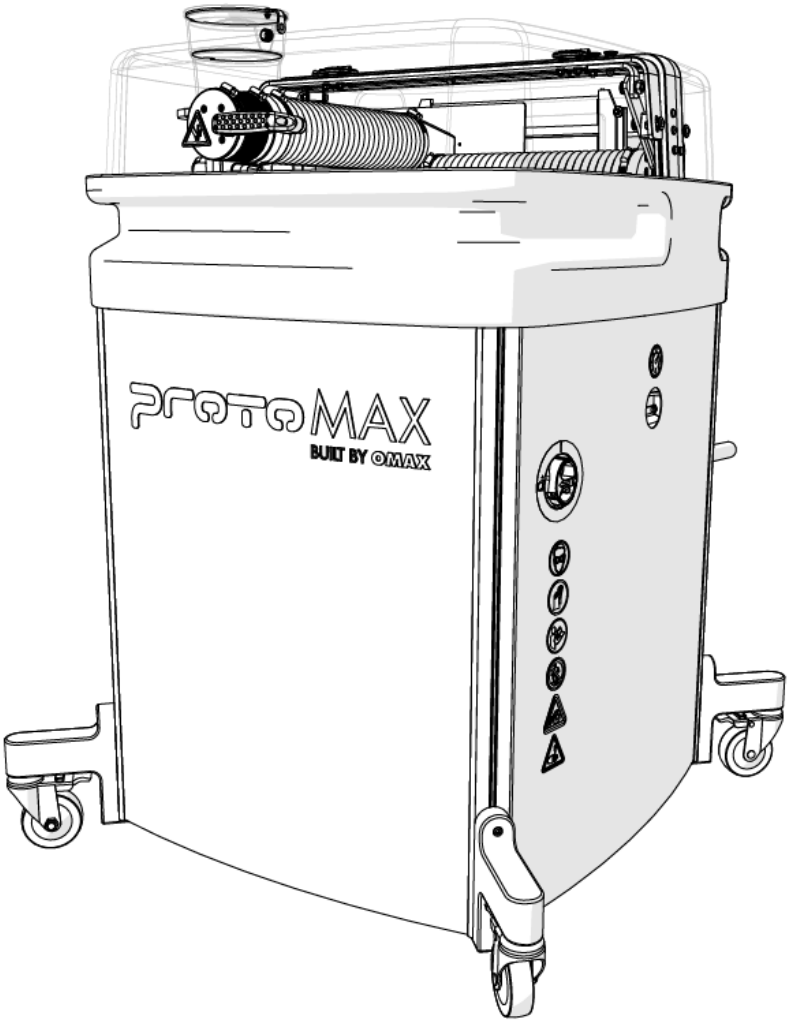
ProtoMAX®

Operation Guide



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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 1-818-647-1994 or e-mail us at info@protomax.com. You can also receive technical support on-line at: Web: http://www.protomax.com.

Original Instructions in English
April 2018

IMPORTANT SAFETY INFORMATION

SAFETY IS YOUR RESPONSIBILITY.

For your own safety, read this guide thoroughly and carefully before installing, operating, maintaining, or troubleshooting the equipment.

Save these instructions.

This guide 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 safety features, safety glasses, hearing protection, and more can reduce potential injury. Exercise caution when installing, operating, and maintaining the equipment. Safety guards and features will not guarantee your safety if you are careless, inattentive, or use poor judgment. If it feels dangerous, do not try it.

YOU ARE RESPONSIBLE FOR YOUR SAFETY IN YOUR SHOP.

MACHINE SAFETY LABELS

The following safety labels may appear on the equipment. If ignored, physical injury, death, or equipment damage may occur. Read the complete safety information provided in the operation, installation or maintenance guide 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.

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

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.

Caution: Pinch Point Hazard
When closing the lid, keep your hands clear from the edge of the tank.

Keep Fingers and Hands Away From Moving Parts!
Fingers and hands can be pinched or 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.

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!

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.

Do Not Operate With Guard Removed
Do not operate machine with guards or panels removed.

Do Not Spray
Do not spray water on or near the machine electrical enclosure.

MANDATORY ACTION! Disconnect Power
To isolate the machine from its electrical supply, always unplug the main AC supply power cord from its electrical supply outlet.

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 Ear Protection
Always wear hearing protection while in the vicinity of the equipment. When cutting above water, noise levels can exceed 70 dBA.

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 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.

Read Manual First!/Do Not Adjust
Never make adjustments to equipment prior to reading the manual. Special instructions may be required.

SAFETY PRECAUTIONS

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

Use the equipment ONLY for its intended purpose.

- Read the installation manual before setting up the equipment to learn about important installation and safety information.
- Read the documentation for recommended accessories. The use of improper accessories may cause risk of injury to persons or damage to equipment.
- Wear eye and ear protection. Always wear ISO-approved impact safety glasses.
- Ensure the equipment is installed properly before startup.

- Never stand on the equipment. Serious injury could occur if the machine tips or if you come in contact with the cutting tool.

Do not make modifications

- Never make unauthorized modifications or 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.

Do not remove panels

- Do not remove panels under normal conditions. Only remove them when required by maintenance or troubleshooting procedures.

Check for damaged parts

- Before further use of the equipment, a guard or other part that is damaged should be carefully checked to determine that it will operate properly and perform its intended function–check for alignment of moving parts, binding of moving parts, breakage of parts, mounting, and any other conditions that may affect its operation. A guard or other part that is damaged should be properly replaced.

Exercise caution, stay alert and attentive

- Do not install, operate, or service the equipment while under the influence of alcohol or drugs. Read the warning labels on prescription and over the counter drugs. If in doubt, do not install or operate the machine.
- Do not install, operate, or service the equipment when you are tired.
- Always observe the safety precautions while installing, operating, or servicing the equipment. Carefully operated, the abrasive waterjet is a safe tool. When operated carelessly, serious injury can result.
- Wear a face or dust mask.
- Do not overreach to operate the machine. Maintain proper footing and balance at all times.
- Keep a minimum of 16 in. (40 cm) away from pressurized equipment during operation.
- Do not try to tighten ultra-high pressure (UHP) fittings while the system is under pressure.

Maintain tools and equipment with care

- Keep machine and accessories clean for best and safest performance.
- Always maintain the equipment in top condition.
- Follow the maintenance instructions for equipment and accessories.
- Maintain all protective guards and shutdown devices.

Keep the equipment and surrounding area clean and free from clutter

- Remove any installation, operation, or maintenance tools from the equipment before operating.
- Keep the work area clean and clutter free to avoid accidents.
- Keep the equipment clean for optimal performance.

Do not operate equipment in a dangerous environment

- Do not use equipment in or around flammable gases or liquids.
- Do not expose equipment to rain, or use outdoors.
- Keep the equipment in a well-lit work area.

Never leave equipment unattended while operating

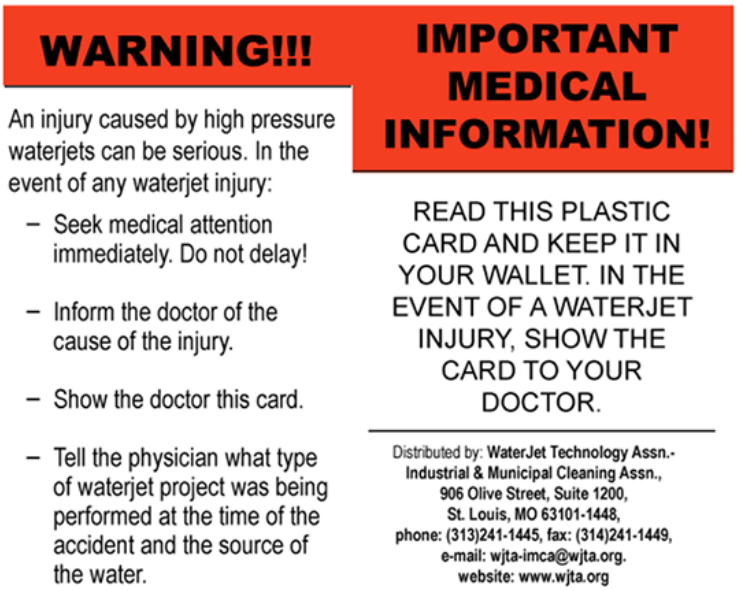
- Always stop and turn off the equipment before leaving.
- Keep visitors at a safe distance from the work area.
- Keep children away from the equipment work area.
- Do not allow children to play around or operate the equipment or any of its components.

Never operate equipment without safety guards or covers.

- Do not modify, bypass, defeat, or render safety guards, covers, or switches inoperable.
- Keep guards in place and in working order.
- Never remove any safety cover or guard while the equipment is running.
- Know the location of the ON/OFF switch.
- Know how to disconnect the main power supply to the equipment.
- Start and operate the machine only when all side panels are securely in place.

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!
- See your WaterJet Technology Association (WJTA) warning card for important medical alert information.



WARNING!!!

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

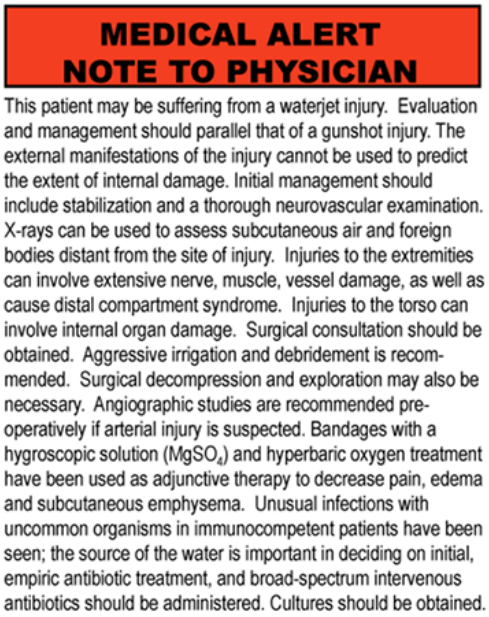
- Seek medical attention immediately. Do not delay!
- Inform the doctor of the cause of the injury.
- Show the doctor this card.
- Tell the physician what type of waterjet project was being performed at the time of the accident and the source of the water.

IMPORTANT MEDICAL INFORMATION!

READ THIS PLASTIC CARD AND KEEP IT IN YOUR WALLET. IN THE EVENT OF A WATERJET INJURY, SHOW THE CARD TO YOUR DOCTOR.

Distributed by: WaterJet Technology Assn.- Industrial & Municipal Cleaning Assn., 906 Olive Street, Suite 1200, St. Louis, MO 63101-1448, phone: (313)241-1445, fax: (314)241-1449, e-mail: wjta-imca@wjta.org. website: www.wjta.org

Figure 1



MEDICAL ALERT NOTE TO PHYSICIAN

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 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 preoperatively if arterial injury is suspected. Bandages with a hygroscopic solution ($MgSO_4$) 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 intervenous antibiotics should be administered. Cultures should be obtained.

Figure 2

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 or qualified individual for installing the main power source for use of the machine.
- Inspect the equipment power and control cables regularly for proper connection and installation. Damaged, exposed, and bare wires can cause electrocution or death!

- Ensure the equipment is properly connected and grounded in accordance with national, state, and local codes. Never remove any prong from the plug. Always plug into a proper electrical outlet.
- Never use any electrical plug adapter.
- Reduce the risk of unintentional starting by ensuring the power switch is in OFF position before plugging in the equipment.
- Always disconnect the equipment from the main power before performing service or maintenance.

Noise Emission Precautions

Environmental factors, such as room or building construction, machines or power tools, and other noise sources affect the environment's true noise level. When installed and operated properly, the equipment A-weighted emission sound pressure level, LpA , is less than 75 dBA (LpA < 75 dBA). Therefore, OMAX recommends that the operator wear hearing protection during equipment operation.

Treat All Injuries with Caution

Injuries involving contact with the water should receive immediate attention. See the WJTA Warning Card for important medical alert information.

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.

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

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.

Equipment Grounding Requirements

- Ensure the equipment is properly grounded in accordance with national, state, and local codes. Never remove any prong from the plug. Always plug into a proper electrical outlet.
- To reduce the risk of electric shock, during a malfunction or breakdown, grounding provides the electric current with a path of least resistance. The machine is equipped with an electric cord designed with an equipment-grounding conductor (EGC) and a grounding plug ***(United States, Canada and Mexico only)***. You must plug the cord into a matching outlet that is properly installed and grounded in accordance with all local codes and ordinances.
- Do not modify the plug provided—if it does not fit the outlet, have the proper outlet installed by a qualified electrician.
- Connecting the EGC improperly can result in electric shock.
- Contact a qualified electrician or service personnel if you do not understand the grounding instructions, or if in doubt as to whether the equipment is properly grounded.
- Do not use extension cords with the equipment.
- If the cord is damaged or worn, immediately replace it. Contact OMAX for replacement parts and instructions for replacement. The insulation of the EGC is covered with a green or green with yellow-striped surface. If replacement of the electric cord or plug is necessary, do not connect the equipment-grounding conductor to a live terminal. Refer to the equipment-specific wiring configuration.

- The equipment is intended to be used on a circuit with an outlet similar to the one shown ***(United States, Canada and Mexico only)***:

Figure 3

- The grounding plug is similar to the one shown ***(United States, Canada and Mexico only)***:

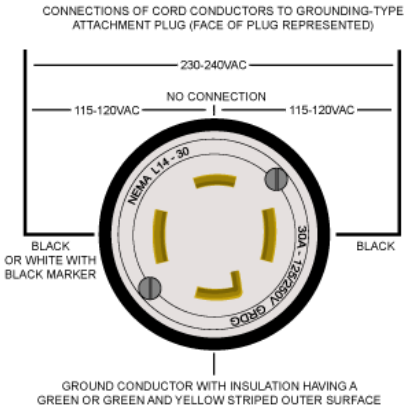


Figure 4

- Ensure that the equipment is connected to an outlet that matches the plug configuration.
- The equipment must not be connected to any different type of electric circuit.
- No adapter is available, or should be used with this equipment.
- For countries other than United States, Canada and Mexico; OMAX does not supply a suitably rated industrial grade plug.
- Contact a qualified electrician or service personnel for installation of a suitably rated industrial grade plug in accordance with national, state, and local codes.
- A pin and sleeve plug, rated at least 30A, 230V, 2-pole+E (3-wire grounding), IP44 or better, having a first-make last-break protective bonding contact (earthing contact) in accordance to standards IEC 60309-1 and IEC60309-2 may fulfill this requirement.

Figure 5

- You must plug the cord into a matching outlet that is properly installed and grounded in accordance with all local codes and ordinances.

Figure 6

Explosive Atmosphere Precautions

Machining certain types of material such as titanium with a waterjet may 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.

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 work area will assist in dissipating the accumulation of gas, vapor, and fumes. Your machine contains 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. Additionally some materials (especially 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. Normally, hydrogen bubbles to the surface and escapes into the shop in harmless, low concentrations.

Take care that no ignition source (such as open flame or electrostatic discharge) is nearby the equipment.

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. 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. Be especially careful when cutting materials that create sparks, such as titanium—these can ignite gases in the tank.

EQUIPMENT SAFETY FEATURES

The abrasive waterjet provides several built-in safety features:

Overpressure Protection

During operation, pump pressure is monitored to prevent an overpressure condition. If the pump exceeds the factory set maximum pressure limit, the safety relief valve activates and shuts down the pump unit.

Electrical Protection

The equipment controller includes short circuit, overcurrent, and thermal protection for the pump motor.

Electrical Disconnect/Emergency Machine Off (EMO)

An electrical disconnect/emergency machine off (EMO) switch is used to remove the main AC electrical supply from the machine. To isolate the machine from its electrical supply, always unplug the main AC supply power cord from its electrical supply outlet.

Safety Lid

The lid of the equipment is designed with a safety interlock to prevent waterjet operation when the lid is open.

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

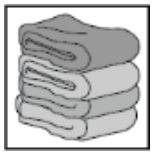
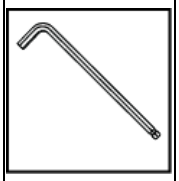
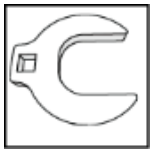
Used to provide supplementary information, emphasize a point or give a tip for easier operation.

REQUIRED TOOLS

The following table contains a list of tools with the appropriate sizes needed when operating the ProtoMAX.

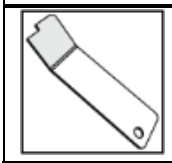
Customer Provided Tools

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

Icon	Tool	Size(s)
	Torque wrench	15–102 in-lb (2–12 N·m)
	Hex socket	4 mm
	Shop towels	
	Allen wrench	4 mm
	Open-end wrench	19 mm
	Crowfoot wrench	19 mm

OMAX Provided Tools

The following table contains a list of tools provided by OMAX that are needed to operate the ProtoMAX. Tools listed with part numbers are included with the ProtoMAX or are available for purchase. Contact technical support for more information.

Icon	Tool	Size(s)
	Stand-off tool (P/N 317876)	

TECHNICAL SPECIFICATIONS

See ProtoMAX Utilities Requirements for the technical specifications.

INTRODUCTION

This guide provides information and instructions to operate the abrasive waterjet cutting system. It explains how the pump and abrasive waterjet system work. It also provides instructions on how to machine a part, how to start and stop the system, and how the software (Intelli-MAX® Proto) is used to machine a part.

ABRASIVE WATERJET OVERVIEW

The ProtoMAX abrasive waterjet is a precision machining tool that operates under software control using high-pressure water and garnet abrasive to cut complex parts out of most materials including metal, plastic, glass, ceramics, stone and composites using standard CAD drawing files.

COMPONENTS

The ProtoMAX takes up little shop floor space. The cutting stage has a 12 in. (30 cm) (X-axis) by 12 in. (30 cm) (Y-axis) cutting area with an easy material alignment system for cutting parts. The precision drive components are protected inside sealed bellows from water and garnet abrasive. The manual Z-axis allows cutting of materials up to 1 in. (3 cm) thick. The cutting area is fully enclosed by a see-through enclosure supporting a safety interlock system to halt abrasive waterjet cutting when opened.

The ProtoMAX consist of the following major components:

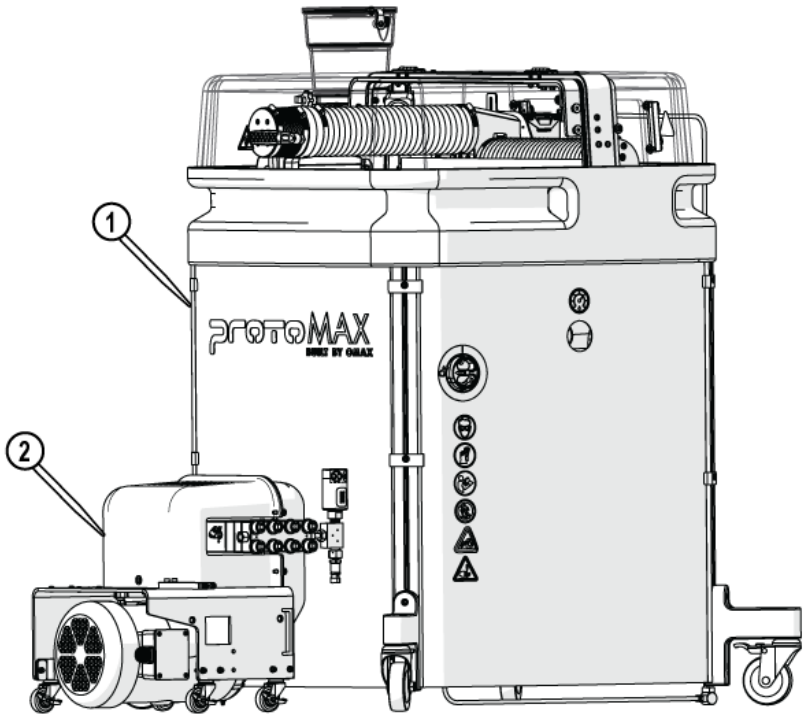


Figure 7

[1] Table assembly [2] High-pressure pump

Table Assembly

The ProtoMAX table assembly is comprised of the cutting stage, garnet abrasive delivery system, catcher tank, electrical control enclosure, water filter, and operator controls.

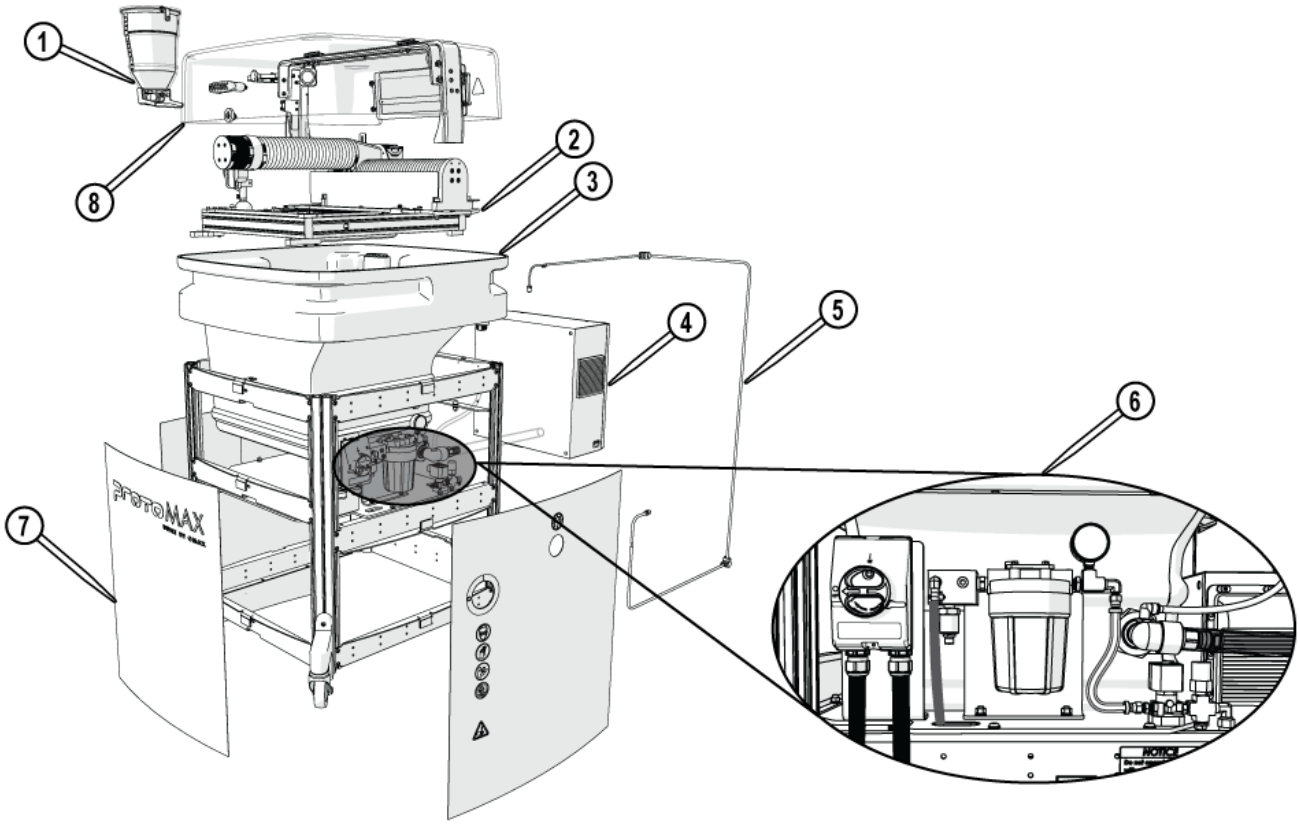


Figure 8

[1] Garnet abrasive delivery system
[2] Cutting stage and X, Y, and Z stage
[3] Catcher Tank
[4] Electrical control enclosure
[5] High-pressure plumbing
[6] Power and water controls
[7] Side panels
[8] Cutting stage lid

Cutting Stage Lid and Side Panels

NOTICE

Do not remove the side panels under normal conditions. Damage may occur when operating the ProtoMAX with the side panels removed. Only remove them when required by maintenance or troubleshooting procedures.

The cutting stage lid provides safe access to view the cutting process. The lid has a built in safety interlock switch that halts all cutting operations (pauses MAKE, stops stage motion, and turns off the pump) when the lid is opened. Always use the Pause button in the software to pause the system before opening the lid. This allows the operator to safely inspect the work and adjust materials as needed. Once the lid is closed, the cutting operation may be continued. Side panels provide protection to the catcher tank and pump. Incoming water pressure may be monitored through the viewing portal located on the right side panel. Panels should remain on the table assembly during operation. Panels can be easily removed for access to the interior components.

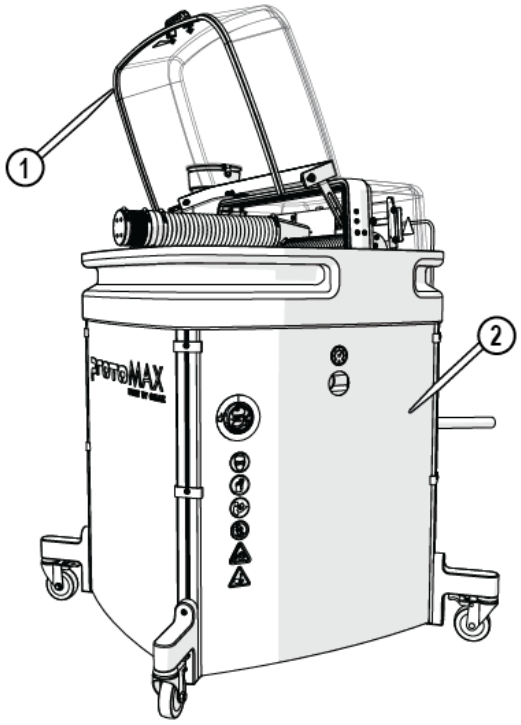


Figure 9

[1] Cutting stage lid [2] Side panel (x 3)

X, Y, and Z-axis Cutting Stage

The cutting stage provides a 12 in. (30 cm) (X-axis) by 12 in. (30 cm) (Y-axis) cutting envelope. The Z-axis allows manual up and down movements for cutting materials up to 1 in. (3 cm) thick.

The cutting stage uses the same grid and coordinate system as in the Intelli-MAX software. When looking down on the table, the X-axis runs left to right and the Y-axis runs front to back. The Z-axis allows vertical movement of the cutting head. When the ProtoMAX is homed, the nozzle is moved to the position X=0 and Y=0 coordinate at the lower left corner of the cutting envelope.

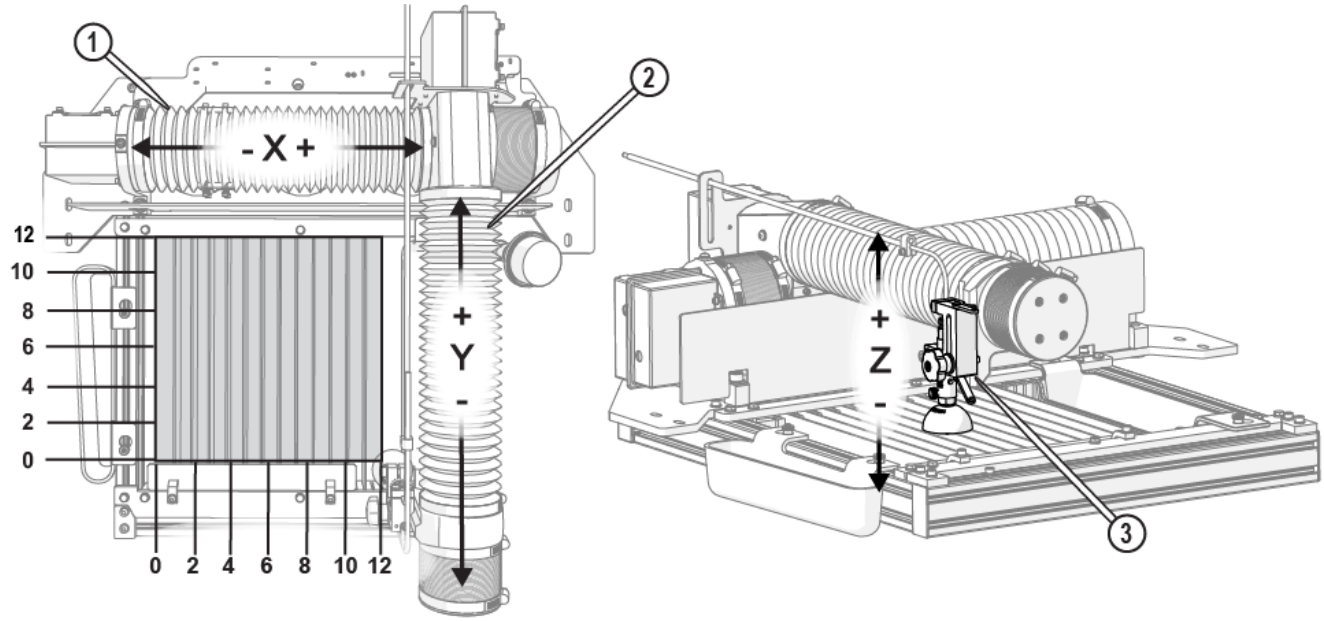


Figure 10

[1] X-axis [2] Y-axis [3] Z-axis

Slat Bed

The cutting stage has a removable slat bed assembly to support cutting materials. The slat bed assembly is removed to access the cutting tank for cleaning and maintenance. The slat bed assembly is secured to the cutting stage frame and provides support for the part being machined.

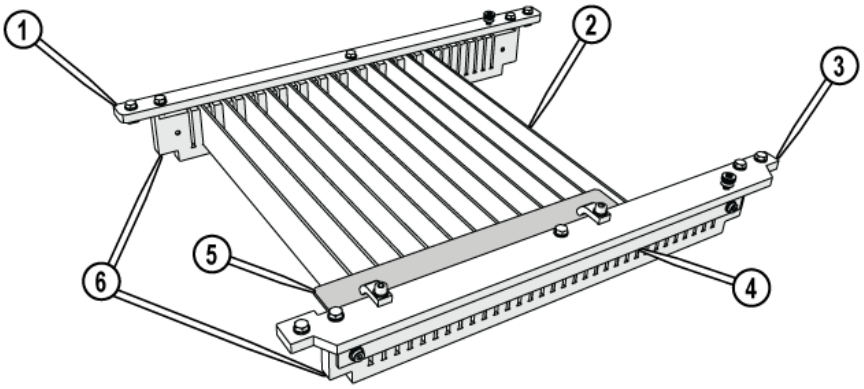


Figure 11

[1] Mounting plate, rear [3] Mounting plate, front [5] Square fixture plate
[2] Slats [4] Slat comb bracket (x 2) [6] Slat comb (x 2)

Catcher Tank

The catcher tank stores the water from the cutting nozzle and provides a settling tank for the spent garnet abrasive and cut away material. The catcher tank bottom is shielded to prevent cutting through when operating the machine.

NOTICE

Do not add chemicals to the catcher tank water. Damage to the catcher tank and other components may occur.

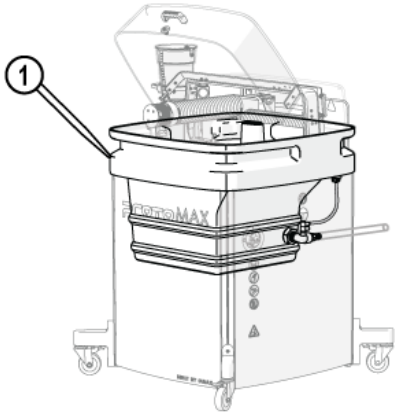


Figure 12

[1] Catcher tank

Tank Drain

The adjustable tank drain helps maintain optimal water level by allowing excess water to drain from the catcher tank during cutting operations. The drain has a flexible tube to adjust the water level as needed and allows cutting underwater. The tank overflow allows excess water to exit through the drain port and drain hose to prevent overfilling.

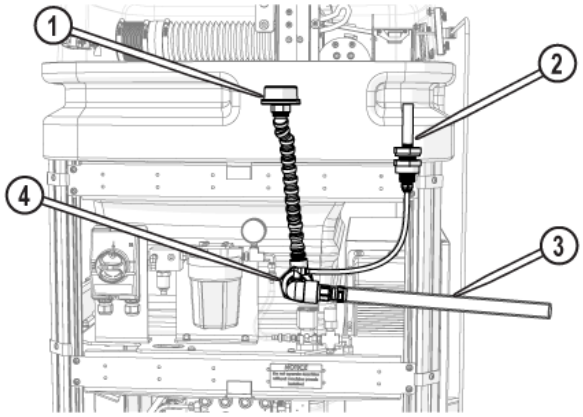


Figure 13

[1] Adjustable tank drain [2] Tank overflow drain [3] Tank drain hose [4] Tank drain port

Material Holding System

The material holding system fixtures (secures) materials while machining a part. Fixturing prevents the material from moving, vibrating, floating, tipping, or falling into the tank. The abrasive jet stream is very powerful. The force exerted from the abrasive waterjet stream into the tank can move or float the material during the cutting process. If the material moves during machining, the part will not be precise and may be ruined.

NOTE

See the help files for best practices tips on fixturing materials.

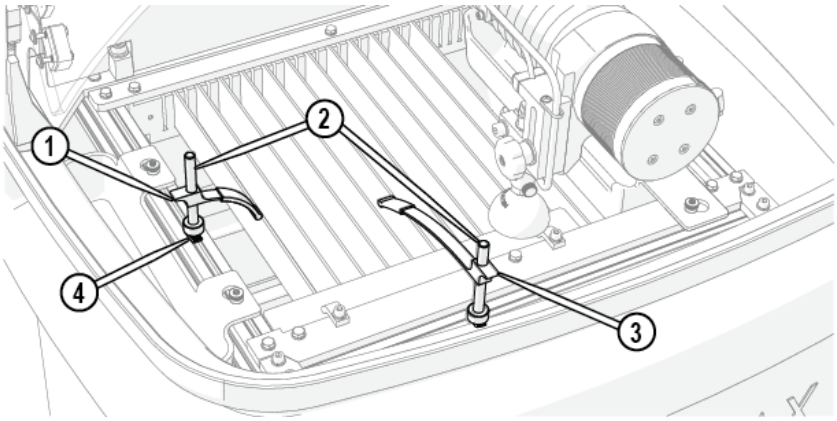


Figure 14

[1] Holding arm, short [3] Holding post [3] Holding arm, long [4] T-nut

Power Switch

AC power is controlled by a power switch located on the electrical control enclosure. All ProtoMAX system power is removed when OFF.

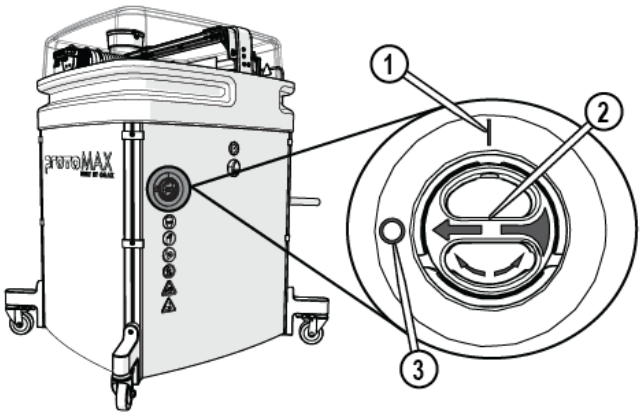


Figure 15

[1] Power ON position [2] Power selector [3] Power OFF position

Garnet Abrasive Delivery System

The garnet abrasive delivery system consists of the high-pressure nozzle, garnet abrasive feed system (hopper and feed tube), and high-pressure plumbing. The garnet abrasive hopper lid keeps the garnet abrasive from being contaminated with debris or getting wet. The garnet abrasive screen helps to filter small pieces of debris when filling the hopper that may clog the feed tube or nozzle. When machining a part, the garnet abrasive flows from the hopper to the abrasive waterjet nozzle through the garnet abrasive feed tube.

NOTICE

The garnet abrasive material in the hopper must be kept clean and dry. If moisture enters the hopper, the garnet abrasive material will clump and clog the feed tube, which will require cleaning. Even very small particles of dirt will clog the mixing tube. Always store the garnet abrasive material in a covered, dry location protected from metal chips and other debris.

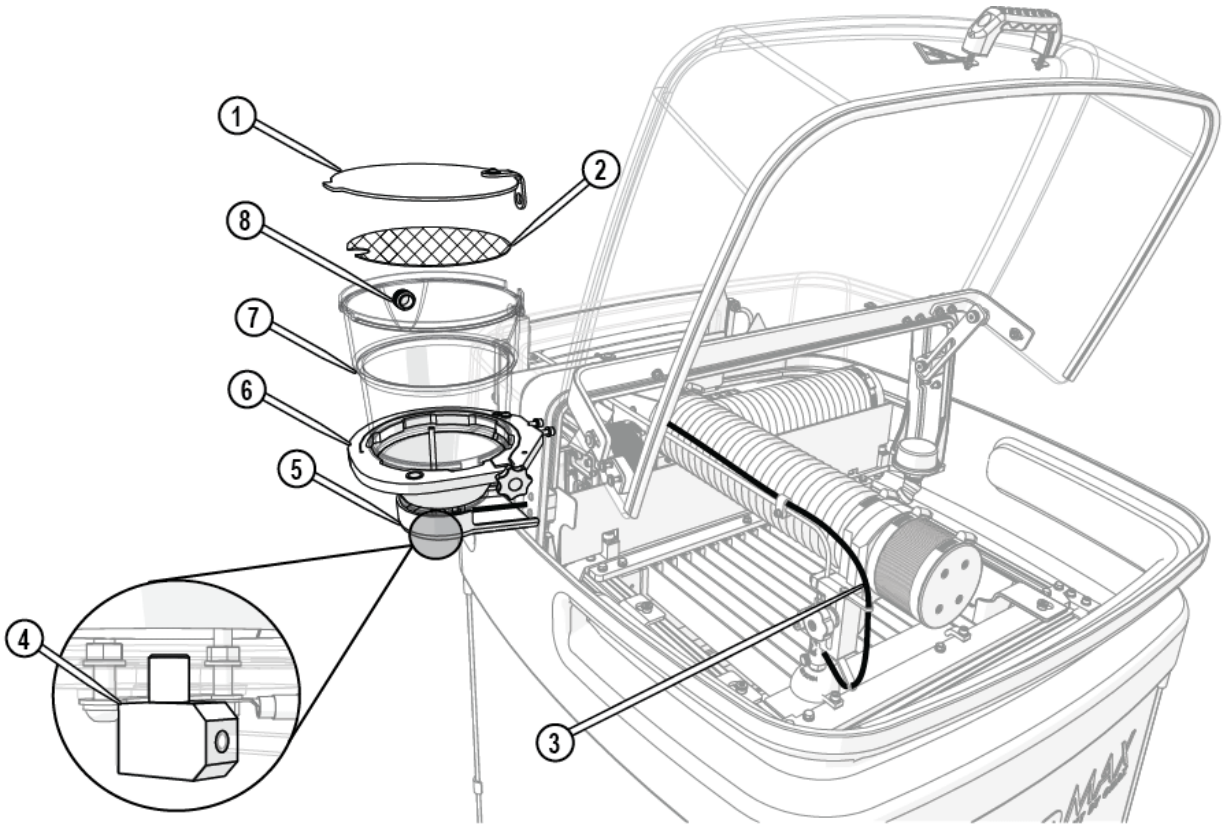


Figure 16

[1] Hopper lid [3] Abrasive feed tube* [5] Hopper splash guard [7] Garnet abrasive hopper assembly

[2] Garnet abrasive screen [4] Abrasive feed block [6] Hopper support plate [8] Bulk abrasive port

** tube routing is for illustration purposes only.*

NOTE

Always use garnet abrasive purchased from OMAX. This high-quality abrasive is more consistent in particle size and contain less dust. Inconsistency in particle size makes it difficult to maintain quality when cutting and increases the likelihood of the mixing tube becoming clogged. When dust is present, static electrical charges can build up, causing the garnet abrasive particles to clump together, hindering the garnet abrasive flow.

Abrasive Waterjet Nozzle

The abrasive waterjet nozzle contains a 0.030 in. (0.762 mm) replaceable mixing tube, 0.008 in. (0.2032 mm) replaceable (drop-in) orifice assembly, and nozzle body. High-pressure water is forced through the orifice and enters into a larger mixing chamber, drawing the garnet abrasive from the abrasive feed tube. The water and garnet abrasive is mixed into a high-speed slurry, and then moves into the mixing tube to form the abrasive waterjet stream. The abrasive waterjet stream exits the mixing tube through the bottom of the nozzle to strike and remove the material being machined.

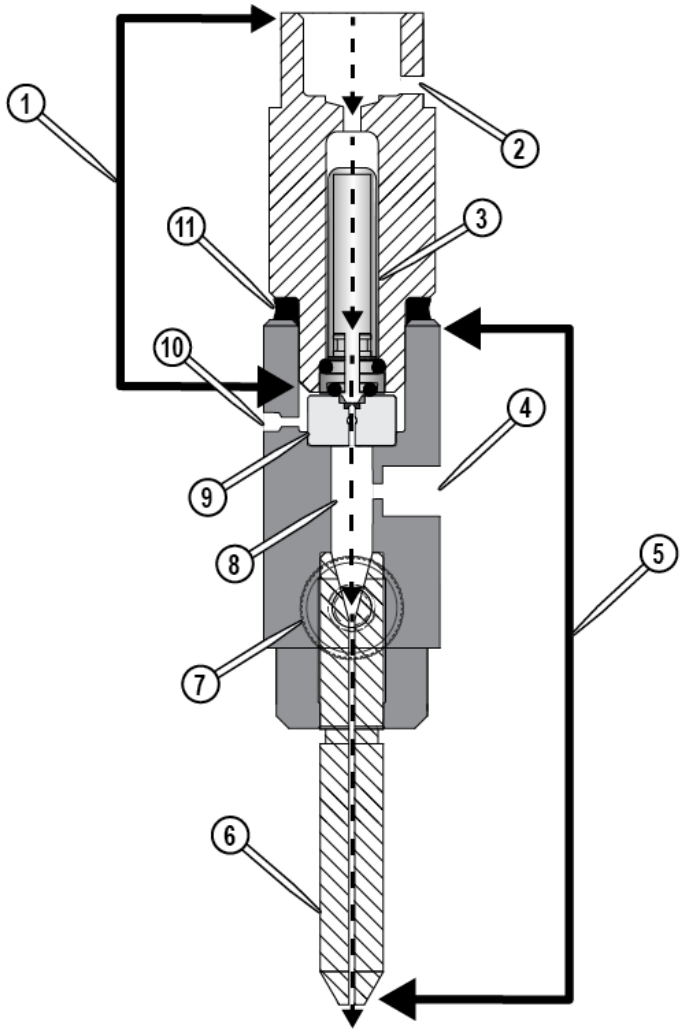


Figure 17

[1] Nozzle inlet body assembly [4] Garnet abrasive inlet [7] Mixing tube retainer [10] Nozzle body weep hole
[2] Inlet body weep hole [5] Nozzle body assembly [8] Mixing chamber [11] Inlet body O-ring
[3] Nozzle filter [6] Mixing tube [9] Orifice assembly

High-pressure Pump

The high-pressure pump provides approximately 30,000 pounds per square inch (psi) of cutting pressure for the ProtoMAX. Output high-pressure from the pump is automatically controlled by a variable frequency drive (VFD). The software helps prevent damage to the pump by halting operation when there is inadequate incoming water pressure, excess water temperature, or overpressure events.

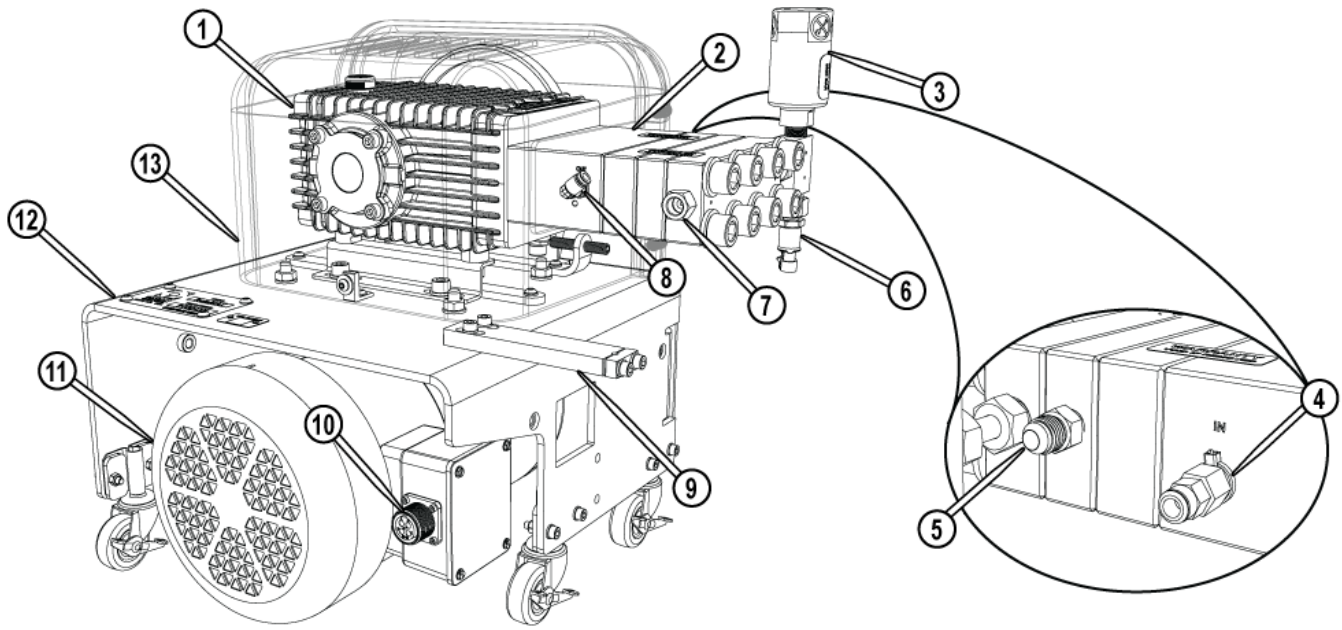


Figure 18

[1] Crankcase	[6] High-pressure water transducer	[11] Electrical motor
[2] High pressure wet-end	[7] High-pressure water OUT connection	[12] Pump frame
[3] Safety valve	[8] Cooling line OUT connection	[13] Crankcase cover
[4] Cooling line IN connection	[9] High-pressure nipple support bracket	
[5] Water IN connection	[10] Electrical connection	

Water Filter

The water filter removes debris from incoming water that can clog and damage the high-pressure components. The water filter is mounted on the side of the table assembly. The outlet water pressure is monitored by the pressure gauge mounted on the water filter.

NOTICE

Do not operate the ProtoMAX without the incoming water supply filter. Operating the ProtoMAX without the water supply filter will introduce debris into the system and may damage the pump and high-pressure system.

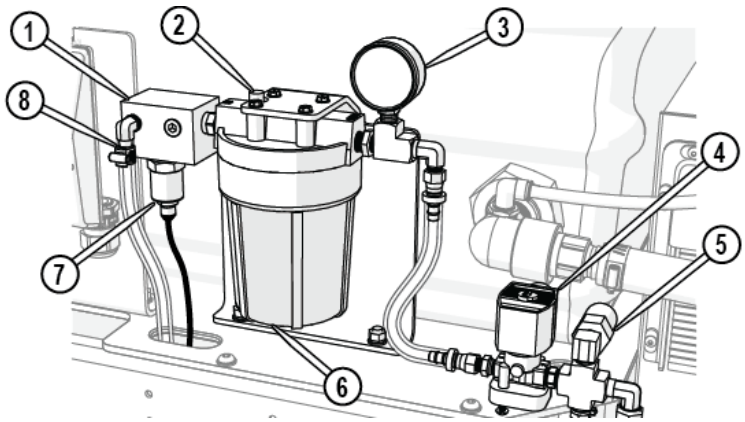


Figure 19

[1] Water manifold	[4] Water control solenoid	[7] Water temperature transducer
[2] Air release button	[5] Water pressure switch	[8] Water connection (incoming)

[3] Water pressure gauge [6] Water filter assembly

Laptop

The ProtoMAX laptop is pre-installed with Intelli-MAX software and is connected to the ProtoMAX by a USB cable.

Figure 20

Intelli-MAX® Proto Software

Intelli-MAX software by OMAX is easy-to-use and maximizes the functionality of the ProtoMAX Abrasive Waterjet.

LAYOUT is computer aided design (CAD) software that creates tool paths for the ProtoMAX abrasive waterjet system. LAYOUT includes all the basic commands expected in a CAD package, as well as tools specific to abrasive waterjet machining. The LAYOUT help system provides information needed to operate LAYOUT's functions.

MAKE software controls the ProtoMAX abrasive waterjet system by sending precise motor control commands to move the nozzle along a part's cutting path, while controlling the high-pressure water. The MAKE help system provides information needed to operate the software's cutting functions.

See the ProtoMAX Help system for more information on LAYOUT and MAKE.

Accessories

Optional accessories for the ProtoMAX can be found at www.protomax.com.

MAKE A PART OVERVIEW

Intelli-MAX LAYOUT and MAKE are the software tools used in making a part. Following the below listed steps provides the process for successfully making a part. See https://knowledgebase.omax.com for detailed information on making a part.

LAYOUT

1. **Import or create a drawing file (DXF file)**.
   The first step in making a part is to obtain or create a drawing file. LAYOUT software provides tools to create and edit new and existing drawing files (.dxf) for machining. Drawing files may also be imported from other CAD programs.
2. **Assign machining qualities (edge finish).**
   The next step is to assign machining qualities (edge finish) to the drawing entities (lines, arcs, etc.) that tell the nozzle how fast or slow to move to obtain the desired edge finish.
3. **Clean the drawing.**
   Next, the drawing should be cleaned to remove duplicate entities, extra dots, gaps, and other garbage entities that are hard to find in the drawing. A clean drawing eliminates machining confusion by defining only one continuous path for the machine to follow.
4. **Add path elements to the drawing.**
   After cleaning, path elements need to be drawn. Path elements tell the machine where to cut, where to travel without cutting (traverse), when to pierce the material (lead in) and the exit points (lead out).
5. **Create the machine tool path file (ORD/OMX).**
   The last step in LAYOUT is to convert the drawing file to a machine tool path file (ORD/OMX) that tells the machine how to

cut the part.

MAKE

6. **Start up 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.
7. **Open and configure the ORD/OMX file.**
   The tool path file is opened and the material setup data is entered so the machine knows the path to cut and the material type and thickness.
8. **Load and secure the material.**
   The material is then placed and secured to the cutting stage. Fixturing the material to prevent any movement in the X, Y, or Z directions is critical in making good parts.
9. **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 start of the machine tool path.
10. **Prepare for machining.**
    Conduct a dry run to ensure the part fits on the material and the nozzle clears any obstacle. Any problems found during the dry run can be corrected before machining the part.
11. **Machine the part.**
    Flip the splash guard cup down. Adjust the drain, then add water to raise it above the material surface (if applicable), then begin machining. When finished remove and inspect the part.

OPERATE THE PROTOMAX

See the Intelli-MAX® Help system for additional information on using LAYOUT and MAKE software.

Startup Checklist

The following checklist is a quick reference to ensure equipment startup tasks are completed in the required sequence. Detailed instructions are located in Start the ProtoMAX.

	Turn ON the laptop (do not open the MAKE application)
	Connect the USB cable to the laptop
	Turn ON the main power; verify the light comes on
	Turn ON the water supply
	Check the water pressure
	Open the MAKE application
	Home the machine
	Conduct a nozzle test without abrasive
	Fill the hopper with garnet abrasive
	Conduct a nozzle test with abrasive
	Verify the garnet abrasive is flowing from the hopper to the nozzle
	Inspect the visible high-pressure plumbing connections for leaks
	Open and configure a kerf check sample file or the part to cut
	Load and secure the material on the cutting stage
	Set the nozzle stand-off
	Position the nozzle at path start point
	Perform a dry run
	Fold down the splash guard cup
	Add water to raise the water level above the material surface, adjust the drain height if needed

	Begin machining the part
	Check the cutting water pressure
	Adjust the tool offset if needed

NOTE

A kerf check is performed only to verify mixing tube wear and to adjust the tool offset if needed.

Start the ProtoMAX

Startup Overview

1. Turn **ON** the **laptop** power.

NOTE

Do not open MAKE. The ProtoMAX USB cable must be plugged in and recognized by the laptop before opening the MAKE program.

2. Connect the **ProtoMAX USB cable** [1] to the **laptop**.

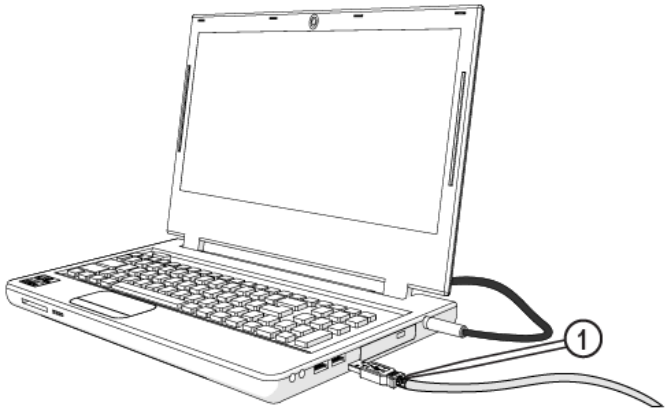


Figure 21

3. Turn **ON** the **main power** [2] and verify the **light** [1] is on.

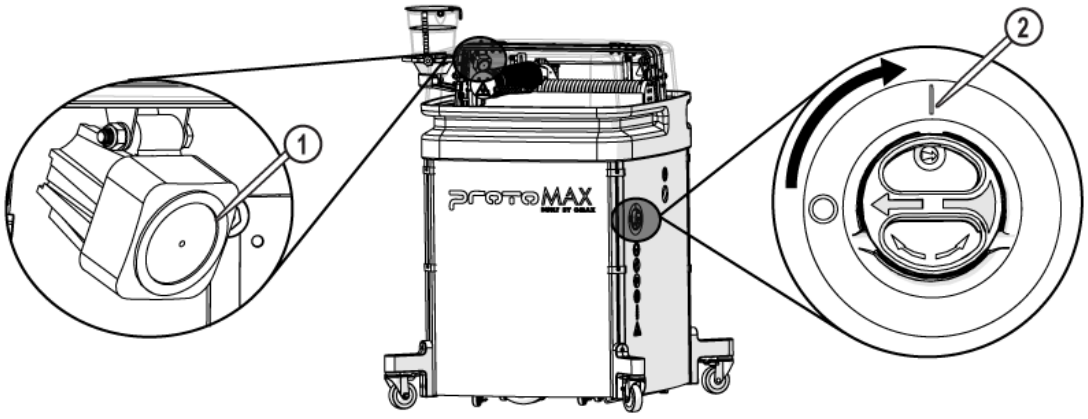


Figure 22

4. Turn **ON** the incoming water supply.
5. Record the incoming water pressure (Figure 23).

NOTE

The incoming water pressure should be 45–85 psi.

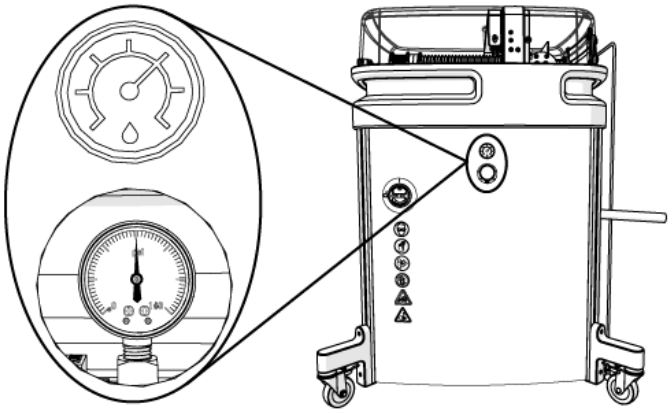


Figure 23

6. Open the MAKE software.
7. Click the Machine needs to be homed banner to home the machine.

NOTE

Home is required after every power cycle. For example, when the main power switch is turned OFF and then turned back ON, during power outages, or the main power cord is disconnected.

Figure 24

8. Conduct a nozzle test without abrasive.
   a. Open and secure the **lid**.

CAUTION

Use care when opening or closing the lid to avoid injury. Keep hand, fingers, or body part away from the side of the table when closing the lid. Never let the lid free-fall.

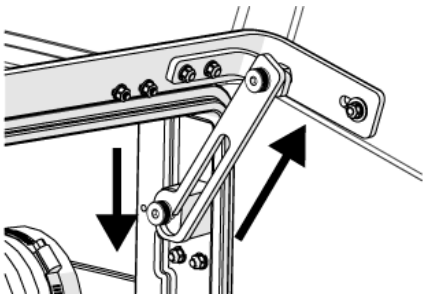


Figure 25

   b. Remove the **abrasive feed tube** from the **nozzle** and place it over the top of the **Y-axis** [1].

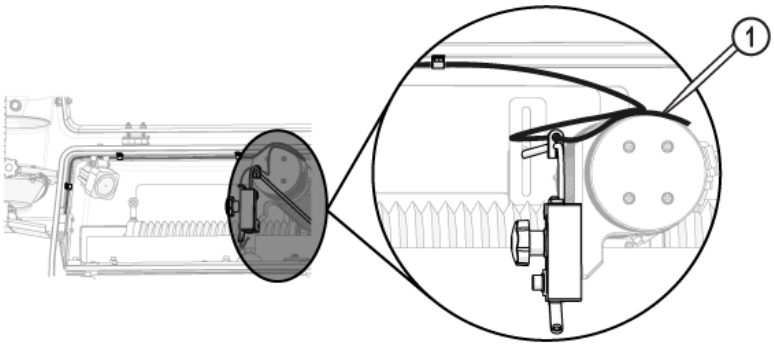


Figure 26

c. Verify the **mixing tube** is properly seated and secured in the **nozzle body**.

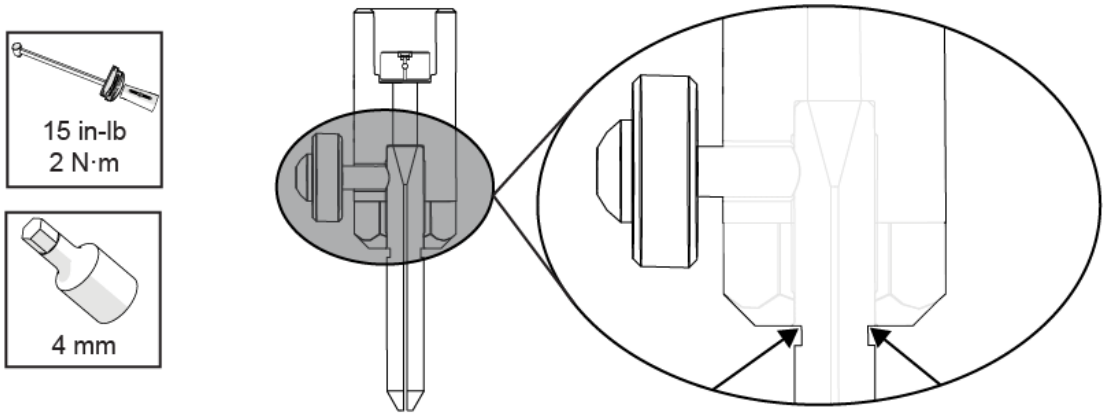


Figure 27

d. Place the **nozzle splash guard** [1] on the **mixing tube** [2] with the cup folded up.

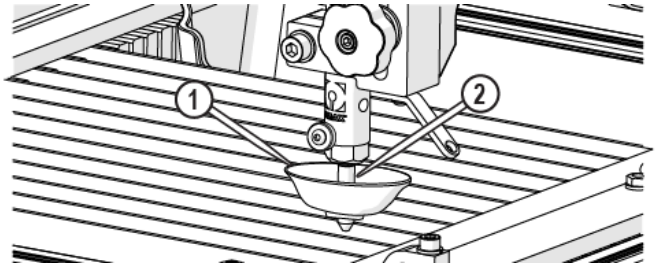


Figure 28

e. Position the **nozzle** in the center of the **tank**, between two **slats** using the X, Y Jog buttons or **keyboard arrow keys**.

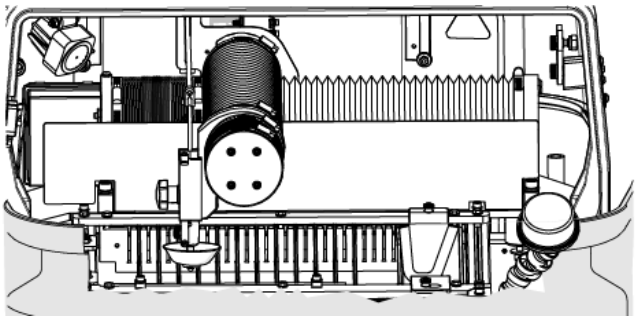


Figure 29

f. Lower the **nozzle** to within 1 in. of the surface of the water.

NOTICE

Always hold the nozzle when loosening the hand knob. Do not let the nozzle fall and strike the cutting deck slats or material to avoid damage to the nozzle and/or nozzle components.

g. Close the **lid**.

h. Click Test [1].

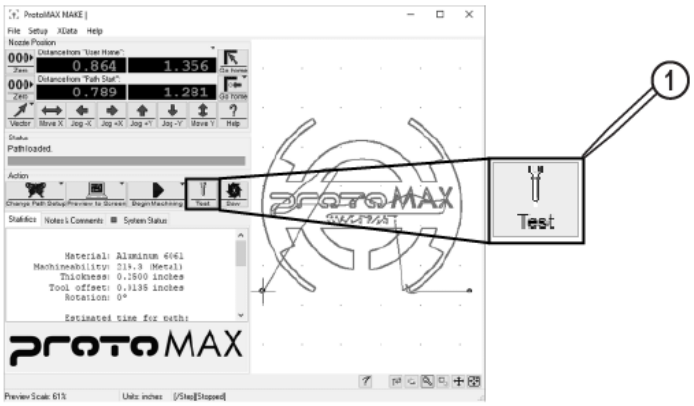


Figure 30

i. In Test Operations, select Test Cutting Head (Pump, Jet, and Abrasive), and click Next.

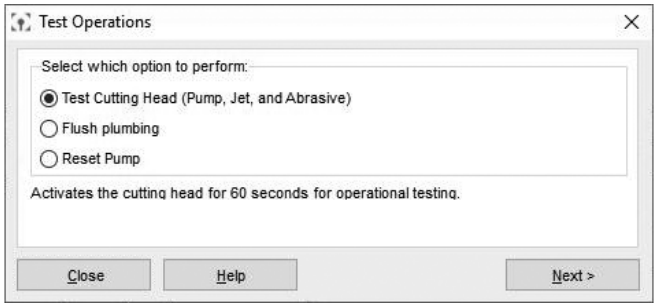


Figure 31

j. Click Start Test.

Figure 32

k. Click Close when the test is complete.

9. Fill the **hopper** with garnet abrasive.

a. Remove the **hopper lid**.

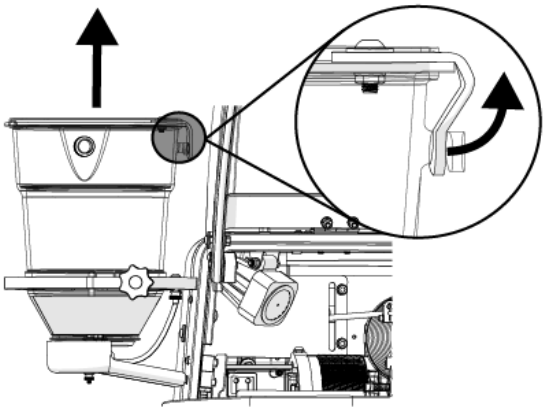


Figure 33

b. Pour the garnet abrasive through the **garnet abrasive screen** into the **hopper**.

NOTE

Gently tap the hopper side to evenly settle the garnet abrasive in the hopper.

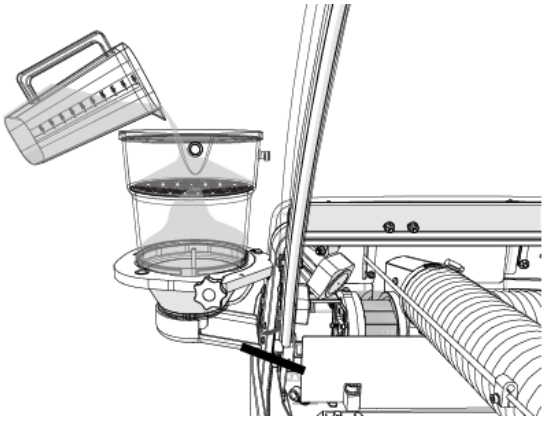


Figure 34

a. Replace the **hopper lid**.

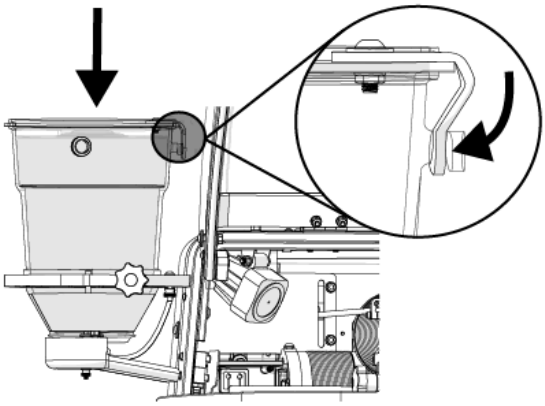


Figure 35

10. Conduct a nozzle test with abrasive.

CAUTION

Use care when opening or closing the lid to avoid injury. Keep hand, fingers, or body part away from the side of the table when closing the lid. Never let the lid free-fall.

a. Open the **lid**.

b. Visually check the condition of the **garnet abrasive feed tube**, replace as needed.

c. Connect one end of the **garnet abrasive feed tube** to the **garnet abrasive feed block** [1] and connect the other end to the **nozzle** [2].

CAUTION

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.

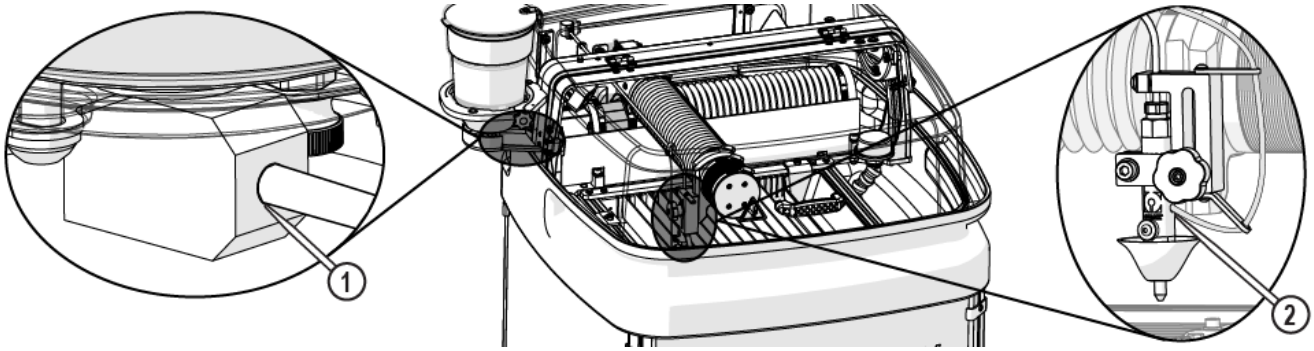


Figure 36

d. Open MAKE and use the X, Y Jog **buttons** [1] or **keyboard arrow keys** to position the **nozzle** between two **slats**.

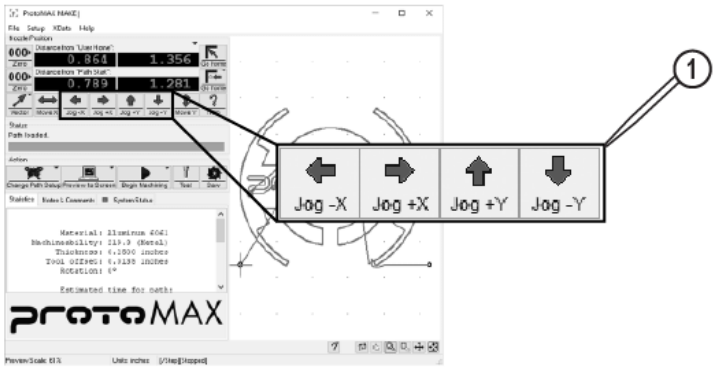


Figure 37

e. Lower the **nozzle** to within 1 in. (3 cm) of the surface of the water, if needed.

NOTICE

Always hold the nozzle when loosening the hand knob. Do not let the nozzle fall and strike the cutting deck slats or material to avoid damage to the nozzle and/or nozzle components.

f. Click **Test** [1].

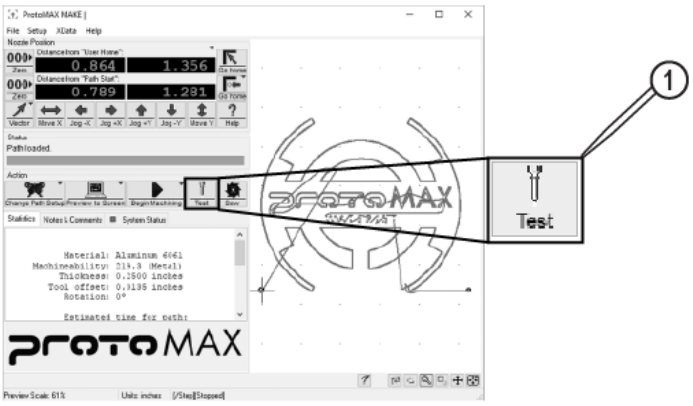


Figure 38

g. In Test Operations, select Test Cutting Head (Pump, Jet, and Abrasive), and click Next.

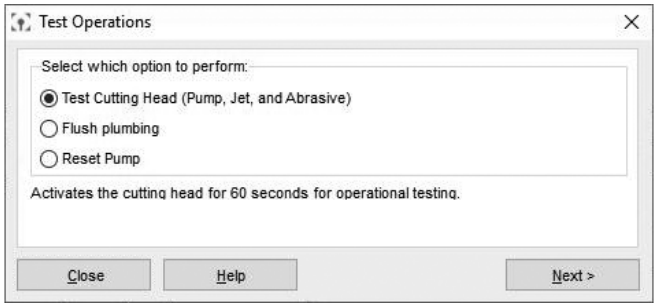


Figure 39

h. Click Start Test.

Figure 40

11. Observe the **garnet abrasive tube** [1] at the **hopper** to verify the garnet abrasive is flowing, then click Close when the test is complete (Figure 41).

NOTE

The garnet abrasive flow is fast and hard to see. The sound increases indicating garnet abrasive is flowing.

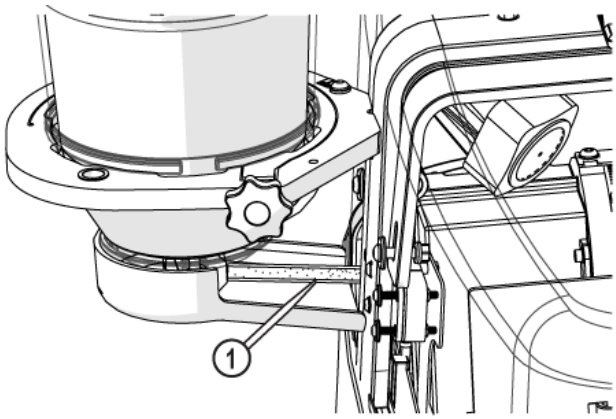


Figure 41

12. Inspect the **nozzle** [1] and all visible **high-pressure plumbing** [2] connections for leaks.

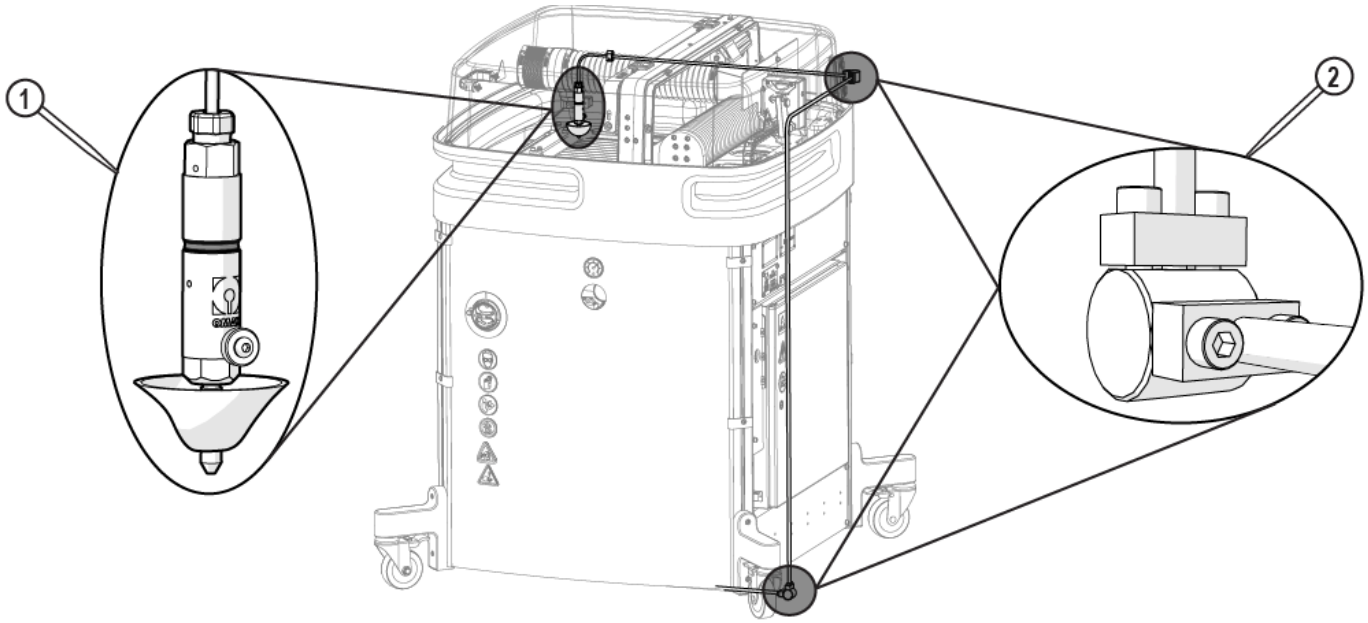


Figure 42

13. Open and configure the kerf check sample file.

Cutting Best Practices and How to Cut the Kerf Check Part

a. In MAKE, open and configure the kerf check sample file.

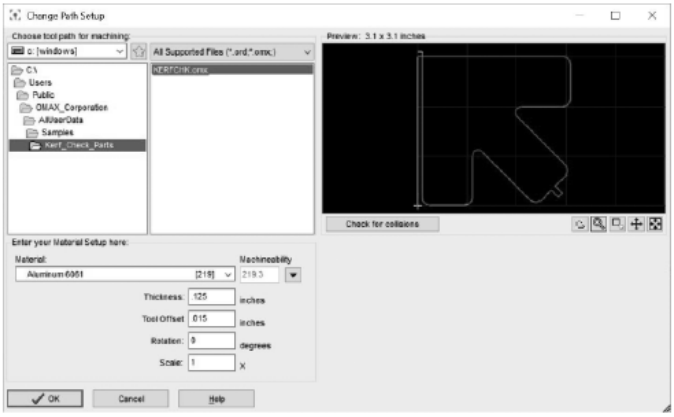


Figure 43

b. Open and secure the **lid**.

CAUTION

Use care when opening or closing the lid to avoid injury. Keep hand, fingers, or body part away from the side of the table when closing the lid. Never let the lid free-fall.

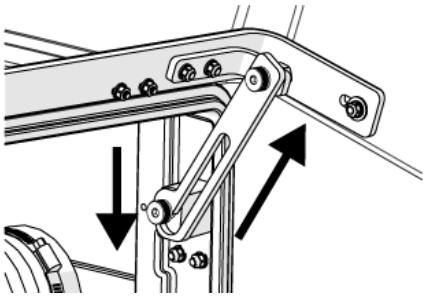


Figure 44

CAUTION

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.

14. Load and secure the material on the **cutting stage**.

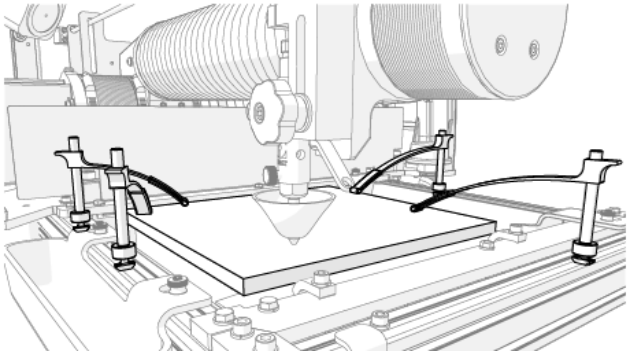


Figure 45

15. Set the **nozzle** standoff at the highest point on the material.

NOTICE

Always hold the nozzle when loosening the hand knob. Do not let the nozzle fall and strike the cutting deck slats or material to avoid damage to the nozzle and/or nozzle components.

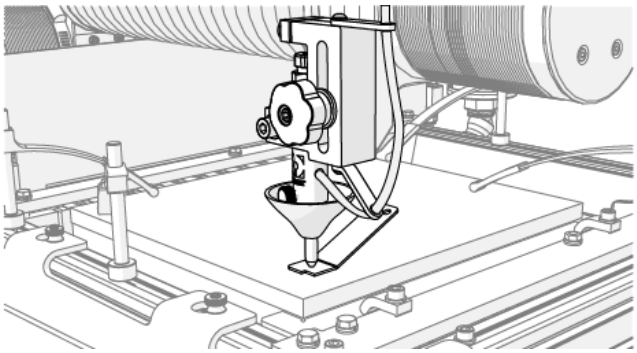


Figure 46

16. Position the **nozzle** at the path start.

NOTICE

To extend the life of the catcher tank, cut towards the center of the tank. Continuous cutting at the outer edges of the cutting envelop may allow the jet stream to wear through the sides of the catcher tank.

17. Close the **lid**.

CAUTION

Use care when opening or closing the lid to avoid injury. Keep hand, fingers, or body part away from the side of the table when closing the lid. Never let the lid free-fall.

a. Lift the **lid** and push the **support arm** towards the back.

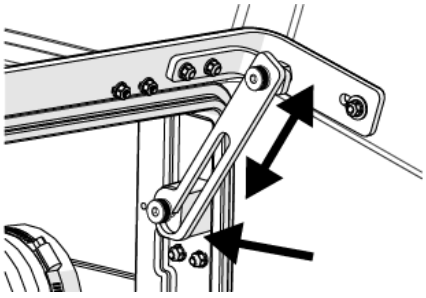


Figure 47

b. Lower the **lid** to the **catcher tank**.

18. Perform a dry run.

a) Open and configure (set the material type and thickness) for the machine tool path for the part.

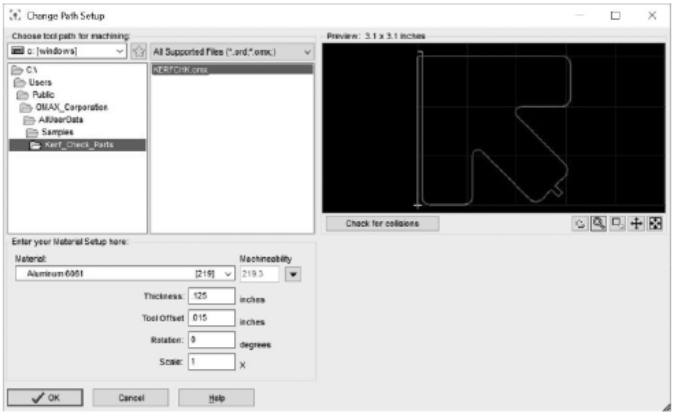


Figure 48

b) Click **Go home** [1] to move the **nozzle** to the Path Start Home position, if needed.

Figure 49

c) Click Begin Machining to display the Path Control dialog box.

Figure 50

d) Right-click the Start button to display a list of dry run options.

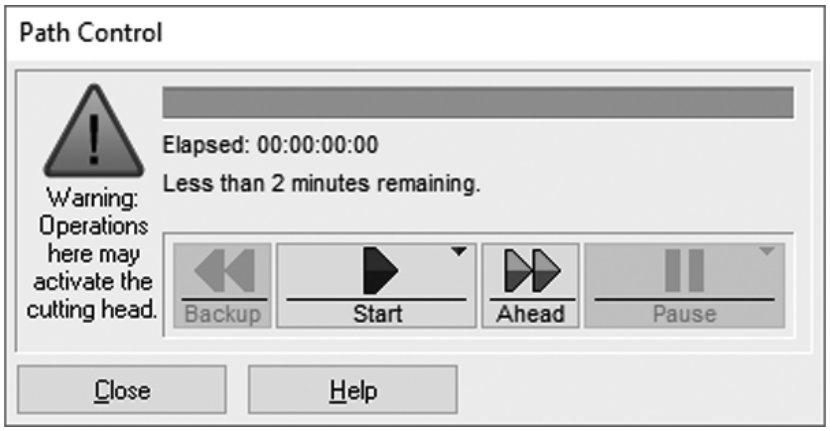


Figure 51

e) Click Dry Run at 1/4 rapid traverse speed....

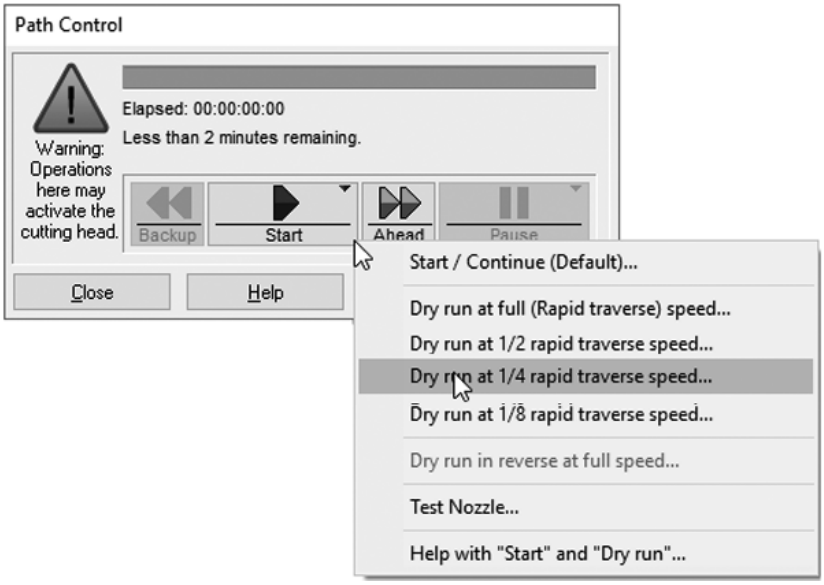


Figure 52

f) At any time, click Pause if potential problems are seen during the dry run process to stop **nozzle** movement.

Figure 53

g) When the dry run is finished, click the Close button to close the Path Control dialog.

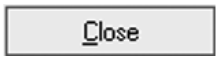


Figure 54

19. Click Go Home in the Path Start dialog box to move the nozzle to the path start point.

Why Cut Under Water

20. Fold down **splash guard cup**.
21. Adjust the **tank drain** [1] and fill the **tank** with water above the material (if possible).

NOTICE

To extend the life of the catcher tank, cut towards the center of the tank. Continuous cutting at the outer edges of the cutting envelop may allow the jet stream to wear through the sides of the catcher tank.

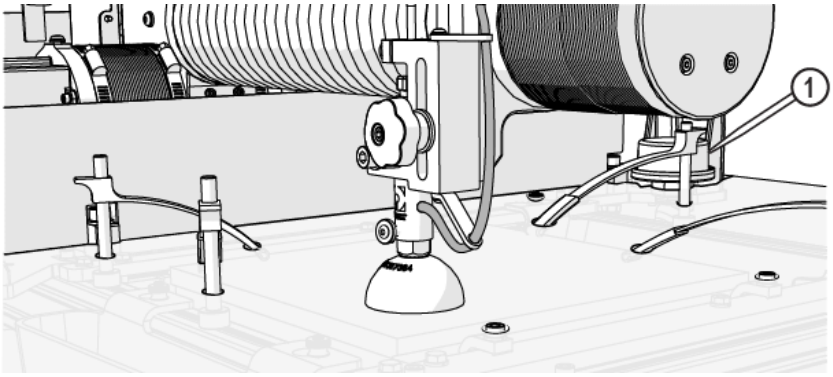


Figure 55

NOTE

Cut parts under water when possible. Cutting under water lowers the noise level and reduces the mist and splash created by the water and abrasive. Cutting under water also helps the garnet bins collect cutting debris instead allowing the debris to settle in the tank, which makes tank cleaning easier.

22. Close the **lid**.
23. Cut the part.
    a. Click **Begin Machining** [1].

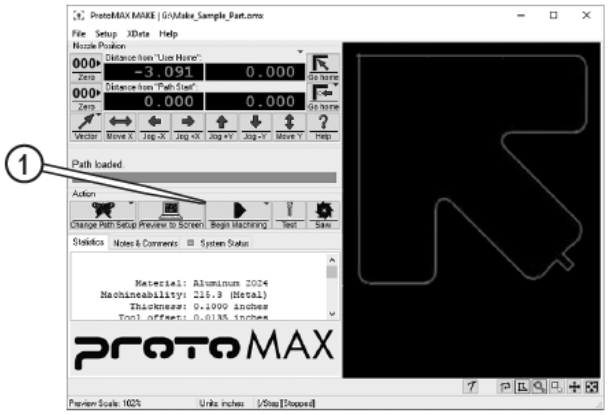


Figure 56

    b. Click Start.

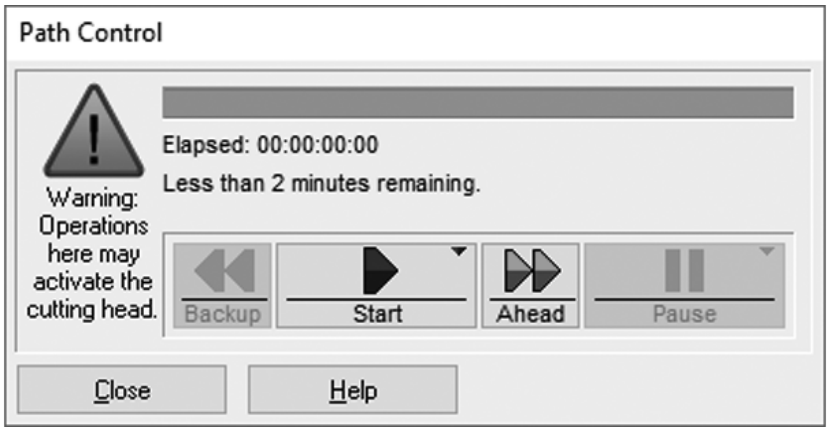


Figure 57

24. Check the cutting water pressure and compare to the recorded incoming water pressure.

If the cutting water pressure is 25 psi or lower, the **water filter** should be changed (see *401440-EN Maintenance, ProtoMAX*).

25. Adjust the **tool offset** [1] if needed, see Measuring the Abrasivejet Kerf.

Figure 58

Shutdown Checklist

The following checklist is a quick reference to ensure equipment shutdown tasks are completed in the required sequence. Detailed instructions are located in Shutdown the ProtoMAX.

	Position the nozzle for shutdown
	Remove the abrasive feed tube from the nozzle
	Run test nozzle to clear the nozzle
	Close MAKE
	Turn OFF the laptop
	Turn OFF the ProtoMAX
	Clean the machine
	Turn OFF the water supply
	Turn OFF the breaker power switch, if needed

Shutdown the ProtoMAX

Shutdown Overview

1. Conduct a **nozzle** flush.
   a. Open the **lid**.

CAUTION

Use care when opening or closing the lid to avoid injury. Keep hand, fingers, or body part away from the side of the table when closing the lid. Never let the lid free-fall.

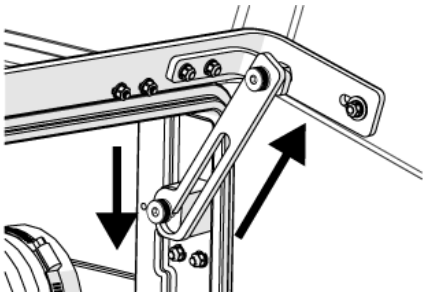


Figure 59

   b. Remove the **garnet abrasive tube** [1] from the **nozzle** and place it over the **Y-axis**.

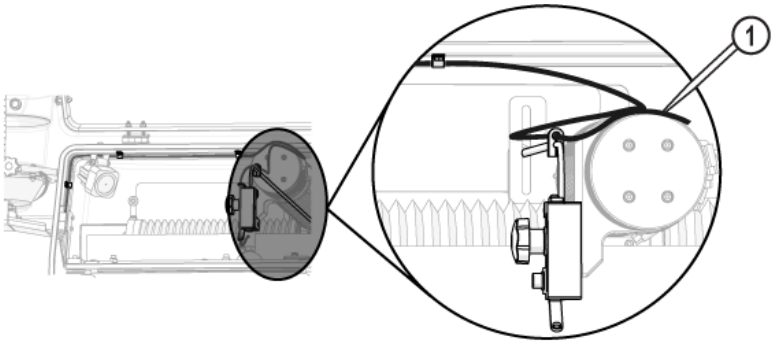


Figure 60

c. Close the **lid**.

CAUTION

Use care when opening or closing the lid to avoid injury. Keep hand, fingers, or body part away from the side of the table when closing the lid. Never let the lid free-fall.

d. Open MAKE and use the **X**, Y jog **buttons** [1] or **keyboard arrow keys** to position the **nozzle** in the center of the tank between two **slats**.

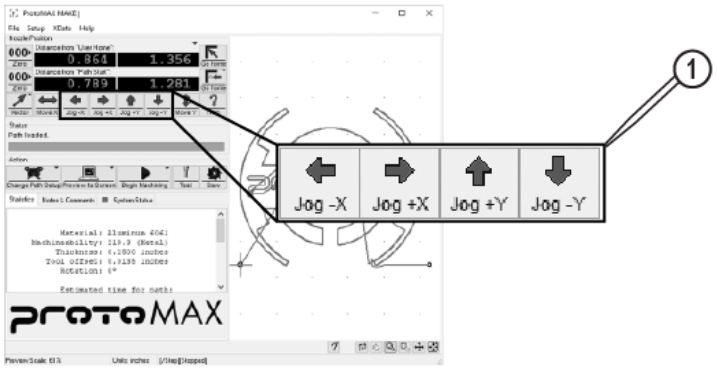


Figure 61

e. Click **Test** [1].

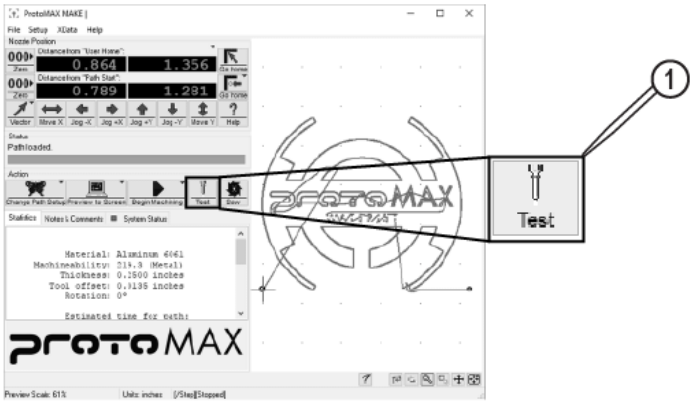


Figure 62

f. In Test Operations, select Test Cutting Head (Pump, Jet, and Abrasive), and click Next.

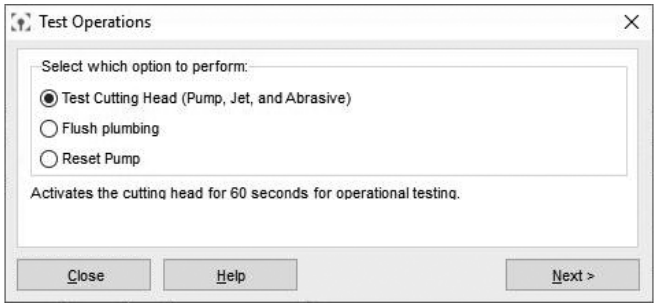


Figure 63

g. Click Start Test.

Figure 64

h. Click Close.

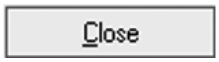


Figure 65

i. Verify there is no moisture or debris in the **abrasive feed tube**.

j. Insert the **garnet abrasive tube** into the **nozzle**.

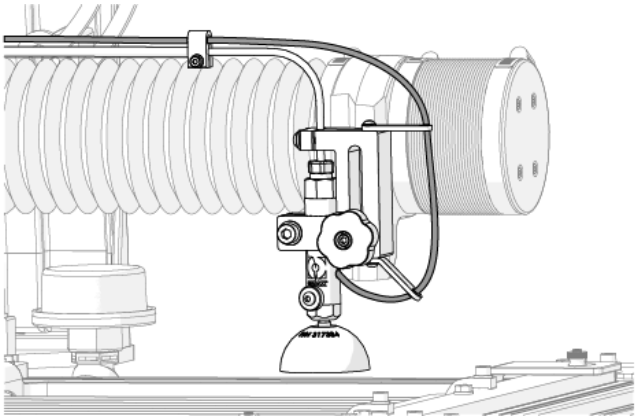
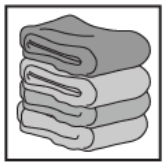


Figure 66

k. Close the MAKE software.

2. Turn **OFF** the **laptop**.

3. Clean the **machine** with a clean, damp cloth.



NOTICE

Never spray water on the electrical control cabinet or exterior surfaces of the machine. Water may enter the electrical control cabinet and damage internal components.

a. Remove any cutting debris from the **cutting stage**.

b. Remove any cutting debris from the **axes bellows**.

c. Remove any cutting debris from the **lid**.

d. Close the **lid**.

e. Wipe down the exterior surfaces of the machine.

CAUTION

Use care when opening or closing the lid to avoid injury. Keep hand, fingers, or body part away from the side of the table when closing the lid. Never let the lid free-fall.

4. Turn **OFF** [1] the ProtoMAX.

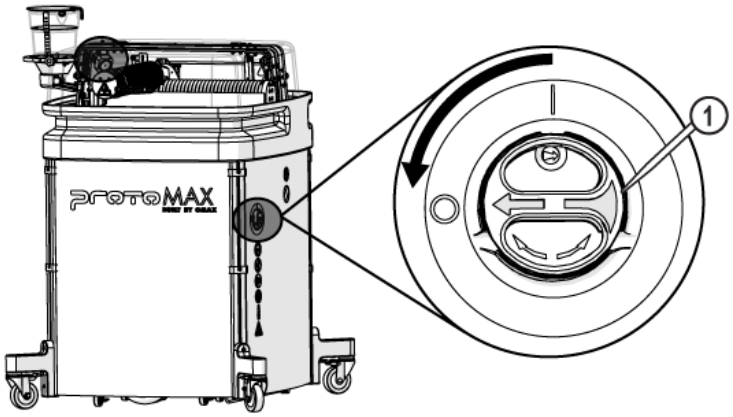


Figure 67

5. Turn **OFF** the water.
6. Turn **OFF** the breaker power switch, if needed.

CUT THE FIXTURING SQUARE

NOTE

See the fixturing-square instructions and video for additional information on cutting the fixturing square.

A **fixturing square** [1] establishes an X and Y reference to a known point in the cutting deck. The square provides a stable base for securing parts for cutting, and assists in maximizing material use when cutting. It can be used to precisely locate features on existing parts, or as a convenient surface to secure material against when cutting.

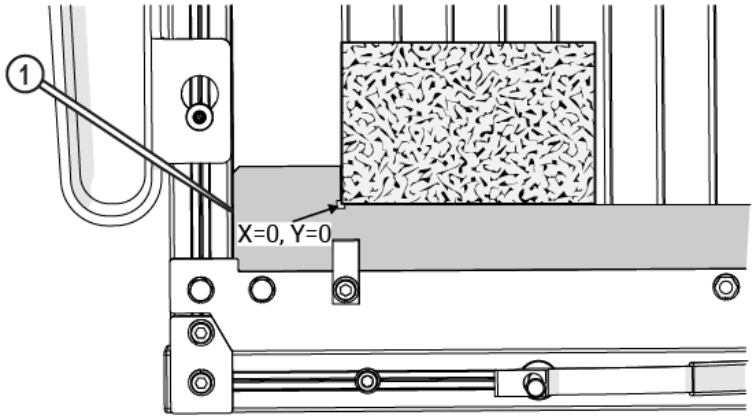


Figure 68

A square fixture is made by clamping material along the X-front frame in the machine cutting deck, and then using the machine to cut an "L" shape into it. Since the machine cuts the "L," we know it to be true and square to the machine's X- and Y-axes.

RECOVER FROM A NOZZLE CLOG

Recover from a Nozzle Clog

There are multiple scenarios resulting from a clog in the nozzle. The fix depends on how far water has traveled back up the abrasive feed tube and whether the water entered the abrasive hopper or not. In all scenarios, correct the condition that caused the nozzle to clog, such as wet garnet, a blocked orifice, a blocked mixing tube, or other before continuing operation.

1. Remove the **garnet abrasive feed tube** from the **nozzle assembly** [2] and the **garnet abrasive feed block** [1].

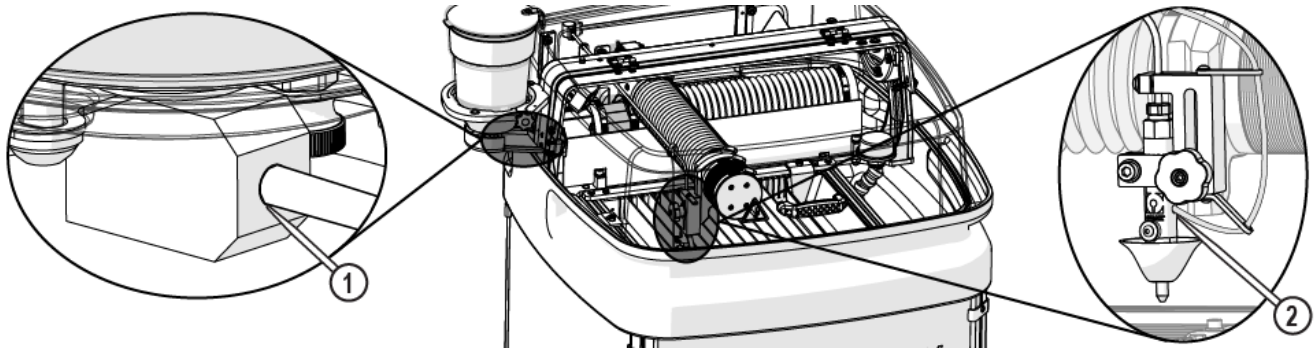


Figure 69

2. Use clean, dry air to completely clear the clog from the **abrasive feed tube**.

If the water entered the abrasive feed block:

3. Remove the **hopper splash guard**.

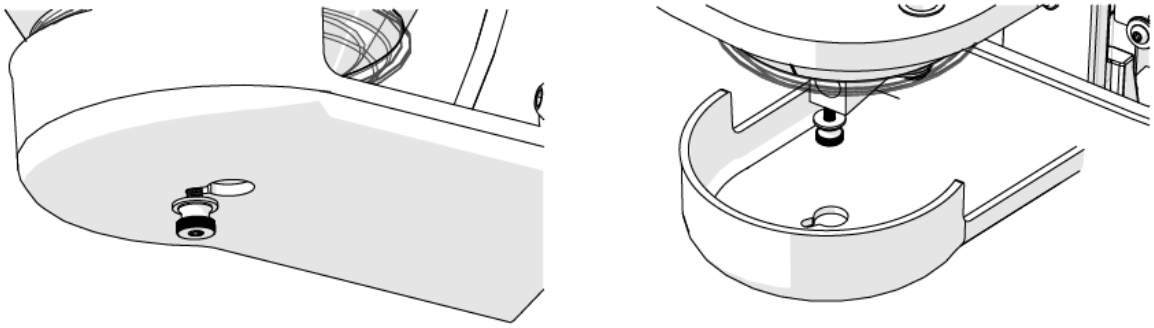


Figure 70

4. Remove the **hopper ground strap** [1].

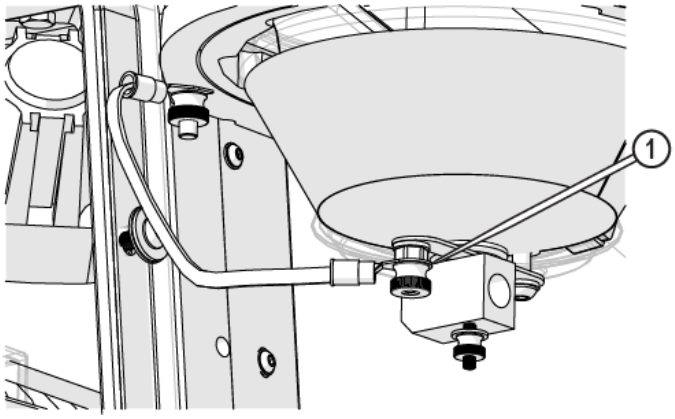


Figure 71

5. Remove the **abrasive feed block** [2] and insert the **red plug** [1] to prevent garnet from pouring out from the bottom of the **hopper assembly**.

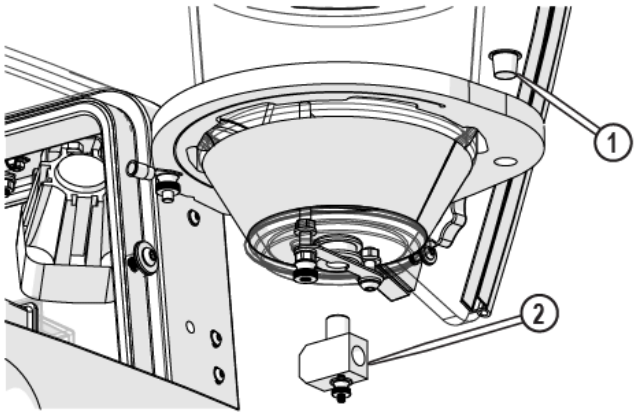


Figure 72

6. Use clean, dry air to completely blow out all debris, clumps, or clogs from the **abrasive feed block**.

If the water entered the hopper assembly:

7. Loosen the **knob** [1] and remove the **hopper assembly** from the **hopper support plate**.

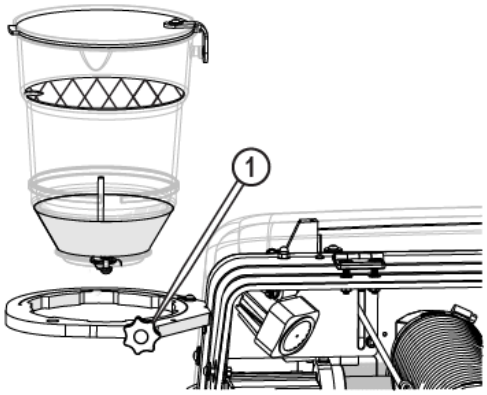


Figure 73

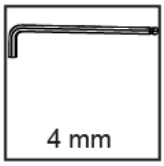
8. Completely empty and wipe out the **hopper**.

NOTE

Make sure the hopper container is completely dry prior to filling with dry garnet abrasive. Do not reuse garnet abrasive. The hopper screen may not sufficiently remove moist clumps from the wet abrasive. Garnet that has been exposed to moisture will clump and cannot be reused. Garnet that has been exposed to moisture will result in additional clogging.

9. Raise the **Z-axis**.

10. Remove the **nozzle splash guard** and **mixing tube** [1] from the **nozzle body**.



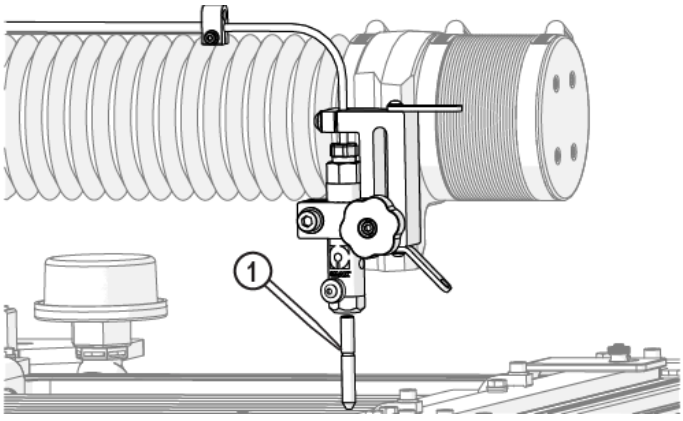


Figure 74

11. Inspect the **mixing tube** to see if light is visible through the bore.

If light is visible:

12. Re-install the **mixing tube** [1] into the **nozzle body**.

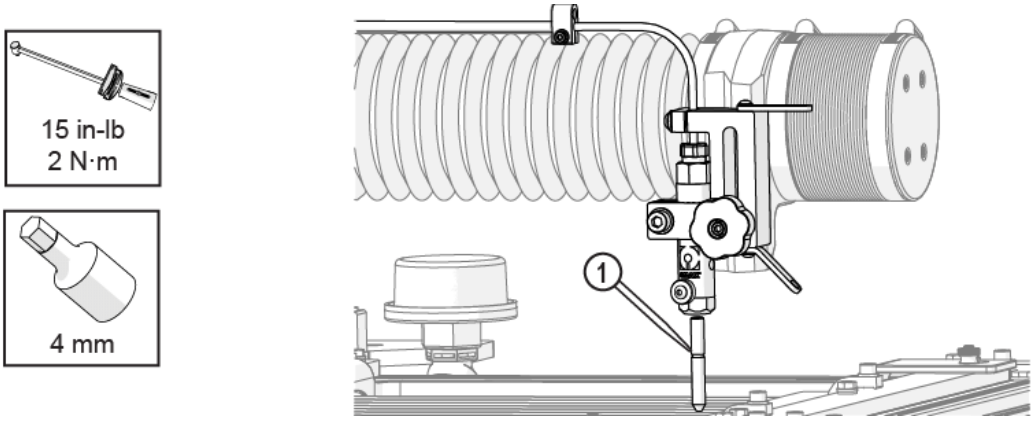


Figure 75

If light is not visible:

13. Turn the **mixing tube** [1] upside down and insert it back into the **nozzle body** and tighten it.

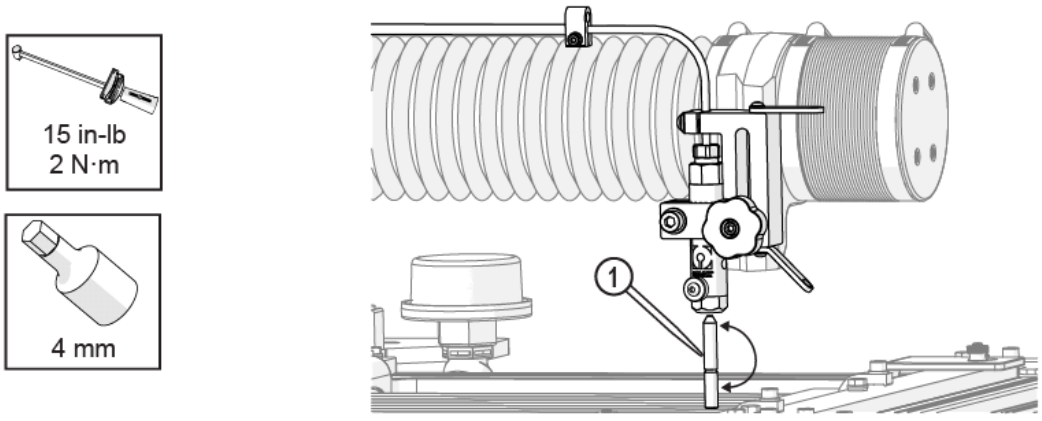


Figure 76

14. Position the **nozzle** towards the center of the **tank** (off the material) between two **slats**.
15. Lower the **Z-axis** to approximately 1 in. (3 cm) above the water surface.
16. Close the lid.

CAUTION

Use care when opening or closing the lid to avoid injury. Keep hand, fingers, or body part away from the side of the table when closing the lid. Never let the lid free-fall.

17. Open the Test dialog box and run a nozzle test to clear the mixing tube.
18. Remove the **mixing tube** [1].

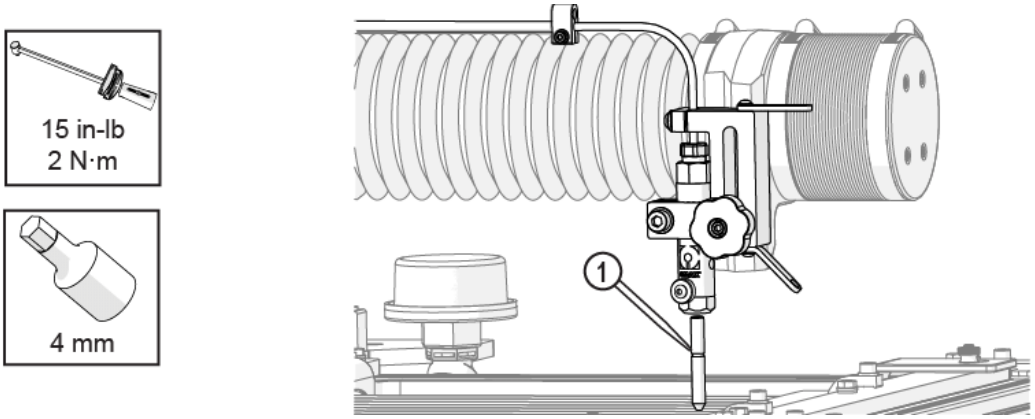


Figure 77

19. Remove the **nozzle body assembly** from the **nozzle inlet body**.

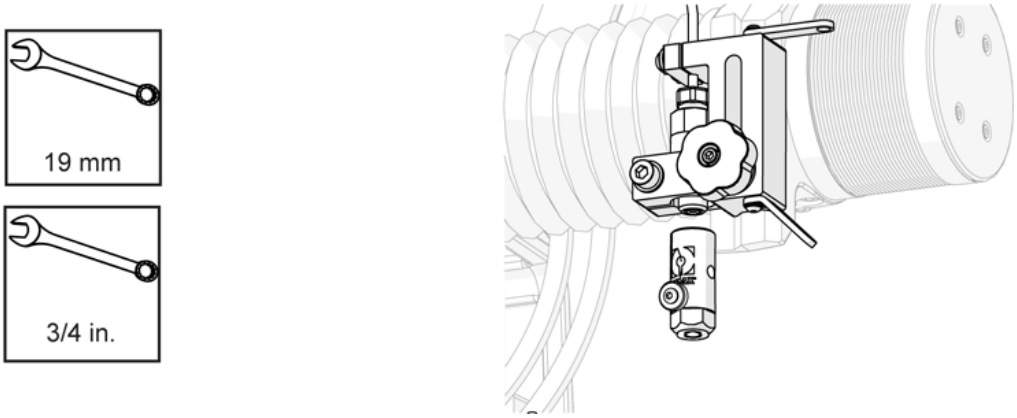


Figure 78

20. Remove the **orifice assembly** [1] and inspect the **chamber bore** [2].

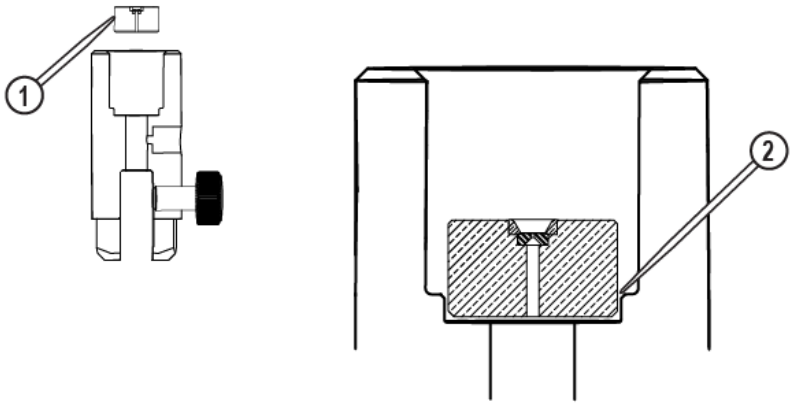


Figure 79

21. Clean the **orifice assembly** and the **nozzle body** (including the air vent hole) thoroughly prior to reassembly.

NOTE

Do not use a brush or cotton swab or foam-tipped applicator to apply lubricants because they may leave fibers and plug the nozzle.

1. Clean the inlet body threads by wiping with a clean rag.
2. Apply a light coat of Blue Goop to the **second and third threads** [1] of the **inlet body**, then spread the lubricant evenly around the **inlet body threads**.

NOTE

Use care when applying lubricants around high-pressure water routes. Lubricants can enter the high-pressure water system and clog the orifice and/or mixing tube.

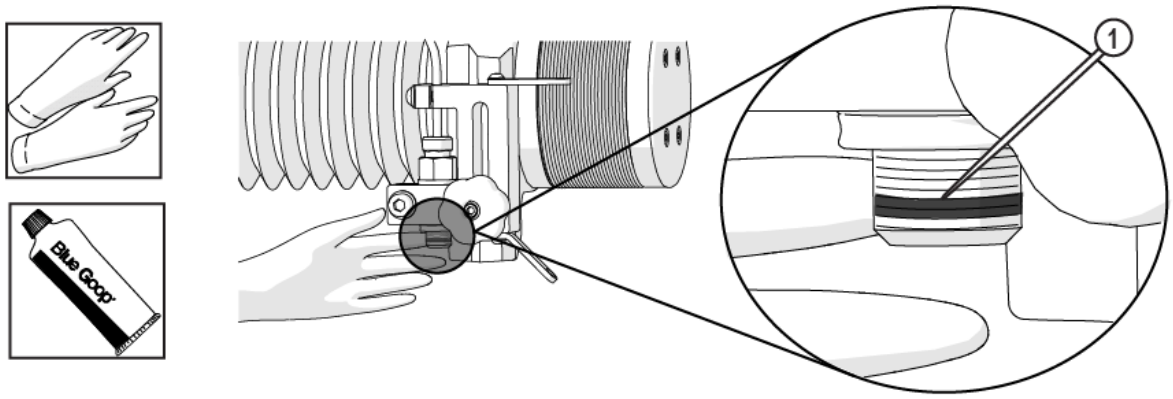


Figure 80

3. Wipe the excess Blue Goop from the end of the **inlet body** [1].

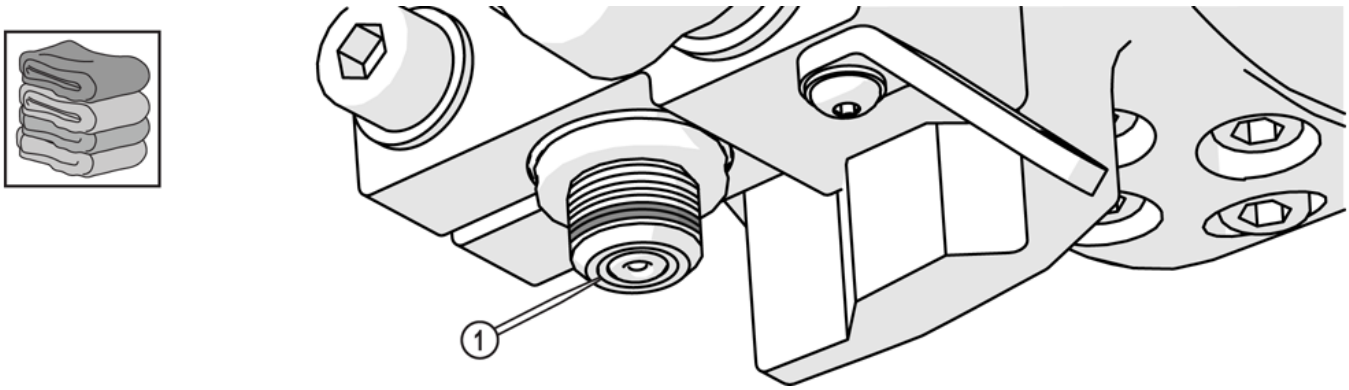


Figure 81

4. Apply a light coat of Blue Goop to the **first and second nozzle body threads** [1], then spread the lubricant evenly around the **nozzle body threads**.

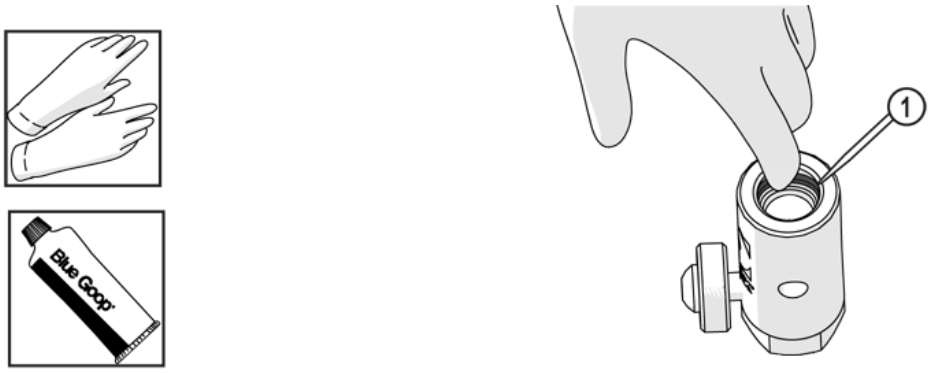
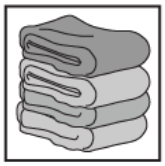


Figure 82

5. Wipe the excess Blue Goop from the end of the **nozzle body** [1].



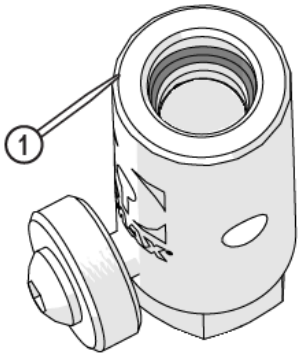


Figure 83

Once the nozzle is completely clean:

NOTICE

Always orient the orifice assembly so the brass [1] is visible from the top of the nozzle body. Inserting the orifice assembly in nozzle body in the incorrect orientation [2] may cause damage to the orifice assembly.

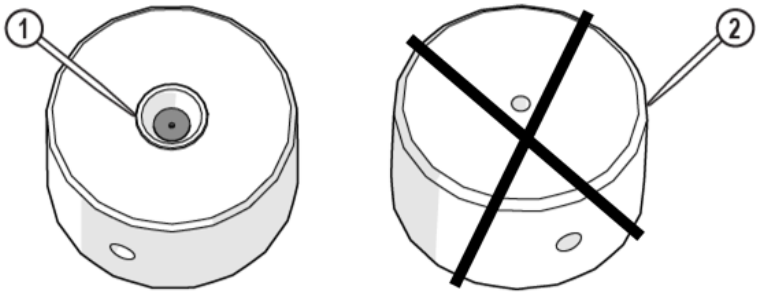


Figure 84

6. Insert the **orifice assembly** [1] into the **nozzle body** and adjust the orifice to ensure the it is seated correctly in the **chamber bore** [2].

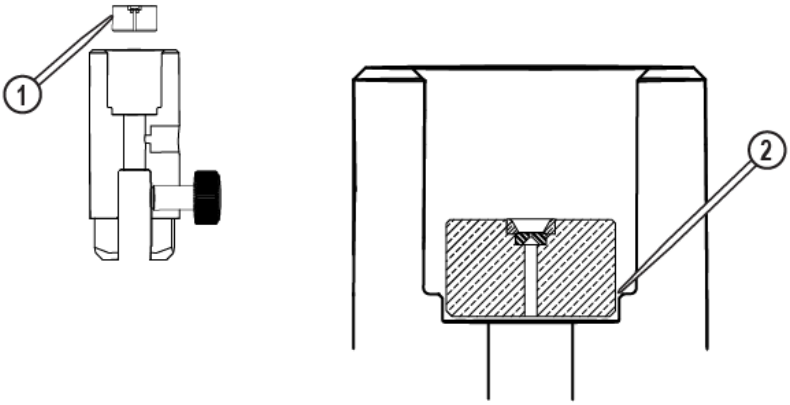


Figure 85

7. Re-install the **nozzle assembly** on the **nozzle inlet body**.

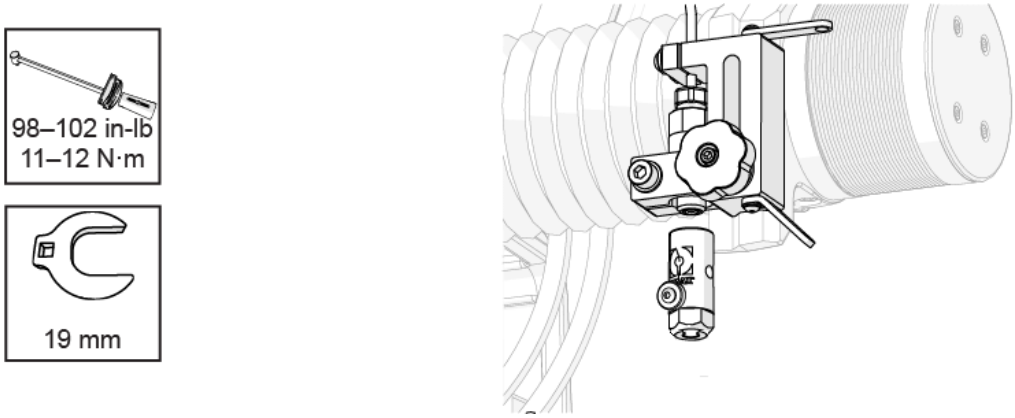


Figure 86

8. Raise Z-axis and move the cutting head over the material.
9. Insert and the mixing tube.
10. Close the Path Control window.
11. Re-install the **hopper** and its components (**abrasive feed block**, **feed tube**, **ground strap**, and **hopper splash guard**.

NOTE

When installing the abrasive hopper, ensure the washer is located on the underside of the hopper splash guard.

12. Fill the **hopper** with fresh, dry abrasive.
13. Connect the **abrasive tube** to the **nozzle body**.

NOTE

If an alert or fault message is displayed, reset the pump (see Reset the Pump).

14. Attach the **nozzle splash guard**.
15. Set the **nozzle stand-off**.
16. Close the **lid**.

CAUTION

Use care when opening or closing the lid to avoid injury. Keep hand, fingers, or body part away from the side of the table when closing the lid. Never let the lid free-fall.

To continue cutting the part, using MAKE:

17. Click Go Home in the Path Start Home dialogue.

Figure 87

18. Right-click Begin Machining.

Figure 88

19. Click Go to Spot on Path.

Figure 89

20. Move the cursor over the spot on the tool path slightly before the clog occurred and left click.
21. Click OK on Machine will now traverse into position dialog box.

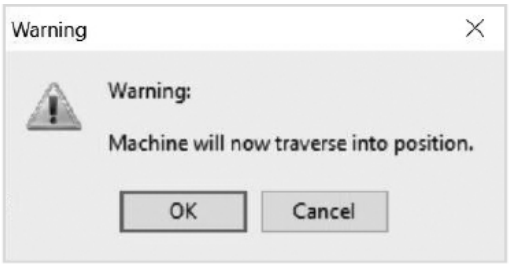


Figure 90

22. Click Continue to start cutting.

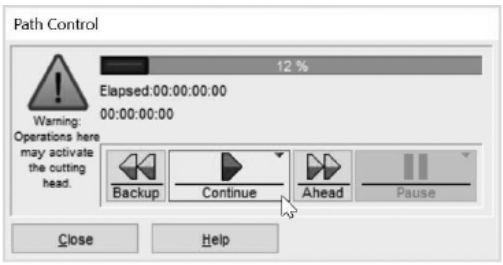


Figure 91

If nozzle clogging continues, it may be necessary to replace the abrasive feed tube, the mixing tube, nozzle orifice, and/or nozzle filter as one or more of these components may be causing the problem.

Reset the Pump

The reset pump test runs a 30 second sequence to reset the pump. This test should be done before operating the ProtoMAX for the first time, after changing the nozzle orifice, repairing or replacing the pump, repairing any high pressure plumbing leaks, or when required by a fault or alert message.

1. Open MAKE.
2. Move the **nozzle** between two **slats**.
3. Click Test.
4. In Test Operations, select Reset Pump, and click Next.
5. Click Start Test and check the **high-pressure plumbing** for leaks (the dialog box closes when the test is complete).

TECHNICAL SUPPORT

Refer to the ProtoMAX website for technical support contact information.

Warranty

Contact Customer Support or go to the ProtoMAX website.