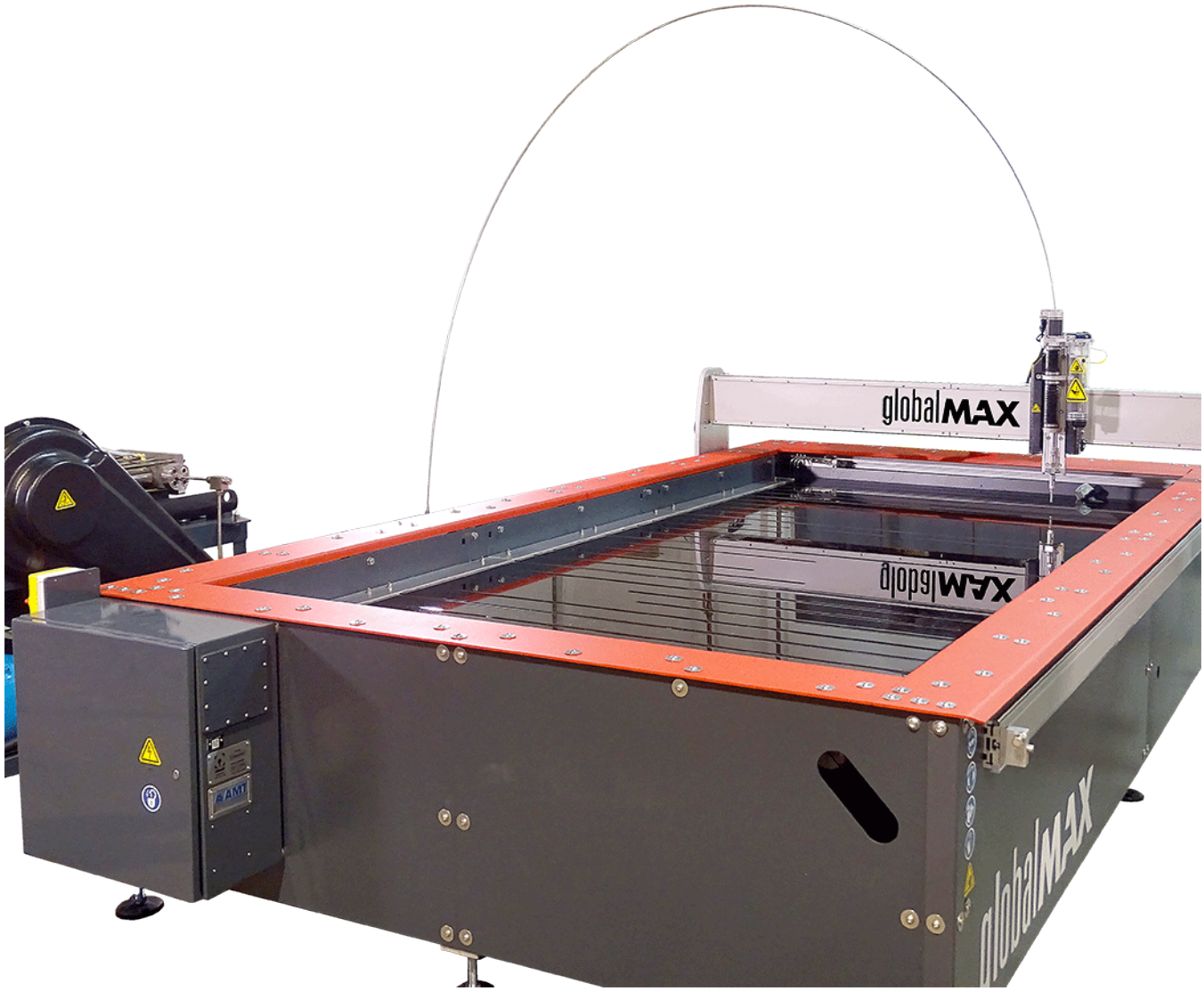
GlobalMAX® Abrasive Waterjet

Operation Guide



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401435B-EN

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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 2018

Contents

Safety

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 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.

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.

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!

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. Never operate the OMAX while handling material in the tank. Always stop the abrasive jet before making any adjustments to the material or the abrasive jet. With time, support slats will also be cut by the abrasive jet. The edges of these support slats can get quite sharp. Always be careful when handling material in the tank. Fingers can be caught between a heavy part and the support slats.

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.

Keep fingers and hands away from moving parts!
Fingers and hands can be crushed and cut by a moving parts hazard whenever the table is powered. Keep hands and fingers out of the path of moving parts. Never reach into moving machinery.

Lockout 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.

Wear ear protection
Always wear hearing protection while in the vicinity of the equipment. When cutting in air, noise levels can exceed 120 dB.

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.

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.

Wear mask
Wear appropriate breathing mask. Be aware of dust hazards associated with all types of materials. Dust created while operating can cause cancer or other long-term respiratory damage.

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.

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

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

Stay clear!
Never operate the equipment with protective guards or covers removed or rendered inoperative.

Read manual first!/Do not adjust
Never make adjustments to equipment prior to reading the manual. Special instructions may be required.

Safety Precautions

The following safety instructions must be followed when installing, operating, or maintaining the equipment. If ignored, physical injury or death may follow, or damage may occur to the equipment. Always observe applicable safety precautions when working with this equipment.

Do not make modifications

- Never make unauthorized alterations to the equipment or components
- Modification to the equipment may pose risk of physical injury to the operator and/or others and may cause damage to the equipment or other property. Modifications to the equipment will invalidate the warranty.
- Do not modify, defeat, or bypass any equipment safety features.

Never operate equipment without safety guards or covers

- Do not modify, bypass, defeat, or render safety guards, covers, or switches inoperable.
- Never remove any safety cover or guard while the equipment is running.
- Know the location of the ON/OFF and E-stop switch.
- Know how to disconnect the main power supply to the equipment.

Never place hands in vicinity of 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!
- See the WaterJet Technology Association (WJTA) warning card for important medical alert information.
- The abrasive waterjet head can crush hands or fingers. Keep hands away from the area between the head and the slats on the machining table.

Use care when handling material in the tank

- Never operate the equipment while handling material in the tank.
- Always stop the abrasive waterjet before making any adjustments to the material or the abrasive jet.
- Always be careful when handling material in the tank. Fingers can be caught between a heavy part and the support slats.
- Use caution around the support slats. Support slats are also cut by the abrasive waterjet; the edges can become very sharp and cause cuts, or collapse.

Do not touch live electrical components or parts

- Always use a licensed electrician for installing the main power source.
- Inspect the equipment power and control cables regularly. Replace any damaged cable or bare wire. Exposed and bare wires can kill!
- Ensure the equipment is properly grounded in accordance with national, state, and local codes. If equipped with a three prong plug, never remove the third prong.
- Always plug three-prong plugs into a three-hole electrical receptacle. If using a two-prong adapter, the adapter must connect to a good, known ground.
- Always disconnect the equipment from the main power before performing maintenance.

Noise emission precautions

The relationship between noise levels and exposure time is not accurate enough to provide information needed to determine hearing precautions. Other environmental factors, such as room or building construction, machines and/or power tools, and other noise sources, affect the environments true noise level. Therefore, it is recommended the operator wear hearing protection during the operation of the equipment.

Treat all injuries with caution!

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 water source. 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 attended to immediately.

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

Implement standard 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 equipment in an explosive atmosphere

Machining certain types of material such as titanium with a waterjet will produce sparks. Do not operate the equipment in an explosive atmosphere. Do not allow explosive or flammable vapors to accumulate in the area of the equipment.

Waste material disposal

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 of aluminum dust in the tank react with the water to generate flammable hydrogen gases. Normally, hydrogen bubbles to the surface and escapes into the shop in harmless, low concentrations. However, thick layers of aluminum and garnet in the catcher tank can trap pockets of hydrogen gas. Periodically check on equipment operation during lengthy continuous use (e.g., checking for smooth operation during a long job). Always, take care that no ignition source (e.g., open flame, electrostatic discharge) is nearby when operating any feature on the abrasive waterjet system.

⚠WARNING

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.

⚠WARNING

Powder created from cutting aluminum will react with water and create flammable hydrogen bubbles. The aluminum powder will collect at the bottom of the tank along with the garnet. Large pockets of hydrogen gas can form and be trapped in the catcher tank if excessive amounts of aluminum and garnet are allowed to accumulate. When machining large amounts of aluminum it is a good idea to regularly remove powder from the bottom of the tank. Do not allow smoking or other sources of ignition near the machine. It is especially important to clean aluminum powder from the tank before cutting materials that spark such as titanium.

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 (E-stop) switches. The E-stop is engaged by pushing it in. Once engaged, 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.

Safety Legend

The following safety signal-word panels and paragraph notifications may appear throughout this guide. 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 of Abrasive Waterjets

The following information represents airborne noise emission sound pressure levels in dBA produced by the abrasive waterjet system while in operation with the nozzle splash guard on. The average ambient noise level with no cutting is 44 dBA. The arrows represent 1 m (3.28 ft) horizontal distance and 1.6 m (5.25 ft) vertical distance from floor (see 401499 Sound Pressure Level Noise Rating, GlobalMAX 1530).

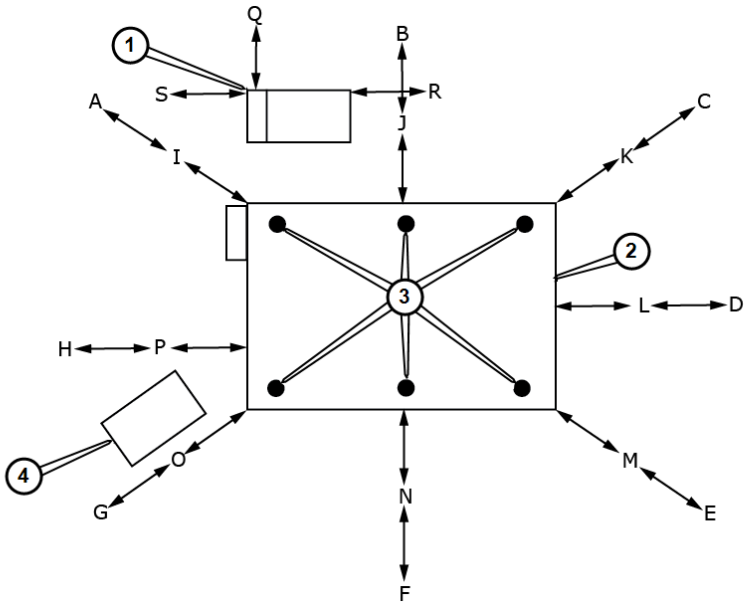

Figure 1

[1] Pump [3] Cutting points

[2] Table [4] Operator Station

1 Meter		2 Meter	
Location	dBA	Location	dBA
I	83	A	84
J	88	B	81
K	81	C	88
L	86	D	78
M	92	E	87
N	84	F	77
O	92	G	85
P	82	H	86
Q	81		
R	76		
S	81		

Required Tools

Icon	Tool	Size(s)
	Scale	0 - 10 lb (4.54 kg)
	Stand-off gauge P/N 315675	
	Allen wrench	5 mm, 6 mm

Chapter 1: Introduction

Abrasive Waterjet Components

Refer to the OMAX web site www.omax.com for machine sizes and specifications.

Figure 2

[1] 20- and 30-hp pump
[2] Operator workstation
[3] Y-axis bridge
[4] Z-axis assembly and abrasive hopper
[5] Catcher tank

Cutting Table

Motion System and Tank

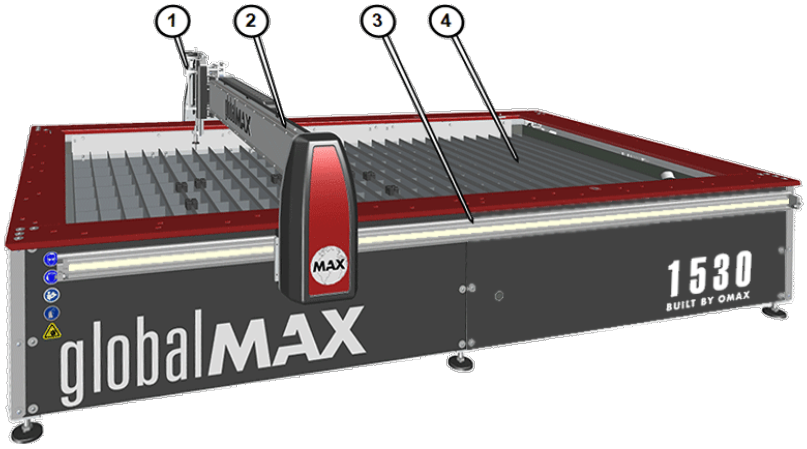

Figure 3

[1] Z-axis assembly
[2] Y-axis bridge
[3] X-axis drive rail and belt
[4] Slat grate

Abrasive Delivery and Motorized Z-axis

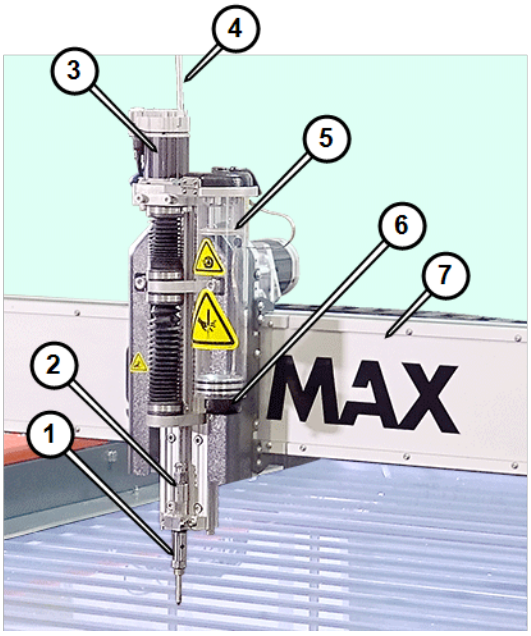

Figure 4

[1] Nozzle assembly
[2] Inlet body assembly
[3] Z-axis motor
[4] High-pressure water line
[5] Abrasive hopper
[6] Abrasive feed block
[7] Y-axis bridge

Operator Workstation

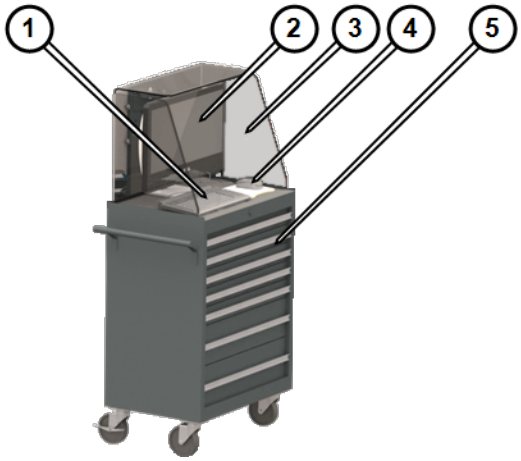

Figure 5

[1] Keyboard
[2] All-In-One PC
[3] Splash guard
[4] Mouse
[5] Toolbox

Controller Power Switch

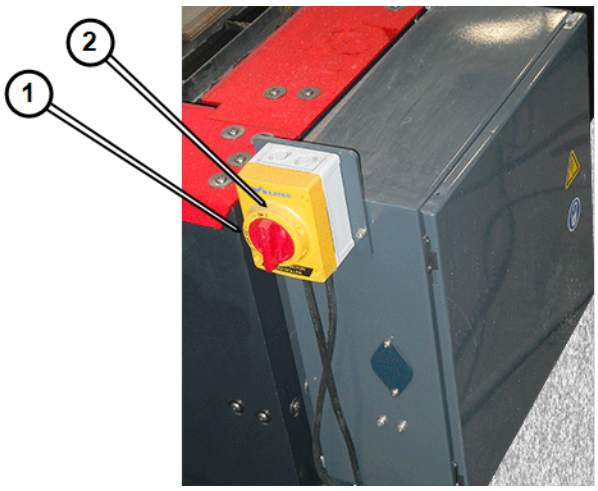

Figure 6

[1] OFF [2] ON

Pendant Controller

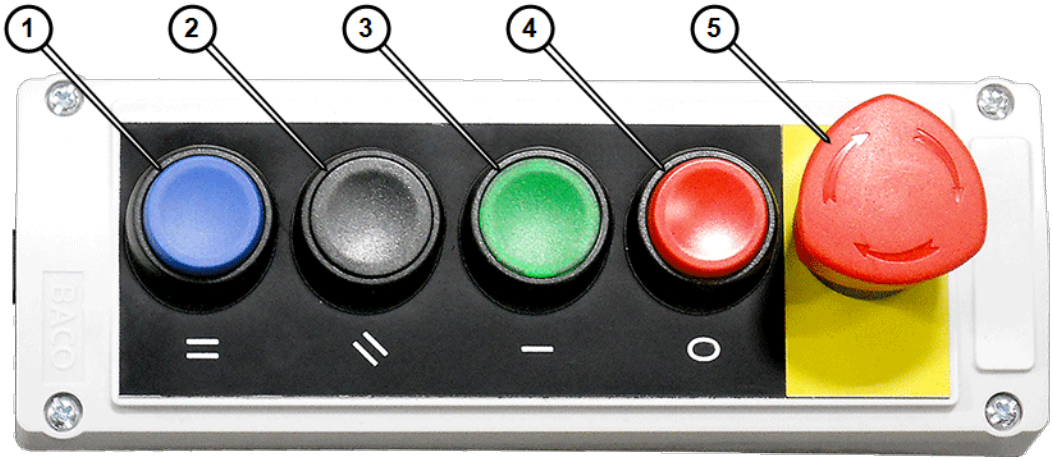

Figure 7

[1] Pause [3] Power ON [5] E-stop

[2] Reset [4] Power OFF

Pumps

See 401427 Operation, GlobalMAXPump.

Intelli-MAX® Global Software

Comprehensive software solutions LAYOUT and MAKE are included with the GlobalMAX Abrasive Waterjet to make quick work of turning a design into reality.

LAYOUT

LAYOUT includes a full range of drawing and editing tools. Files from other CAD programs can be imported into LAYOUT. LAYOUT creates an OMAX Routed Data file (ORD/OMX) that includes the machine cutting path and routing instructions for use in MAKE.

MAKE

MAKE controls the cutting process. It calculates the speed of the abrasive waterjet for optimum results and controls all machining operations. MAKE also calculates how much time and abrasive will be required to machine the part, and allows you to review the exact path of the nozzle, even when not connected to the abrasive waterjet.

Intelli-MAX Global Help Files

Help files documenting features of LAYOUT and MAKE are included with the Intelli-MAX Global.

To access the Help files:

1. Click **Help** when using a command.

NOTE: *Many LAYOUT and MAKE commands provide context sensitive help that opens the help file to the specific topic describing that command.*

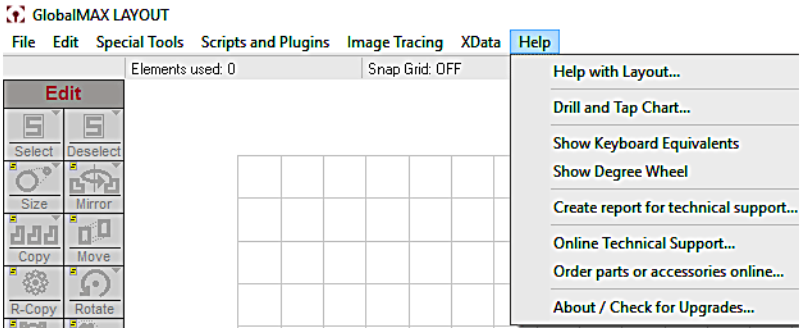

Figure 8

2. Press **F1** while in either **LAYOUT** or **MAKE**.
3. On the **Help** menu, click **Help with LAYOUT** or **MAKE**.

Chapter 2: Abrasive Waterjet Operation

An abrasive waterjet uses water pressurized to more than 40,000 pounds per square inch (psi). This high-pressure water enters at the top of the cutting nozzle and is forced through an orifice assembly containing a round jewel with a small hole in it. This fast moving stream moves into a larger chamber where the speed of the water creates a suction that draws in the flow of abrasive. This water stream plus abrasive moves into the mixing tube. The mixing tube has a small hole through the center that contains the water and abrasive as they mix. The water and abrasive are combined into a high-speed slurry at the bottom of the mixing tube. This slurry becomes the cutting tool as the tube focuses the jet stream at high velocity out of the bottom of the tube and into the material being machined.

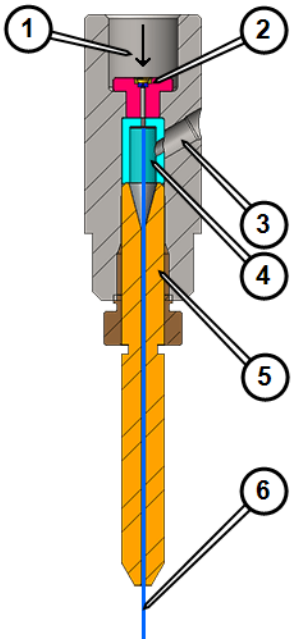

Figure 9

[1] High-pressure water flow [3] Abrasive tube inlet [5] Mixing tube

[2] Orifice assembly [4] Mixing chamber [6] Jet stream

Draw a Part

LAYOUT creates part geometry using lines, arcs, and shapes such as for rectangles and circles. Once drawn, a cutting speed (quality) is assigned 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.

To draw a part in LAYOUT follow these steps:

1. In Windows, click **Start**, click **Programs**, click **Intelli-MAX Global LAYOUT and MAKE**, and then click **Intelli-MAX Global LAYOUT**.
2. Draw the part using the **Draw** and **Edit** tools.
3. Click **Quality** on the toolbar and assign a cut quality to your drawing.
4. On the **Special** toolbar, click **Clean** to clean up the drawing.
5. On the **Draw** toolbar, add lead ins, lead outs, and traverses to the drawing.

NOTE: *The following list describes several critical LAYOUT parameters and requirements:*

- Lead ins are typically drawn longer; lead outs are drawn shorter.
- The side of the entity where you placed the lead in/out determines whether the nozzle pierces on the left or right side of the entity.
- The nozzle travels in the direction of the least sharp turn (the widest angle) on the lead in.
- Always verify the lead in and lead out configurations in LAYOUT.
- Use a 90° 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.

6. On the **File** menu, click **Save As** and type a name for the file.
7. On the **Special** toolbar, click **Path** to convert the drawing file to a machine tool path.
8. Click **Check for Problems** and resolve any problems found.
9. Save the machine tool path as an ORD/OMX file.

Determine Quality

Each entity in a drawing is assigned a quality value which controls how quickly the cutting nozzle moves when it cuts the piece. The slower the cutting nozzle moves, the higher the quality of a cut.

The figure below shows how the surface finish changes with the quality assigned. As the quality number goes lower, the cutting speed becomes faster, and the cut surface becomes less smooth.

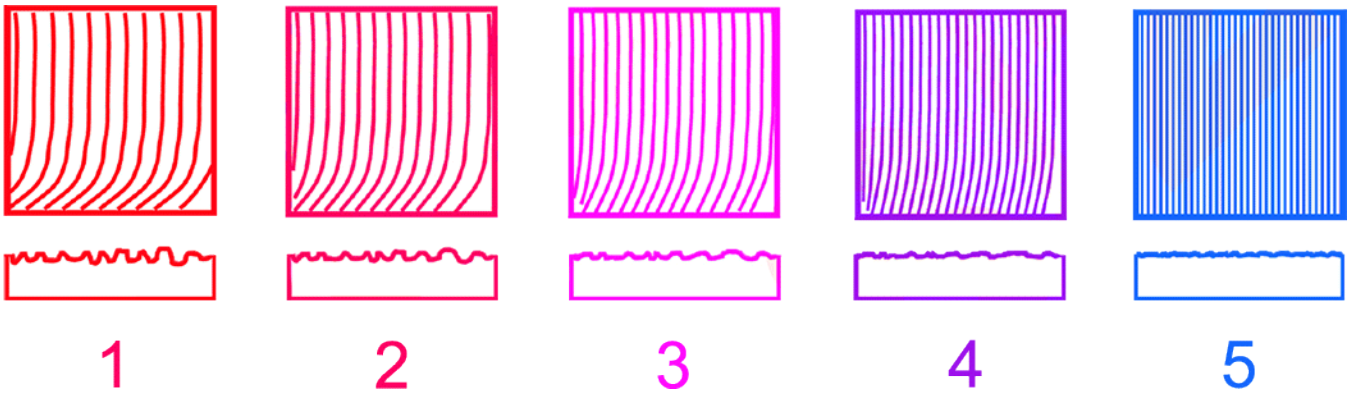

Figure 10

Make the Part

Once the tool path is defined and the ORD/OMX file created, MAKE controls movement of the abrasive waterjet and the cutting of the part. Before beginning the machining operation, you can preview how the part will be cut, how long it will take to make the part, and the amount of abrasive required.

Configure Intelli-MAX Global Make

If the drawing was developed using a PC other than the abrasive waterjet workstation, you must move it to the workstation by either copying it onto a USB drive and inserting in into one of the USB ports on the workstation, or moving it across your network to the controller.

1. On the desktop, click the **MAKE** shortcut.
2. Click **Change Path Setup** and follow the path to where the drawing file is stored. Click the **ORD** or **OMX** file to open the tool path.
3. Click **Change Path Setup**, and under **Enter your Material Setup here**, select the **Material** from the drop-down list.

Figure 11

Clamp and Position Materials

⚠CAUTION

Slat grates have sharp edges. Heavy materials can pinch hands or fingers between the material and grates causing scratches or cuts. Be careful when handling material on the cutting table.

Large clamping forces are not ordinarily needed to secure material to the cutting table, but the material must not be allowed to move as it is being machined. A primary cause for out-of-tolerance parts is the material moves while being cut. A small downward force, about one pound (4 N·m), is exerted on the material from the jet stream; however, a much larger upward force is exerted from all the air forced down with the jet stream. Once released, this air pushes upwards against the material. The best way to secure material is to clamp it against the grate or tank wall.

NOTE: *Use tabs on the material, or a sacrificial material cutting platform to hold small parts, preventing them from slipping past the slats and down into the catcher tank.*

Ensure Clean and Quiet Machining

Always place a splash guard on the nozzle when machining to reduce cutting noise and splash and to protect the Z-axis assembly components.

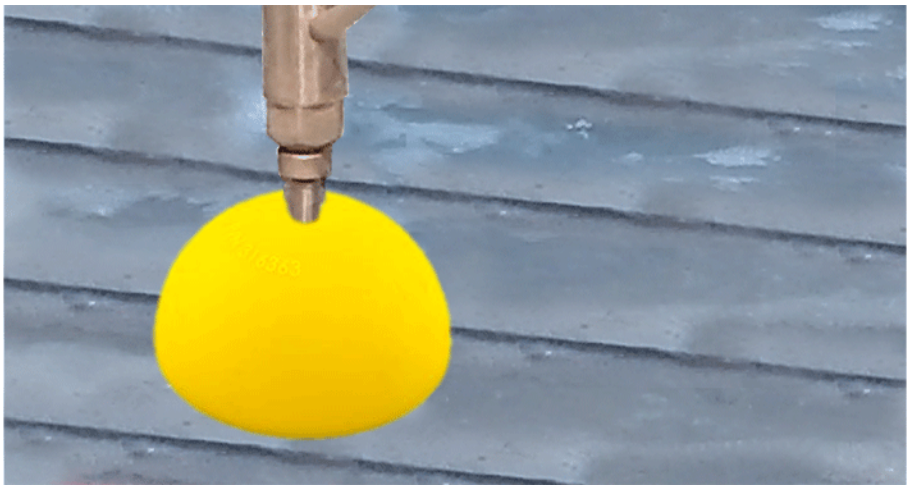

Figure 12

If too much abrasive accumulates on a part while machining, wash away the deposits with a hose while the jet stream continues the cut.

Chapter 3: Startup Equipment

When starting the equipment, follow these steps to ensure that all equipment startup tasks are completed in the required sequence. Each step is explained after the Startup Checklist.

Startup Checklist

1.	Turn power **ON** main breaker box
2.	Open air supply valve (if applicable)
3.	Open water supply valve
4.	Open **input water ON/OFF valve**
5.	Turn **charge pump** power **ON**
6.	Open the **flush ON/OFF valve** to flush out warm water
7.	Allow water to run for 15 minutes or until water temperature is 70°F (21.1° C) or less prior to operating the pump at high pressure
8.	Verify **E-stop** on **pump** is not activated
9.	Verify **E-stop** on table **pendant controller** is not activated
10.	Turn **ON controller power switch**
11.	Turn **ON high-pressure pump**
12.	Close **flush ON/Off valve** when warm water has been flushed
13.	Press green power **ON** switch on the **controller pendant** to power up motors
14.	Turn **ON** the **PC**
15.	Verify cooling water flow from the **cooling return lines**
16.	Verify/adjust **tank drain** height
17.	Start MAKE
18.	Auto home to set absolute home position
19.	Verify/enable soft limits
20.	Verify correct **nozzle orifice** and **mixing tube** size
21.	Position **nozzle** between **slats**, 1- 1.5 in. (2.54 - 3.8 cm) maximum above the water level
22.	Remove **abrasive hose** from hopper end and plug end of hose
23.	Perform nozzle water test
24.	Verify jet stream is straight and narrow
25.	Adjust **pump** rpm and record pressure for desired pressure setting

26.	Inspect **high-pressure plumbing** components for leaks
27.	Stop nozzle test
28.	Verify correct abrasive size and type
29.	Remove and weigh **abrasive hopper** (hopper should be at least ½ full). Record weight
30.	Verify condition of **abrasive feed tube**
31.	Re-attach **hopper**, insert **abrasive hose** back into the **hopper abrasive block**, reattach **grounding strap**
32.	Perform water and abrasive test for 1 minute. Click **Test**, **Start**
33.	Confirm increased sound level and stream diameter
34.	Stop water and abrasive test after 1 minute
35.	Remove and weigh **abrasive hopper**. Record weight and calculate the abrasive flow
36.	Re-attach **hopper**, insert **abrasive hose** back into the **hopper abrasive block**, reattach **grounding strap**
37.	Pressurize the **bulk feed hopper** (if applicable)
38.	Verify level of abrasive in **carriage hoppe**r and fill if needed
39.	Update **Pump and Nozzle** settings in MAKE per tests performed
40.	Verify **Pump and Nozzle** setting values match operational data recorded during testing
41.	Verify **Event and Relay Timing** settings are correct for application
42.	Cut kerf check part and adjust tool offset as needed

Start the Abrasive Waterjet

Before powering up this equipment, ensure operators have access to the required protection (safety glasses, ear plugs, and gloves).

1. Turn the main power breaker **ON**.
2. Open the air supply valve (if applicable).
3. Open the water supply valve.

Pump

Refer to the operator guide for the specific high-pressure pump for information on components, controls, and operating instructions.

Software Startup

1. Click the **Intelli-MAX Goblal MAKE** Standard icon on the desktop to open **MAKE**.

Auto Home the Table

There are two types of limits that restrict the area of nozzle movement on a table's cutting surface.

Absolute Home Limits define the physical movement of the X-axis and Y-axis on the machine. These are hardware limits that are set using physical stops installed on the ends of the X and Y-axis rail assemblies (Y=0, X=0 points). Although the cutting head can be commanded to reach these absolute limits, this seldom is done since this frequently is where the cutting head would crash into the side of the table and cause serious equipment damage, especially if the crash is done at full speed.

Soft Limits are defined in software to prevent the cutting head from reaching the table's absolute limits or to avoid hitting other fixtures placed within the cutting area. These limits should be set to create a smaller working area within the available maximum travel area. When a soft limit is reached, a controlled stop is immediately initiated that prevents further cutting head movement. Whenever nozzle movement is commanded that will exceed a defined soft limit, a message warns the operator that set limits will be exceeded. When using the keyboard to move the cutting head manually and a soft limit is reached, the software immediately halts head movement using a controlled slowdown and stop that prevents the nozzle from exceeding a user-defined soft limit.

Auto homing is the process of locating a table's Absolute Home limits. All home positions and soft limits are points relative to Absolute Home. Absolute Home is the only home position that can be lost. Resetting Absolute Home resets all other homes to their correct positions. It is important that Auto Home be run to re-zero Absolute Home at the beginning of each work day and whenever the machine is shut down for maintenance or when restarting the table controller, or when the machine is faulted.

2. To auto home:
    a. Move the **machining head** so that it is 5 - 12 in. (12.7 - 30.5 cm) from the **hard stops**.

NOTE: *The hard stops are located in the lower left corner of the machine (near where the operator would stand when at the controller, unless specified otherwise).*

NOTE: *The Y-bridge must be moved away from the X-rail hard stops prior to beginning the homing routine, or the machine will fault and will not be able to perform the auto homing routine.*

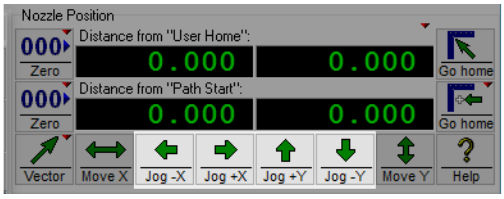

Figure 13

b. In **MAKE**, right-click **Zero** [1], then select **Auto-Home XY...**[2].

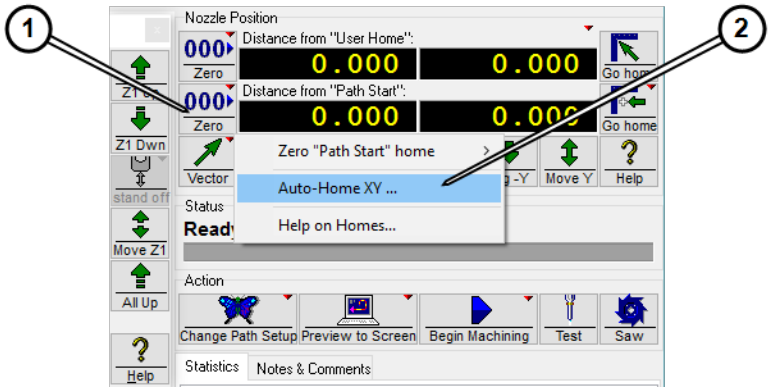

Figure 14

c. In the **Raise the Z-axis by:** text box [1], enter the distance to move the **Z-axis** up so that it clears any obstacles and/or the edge of the machine. If the **Z-axis** does not need to be raised, enter *0* (zero).

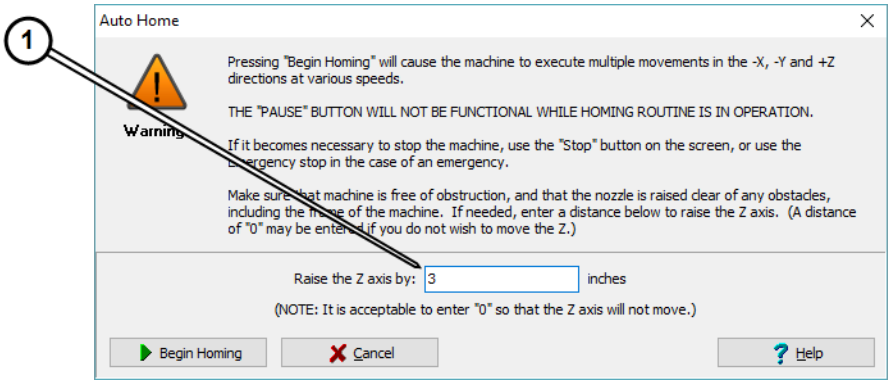

Figure 15

NOTE: *Z-axis accessories may require components be removed or adjusted prior to auto homing. The Begin Homing button is grayed out until a number is entered into raise the Z-axis.*

d. Click **Begin Homing** to start the automatic homing process.

NOTE: *Homing can take over two minutes. Z Height moves to the distance specified, and the Traversing: dialog box appears counting down time remaining to find X home.*

e. When the **X-axis hard stop** is found, click **X** [1].

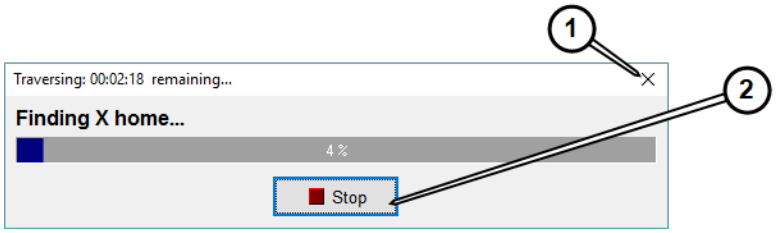

Figure 16

NOTE: *Do Not press Stop [2] (Figure 19). MAKE automatically switches to finding the Y hard stop.*

f. When the **Y-axis hard stop** is found, click **X** [1].

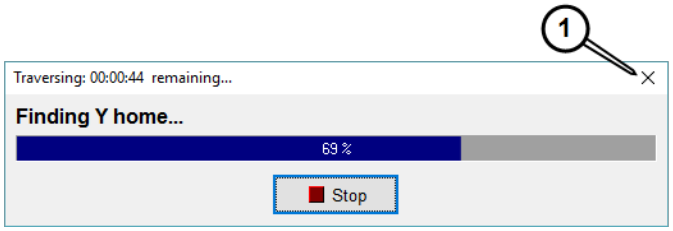

Figure 17

g. Click **OK**.

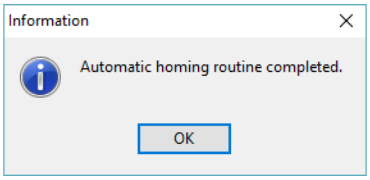

Figure 18

NOTE: *If the X-axis hard stop is not found within the time allowed, MAKE automatically starts searching for the Y-axis hard stop. If the Y axis also times out before finding the hard stop the Automatic home routine completed box appears. However, homing is not actually complete.*

h. If the **hard stop** is not found within the time limit, click **Stop** and jog the **X** and **Y-axes** to with 12 in. (30.5 cm) of the **hard stops**. Restart the homing process.

Soft Limits

1. On the **Setup** menu, point to **Advanced**, then **Soft Limits**, and click **Enable soft Limits** to place a check next to it. If the soft limits have not previously been set, set them before proceeding.

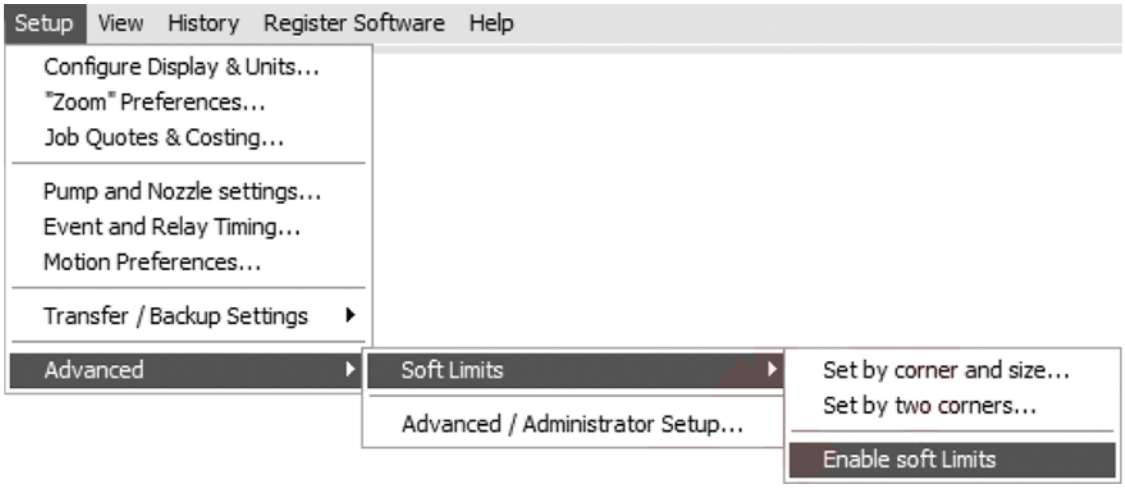

Figure 19

NOTE: *Instructions for setting soft limits are in the software help files.*

Nozzle Assembly

Verify the nozzle orifice, nozzle mixing tube, and hopper abrasive gate are correctly matched to the size of the pump motor being used (see following table).

Pump Motor Size	Nozzle Orifice	Nozzle Mixing Tube	Maximum Pres-sure	Hopper Abrasive Gate
GlobalMAX 20 hp	0.012 in. (0.305 mm)	0.030 in. (0.762 mm)	45,000 psi (3062 bar)	0.5 lb / min (226.8 g)
GlobalMAX 30 hp	0.015 in. (0.381 mm)	0.042 in. (1.067 mm)	45,000 psi (3062 bar)	1 lb / min (453.6g)

See 401458 Installation and Maintenance, GlobalJET Nozzle.

Adjust Tank Drain

The water level in the catcher tank is controlled by the position of the **tank drain** [1]. Raise or lower the tank drain so that the water level is at, or slightly above, the slat grates.

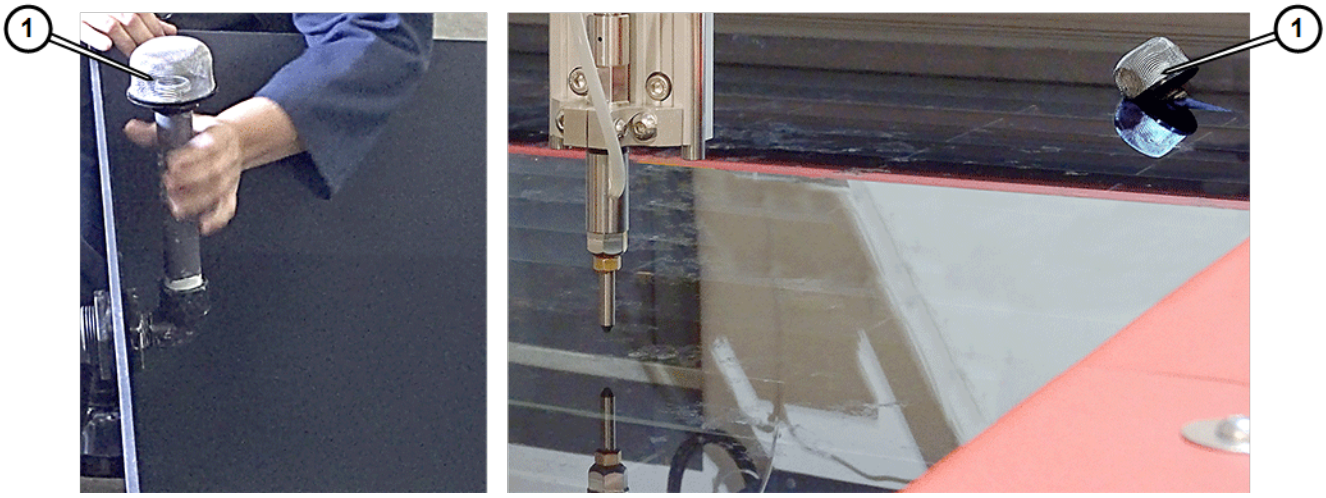

Figure 20

Pump and Nozzle Tests

Gather the following information and enter into the Pump and Nozzle Settings in MAKE. Prior to starting the high-pressure pump, verify everyone is clear of the high-pressure cutting nozzle.

NOTE: *Tests should be performed over the armor plate in the front left corner of the tank to reduce possibility of piercing through the tank. Avoid repeated testing at the exact same location.*

Set the High-Pressure Pump RPM and Pressure

The pump rpm determines cutting pressure and may be adjusted up or down as needed. See*401427 Operation, GlobalMAX Pump*.

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. (3.81 cm). Air entrapment in the jet stream 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 using "Test Nozzle" and cutting thick materials at a high quality setting. Always make sure the tank water level is immediately below the work piece. Placing a plate of scrap material on the tank bottom is a way to provide better catcher tank protection.

Nozzle Test

1. Position the **cutting nozzle** between **grate slats** 1 - 1.5 in. (2.54 - 3.8 cm) above the water level.
2. Remove the hopper end of the **abrasive feed tube** from the **abrasive feed block**.
3. In **MAKE**, click the **Test** button.

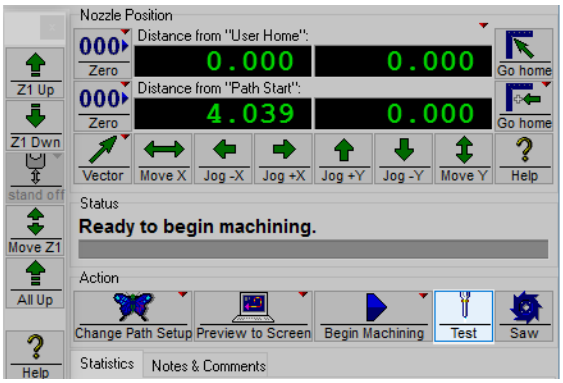

Figure 21

4. Select **Test Cutting Head (Pump, Jet, and Abrasive)** button and click **Next**.

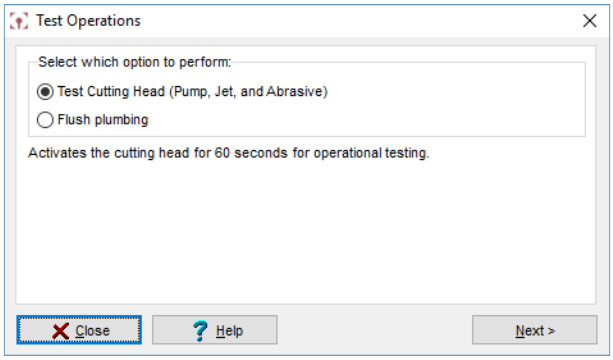

Figure 22

⚠WARNING

The cutting head is about to turn ON. For safety, ensure that the nozzle is positioned correctly and everyone is clear of the cutting area.

5. Click **Start Test** to start the nozzle test.

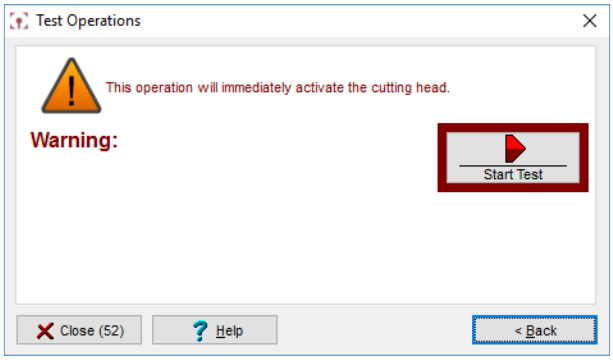

Figure 23

NOTE: *The nozzle test runs automatically for 60 seconds.*

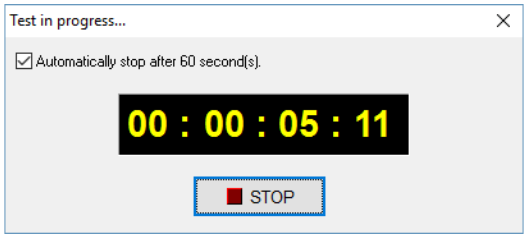

Figure 24

6. When the jet stream starts, pinch the loose end of the **abrasive feed tube** to block air flow, then examine the jet stream quality.

NOTE: *Air from the abrasive feed tube interferes with the jet stream and makes inspection difficult.*

Figure 25

[1] Good quality [2] Poor quality

7. During the jet stream test.

   a. Adjust high-pressure pump rpm to achieve the desired high-pressure by turning the "HP" **high pressure knob** (clockwise increases, counterclockwise decreases) and record the pump rpm and psi values from the pump display.

NOTE: *The high-pressure setting is the value that the pump normally returns to when started. The high-pressure mode can be activated from MAKE.*

   b. Check the **pump'swater pressure gauges** at high rpm.

NOTE: *The difference between the two gauge readings must not exceed 20 psi. If more than 20 psi, the water filters must be replaced immediately. See 401074 Maintenance, Change Pump Water Filter.*

8. In **Test Operations** click **Close**.

NOTE: *The Test Operations dialog box will close automatically after 60 seconds.*

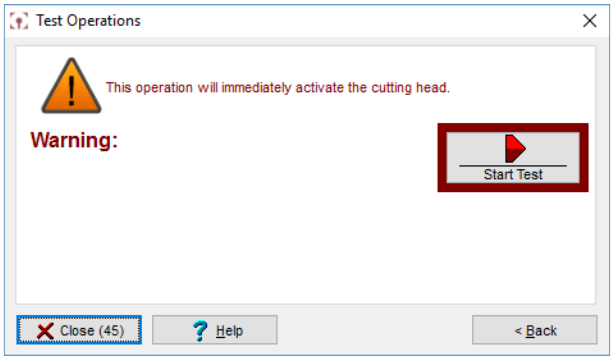

Figure 26

Stop the High-pressure Pump

During normal cutting operation, MAKE automatically starts and stops the high-pressure pump as required. The pump can also be stopped using the keypad by pressing the Stop button, or by pressing the Pause button located on the pendant controller

The pump can be immediately stopped at any time by pressing any of the E-stop switches, located on the pump control box or the pendant controller.

NOTE: *Use the E-stop only for emergency situations. When activated, all nozzle positioning information is lost which then requires re-homing, resetting soft limits, etc.*

Recover Following an Emergency Stop

1. Manually twist and pull the **emergency stop switch** back to its original position.
2. Reset the equipment by pressing the **Reset** button.
3. Re-establish the machine limits and auto home positions.
4. When applicable, power **ON** any attached abrasive waterjet accessories.
5. Click the **MAKE** icon on the desktop to open **MAKE**.
6. **Auto Home** the machine to ensure the machine's zero (Absolute Home) position is set.

Water and Abrasive Test

1. Position the **cutting nozzle** between **grate slats** 1 - 1.5 in. (2.54 - 3.8 cm) above the water level.
2. Attach the **abrasive hose** to the **nozzle** and **hopper**.
3. Click the **Test** button to display **Test Operations**.

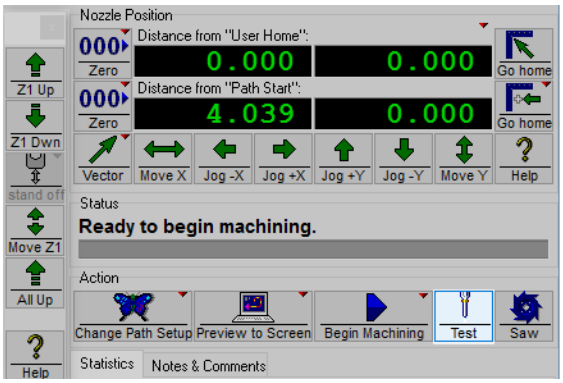

Figure 27

4. Select **Test Cutting Head (Pump, Jet, and Abrasive)**.

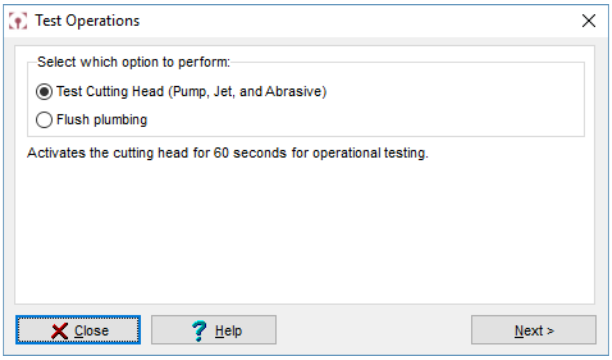

Figure 28

⚠WARNING

The cutting head is about to turn ON. For safety, ensure that everyone is clear of the cutting area and that the nozzle is positioned correctly.

5. Click **Next**.
6. Verify there is an increase in the sound level and stream diameter from the abrasive flow.
7. Verify abrasive is flowing from **abrasive feed tube** into the **nozzle**.
8. Click **Stop** to end the **Water and Abrasive** test.

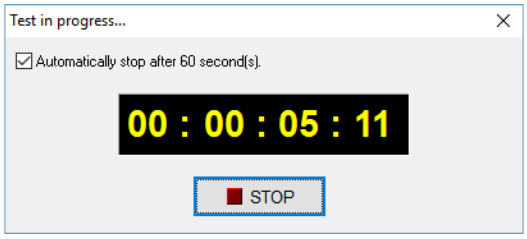

Figure 29

Measure Abrasive Flow Rate

Remove the Abrasive Hopper

1. Fill the **hopper** [1] at least one half full.

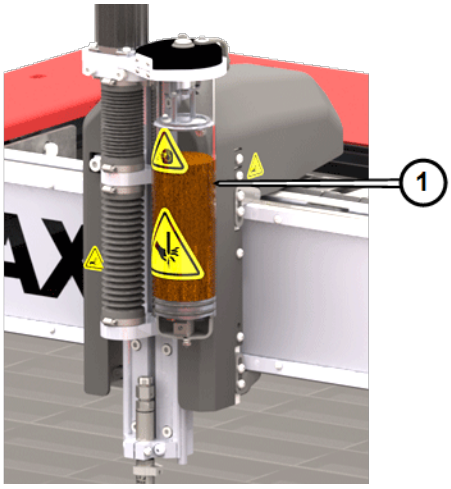

Figure 30

2. Remove the **abrasive feed tube** [1] from the **abrasive feed block**.

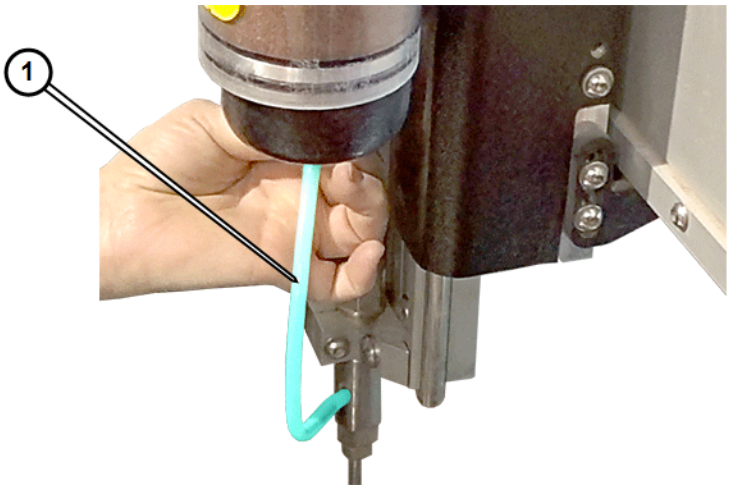

Figure 31

3. Remove the hopper **ground wire** [2] from the bottom of the **clamp plate** [1].

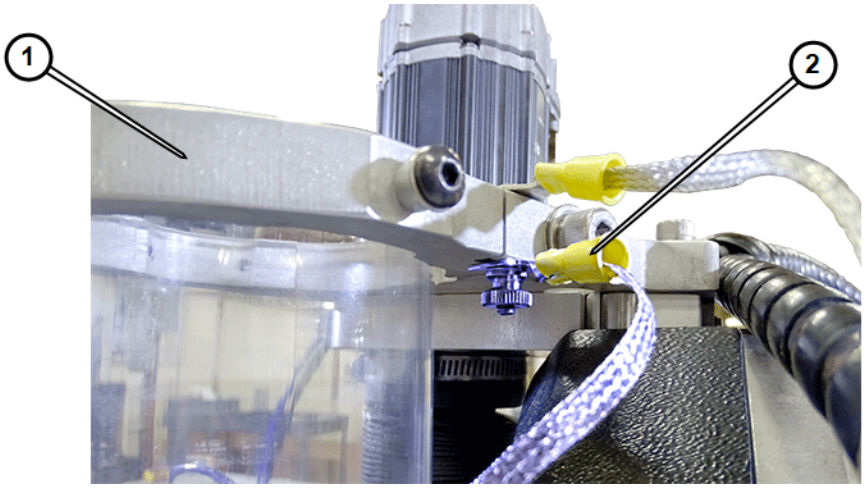

Figure 32

4. Open the **abrasive hopper lid**.
5. Hold onto the **abrasive hopper** to keep it from falling.
6. Loosen the **abrasive hopper clamp screw** and lower the **hopper** out of the **clamp plate**.

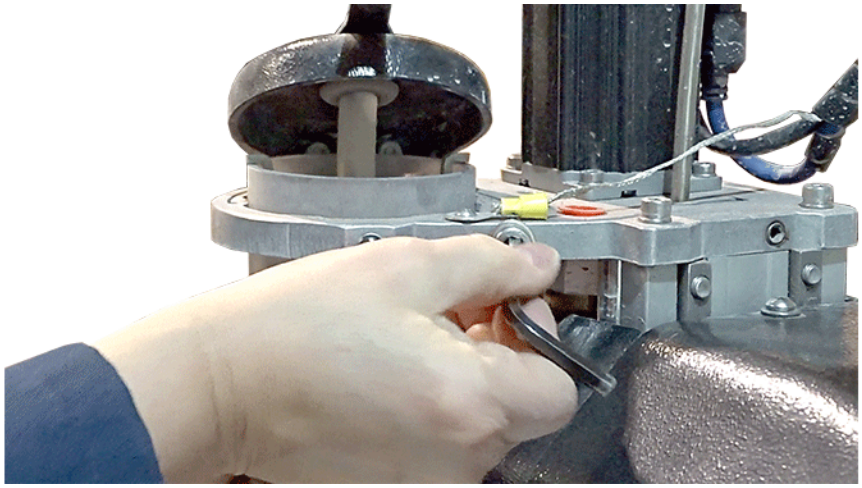

Figure 33

7. Weigh the **hopper assembly** using a scale.

Figure 34

NOTE: *The hopper assembly may by placed in another container to hold it for easy weighing.*

8. Record the weight.

Reinstall the Abrasive Hopper

1. Slide the **abrasive hopper** into the **abrasive hopper clamp**.
2. Turn the **abrasive hopper** so the **ground wire** [1] faces away from the **controller wall**.

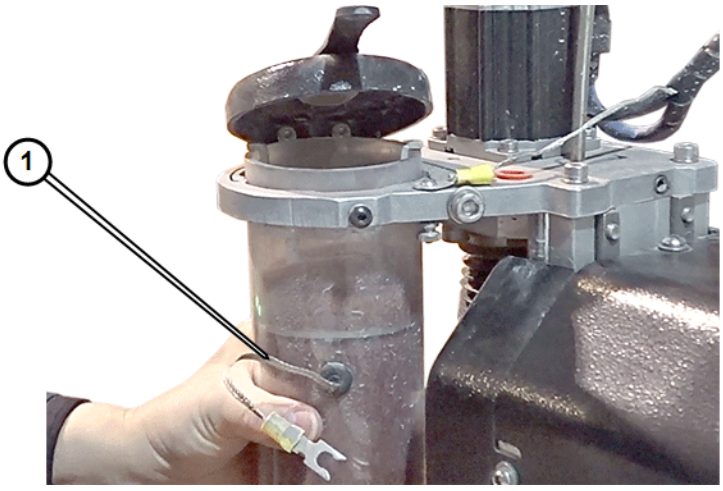

Figure 35

3. Tighten the **hopper clamp screw** making sure that the top of the **abrasive hopper** is just above the top of the **abrasive hopper clamp**.

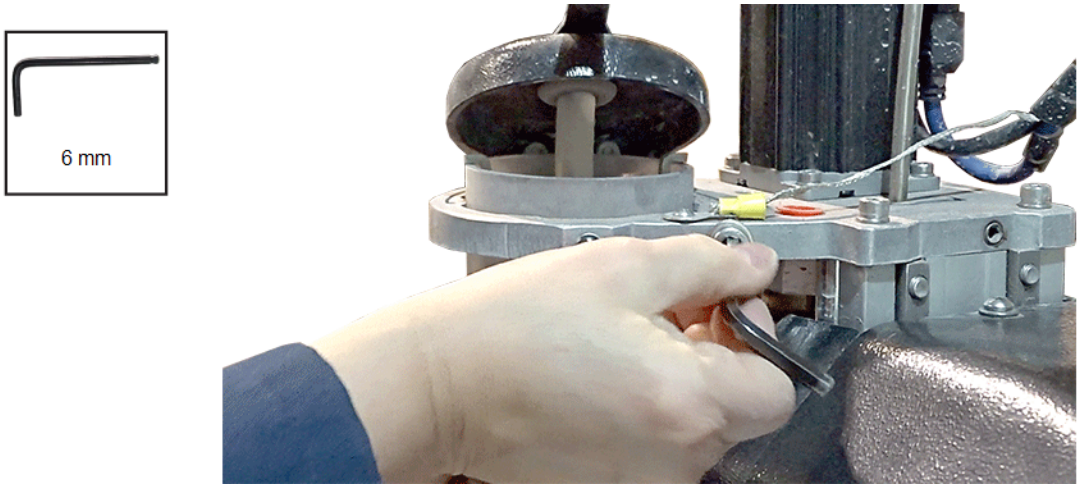

Figure 36

4. Install the **abrasive feed hose** [1] and **grounding wire** [2].

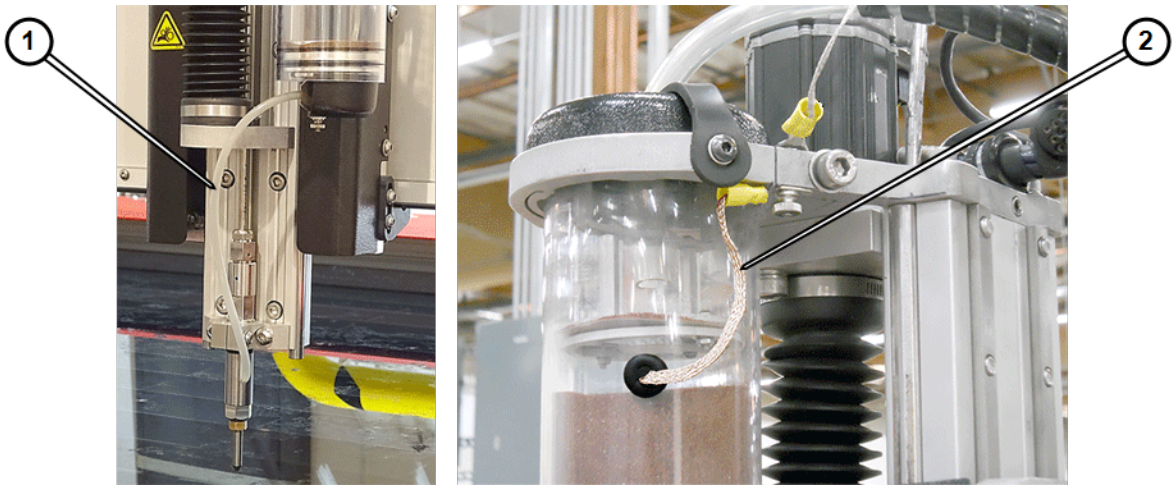

Figure 37

Test the Abrasive Flow Rate

1. Run the machine for one minute exactly.
2. Remove the **hopper assembly**, from the machine.
3. Weigh the **hopper assembly** and record the weight.
4. Determine the abrasive flow rate using the following formula:
   • weight before cut - weight after cut = abrasive flow rate.
5. Reinstall the **hopper assembly**.

6. Click **Setup** in **MAKE** and select **Pump and Nozzle settings**.

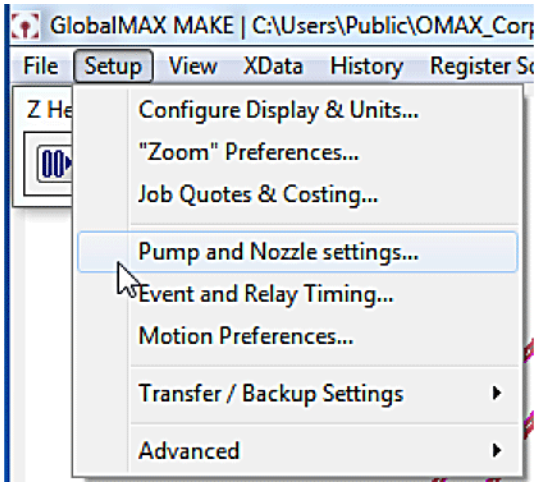

Figure 38

7. Record the abrasive flow rate in the **Pump and Nozzle Settings...**.

Verify Abrasive

1. Record the abrasive type and mesh; it will be entered into the **Pump and Nozzle Settings** later.
2. Verify abrasive level in **hopper**; add as needed.
3. Verify **abrasive hopper** is grounded.
4. Pressurize the **bulk feed hopper** (if applicable).

Software Configuration

Values in the Pump and Nozzle Configuration tab of the GlobalMAX Machine Setup dialog box must match the equipment being used and the measurements taken earlier.

Update Pump and Nozzle Settings

NOTE: *It is critical the settings for the Pump and Nozzle Configuration settings in the GlobalMAX Machine Setup are entered exactly as measured for the pump pressure and the abrasive flow rate and the orifice and mixing tube diameters must match the equipment installed on the machine. If these values to do not match, the machine cutting ability is degraded.*

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

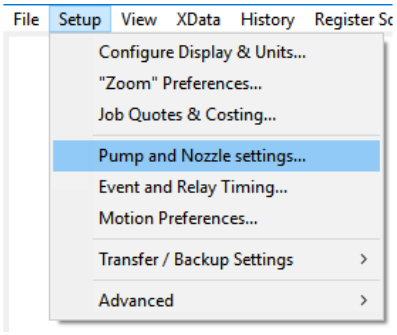

Figure 39

2. Correct any values being displayed that differ from those recorded during testing.

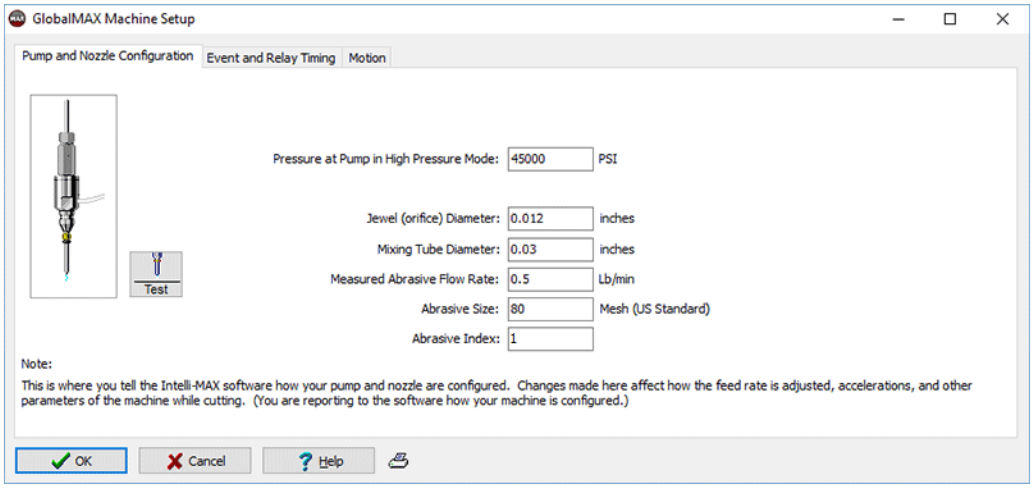

Figure 40

3. Click **OK** to save any changes.

Verify Event and Relay Timing

To determine values for Event and Relay Timing, it is best to start with the default values and adjust these values to match your own requirements.

1. In **MAKE**, click **Setup** and select **Event and Relay Timing**.

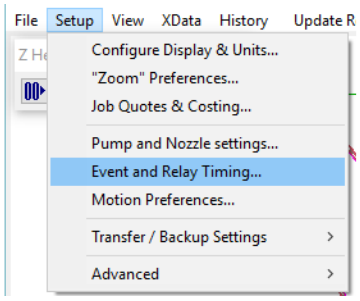

Figure 41

2. Verify the correct values are displayed for the machine and cutting application.

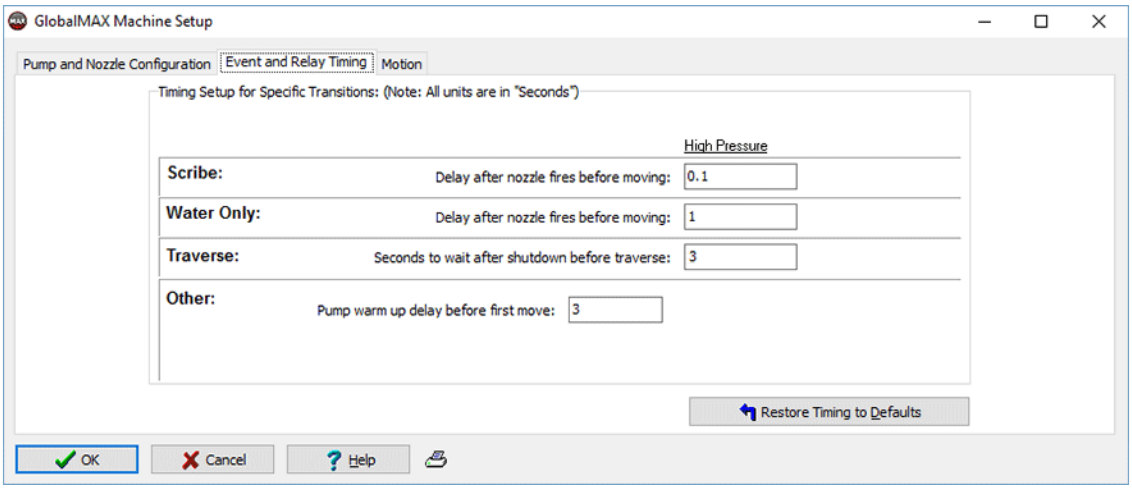

Figure 42

3. Click **OK** to save any changes made.

Kerf Check

Cut a kerf check part and adjust the tool offset as needed.

1. Kerf check part files are located in the **Sample Files**, **Kerf_Check_Parts** folder.
2. Measure the cut part against the drawing dimensions.
3. Adjust **Tool Offset** as needed.

NOTE: *The Tool Offset will change as the mixing tube wears and becomes larger.*

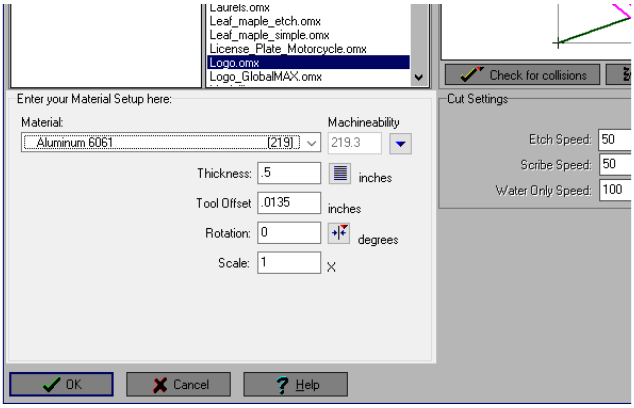

Figure 43

Cut the Part

1. Move the **nozzle** to an out-of-way area on the table that allows room for the material to be placed and secured to the **table**.

NOTE: *Refer to Keyboard Shortcuts in the MAKE help files for the X, Y, and Z-axis movement commands.*

2. Place the material to be cut on the **slat grates** and use adequate fixturing to secure the material flat and stable during cutting.
3. Position the **nozzle** to begin the cut and set the **Path Start Home** [1] to zero.

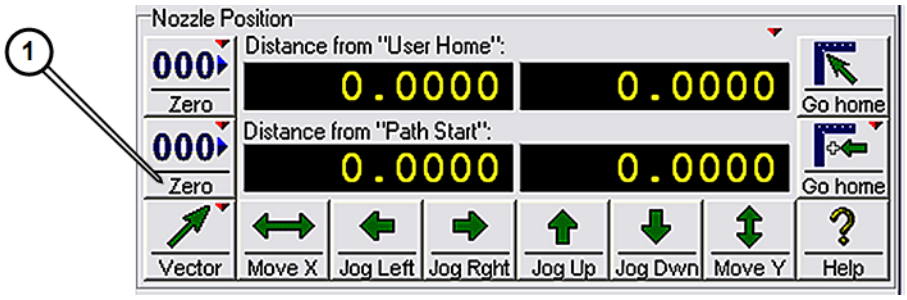

Figure 44

NOTE: *The distance from Path Start zeroes automatically when Begin Machining is clicked.*

4. Set the **nozzle stand-off**:
   a. Adjust the nozzle stand-off at 0.060 in. (1.52 mm) above the material by placing the **stand-off gauge** between the **nozzle** and the material being cut and adjusting the **Z-axis** appropriately.

NOTE: *Do not run the tip of the mixing tube down into the stand-off gauge as this may damage the mixing tube.*

   b. When adjusted, click **View/Show Z Coordinates** to display the **Z Height** window.

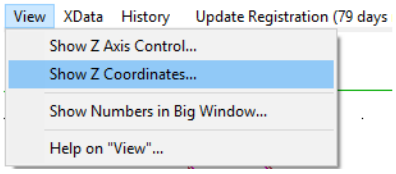

Figure 45

c. On the **Z Height**, click the **00> button** [1] to set the Z Height coordinates to zero.

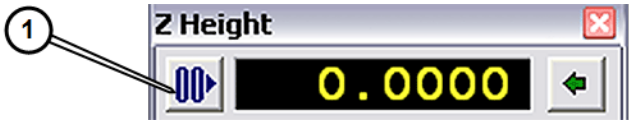

Figure 46

5. Conduct a dry run to verify the cutting path:

a. Click **Begin Machining** to display the **Path Control** dialog box.

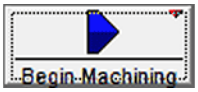

Figure 47

b. Right-click **Start** to display the options **submenu**.

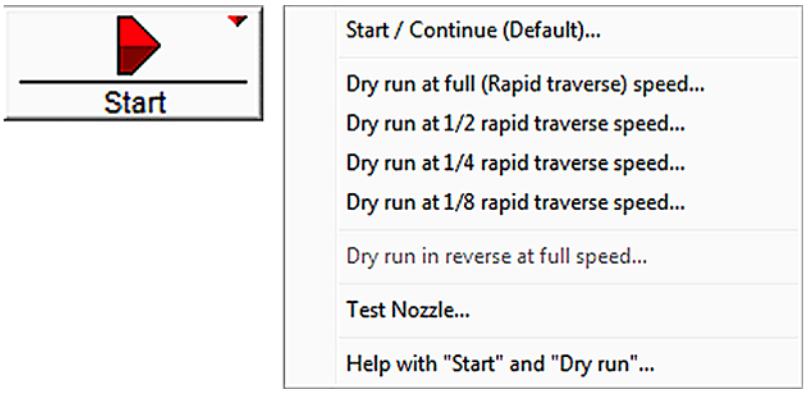

Figure 48

c. Click **Dry run at full (Rapid traverse) speed** (or another speed of your choice) to start the dry run.

d. Verify the **nozzle** travels over the material to be cut as expected.

e. If necessary, correct the **Path Start Home** position and try another dry run.

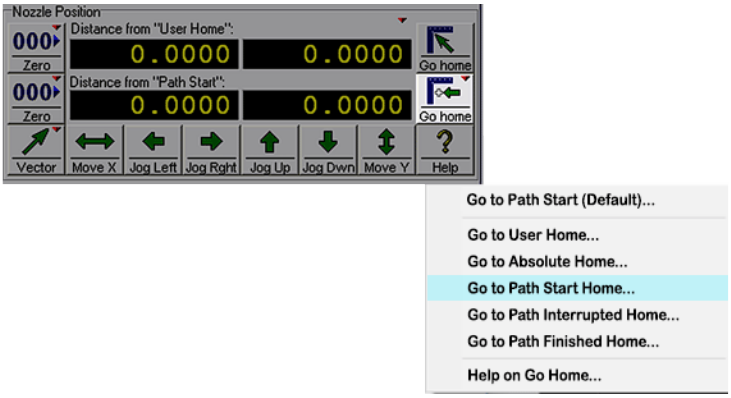

Figure 49

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

7. Lower the **nozzle** to its zero Z-axis coordinates by clicking the **arrow** [1].

Figure 50

8. Click **Begin Machining**.

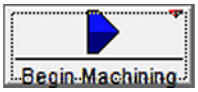

Figure 51

NOTE: *Always remain near the equipment during the cutting process. Use the Pause button to halt operation if needed. In the event of a serious problem, use the E-stop switch to immediately halt operations.*

9. Once machining stops, click **Close** [1] in the **Path Control** dialog box.

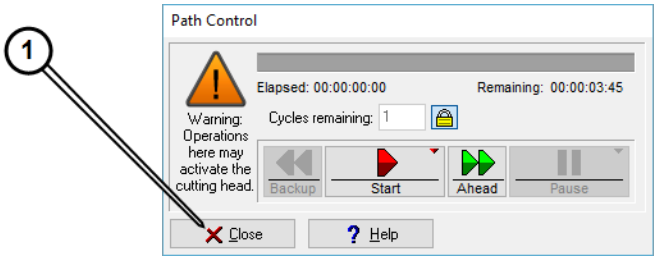

Figure 52

Chapter 4: Shutdown Checklist

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

1	Position **nozzle** between **slats**, 1 - 1.5 in. (2.54 - 3.8 cm) maximum above water level
2	Remove **abrasive feed tube** from **nozzle**
3	Start **nozzle** test, click **Start Test**
4	Run **nozzle** test for 20 seconds to clean and clear all abrasives, then stop test
5	Position **nozzle** at desired location for shut down
6	Remove USB/other media
7	Close MAKE software
8	Initiate Windows® shutdown
9	Verify **PC** shutdown (no PC lights; black monitor screen)
10	Power **OFF motors** (red button on pendant)
11	Power **OFF table controller** (main power switch on controller)
12	Depressurize **bulk feed hopper** (if applicable)
13	Power **OFF high-pressure pump**
14	Power **OFF charge pump**
15	Close **input water ON/OFF valve**
16	Power **OFF** main electrical breaker box
17	Clean **machine**
18	Close main water supply valve
19	Close main air supply valve (if applicable)

The equipment is now properly shut down.

Shut Down the Abrasive Waterjet

1. Position the **nozzle** between **slat grates** at 1 - 1.5 in. (2.54 -3.8 cm) maximum above the water surface.

2. Remove the **abrasive feed tube** from the **nozzle**.

a. Click the **Test** button.

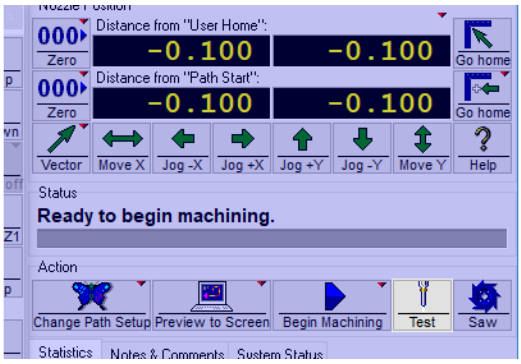

Figure 53

b. Select **Test Cutting Head (Pump, Jet, and Abrasive)** and click **Next**.

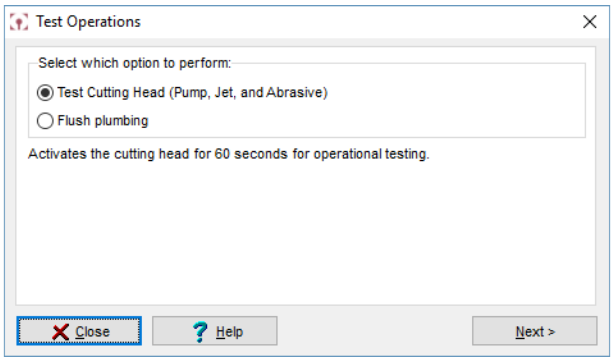

Figure 54

⚠WARNING

The cutting head is about to turn ON. For safety, ensure that the nozzle is positioned correctly and everyone is clear of the cutting area.

c. Click **Start Test**.

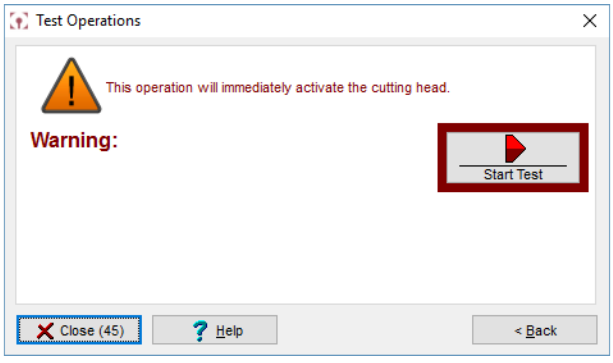

Figure 55

d. After approximately 20 seconds, click **STOP**.

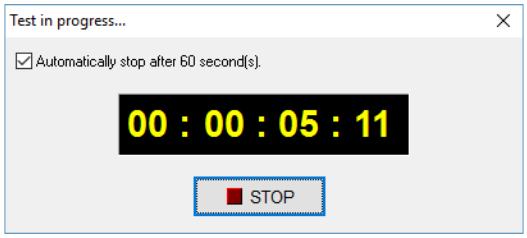

Figure 56

e. Click **Close**.

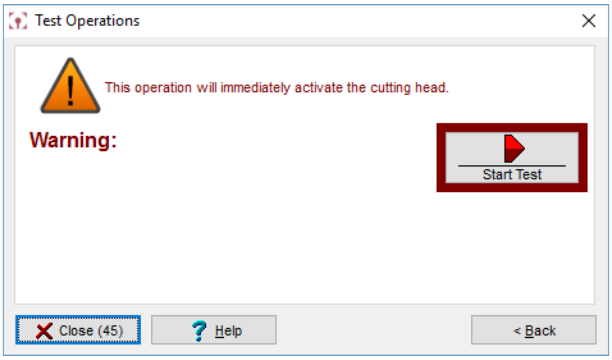

Figure 57

3. Position **nozzle** at desired location for shut down.
4. Remove USB flash drive from computer (if needed).
5. Close **MAKE** and all other software applications running on computer.
6. Exit Windows®, click **Start**, and then click **Shut down**.
7. Verify **table controller** shutdown (black monitor screen).
8. Turn **OFF** main **table controller power**.
9. Depressurize **bulk hopper** (if applicable).
10. Power **OFF** any other accessories.
11. Turn **OFF charge pump**.
12. Turn **OFF high-pressure pump**.
13. Turn **OFF** main electrical breaker box.
14. Clean **machine** and work area and remove any debris in **catcher tank**.
15. Close water supply valve.
16. Close air supply valve (if applicable).

Chapter 5: Pump and Table Maintenance

Follow the maintenance schedule to ensure reliable equipment performance and accuracy. The frequency of most maintenance activities is based upon the length of time the equipment has been in operation; however, harsher than normal environmental conditions can require these activities be scheduled more frequently than indicated in the maintenance checklist. Refer to applicable document for maintenance procedures.

Task	Frequency	Reference Document
Pump Power-end Maintenance		
Change crankcase oil, check belt tension	After first 50 hours of operation	401073 Maintenance, Change Pump Crankcase Oil 401083 Maintenance, Pump Belt EnduroMAX, MAXIEM
Change crankcase oil, check belt tension	Every 300 hours after first oil change	
Lubricate main electric motor bearings	6 months for continuous high ambient temperature; dirty or moist locations; high vibrations	401075 Maintenance, Lube Pump Electric Motor Bearings
	Seasonally (each year) if idle 6 months or more	
	Annually if continuous operation	
	3 years if 5,000 hours per year	
Inspect and adjust tension or replace belt	Periodically inspect, adjust tension, and replace as needed	401083 Maintenance, Pump Belt EnduroMAX, MAXIEM
Pump Water Filtration		
Change water filters	Whenever the difference in the pressure between the inlet and outlet filter gauges is equal to, or greater than 20 psi	401074 Maintenance, Change Pump Water Filter
Wet end Maintenance		

Task	Frequency	Reference Document
Pump rebuild	20 hp Rebuild every 500 hours, alternate Minor/ Major rebuild kits	401076 Maintenance, Pump Wet End Rebuild, OMAX-MAXIEM
	30 hp Rebuild every 500 hours, alternate Minor/ Major rebuild kits	
Replace plunger assemblies	3,000* hours *Or if plungers are "rubbed" or damaged	
Replace cylinders	2,000* hours *Or if cylinders are damaged or leaking	
Replace check valve bodies	3,000* hours *Or if check valves are damaged or leaking	
Replace manifolds, port adapter, end caps	4,000* hours *Or if components are damaged or leaking	
Other Pump Maintenance		
Rebuild safety valve	When leaking occurs; replace if safety valve continues to leak after rebuild	400995 Rebuild OMAX Safety Valve
High-pressure 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
High-pressure lines and fittings	Replace if damaged or if continued leaking occurs; do not try to repair	401081 1/4 in. High Pressure Fittings OMAX
PC Controller		
Clean keyboard and mouse	As needed	–
Clean monitor screen	Per PC manufacturer instructions. As necessary for sharp viewing	–
Reboot PC controller	Daily	--
Update OMAX software	When updates are released by OMAX	401430 Installation and Operation, GlobalMAX PC

Task	Frequency	Reference Document
Other as specified in the PC User's Manual (provided by manufacturer)	PC manufacturer recommended	–
Tank		
Wash away abrasive accumulation from equipment working area	Daily and as often as required to maintain a clean working environment	–
Remove all garnet, sludge, and slugs from the tank bottom	Whenever abrasive particles begin to excessively accumulate on the material being machined	–
Inspect slat grates	Rotate monthly or more frequently if needed; replace when excessively scored and no longer stable or level	–
Clean the outlet water filter	Daily or more frequently if needed	–
Table		
Lubricate the Z-axis lead screw	Yearly, or as needed to maintain smooth operation	401442 Maintenance, GlobalMAX System
Wipe down X and Y rails	Weekly, or as needed to maintain uninterrupted operation	
Wipe down X and Y belts	Weekly, or as needed	
Adjust X and Y-bridge belt tension	As needed	
Clean nozzle orifice	Clean the jewel/nozzle orifice assembly once a week minimum to prevent mineral buildup in the jewel assembly	401458 Installation and Maintenance, GlobalJET Nozzle
Abrasive tubing (hopper to nozzle)	Inspect daily or weekly (depending on how many hours you cut each day), replace as needed	401442 Maintenance GlobalMAX System
Rotate/replace nozzle mixing tube	Rotate 90 degrees (one quarter turn) every 8 hours of cutting to even out wear; replace as needed	

Task	Frequency	Reference Document
Replace last chance inlet body filter	If damaged or completely plugged with debris	401459 Installation and Maintenance, Inlet Body Extension, GlobalMAX
Rebuild the nozzle inlet body	Replace applicable components (e.g. poppet) if water drips from the weep hole	

NOTE: *The hours listed in this checklist for recommended pump maintenance scheduling are NOT warranty hours. Please refer to the Limited Warranty provided on the website for warranty information.*

NOTE: *Repeat the time durations shown for your particular pump after every rebuild kit.*

Pump Maintenance

See *401427 Operation, GlobalMAX Pump*.

Table Maintenance

Lubricate the Z-axis

See *401442 Maintenance GlobalMAX System*.

Flush Machine After Maintence

See *401442 Maintenance GlobalMAX System*.

Nozzle Care and Maintenance

See *401458 Installation and Maintenance GlobalJET Nozzle*.

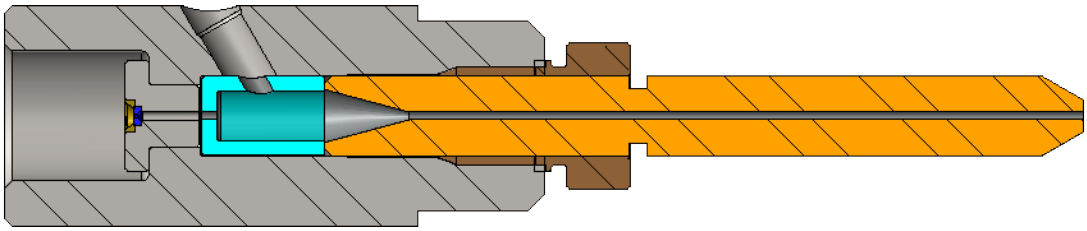

Figure 58

Chapter 6: Troubleshooting

The following lists most issues that may be encountered with equipment operation. Possible causes for each issue are provided with the most likely causes listed first. If you continue having a problem after following these procedures, contact Technical Support.

Issues (Symptoms)

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

Condition and Possible Causes	Corrective Actions
High-pressure Pump Fails to Start or "Pump fault" on Keypad.	
The charge pump is not powered ON.	1
Insufficient water pressure or flow to the charge pump.	1, 2
Water pressure from charge pump too low.	2, 3
E-stop is activated.	34
Machine and pump were not started in the specified sequence.	42
Abrasive Waterjet Nozzle Does Not Move	
A soft limit has been reached.	7
The nozzle collided with the cutting material and stalled.	8, 15
Fault Message on Controller	
The emergency stop switch was either activated, the nozzle collided with some object, or for some other reason the machine detected a fault.	33
Parts are Too Short or Flat Spots Appear on Curves	
The cutting material is not securely fixtured.	9
The nozzle has reached its hardware limits.	10
Poor Surface Finish	
The values defined in MAKE are not consistent with the actual cutting requirements.	11
An abrasive other than the recommended garnet is being used.	12
Mixing tube is excessively worn and unable to form a perfect jet stream.	13
Jewel that forms the jet is chipped, dirty, or out-of-tolerance.	14
Abrasive flow stopped or has been reduced by the presence of dirt or wet abrasive.	15, 30
Poor fixturing of the cutting material.	9
Grates may be worn past useful life.	40
Excessive Turbulence While Cutting	
Water level is too low.	39
Abrasive Gets Wet During Cutting or Piercing	
The jet is spraying back.	41, 30

Condition and Possible Causes	Corrective Actions
Holes are Too Large and Parts Undersized	
The tool offset is set incorrectly.	16
Tool offset is on the wrong side of the path.	17
Excessive Taper on Part Edge	
The cut was made with the quality value set too low.	18
The stand-off between the abrasive waterjet nozzle and the material is too high.	19
Setup values in MAKE are not consistent with actual physical requirements.	11
An abrasive other than the recommended garnet is being used.	12
The mixing tube is worn and unable to form a perfect jet stream.	13
The jewel that forms the jet is chipped, dirty or out of tolerance.	14
Holes are Not Round	
The cutting material is not securely fixtured.	9
The jewel that forms the jet is chipped, dirty or out of tolerance.	14
The mixing tube is worn and unable to form a perfect jet stream.	13
Abrasive Waterjet Not Piercing Material or Skipping Sections of the Cut	
Setup values entered in MAKE are not consistent with actual physical requirements.	11
An abrasive other than the recommended garnet is being used.	12
Stand-off between the abrasive waterjet nozzle and the material being cut is too high.	19
Abrasive flow stopped or has been reduced by the presence of dirt, wet abrasive, or worn out abrasive tube that collapses or leaks air.	15
Mixing tube is worn and unable to form a perfect jet stream.	13
Jewel that forms the jet is chipped, dirty or out of tolerance.	14
Machine is not properly grounded.	35
Pump is not delivering the pressure specified.	21
Abrasive Waterjet Quit Cutting	
Abrasive flow stopped or has been reduced by the presence of dirt, wet abrasive, or worn out abrasive tube that collapses or leaks air.	15
Mixing tube in the abrasive waterjet nozzle is plugged.	22
Jewel orifice is plugged with foreign material.	23, 14
Pump is not delivering the pressure specified.	21
Keyboard or Mouse Does Not Work	
Wires or connections in the computer may have become loose.	24
Blue Screen Errors	
Corrupt device driver.	26
Pause activated.	28

Condition and Possible Causes	Corrective Actions
Water Flows Up the Abrasive Tube (past approximately 2 in. (5.80 cm))	
Check valve is leaking.	29, 37
Mixing tube in the abrasive waterjet nozzle is plugged.	22
Stand-off distance is so narrow that the nozzle is plugged by the work piece before it starts cutting, and water is forced up the abrasive tube.	19
Pump is not delivering the pressure specified.	21
Charge pump is not turned ON.	1
The Jet Looks Wide and Fuzzy	
Jewel that forms the jet is chipped, dirty or out-of-tolerance.	14
Mixing tube is worn and unable to form a perfect jet stream.	13
Mixing tube is improperly seated in the nozzle.	36
No Abrasive Flow	
Abrasive flow stopped or has been reduced by the presence of dirt, wet abrasive, or worn out abrasive tube that collapses or leaks air.	15
Stand-off distance is so narrow that the nozzle is plugged by the work piece before it starts cutting and water is forced up the abrasive tube.	19
No Abrasive Flowing from the Abrasive Tube	
Abrasive flow stopped or has been reduced by the presence of dirt, wet abrasive, or worn out abrasive tube that collapses or leaks air.	15, 30
Stand-off distance is so narrow that the nozzle is plugged by the work piece before it starts cutting and water is forced up the abrasive tube.	19
Water Sprays Out of the Tank	
Part is positioned on top of a slat, causing the jet stream to reflect upwards.	30
Abrasive Piles Up on the Work Piece	
Accumulation of abrasive silt at the bottom of the tank is excessive.	31
Water Leaks from Mixing Tube	
When charge pump and main pump are off - indicates failed seal in the inlet body.	37
Nozzle Collision with Material Surface	
Uneven or warped material.	38
Material moved during cutting process.	9
The Table Has an Unpleasant Odor	
Excessive bacteria growth in the tank.	32
Excessive "Frosting" Around the Cut	
The mixing tube may not be seated; the orifice assembly (jewel) may be dirty or damaged; inlet check valve component failure.	36, 37, 14

Solutions

Refer to Issues for a list of problems encountered.

Corrective Action	Description
1	Verify charge pump on/off switch is in the ON position.
	Verify charge pump's AC power source is ON.
	Verify pump power switch is ON.
2	Check water supply source and verify adequate flow and pressure. Replace charge pump water filters if they are restricting flow.
3	The pump will not run when the water pressure drops below 50 psi. Check the pressure gauges before and after the water filters. If the downstream gauge exceeds 50 psi, the pressure gauge may be defective. If the upstream gauge does not exceed 70 psi, the charge pump may be partially plugged or defective.
	Check water filters are not plugged or damaged. If the pressure difference between the pressure gauges is more than 20 psi, replace the filter elements.
7	Soft limits may have been corrupted by an abnormal stop such as a collision, power failure, or use of the emergency stop switch. If so, redefine values for the machine's soft limits and homes.
8	Cycle machine power OFF and then ON.
	Verify material position and fixturing; remove any obstacles from nozzle path.
9	The material was able to move during the cutting process due to drag of the nozzle or upwelling of the water below. Ensure material being cut is securely fixtured. This is the most common reason for scrapped parts. Improperly secured material will vibrate, causing a rough edge on the cut part.
	Specify a higher cut quality such as 3 or 4.
10	Relocate work piece toward the table center. Set software limits to provide a warning before hardware limits can be reached.
11	Check that values entered for the following parameters were correctly entered in MAKE: • Material Type and Material Thickness • Verify parameters entered for the following Pump and Nozzle Settings are correct: • Water pressure • Abrasive index • Orifice diameter • Mixing tube diameter • Abrasive flow rate • Abrasive size
12	Many abrasives do not cut as well as garnet, and the Abrasive Index should be reduced when using these abrasives. It may be necessary to experiment to determine the best setting.
	Verify the settings for Abrasive Index are correct in the Pump and Nozzle Settings.
13	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 for precise cutting.
14	Clean or replace the orifice assembly/jewel.

Corrective Action	Description
15	Disassemble plugged items, blowing them clean and dry with an air hose. Replace nozzle abbrasive tube if showing any signs of wear. Verify abrasive flows freely and is clean and dry.
16	If not enough material is being removed (hole too small or part too large), decrease the tool offset by half the dimensional error observed. If too much material is being removed, increase the offset by half the dimensional error. By measuring parts as they are finished, you can monitor the wear of the mixing tube and periodically reset the tool offset to achieve more precise cutting. Refer to the kerf check part drawings included with the software.
17	Switch the lead in and lead out and then use the Generate Tool Path command in LAYOUT to recreate the part. Check the tool offset using Preview in MAKE.
18	A quality of 1 will just barely pierce the material and usually has a significant taper. Both taper and surface finish should improve as the quality value is raised (taking longer to make the part).
19	A stand-off of 0.060 in. (1.52 mm) is generally recommended. Typically, lower stand-off distances decrease the amount of taper, but a lower stand-off increases the likelihood of nozzle plugging or being damaged on uneven part stock.
20	If the jet remains elliptical, change the mixing tube. If that does not correct the issue, change the orifice assembly/jewel.
21	Measure the pressure to see if it is below specification. Follow pump troubleshooting procedures.
22	In an attempt to dislodge the plug, use MAKE to turn the high-pressure pump ON and OFF. If this fails, clean the nozzle or replace the mixing tube.
23	Remove the nozzle and inlet body. Remove the jewel assembly from the inlet body and clean in an ultrasonic white vinegar bath for 20 minutes.
24	Verify the mouse and keyboard connections are firmly inserted. Reboot the PC.
25	Ensure the USB cables are plugged in firmly to a USB 2.0 port. Do not use a SuperSpeed (SS) USB port. Restart the table controller.
26	Reinstalling Intelli-MAX software can fix this. Be sure to fully power down the controller, wait 10 or more seconds, Then turn it back ON for all driver related changes to refresh.
28	Deactivate Pause
29	Tighten the nozzle body.
30	Contain the spray with a splash guard on the nozzle.
31	Remove the slat grates and clean out the abrasive from the tank bottom.
32	Contact Technical Support.
33	Manually twist and pull the emergency stop switch back to its original pre-activated position and press the controller pendant Reset button. The fault message should now be cleared. If the fault was caused by a nozzle collision or other machine fault, pressing the Reset button in for 2 seconds will clear it once the original fault condition has been corrected.
34	Manually twist and pull the emergency stop switch back to its original pre-activated position. Restart the machine. For detailed steps, see Stopping the High-pressure Pump.
35	Verify all grounding points on the machine are properly connected.

Corrective Action	Description
36	Mixing tube should be seated against the mixing chamber (all the way to the groove) on the mixing tube. Clean the nozzle body and reseat the mixing tube.
37	Replace inlet body check valve components.
38	Find high spot on the material and set stand-off accordingly. Use a terrain follower.
39	Raise the water level to just above the slat grates.
40	Change the slat grate.
41	Verify cap is attached to the bottom of the hopper.
42	Press the Reset button on the pump VFD keypad.

Customer Support

Log in to your customer account at the omax.com website for technical documents and distributor support.