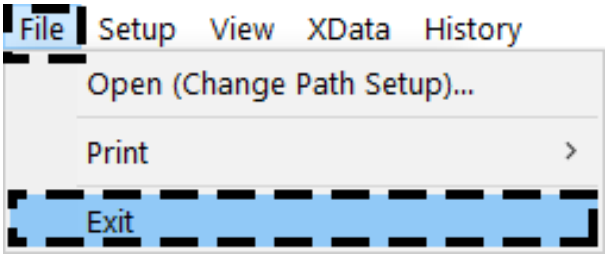


Figure 88

7. Select **Start** ⊞ [3], **Power** [2], then **Shut down** [1] to exit Windows and turn the PC **OFF**.

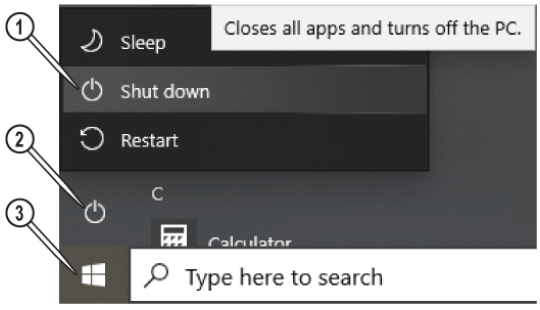


Figure 89

8. Make sure the **PC** is **OFF** (black monitor screen).
9. Turn **OFF** the **motors** by pressing **Stop** [1] on the **pendant**.

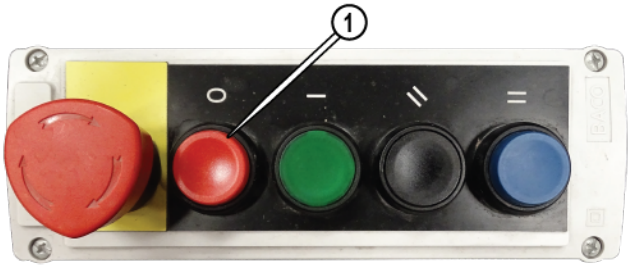


Figure 90

10. Turn **OFF** the primary **table controller** power.

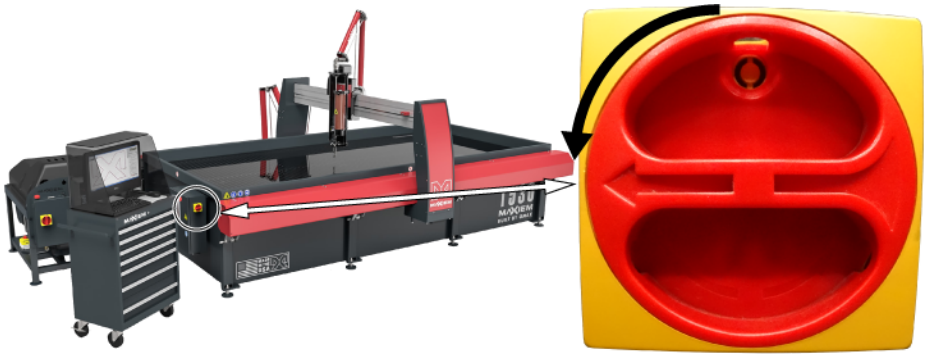


Figure 91

11. Depressurize the **bulk abrasive hopper** (if equipped). See *401112 Operation and Maintenance Bulk Abrasive Delivery System*.
12. Turn **OFF** any other accessories. See the applicable accessory guide.
13. Turn **OFF** the **charge pump**.

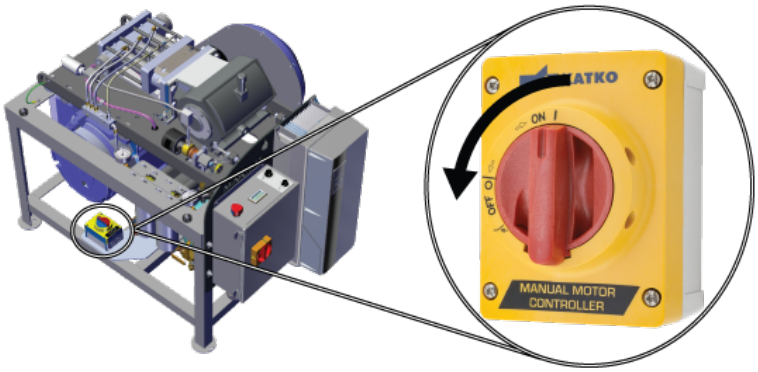


Figure 92

14. Turn **OFF** the **high-pressure pump**.

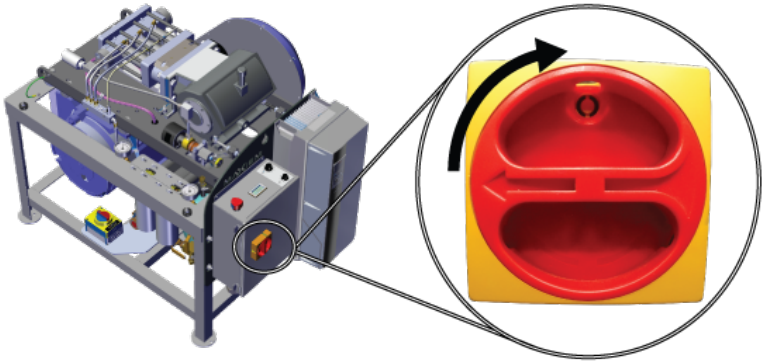


Figure 93

15. Turn **OFF** the primary electrical breaker box.

Figure 94

16. Clean the **machine** and work area. Remove any debris from the **catcher tank**.
17. Close the **water** [2] and **air** [1] supply valves.

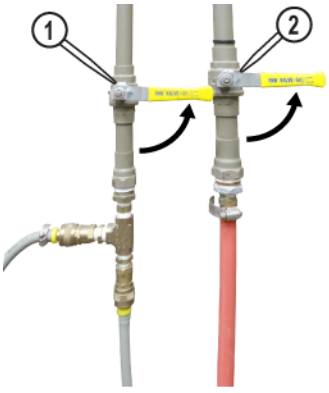


Figure 95

Operate the Emergency Stop

When the E-stop button is pushed, the E-stop immediately shuts down the pump and the abrasive waterjet system. Use the E-stop switch ONLY in the case of an emergency. Reset the E-stop before restarting the pump.

NOTE

All nozzle position information is lost when the E-stop is pushed and requires the machine to be restarted, see the Startup Checklist.

- To operate the E-stop, push the **E-stop** button on the **control pendant** or the **high-pressure pump** (see the high-pressure pump guide).

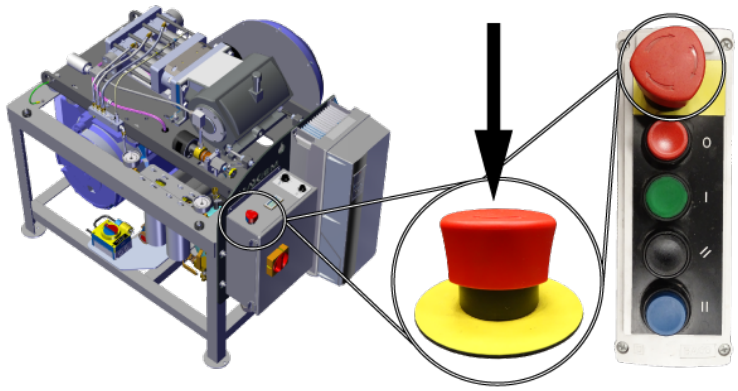


Figure 96

Restart After an Emergency Stop

1. Twist the **emergency stop switch** in the direction of the **arrows** to disengage the emergency stop.

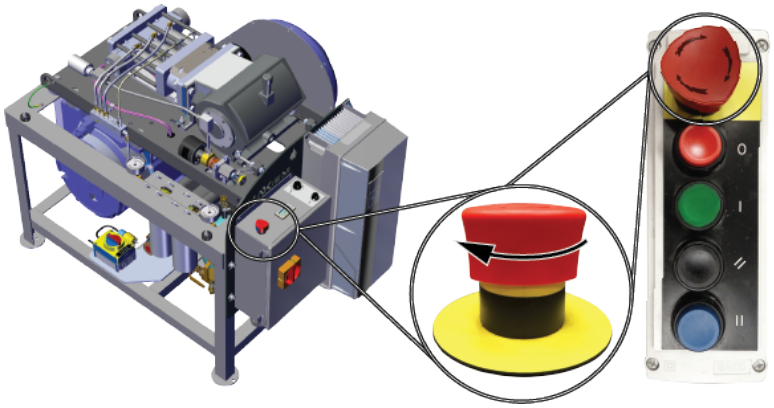


Figure 97

2. Start the machine, see the Startup Checklist
3. When applicable, turn **ON** any connected accessories.
4. Open MAKE.
5. **Auto Home** the machine, auto homing resets the machine's zero (**Absolute Home**) position.
6. Make sure the **soft limits** are enabled.

MAINTENANCE

This section documents the maintenance required to make sure the abrasive waterjet system operates reliably.

NOTICE

All maintenance activities must be performed by qualified personnel to prevent damage to the machine.

Follow the maintenance schedule to make sure the equipment performance is reliable. The frequency of most maintenance activities is dependent upon the length of time the equipment has been in operation; however, harsher than usual environmental conditions may require more frequent scheduled maintenance activities than indicated in the maintenance schedule.

NOTICE

Machine Alignment! Machine X- and Y-carriages are factory aligned using highly accurate test instruments and alignment procedures. The nuts and bolts used to secure these components are critical in maintaining machine alignment. NEVER adjust or remove the carriage nuts and bolts during table maintenance or for any other reason. Doing so may permanently upset the alignment and cutting accuracy of the machine. Contact OMAX Technical Support if unsure about the disassembly of any carriage components.

Maintenance Schedule

Use the following maintenance activities and schedules to develop a successful equipment maintenance program. Reference documents and videos provide instructions for performing the specific task. After any maintenance procedure, perform a post-maintenance flush. See *401082 Maintenance, Perform Post-Maintenance Flush*, and the Post Maintenance Flush video, located at https://elearning.omax.com/.

NOTE

- *The expected life of components varies based on specific use cases and environmental conditions.*
- *The hours listed in this schedule for recommended maintenance are NOT warranty hours.*

Task	Frequency	Reference Document
Pump Maintenance		
Maintain high-pressure pump	As required	401056 Operate MAXIEM 1.5 Pump
UHP Plumbing System		
Rebuild or replace swivel	Rebuild if any leaks; replace if leaking continues after rebuild or if damaged	400697 Rebuilding the Dual Port Swivel 401240 Rebuild Dual Axis Swivel
Rebuild on/off valve	Water entering the abrasive feed tube when the nozzle first fires (leaky seal) Water drips from the mixing tube (leaky valve stem) Water leaks 180 degrees from where the UHP plumbing enters the dual on/off valve (bad valve seal) Water drips from the UHP nipple on the dual	400475 Rebuilding the dual On-Off Valve

Task	Frequency	Reference Document
	on/off valve (loose fitting, cracked body or fitting)	
Replace air actuator	Replace annually or as needed	401060 Installation and Maintenance OMAX Air Actuator
High-pressure lines and fittings	Replace if damaged or if continued leaking occurs; do not try to repair	401044 High Pressure Fittings, .375 in Tubing 401081 High Pressure fittings document, .25 in tubing
PC Controller 		
Clean keyboard and mouse	As needed	See Maintain the Controller
Clean monitor screen	As needed for sharp viewing.	Per PC manufacturer instructions
Restart PC controller	Daily	See Restart the PC
Update Intelli-MAX software	When OMAX releases updates	See Update Intelli-MAX Software
Tank 		
Clean abrasive accumulation from equipment working area	Daily and as often as required to maintain a clean working environment	See Clean the Machine
Remove all abrasive, sludge, and slugs from the tank bottom	Whenever abrasive particles begin to accumulate excessively on the material to be machined	See Remove Abrasive Accumulation
Do an inspection of the slat grates	Rotate monthly or more frequently if needed; replace when excessively scored and no longer stable or level	See Do an Inspection of the Slats
Clean the outlet water filter (drain)	Daily or more frequently if needed	See Clean the Water Outlet Filter Screen
Run tank cleaning program	As needed when using a solids removal system	401064 Operation and Maintenance for LSRS 401109 Operation, Variable Speed SRS, High-Pitch Propeller

Task	Frequency	Reference Document
Table 		
Lubricate Z-axis shafts (left and right)	Annually, or as needed to maintain smooth operation	401722 Maintenance, X, Y, and Z Components, MAXIEM
Lubricate the Z-axis lead screw	Annually, or as needed to maintain smooth operation	401722 Maintenance, X, Y, and Z Components, MAXIEM
Wipe down X and Y rails	Daily, or as needed to maintain uninterrupted operation	401722 Maintenance, X, Y, and Z Components, MAXIEM
Wipe down X and Y magnetic encoder strips	Daily, or as needed to maintain uninterrupted operation	401722 Maintenance, X, Y, and Z Components, MAXIEM
Nozzle 		
Rotate/replace nozzle mixing tube	Rotate 90 degrees (one-quarter turn) every 8 hours of cutting to even-out wear. Replace as needed.	400715 MAXJET 5i Installation and Maintenance
Clean nozzle orifice (or the whole nozzle body if using the MAXJET 5i)	Clean the jewel and nozzle orifice assembly once a week minimum to prevent mineral buildup in the jewel assembly	400715 MAXJET 5i Installation and Maintenance
Change the nozzle filter	One time per week (or more frequently if needed)	400715 MAXJET 5i Installation and Maintenance
Abrasive tubing (hopper to nozzle)	Examine daily or weekly (depending on daily cutting hours), replace as needed	400715 MAXJET 5i Installation and Maintenance

Maintenance Log

Run Hours	Maintenance Performed	Done By	Date

Maximize Nozzle Life

Here are some ways to maximize the life of the nozzle and nozzle components:

- Do not change the mixing tube simply because the jet stream looks wide.
- Cut test parts and do kerf checks regularly to see when cutting performance begins to degrade.
- If the surface quality and accuracy are as expected, continue using the nozzle assembly.
- If the quality of the cut part is not as expected, prompt correction of the problem minimizes complications.
- Take advantage of features in MAKE that allows the use of different offset values and mixing tube diameters to adjust for mixing tube wear.
- Enter the correct offset values in MAKE to maintain part tolerances and extend mixing tube life.

All nozzle components are negatively affected by contamination, dirt, or other materials present in high-pressure systems. In general, cleanliness is a crucial controllable factor in extending the life of nozzle components.

Here are some ways to maintain cleanliness:

- Keep the work area clean.
- Store spare nozzle components and other parts in sealed, clean containers or bags until ready to use.
- Thoroughly clean all parts and high-pressure fittings before assembly or reassembly.
- Use an ultrasonic cleaner with white vinegar to remove mineral build-up in the orifice assembly.
- Prevent abrasive contamination.
    - Do not store abrasive in open bags or buckets—store in closed containers.
    - Use a sharp blade to open abrasive bags.
    - Always keep the abrasive hopper covered to keep moisture out.

Here are some best practices for parts and components that can extend nozzle life:

- Do not use damaged parts. Examine parts and all orifices before use.
- Always use pump manifold and last chance nozzle filters. Examine and replace them regularly.
- Depending on the application, and if speed and longer life are the primary concern, use a 0.042 in. (1.06 mm) mixing tube instead of the standard 0.030 in. (0.76 mm) mixing tube. Parts may have slightly more taper and a wider kerf when using a 0.042 in. (1.06 mm) mixing tube.
- Use only high-quality abrasive; it contains less dust and more uniform particle size.
- Use a terrain follower to help protect the mixing tube from damage during cutting, if equipped.

Here are some ways to reduce downtime during nozzle maintenance:

- Have a spare nozzle body built and ready to replace on the machine when needed.
- Have new consumable parts on hand and replace them when rebuilding the nozzle. Once the nozzle is installed and running, determine which parts are reusable as spares in the future.

Here are some ways to extend the life of the nozzle and components:

- Use a nozzle splash guard and, whenever possible, cut underwater to reduce splash-back. The splash-back contains water, abrasive, and eroded material from the tank that can damage cutting head components; it is preventable damage that may affect the warranty.
- After servicing the pump, nozzle, or replacing a piece of plumbing, flush the system, (see *401082 Maintenance, Perform Post-Maintenance Flush*, and the Post Maintenance flush video, located at https://elearning.omax.com).
- After every eight hours of cutting, rotate the mixing tube 90 degrees, so the internal diameter of the mixing tube wears evenly.

Do an Inspection of the Plumbing

Regular inspection of plumbing components helps maintain consistent pressure within the system for accurate and precise cutting. The UHP plumbing routes the water from the high-pressure pump to the abrasive waterjet nozzle. The plumbing system requires periodic inspections for leaks. Inspection should include all tubing, the high-pressure fittings, swivels, and dual on/off valves.

See The Ultra High-Pressure Plumbing System video, located at https://elearning.omax.com.

Do the following when there is a leak on a fitting:

1. Turn **OFF** the **pump**.
2. Release any remaining pressure from the **high-pressure system**.
3. Re-torque the leaky **fitting**.

If the leak continues, make sure the components are assembled correctly and are not damaged. See *401044 High Pressure Fittings, .375 in Tubing*.

If the components are assembled correctly and the leak continues, the sealing surface is compromised. Do the following to repair.

1. Disassemble the **fitting.**
2. Examine and replace any damaged or eroded components.

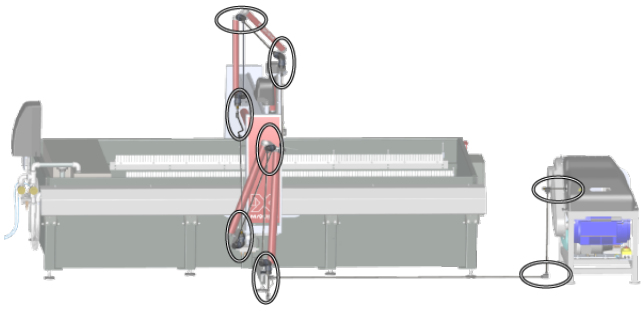


Figure 98

Do an Inspection of the Slats

Over time, table slats become scored with deep abrasive waterjet cuts and may not provide stability and support required for precision cutting. Examine the slats for wear at least once a month. Replace worn and weakened slats.

See the Tank Maintenance video, located at https://elearning.omax.com.

NOTE

Periodically rotate the slats to different table locations to improve the slat life.

When replacing a defective slat, examine the slat holder for excessive wear. Slat holders with excessive wear no longer prevent slats from rocking back and forth, which can interfere with cutting precision. Replace the worn slat holders.

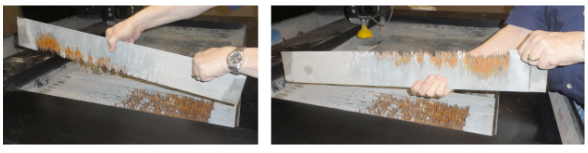


Figure 99

Clean the Machine

At the end of each shift or day, wash all abrasive particles and grit from exposed surfaces. The machine design prevents abrasive from contaminating bearings and other critical parts. A clean machine lasts longer and requires less maintenance.

See the Tank Maintenance video, located at https://elearning.omax.com.

NOTICE

When washing down the A-Jet, hold the hose at a distance of at least 18 in. (46 cm) from the surface to prevent possible damage to exposed seals. If using air to blow away grit, maintain the same distance, at least 18 in. (46 cm), to prevent damage to exposed seals.

Tips for Cleaning the Machine

Keep water away from the controller.

- Never spray water directly at the controller cabinet, keyboard, or mouse. Wipe down the outside of the controller regularly.
- Use a splash shield during machining. A splash shield (available from OMAX) keeps water spray inside the tank while giving the operator full view of the machining process.
- Keep material surfaces clean while machining. When cutting thick materials, abrasive particles build up on top of the material; wash off the accumulation. Otherwise, significant accumulations of abrasive tend to pile up on the cutting path, which can affect machining accuracy.

Clean abrasive flows better than contaminated abrasive.

- Even small particles of paper allowed to mix in with the abrasive material can clog the nozzle, costing downtime and possibly a ruined part. Always use clean abrasive.
- Make sure the abrasive remains dry. Always store the abrasive in a location away from and protected from the typical wet, abrasive waterjet environment. Damp abrasive may lump together and not flow properly.

Remove Abrasive Accumulation

NOTE

The Solids Removal System (SRS) is an effective alternative to manually cleaning the tank.

Abrasive and metal particles steadily accumulate in the tank during cutting. A regularly scheduled removal of accumulated deposits is necessary. When removing abrasive material from the bottom of the tank, it is best to completely drain water from the tank before attempting to remove the abrasive waste. The drier the abrasive, the easier it is to remove.

See the Tank Maintenance video, located at https://elearning.omax.com. For more information about safe disposal, see Disposing of Waste Materials.

Clean the Water Outlet Filter Screen

Water accumulated in the catcher tank exits through a water outlet filter. Periodically examine the filter to determine if cleaning the screen is required.

See the Tank Maintenance video, located at https://elearning.omax.com.

- Remove and clean the **outlet filter screen** using a mixture of mild soap and water, then rinse thoroughly with water.

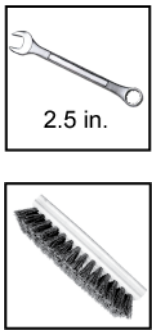


Figure 100

Maintain the PC Controller

The keyboard and mouse are industrial-grade components that can withstand exposure to water and abrasive particles present in an abrasive waterjet environment. Follow the manufacturer instructions for cleaning the keyboard, mouse, and monitor screen.

See the MAXIEM PC Maintenance videos, located at https://elearning.omax.com.

Restart the PC

The Windows operating system manages all memory, disk reading and writing, and memory operations for every program that runs on the PC.

To minimize operating system problems:

- Restart the PC once a day. A restart may fix most PC operating errors.
- Restart the PC if any program crashes.
- Wait for Windows to load before opening programs. Wait until all disk activity is complete before operating the machine.

Update Intelli-MAX Software

Software updates are available from the Customer Dashboard (https://support.omax.com). A user name and password are required..

New versions of the software are typically posted once or twice a year and may automatically overwrite the existing version when installed. Follow the installation wizard instructions.

See the MAXIEM PC Maintenance video, located at https://elearning.omax.com.

NOTE

• DO NOT uninstall previous versions of the software. When upgrading to a new version of the software, use the installer to uninstall any previous versions of the software. The OMAX installer retains unique machine configuration settings.
• Always use installation defaults. Do not change the suggested installation settings. Always use the suggested installation location unless there is a good reason not to. If not using the default settings, future upgrades must be installed to the same non-standard directory to work correctly.
• Always restart Windows BEFORE installing software updates to make sure the existing software copies are not running and Windows initialized.
• After the restart, do not run other programs before installing the software update. Other programs could conflict with the software installer.
• If upgrading a PC connected to an OMAX machine, ALWAYS shut down the abrasive waterjet machine and turn it OFF after the software installation is complete (the install program provides a reminder to shutdown). Otherwise, the software may not correctly control the OMAX.

Unclog the Mixing Tube

Over time, the flow of high-pressure water and abrasive wears away the inside of the mixing tube. This wear results in a gradual, irregular widening of the internal diameter of the mixing tube, causing a less accurate stream of abrasive and water. A cross-section of these mixing tubes reveals the irregular wear of their internal diameter.

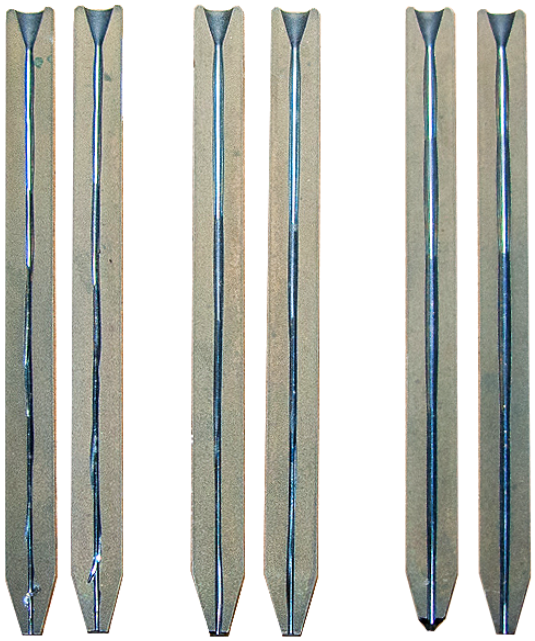


Figure 101

The mixing tube is brittle and easily breaks when dropped or impacted. A well-maintained orifice and jewel extends the operating life of the mixing tube. Damage to mixing tubes caused by misaligned jets or a damaged jewel is not apparent when looking through the bore of the mixing tube. The size of the kerf and cutting performance are the best indicators of mixing tube wear. The kerf is the width of the cut made by the abrasive waterjet. For a 0.030 in. (0.762 mm) mixing tube, the kerf can range from 0.015 in. (0.38 mm) to 0.060 in. (1.52 mm), depending on the nozzle, the thickness of the material, and the amount of wear on the mixing tube.

A clogged mixing tube is frequently caused by contaminated abrasive. Even a small particle of dirt can clog the mixing tube because the opening can be as small as 0.030 in. (0.76 mm) on a MAXJET 5i. Other potential causes of clogging include contaminated or wet abrasive. Metal chips from other shop operations and paper from the abrasive bag are two

common sources of contamination. Regularly clean the mixing tube and examine the inlet and outlet ends and replace it as needed.

If the mixing tube is clogged, do the following to dislodge the blockage.

1. In MAKE, select **Test**.

⚠WARNING

The cutting head is about to turn ON. To prevent serious injury, make sure the nozzle is in the correct position, and everyone is clear of the cutting area.

2. Select **Pump Only (Jet is off, Main Pump is active)**, then **High**, and then **Start Test**.

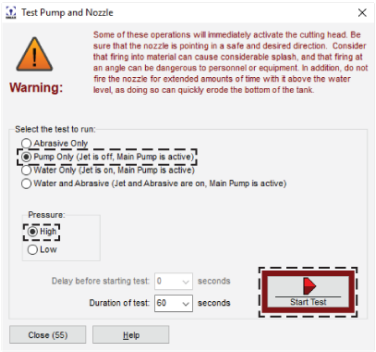


Figure 102

3. Toggle the **Water Only** test **ON** and **OFF** several times to clear the clog.

If the clog remains, do the following.

1. Shut down the machine; see the Shutdown Checklist.
2. Remove the **mixing tube** from the **nozzle**, see *400715 MAXJET 5i Installation and Maintenance*.
3. Turn the **mixing tube** [1] upside down, insert it into the **nozzle body**, then tighten.

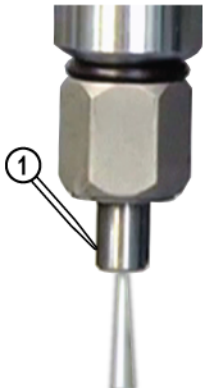


Figure 103

4. Start the **machine**; see the Startup Checklist.
5. Select **Pump Only (Jet is off, Main Pump is active)**, then select **High**.

6. Select **Start Test** and repeat the **Water Only** test to try and dislodge the clogged material.

⚠WARNING

The cutting head is about to turn ON. To prevent serious injury, make sure the nozzle is in the correct position, and everyone is clear of the cutting area.

NOTE

The test automatically stops after 60 seconds.

If the clog remains, replace the mixing tube.

TROUBLESHOOTING

This section provides information for troubleshooting issues that may occur during operation. Possible causes for each condition are provided with the most likely causes listed first. If the problem continues after following these procedures, contact OMAX Technical Support.

NOTICE

All maintenance activities must be performed by qualified personnel to prevent damage to the machine.

Issues

The following lists most problems encountered during operation. Possible causes for each condition are provided with the most likely causes listed first. If the problem continues with the system after following these procedures, contact OMAX Customer Service.

See the Solutions section to match the corrective action number listed below with the steps suggested to correct an issue.

Conditions and Possible Causes	Corrective Actions
High-pressure Pump Fails to Start or "Pump fault" on Keypad	
Charge pump not ON.	39
Insufficient water pressure or flow **to** the charge pump.	42
Water pressure **from** the charge pump too low.	43
E-stop is pushed.	2
Abrasive Waterjet Nozzle Does Not Move	
Soft limit(s) reached.	1, 5
Nozzle collided with cutting material and stalled.	3, 27
E-Stop is pushed.	2
Pause activated.	23
The machine detected a fault.	28
Loose wire, connection, or cable.	29
Motors stalled.	30
Machine stops running, no message(s) displayed, and cannot close MAKE. Severe noise or noise spike on USB cable caused a device driver to lock.	30, 31
Mechanical issues.	45
Incorrect speed, acceleration, or jerk setting.	46

Conditions and Possible Causes	Corrective Actions
Fault Message on Controller	
E-stop is activated, nozzle collided with an object, or machine detected a fault.	3, 27, 28
Parts are Too Short, or Flat Spots Appear on Curves	
Cutting material not securely fixtured.	4
Hardware limits reached.	4, 5
Poor Surface Finish	
Values defined in MAKE, Pump and Nozzle settings do not match values obtained during operation tests.	6
Stand-off distance too close to the material surface. The nozzle is plugged by material before cutting starts, and water is forced up abrasive tube.	14
Jet stream too wide.	15, 8, 9, 36, 47
Abrasive other than the recommended garnet is used.	7
Abrasive Index value not changed to compensate for its lesser cutting ability.	7
Worn mixing tube and unable to form a good jet stream.	9
Jewel orifice chipped, dirty, out-of-tolerance, or misaligned.	8
Abrasive flow stopped or reduced by dirty or wet abrasive, or worn abrasive tube collapses or leaks air.	10
Poor fixturing of cutting material.	4
High-pressure pump is not delivering pressure specified in pump and nozzle settings.	16
Holes are Too Large and Parts Undersized	
Tool offset is incorrect.	11, 14
Tool offset is on wrong side of path.	12
Excessive Taper on Part Edge	
Cut quality set too low.	13
Stand-off distance too close to the material surface.	14
Setup values in MAKE are not consistent with equipment performance.	6
Abrasive other than the recommended garnet is used.	7
Abrasive Index value not changed to compensate for its lesser cutting ability.	7
Worn mixing tube and unable to form a good jet stream.	9
Jewel orifice chipped, dirty, out-of-tolerance, or misaligned.	8

Conditions and Possible Causes	Corrective Actions
Holes are Not Round	
Cutting material not securely fixtured.	4
Elliptical jet stream (not round) due to mixing tube wear or imperfect orifice.	8, 15
Abrasive Waterjet Not Piercing Material	
Setup values in MAKE are not consistent with equipment performance.	6
Abrasive other than the recommended garnet is used.	7
Stand-off distance too close to the material surface. Nozzle is plugged by material before cutting starts, and water is forced up abrasive tube.	10, 14
Abrasive flow stopped or reduced by dirty or wet abrasive, or worn abrasive tube collapses or leaks air.	10
Abrasive valve stopped working.	47
Worn mixing tube and unable to form a good jet stream.	9
High-pressure pump is not delivering pressure specified in pump and nozzle settings.	16
Abrasive Waterjet Quit Cutting	
Abrasive flow stopped or reduced by dirty or wet abrasive, or worn abrasive tube collapses or leaks air.	10
Clogged mixing tube.	17
Jewel orifice clogged with debris.	18
Abrasive valve stopped working.	47
Pause activated.	23
High-pressure pump is not delivering pressure specified in pump and nozzle settings.	16
Accuracy Errors	
Cutting material not securely fixtured.	4
Nozzle body not tightened to specification.	24
Nozzle assembly not perpendicular to the material.	48
Cutting material has internal stresses.	32
Temperature caused material expansion. Material stored at a different temperature than tank water may thermally expand and change size during or after cutting.	33
Poor quality cutting material.	49
Nozzle collided with cutting material.	3, 34
Slat be may be uneven/not level.	51
Worn mixing tube (out-of-round). Uneven wear on mixing tube can result in a square box cut as a rectangle or similar errors of up to approximately 0.010 in. (0.25 mm).	19, 35

Conditions and Possible Causes	Corrective Actions
Keyboard or Mouse Does Not Work	
Loose PC wires, cable, or connections.	19
No mouse movement.	19
Keyboard not responding.	19
Blue Screen Errors	
Loose USB cable. If USB cable is unplugged while MAKE is running, monitor displays a blue-screen.	20
Corrupt device driver.	21
Low air pressure.	22
Water Flows Up Abrasive Tube	
Nozzle body not tightened to specification.	24
On/off valve leaks.	37
Clogged mixing tube.	17
Stand-off distance too close to the material surface. Nozzle is plugged by material before cutting starts, and water is forced up abrasive tube.	14
High-pressure pump is not delivering pressure specified in pump and nozzle settings.	16
Charge pump not ON.	39
Sticky on/off valve affects timing.	44
Inlet body or valve body is damaged.	36
Jet Stream Looks Wide and Fuzzy	
Jewel orifice chipped, dirty, out-of-tolerance, or misaligned.	8
Worn mixing tube and unable to form a good jet stream.	9
No Abrasive Flow from Hopper	
Abrasive flow stopped or reduced by dirty or wet abrasive, or worn abrasive tube collapses or leaks air.	10
Stand-off distance too close to the material surface. Nozzle is plugged by material before cutting starts, and water is forced up abrasive tube.	10, 14
Insufficient shop air pressure to open abrasive valve.	22
Abrasive valve stopped working.	47
No Abrasive Flowing from Abrasive Tube	
Abrasive flow stopped or reduced by dirty or wet abrasive, or worn abrasive tube collapses or leaks air.	10
Stand-off distance too close to the material surface. Nozzle is plugged by material before cutting starts, and water is forced up abrasive tube.	10, 14

Conditions and Possible Causes	Corrective Actions
Insufficient shop air pressure to open abrasive valve.	22
Warped Material.	32
Clogged mixing tube.	17
On/off valve leaks.	37
Water Comes Out Abrasive Feed Tube Top	
Abrasive flow stopped or reduced by dirty or wet abrasive, or worn abrasive tube collapses or leaks air.	10
Stand-off distance too close to the material surface. Nozzle is plugged by material before cutting starts, and water is forced up abrasive tube.	10, 14
Jewel orifice clogged with debris.	18
Water Sprays Out Tank	
Piercing at an angle with tilting cutting head.	50
Part path positioned on top of a slat, causing jet stream to reflect upwards.	25, 40, 50
Abrasive Piles Up On Work Piece	
Excessive abrasive accumulation at tank bottom.	26
Fault Message	
Low air pressure.	22
Motor circuit fault.	27, 28
Pause activated.	23, 28
Access Control Circuit triggered.	38, 28
Home Position or Soft Limits are Lost	
Hardware limits reached.	5
Loose wire, connection, or cable.	29
Charge Pump Motor Does Not Start or Stops During Operation	
Charge pump motor senses an overload condition and trips reset circuit.	41
On/off Does Not Cycle Between Nozzle On/off and Pump Dump On/off Valve	
Air actuator is not working.	44

Solutions

Refer to Issues for a list of problems encountered.

Corrective Action	Description
1	Reset the soft limits if they are: • too restrictive, • or if they need to be changed to another position.
2	• Reset the E-stop, see Restart After an Emergency Stop. • Restart the machine, see Startup Checklist.
3	• Make sure the material is positioned and fixtured correctly. • Remove obstacles from the nozzle path. • Push or turn the reset switch. • Power cycle the machine.
4	• Material moved during cutting due to nozzle drag or upwelling water from below. Material movement is the most common reason for scrapped parts. Make sure the material is securely fixtured; improperly secured material vibrates, causing a rough edge on the cut part. • Secure material in X, Y, and Z directions, even if the material is heavy. • Never secure material directly to slats. Slats can move or vibrate. • Never fixture directly to slats, slats can move during cutting.
5	• Relocate work piece and path to within the table cutting area. • Set soft limits to warn before hardware limits are reached. • Auto Homing should recover all machine positioning, including soft limits.
6	Check Material Type and Thickness values are correct in MAKE. Make sure the values entered for Pump and Nozzle Configuration are correct and match actual machine performance: • Water pressure (Pressure at Pump in High Pressure/Lower Pressure Mode) • Abrasive Index • Jewel (orifice) diameter • Mixing tube diameter • Abrasive flow rate (Measured Abrasive Flow Rate) • Abrasive Size
7	Make sure the following settings for abrasive are correct in the Pump and Nozzle Configuration: • Abrasive Size • Abrasive flow rate (Measured Abrasive Flow Rate) • Abrasive Index Many abrasives do not cut as well as garnet, reduce the Abrasive Index when using other abrasives. It may be necessary to experiment to determine the best settings. OMAX recommends garnet as the abrasive because it provides good cutting rates with relatively low mixing tube wear.
8	Clean or replace the integrated diamond nozzle body.
9	• If not using a MAXJET 5i, replace the jewel orifice assembly in the nozzle.

Corrective Action	Description
	If that does not correct the problem, then check the mixing tube and replace it if needed. • Mixing tube wear occurs first at the inlet; then, a conical wear zone grows toward the exit end of the mixing tube. Check the tube bore at both ends using a drill or gauge pin when the outlet has increased in size by 0.005 in. (0.13 mm), the mixing tube is near the end of its useful life.
10	• Disassemble clogged items, blow them clean and dry, with an air hose. • Replace nozzle abrasive tube if showing any signs of wear.
11	• If not enough material removed (hole too small or part too large), decrease the tool offset by half the dimensional error observed. • If too much material removed, increase the offset by half the dimensional error. • Measure parts after cut to monitor the wear of the mixing tube, periodically update the tool offset to achieve more precise cutting. See the kerf check part drawings included with the software.
12	• Switch the lead in and lead out, then use the Post command in LAYOUT to recreate the part. • Check the tool offset using Preview in MAKE.
13	Quality setting 1 barely pierces material and has significant taper. Both taper and surface finish should improve as the quality value is raised (takes longer to make the part).
14	For best results, use the following nozzle standoff. • Motorized-Z: 0.040–0.050 in. (1.0–1.3 mm) • A-Jet: 0.080 in. (2 mm)
15	Raise the nozzle approximately 1.5 in. (3.8 cm) and initiate a high-pressure, water-only test. Make sure that the jet stream is narrow and sharp. If the jet stream is wide, replace the orifice jewel assembly, the nozzle filter, and examine the mixing tube. If the mixing tube's outlet hole shows elliptical wear or the diameter has grown approximately 0.005 in. (0.127 mm), replace the mixing tube.
16	Measure pump pressure, adjust as needed. Make sure the pump and nozzle settings match the measured pump pressure.
17	Use MAKE to turn the water ON, then OFF to clear the clog. If this does not work, disassemble the nozzle and clean the mixing tube or replace it if necessary.
18	• Remove the nozzle and nozzle filter, then flush the lines. • Replace the nozzle filter. • Replace the integrated diamond nozzle assembly.
19	• Make sure the keyboard/mouse cable connectors are firmly connected to the applicable port. • Unplug the cable, examine the USB connector for bent or damaged pins. • Make sure the mouse optical sensor is clean. • Restart the PC. • Replace with a known good keyboard/mouse.
20	Make sure the USB cables are inserted firmly. Restart the PC.
21	Reinstall Intelli-MAX software. Fully power down the PC, wait 10 or more seconds, then power up the PC for all driver related changes to refresh.
22	Make sure the system air pressure is 75–120 psi. Adjust as needed.

Corrective Action	Description
23	Deactivate Pause.
24	Make sure the nozzle body is tightened to specification.
25	Contain the spray with a nozzle splash guard.
26	Remove the slats and clean the tank.
27	• Reset the E-stop. Press the Reset button. The fault message should clear. • If the fault was caused by a nozzle collision or other machine fault, clear the fault, press the Reset button to clear the fault. If the cause for the fault condition cannot be identified, contact OMAX Technical Support.
28	**NOTICE** *Identify the cause of the fault before attempting a fault override. Continuing to operate the system using a fault override may cause damage.* Several fault switches monitor machine operation. When a fault is triggered, the abrasive waterjet immediately stops operation; machining stops, and the nozzle cannot be moved. When a restart is attempted, a fault error message appears. To recover from a fault, correct the cause that triggered the fault, then press the Override on the operator control panel. Contact OMAX Technical Support if the cause for the fault condition cannot be identified.
29	• Shutdown system. • Turn OFF primary power, Lockout/Tagout. • Make sure the connectors, wires, and/or cables are firmly seated. • Turn ON primary power. • Startup the system and make sure the issue(s) are resolved.
30	Cycle power to the machine, auto home the machine, then continue operation.
31	Restart the PC.
32	• Material stresses can cause huge part errors. As the part is machined, these stresses can cause the material to move and stress-relieve. • Use Terrain Follower.
33	Let material acclimate to the cutting environment before cutting.
34	• Avoid traversing over previously cut features. • Watch for parts or slugs that tip or float.
35	Replace the mixing tube.
36	Examine inlet and valve bodies for damage/cracks; replace it if damaged.
37	See *400475 Rebuilding the Dual On/off Valve*.
38	Reactivate the Access Control Circuit. See *401436 Operation, Access Control Circuit, OMAX, MAXIEM, GlobalMAX*.
39	• Turn ON the charge pump. • Make sure the pump power is ON.

Corrective Action	Description
40	Use a splash shield system/enclosure to contain the spray.
41	• Turn OFF the charge pump. • Press the charge pump motor reset button. **NOTE** *If the charge pump motor is overheated, wait five minutes or more to let the charge pump motor to cool down.*
42	Check water supply source and make sure there is adequate flow and pressure.
43	If the pressure difference between the prefilter (incoming) and final filter (outgoing) water pressure gauges is more than 20 psi, replace the filter elements. The pump does not run when the water pressure drops below 80-100 psi. Check the water pressure gauges: • If the downstream (prefilter) gauge exceeds 80-100 psi, the pressure gauge may be defective and requires replacement. • If the upstream (final filter) gauge does not exceed 80-100 psi, the charge pump may be partially plugged or defective and requires replacement.
44	Replace applicable on/off valve air actuator.
45	Identify the cause for the mechanical issue and repair/remedy as needed before continuing operation. Contact OMAX Technical Support if the cause cannot be identified.
46	Make sure the speed, acceleration and jerk settings in MAKE are correct; see the software Help Files.
47	Repair or replace abrasive valve.
48	Perform precision calibration if using a tilting cutting head.
49	Use high-quality material with controlled tolerances. Using out-of-tolerance or poor quality material results in inaccurate parts.
50	Pierce perpendicular to cutting material when possible.
51	Level the slat bed/change slats if needed.

Correct Water Leaks in the Nozzle Assembly

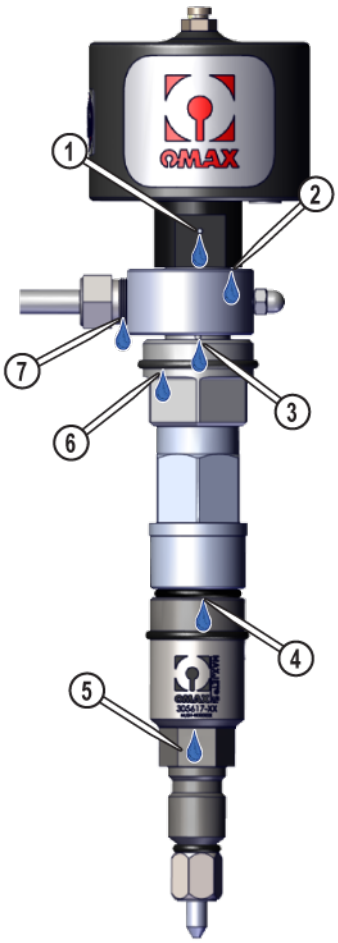


Figure 104

Leak Point	Leak Point Description	Suspected Cause	Recommended Action
1	Air actuator weep hole	Leaky seal	Make sure the air actuator is torqued at 21 ft-lb (28.5 N·m); replace seal
2	Between air actuator and fitting ring	Leaky seal	Replace seal
3	Between fitting ring and valve gland nut	Cracked body; loose nut	Replace defective component; tighten nut
4	Between nozzle body and inlet body	Cracked inlet or nozzle body; leaky O-ring	Replace defective component
5	Nozzle body weep hole	Chipped jewel, cracked body, leaky seal	Replace defective component
6	Valve body	Cracked inlet or valve body; loose nut	Replace defective component; tighten nut

Leak Point	Leak Point Description	Suspected Cause	Recommended Action
7	Between fitting ring and gland nut	Cracked body, bad UHP tubing, loose gland nut	Replace defective component; make sure the gland nut is torqued at specification

CUSTOMER SUPPORT

For service and support, go to omax.com.