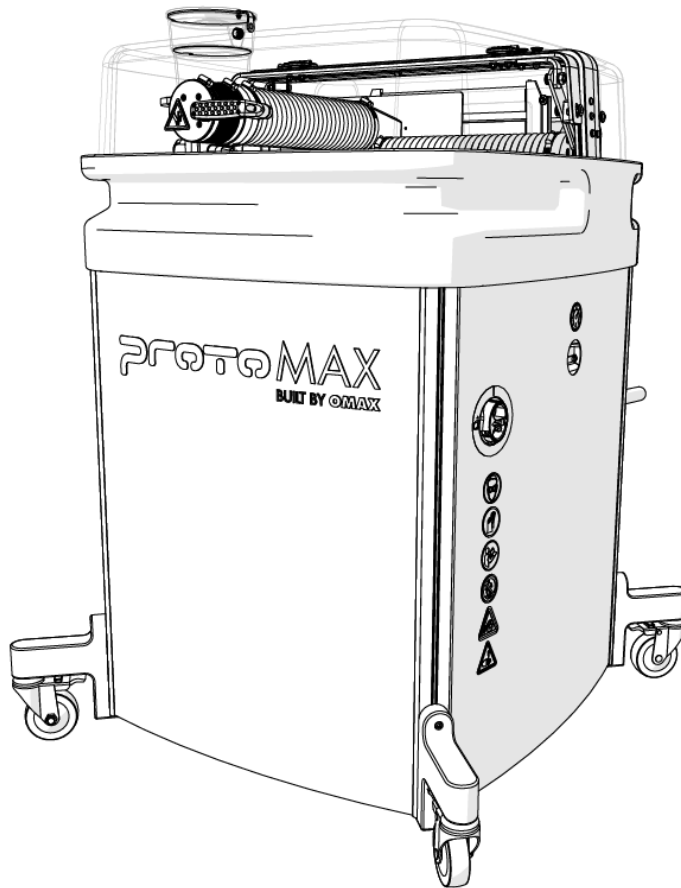


ProtoMAX®

Operation Guide



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 205

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

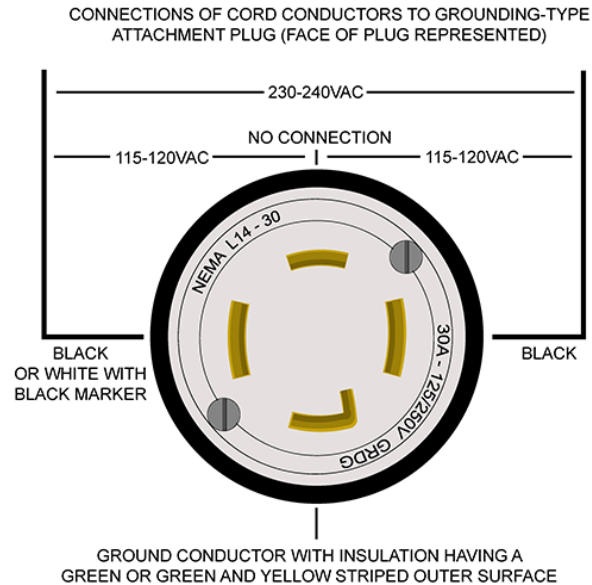


Figure 206

- 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 207

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



Figure 208

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.

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, over current and thermal protection for the pump motor.

Electrical Disconnect/Emergency Machine Off (EMO)

An electrical disconnects/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.

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	
	Torque wrench	15-102 in-lb (2-12 Nm)
	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	
	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:

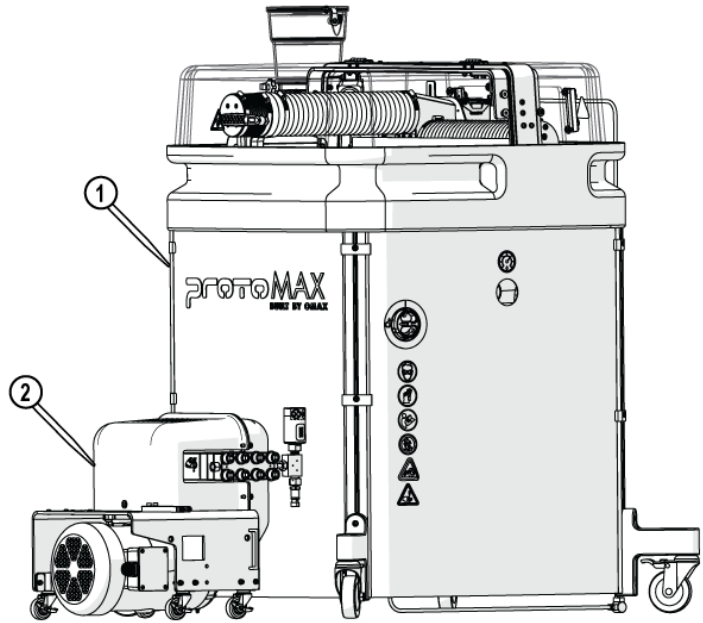


Figure 209

1] Table assembly
Table Assembly

[2] High-pressure pump

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

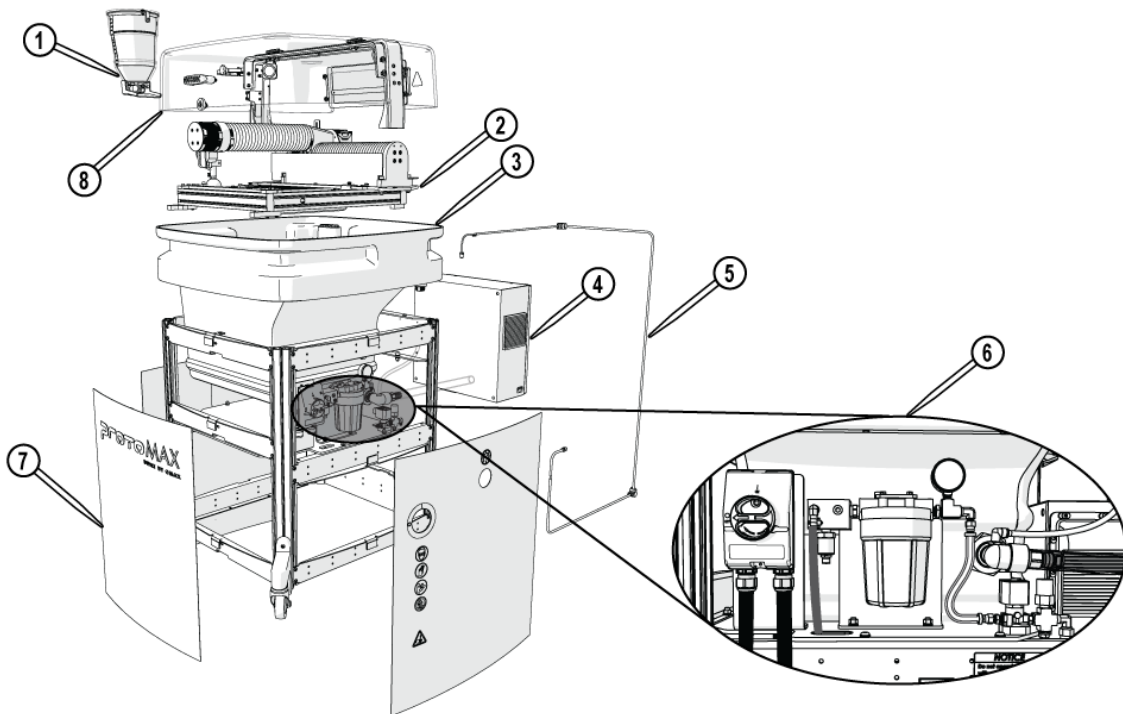


Figure 210

- [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

Cutting Stage Lid and Side Panels

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.

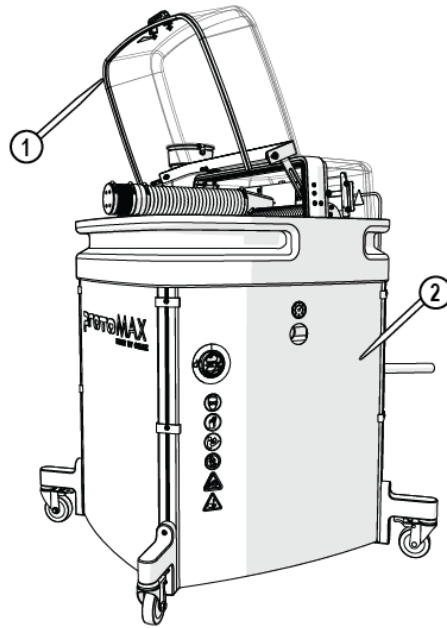


Figure 211

- [1] Cutting stage lid
- X, Y, and Z-axis Cutting Stage**

- [2] Side panel (x 3)

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 IntelliMAX 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.

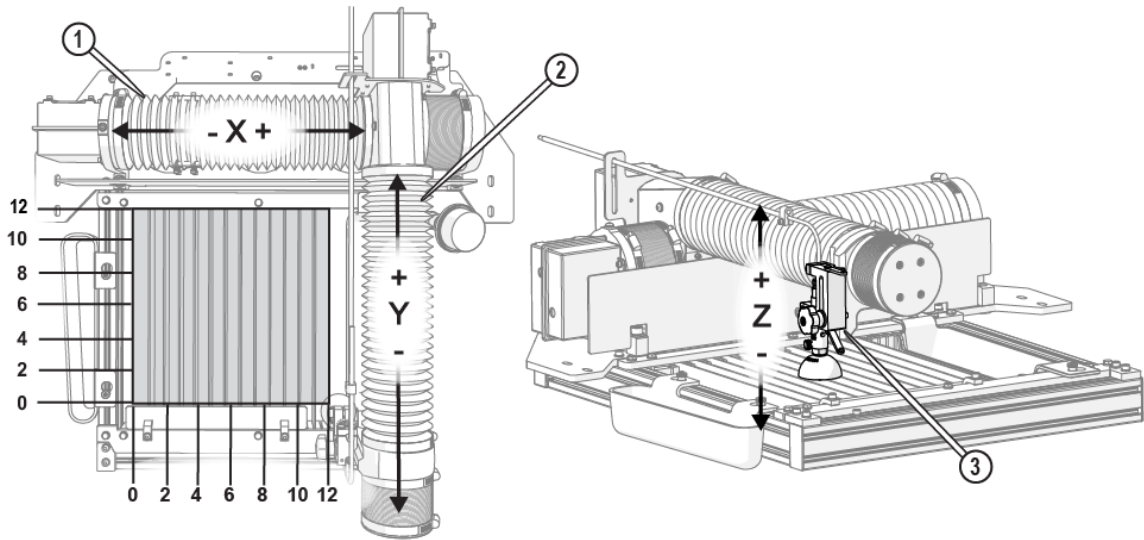


Figure 212

[1] X-axis

[2] Y-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.

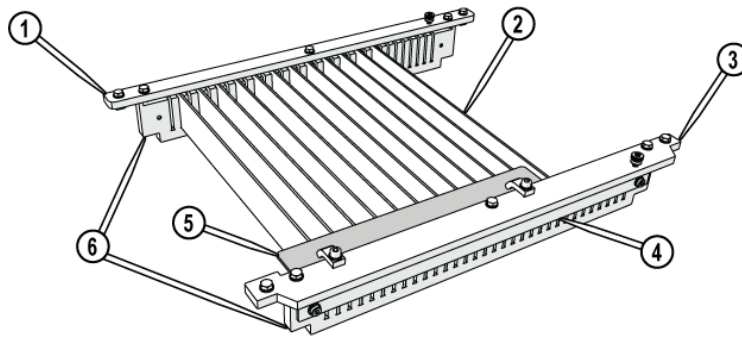


Figure 213

[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.

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

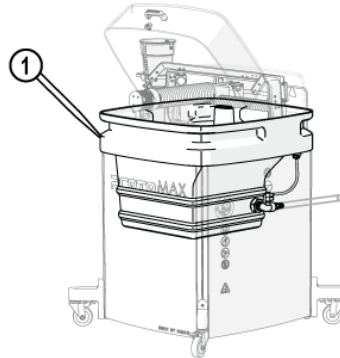


Figure 214

[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.

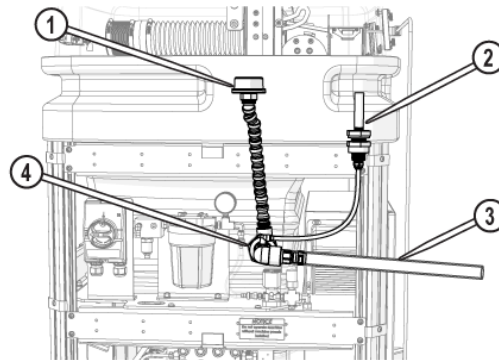


Figure 215

[1] Adjustable tank drain

[2] Tank overflow drain

[3] Tank drain hose

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.

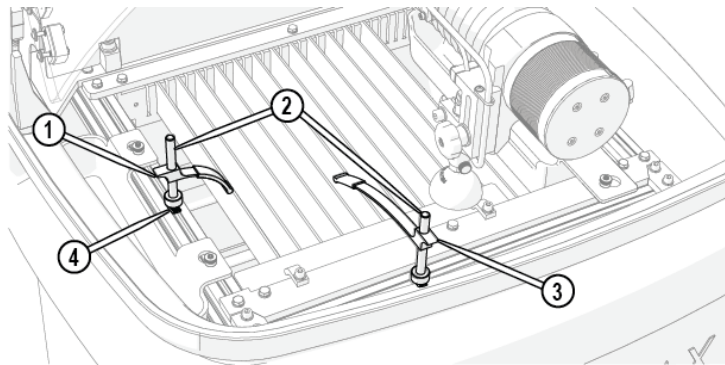


Figure 216

[1] Holding arm, short
Power Switch

[3] Holding post

[3] Holding arm, long

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

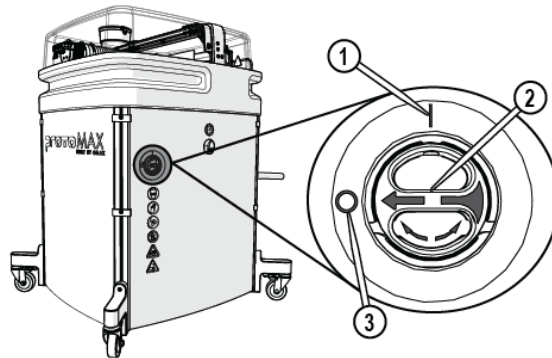


Figure 217

[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.

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.

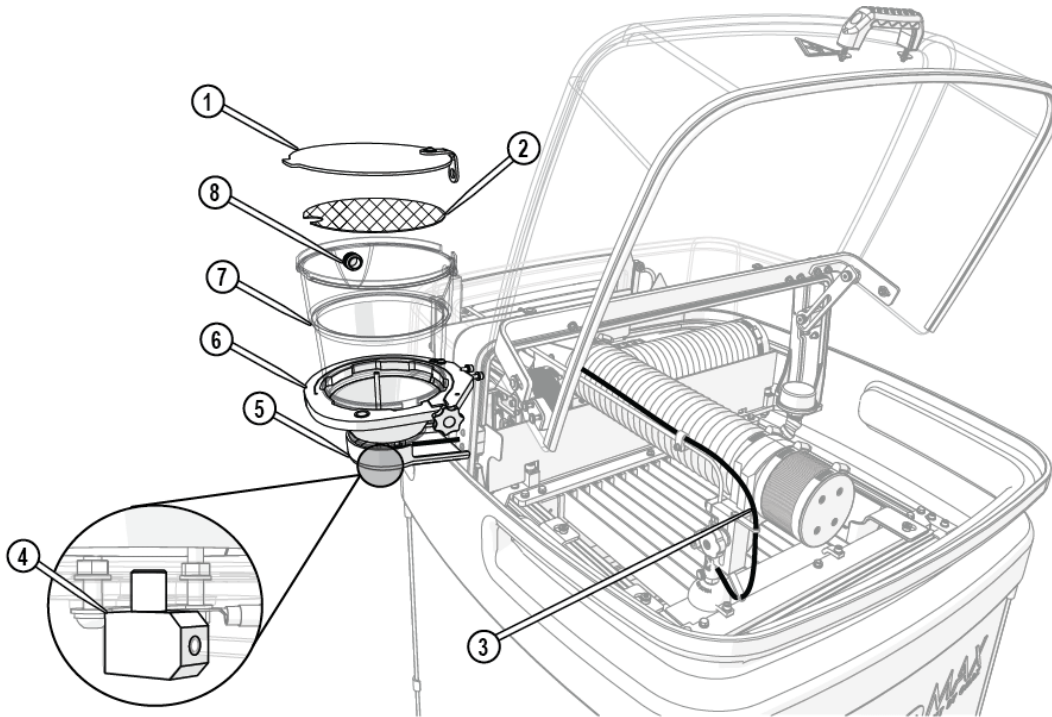


Figure 218

- | | | | |
|----------------------------|-------------------------|--------------------------|-------------------------------------|
| [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 contains 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 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.

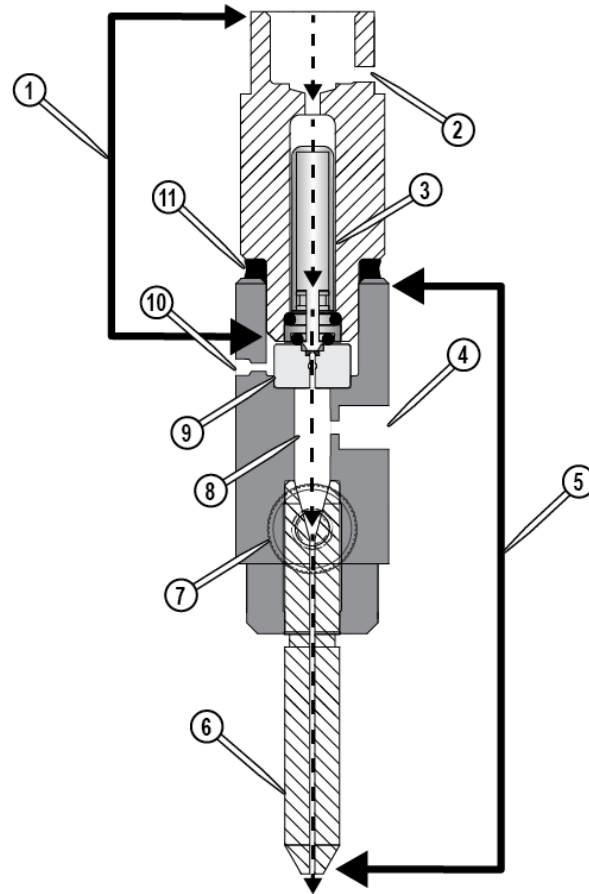


Figure 219

[1] Nozzle inlet body assembly

[4] Garnet abrasive inlet

[7] Mixing tube retainer

[2] Inlet body weep hole

[5] Nozzle body assembly

[8] Mixing chamber

[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.

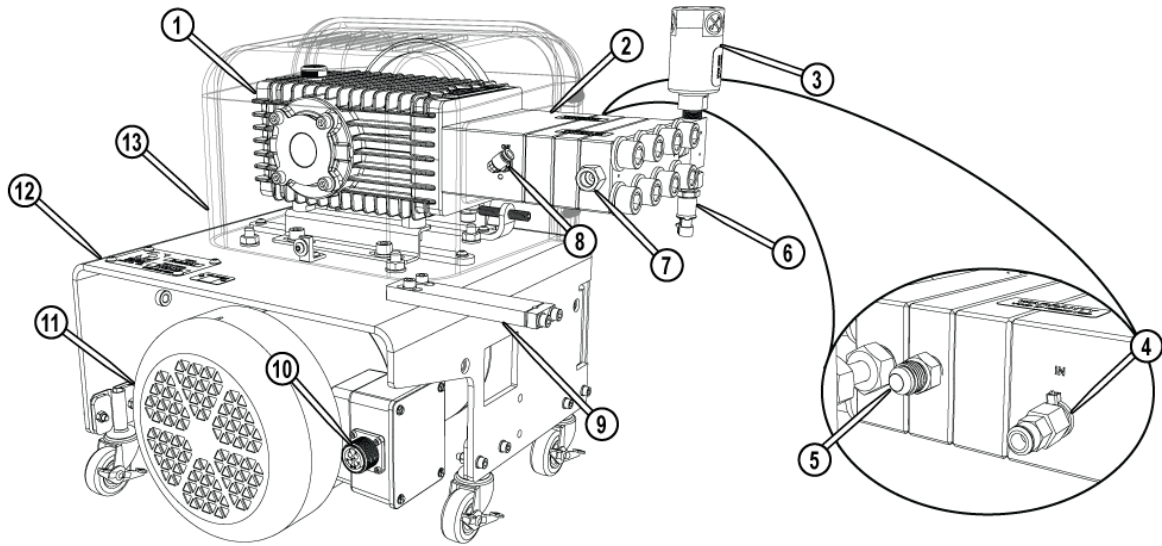


Figure 220

- | | |
|--------------------------------|--|
| [1] Crankcase | [6] High-pressure water transducer |
| [2] High pressure wet-end | [7] High-pressure water OUT connection |
| [3] Safety valve | [8] Cooling line OUT connection |
| [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.

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.

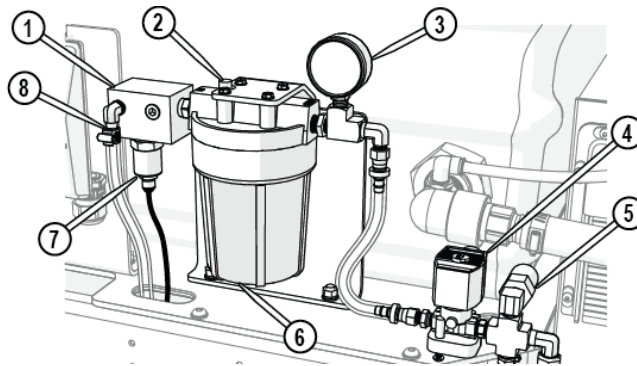


Figure 221

[1] Water manifold

[4] Water control solenoid

[7] Water temper

[2] Air release button

[5] Water pressure switch

[8] Water connection

[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 222

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, and 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.

Operate the ProtoMAX

See the [Intelli-MAX® Help](#) system for additional information on using LAYOUT and MAKE software.

Startup Checklist

[Startup Overview](#)

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 223

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

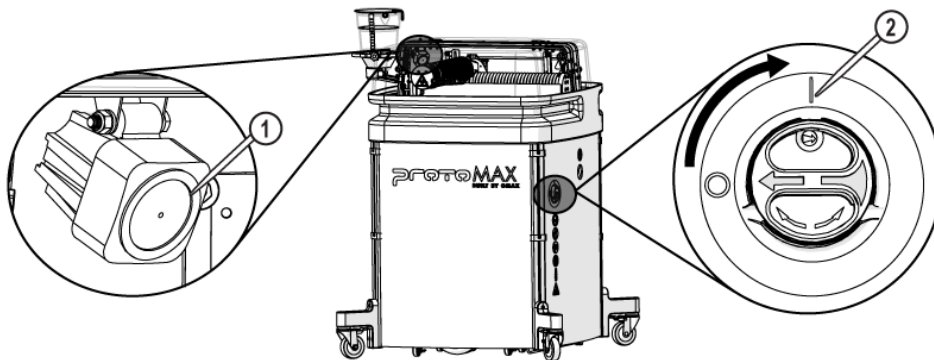
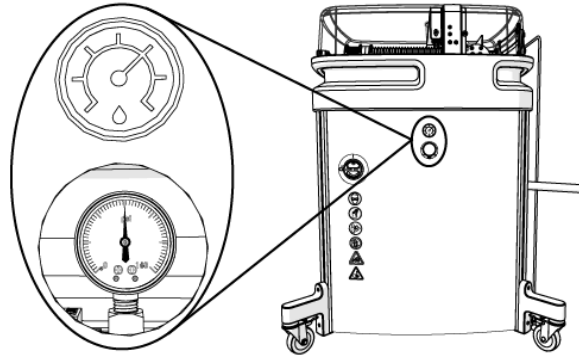


Figure 224

4. Turn **ON** the incoming water supply.
5. Record the incoming water pressure ([Figure 225](#)).

NOTE:

The incoming water pressure should be 45–85 psi.



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 226

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.

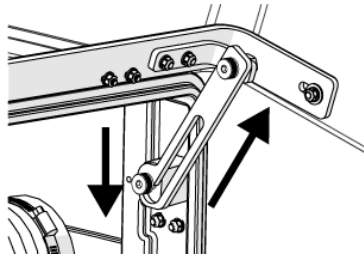


Figure 227

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

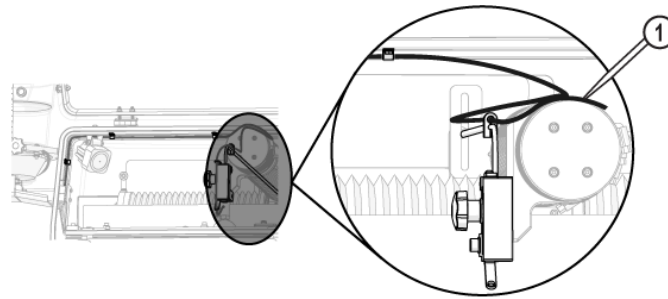


Figure 228

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

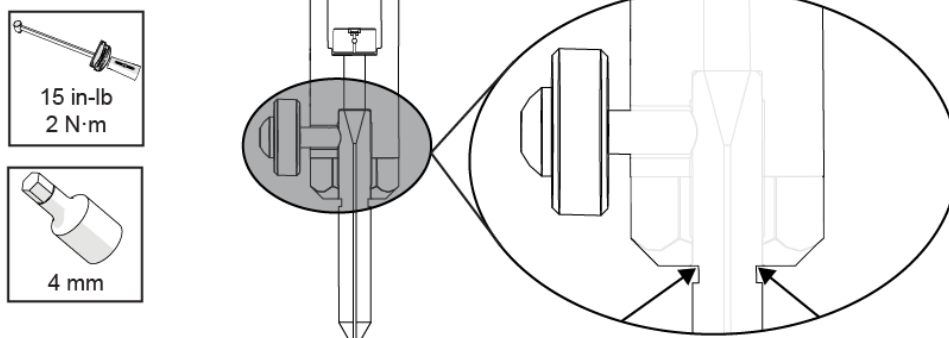


Figure 229

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

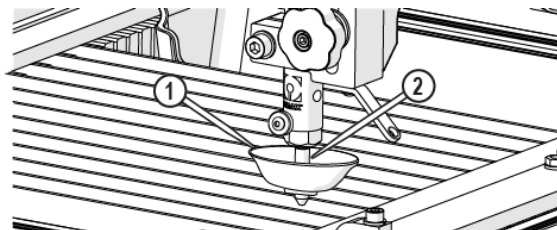


Figure 230

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

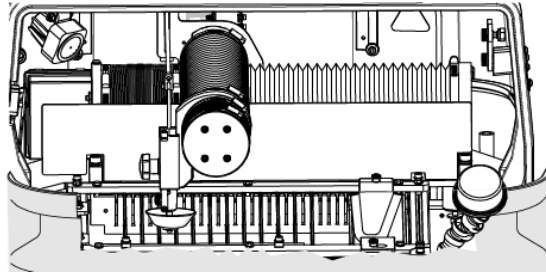


Figure 231

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

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].

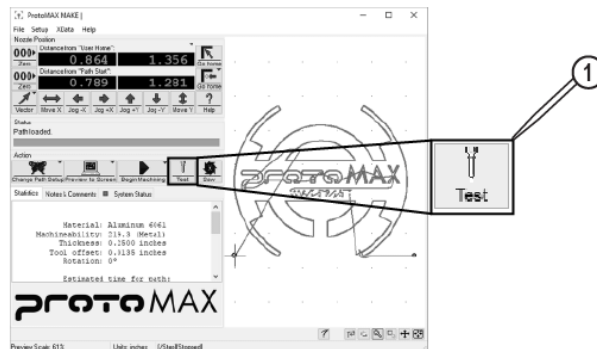


Figure 232

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

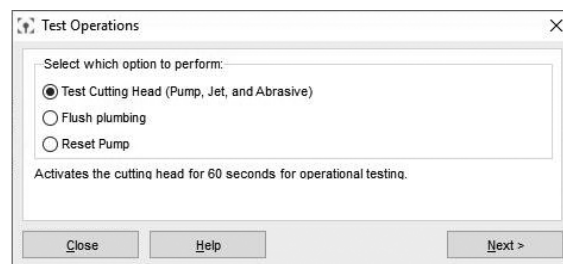


Figure 233

j. Click **Start Test**.

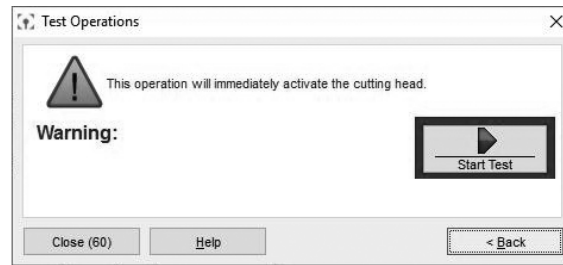


Figure 234

k. Click **Close** when the test is complete.

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

a. Remove the **hopper lid**.

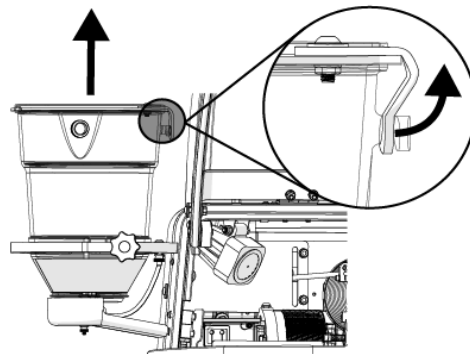


Figure 235

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.

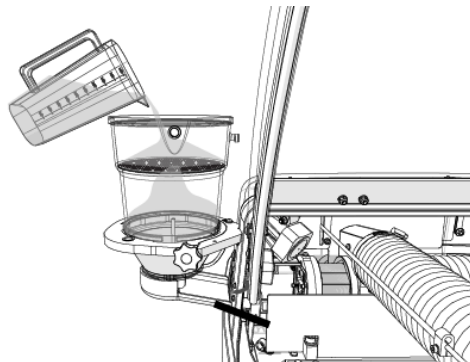


Figure 236

a. Replace the **hopper lid**.

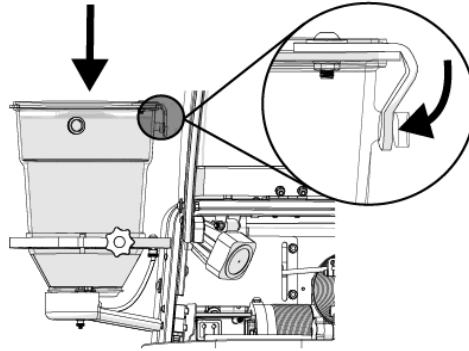


Figure 237

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.

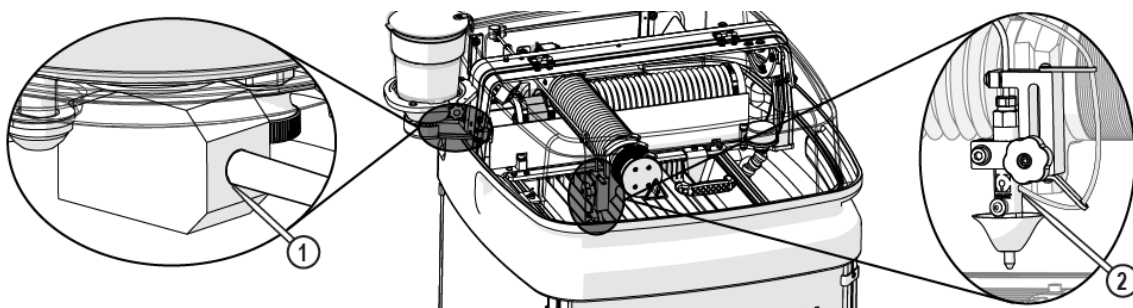


Figure 238

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

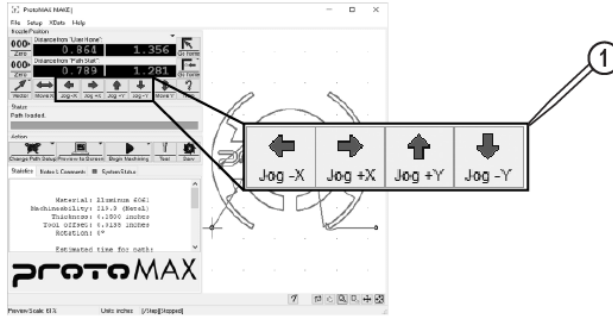


Figure 239

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

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

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

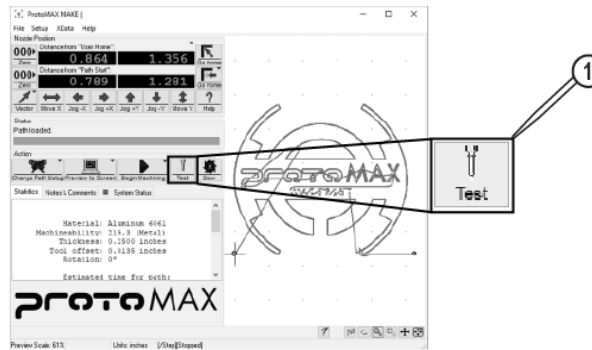


Figure 240

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

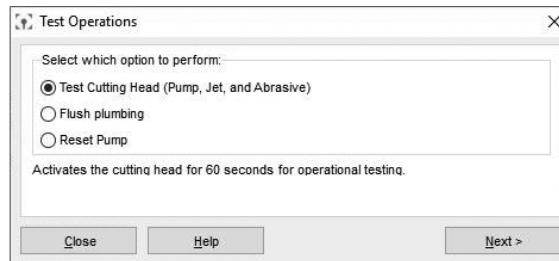


Figure 241

h. Click **Start Test**.

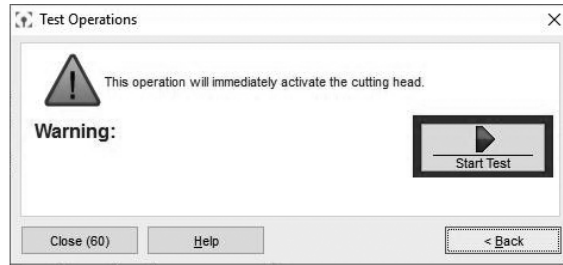


Figure 242

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 243](#)).

NOTE:

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

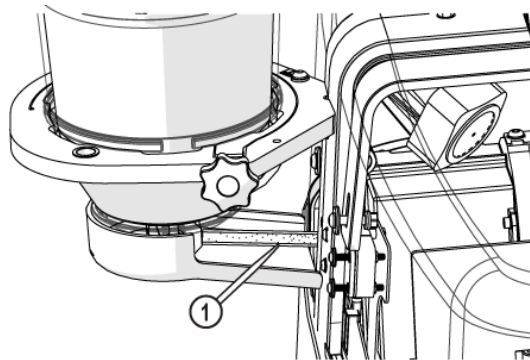


Figure 243

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

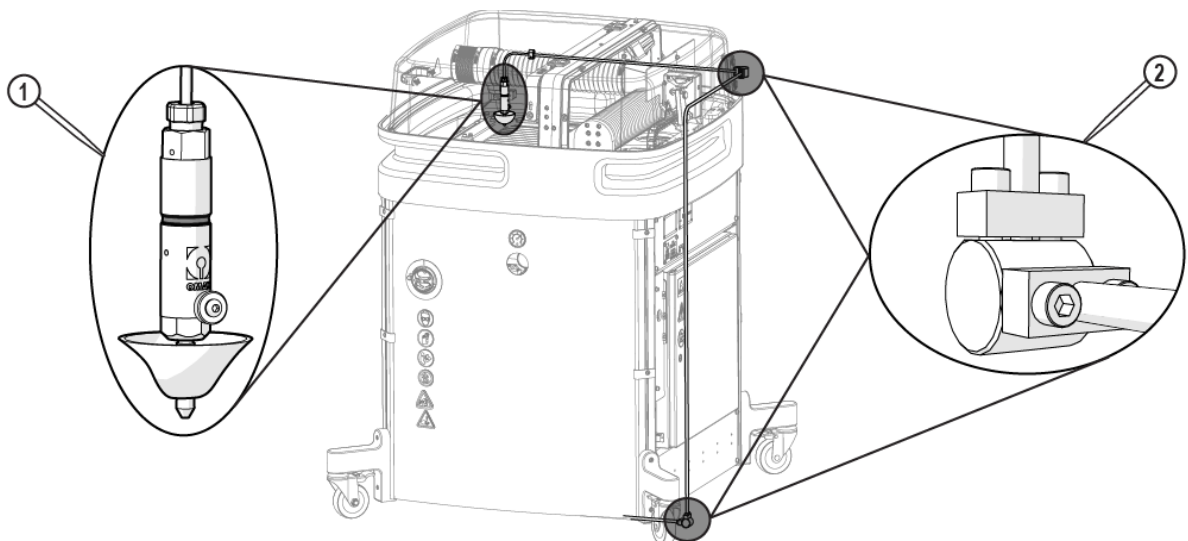
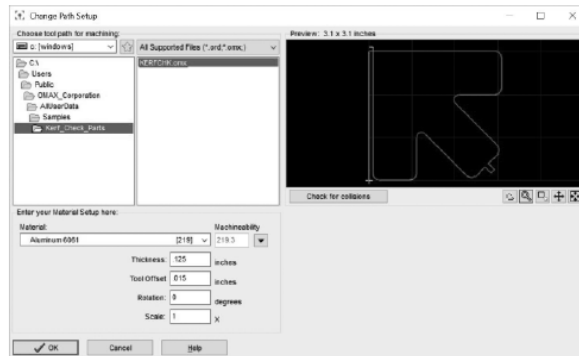


Figure 244

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



- 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.

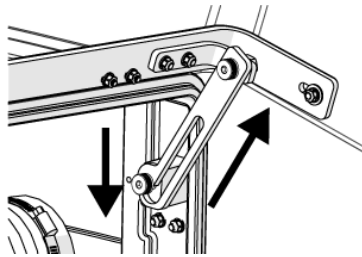


Figure 246

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**.

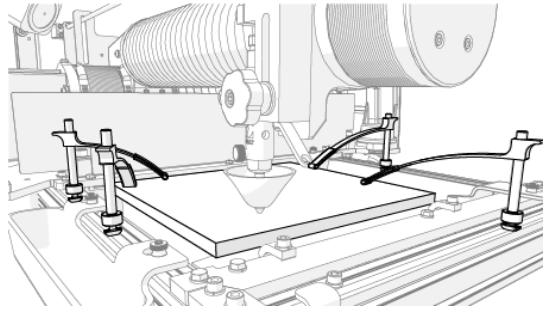


Figure 247

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

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.

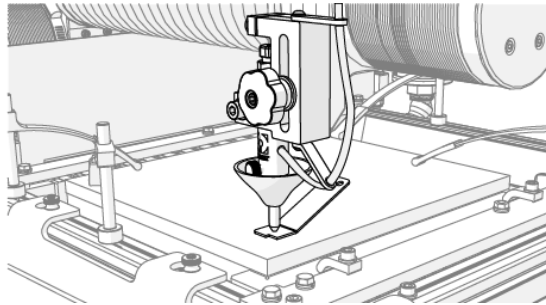


Figure 248

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

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.

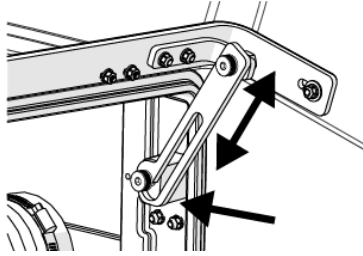


Figure 249

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.

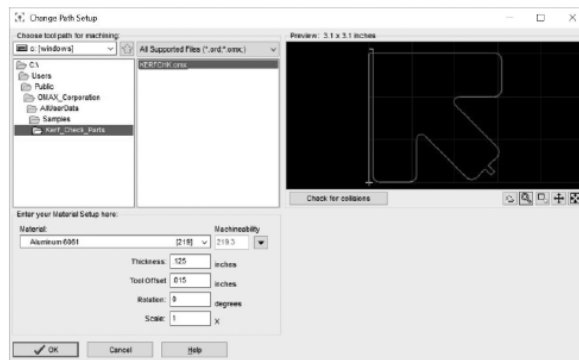


Figure 250

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



Figure 251

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



Figure 252

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

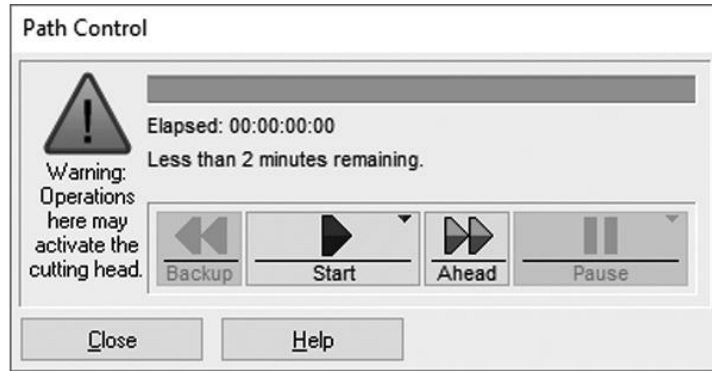


Figure 253

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

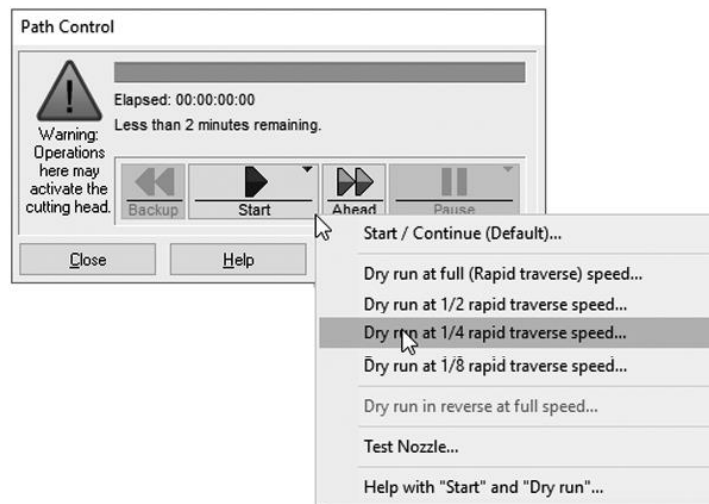


Figure 254

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



Figure 255

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

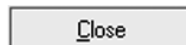


Figure 256

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

20. Fold down **splash guard cup**.

21. Adjust the **tank drain** [1] and fill the **tank** with water above the material (if possible).

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.

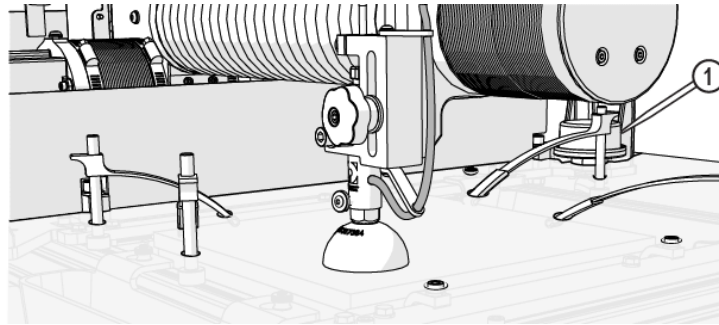


Figure 257

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].

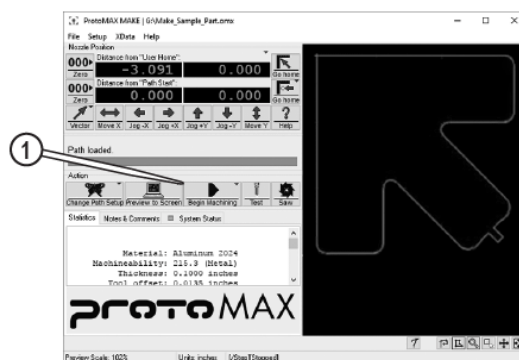


Figure 258

b. Click **Start**.

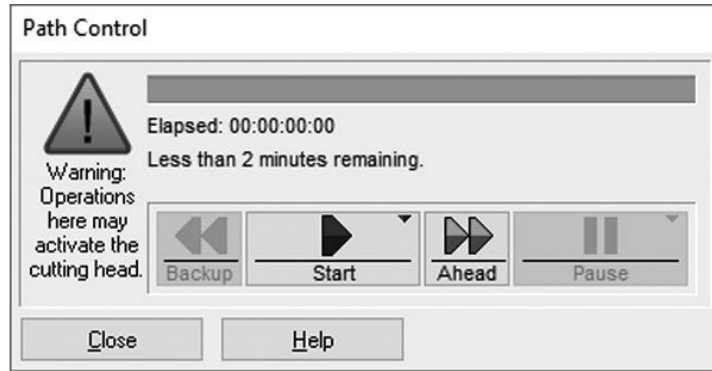


Figure 259

Shutdown Checklist

[Shutdown Overview](#)

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.

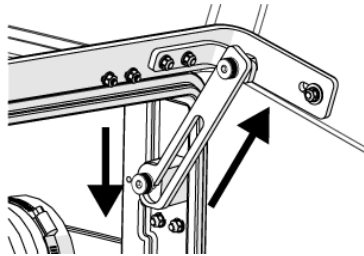


Figure 261

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

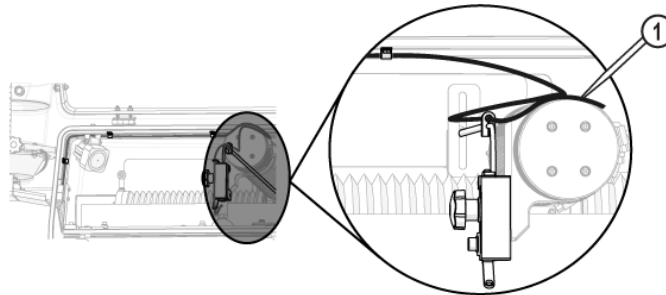


Figure 262

- 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**.

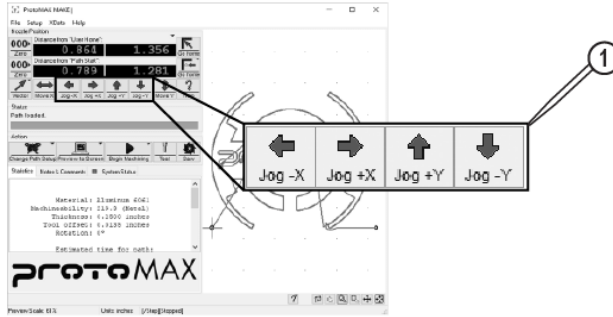


Figure 263

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

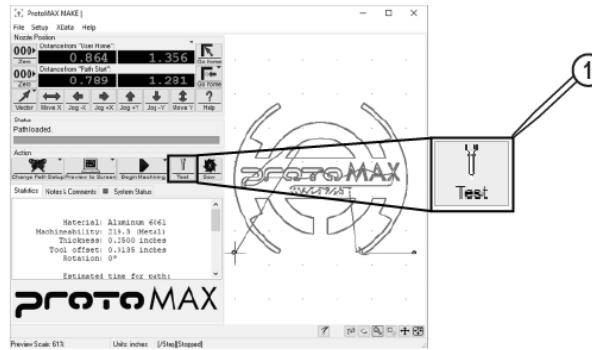


Figure 264

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

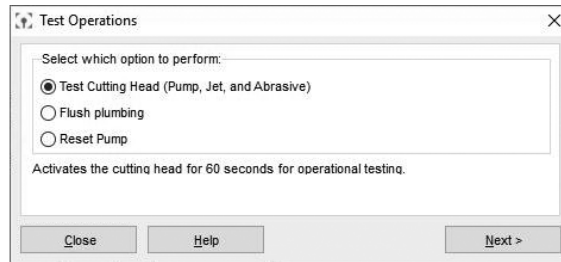


Figure 265

g. Click **Start Test**.

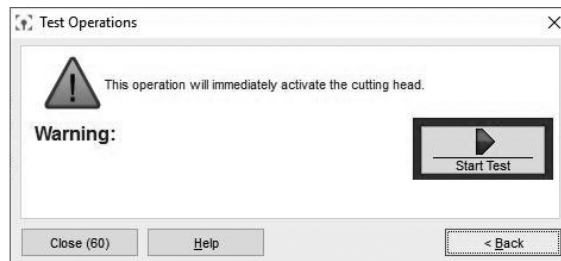


Figure 266

h. Click **Close**.



Figure 267

- i. Verify there is no moisture or debris in the **abrasive feed tube**.
- j. Insert the **garnet abrasive tube** into the **nozzle**.

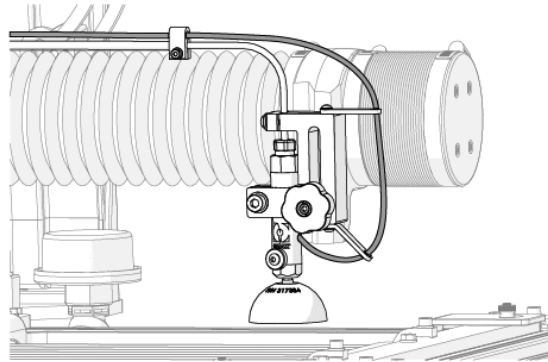


Figure 268

- k. Close the **MAKE** software.
2. Turn **OFF** the **laptop**.
3. Clean the **machine** with a clean, damp cloth.

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.

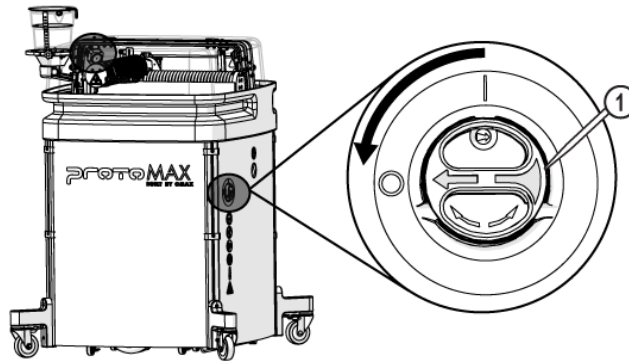


Figure 269

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.

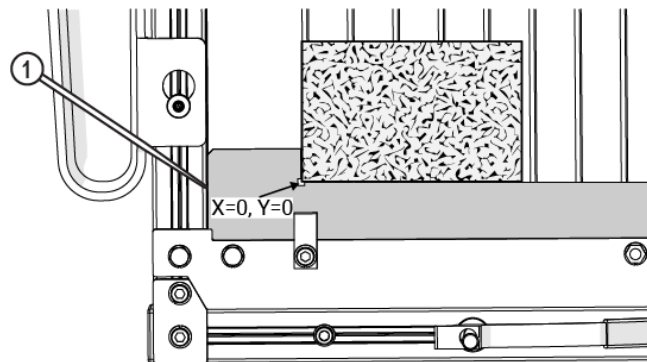


Figure 270

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].

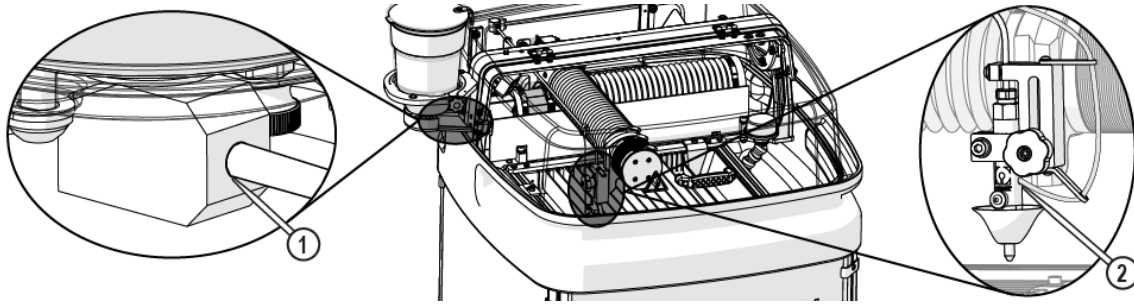


Figure 271

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**.

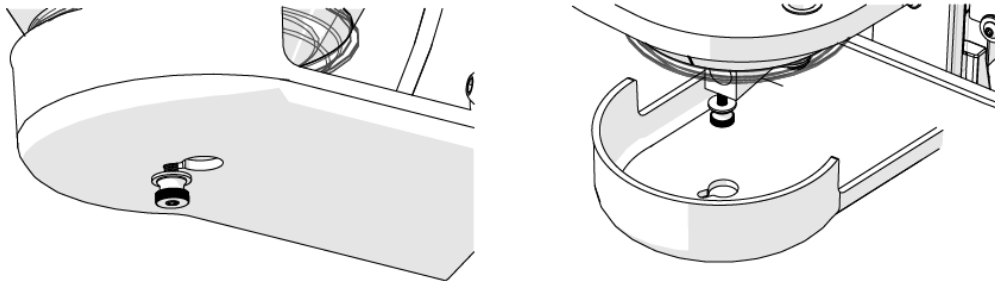


Figure 272

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

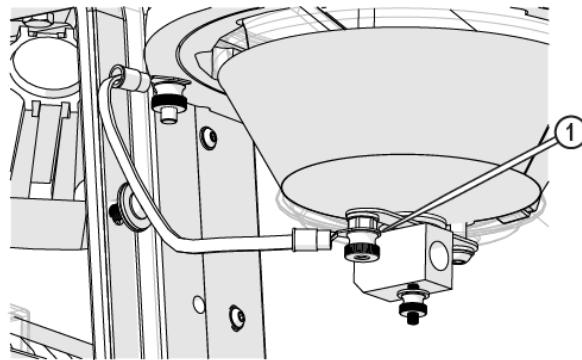


Figure 273

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**.

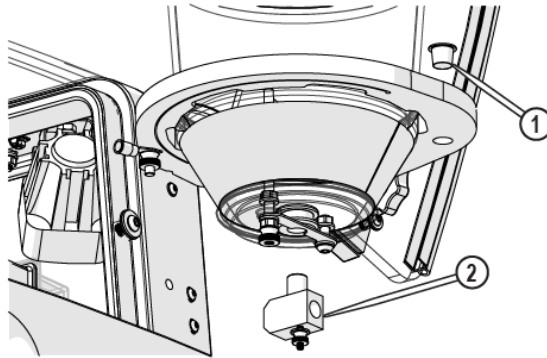


Figure 274

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**.

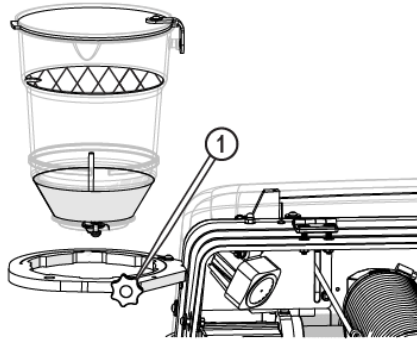


Figure 275

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**.

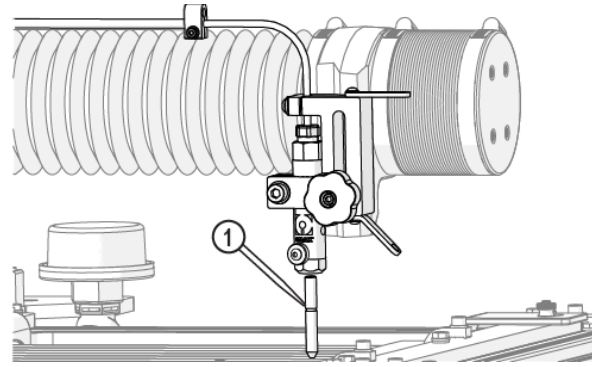
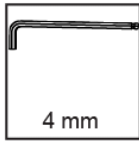


Figure 276

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**.

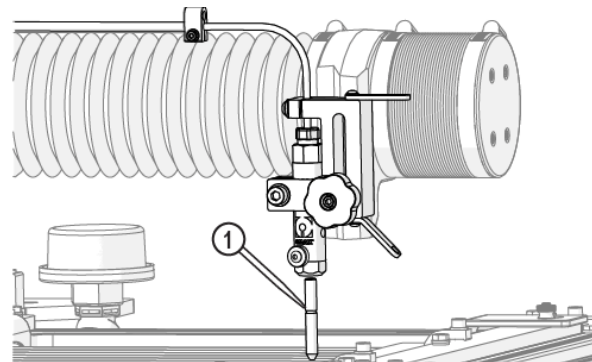
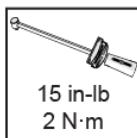


Figure 277

If light is not visible:

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

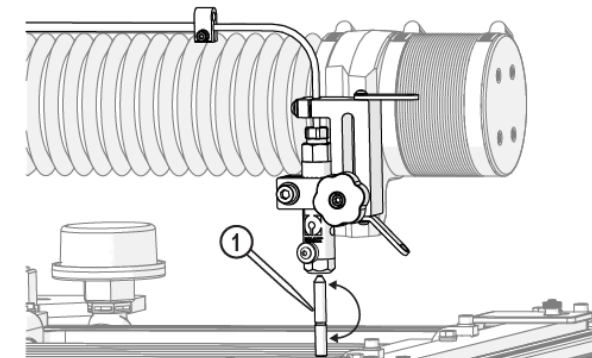
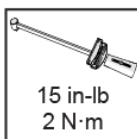


Figure 278

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 and replace the **mixing tube** [1] in the proper orientation in the **nozzle body** (if applicable).

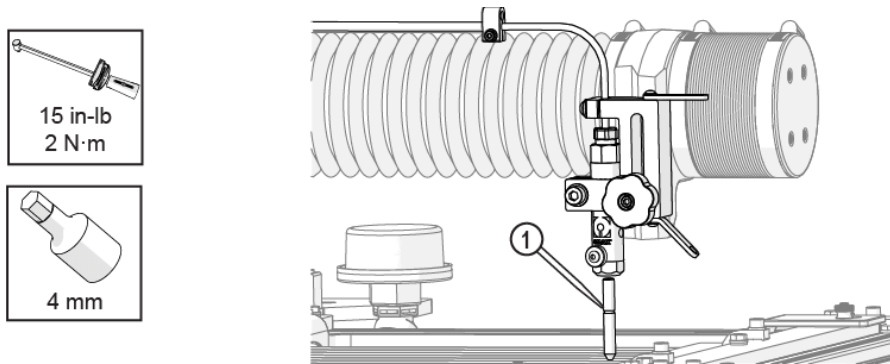


Figure 279

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

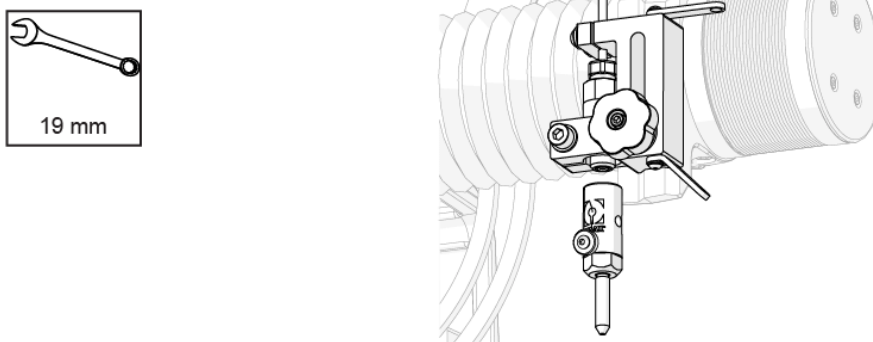


Figure 280

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

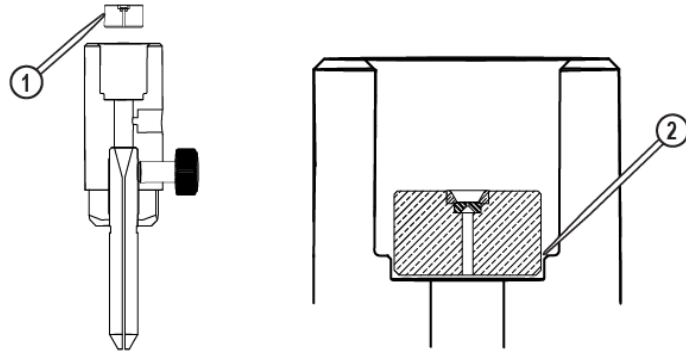


Figure 281

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 clog the nozzle.

22. Apply a light coat of Blue Goop to the **second and third threads** [1] of the **inlet body**, and 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.

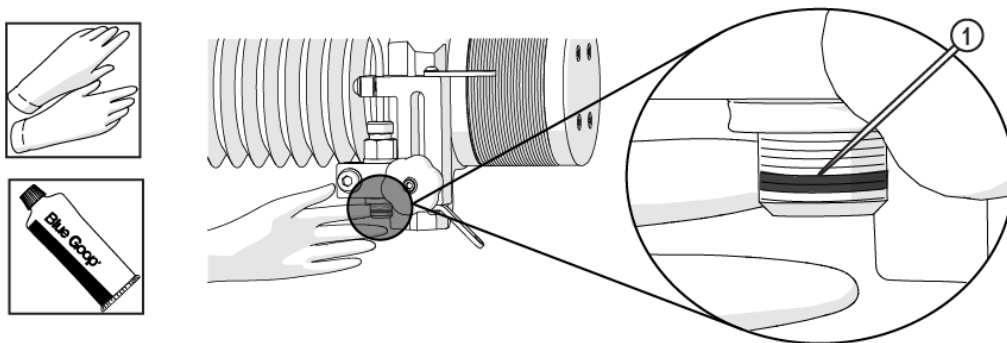


Figure 282

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

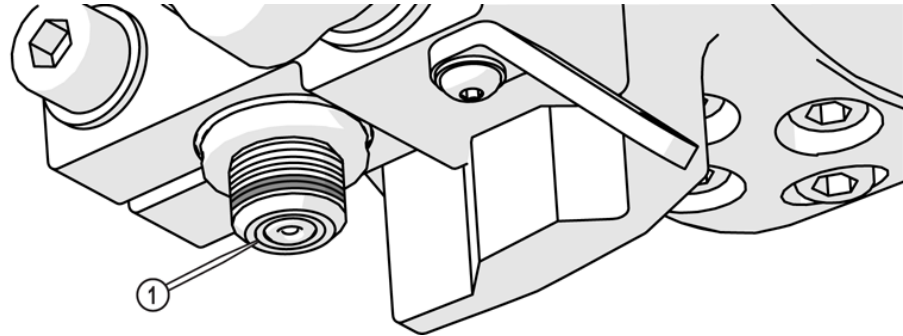
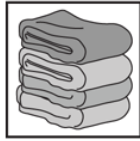


Figure 283

24. 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**.

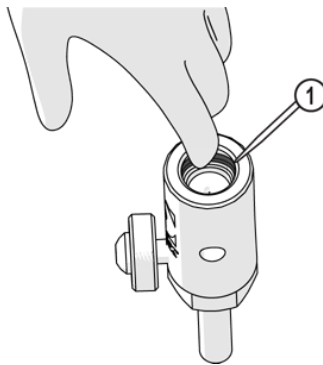


Figure 284

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

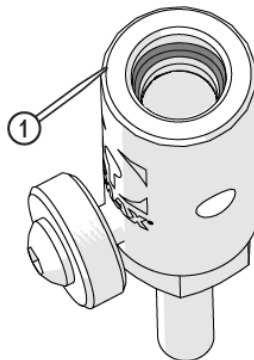
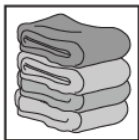


Figure 285

Once the nozzle is completely clean:

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.

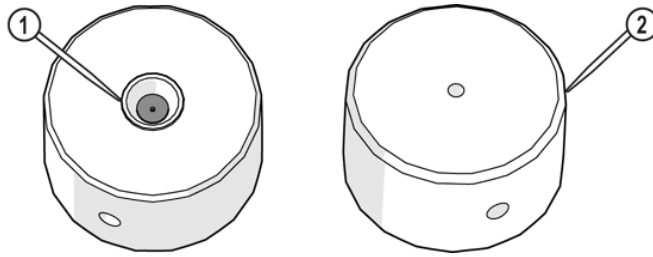


Figure 286

26. 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].

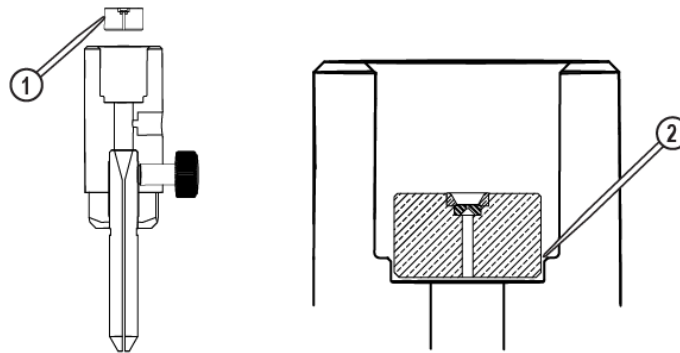


Figure 287

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

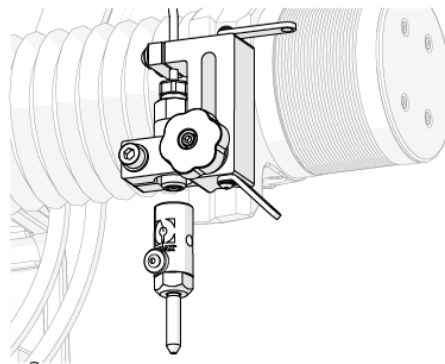
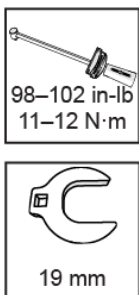


Figure 288

28. Close the **Path Control** window.

29. 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.

30. Fill the **hopper** with fresh, dry abrasive.

31. Connect the **abrasive tube** to the **nozzle body**.

NOTE:

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

32. Attach the **nozzle splash guard**.

33. Set the **nozzle stand-off**.

34. 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:

35. Click **Go Home** in the **Path Start Home** dialogue.

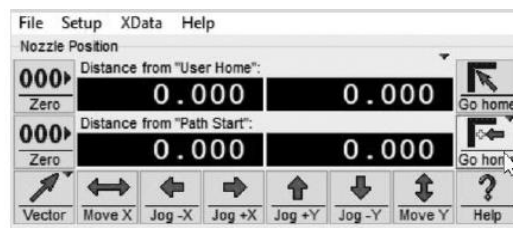


Figure 289

36. Right-click **Begin Machining**.



Figure 290

37. Click **Go to Spot on Path**.

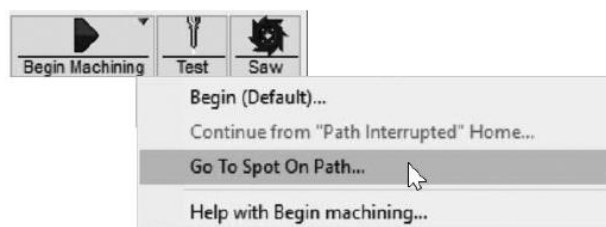


Figure 291

38. Move the cursor over the spot on the tool path slightly before the clog occurred and left click.

39. Click **OK** on **Machine will now traverse into position** dialog box.

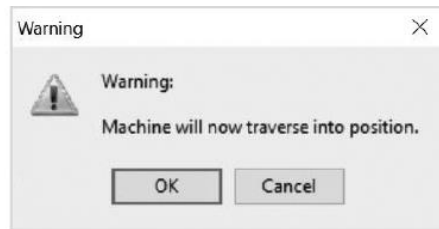


Figure 292

40. Click **Continue** to start cutting.



Figure 293

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

[Flush the Plumbing, Reset the Pump, and Test the Nozzle](#)

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.

