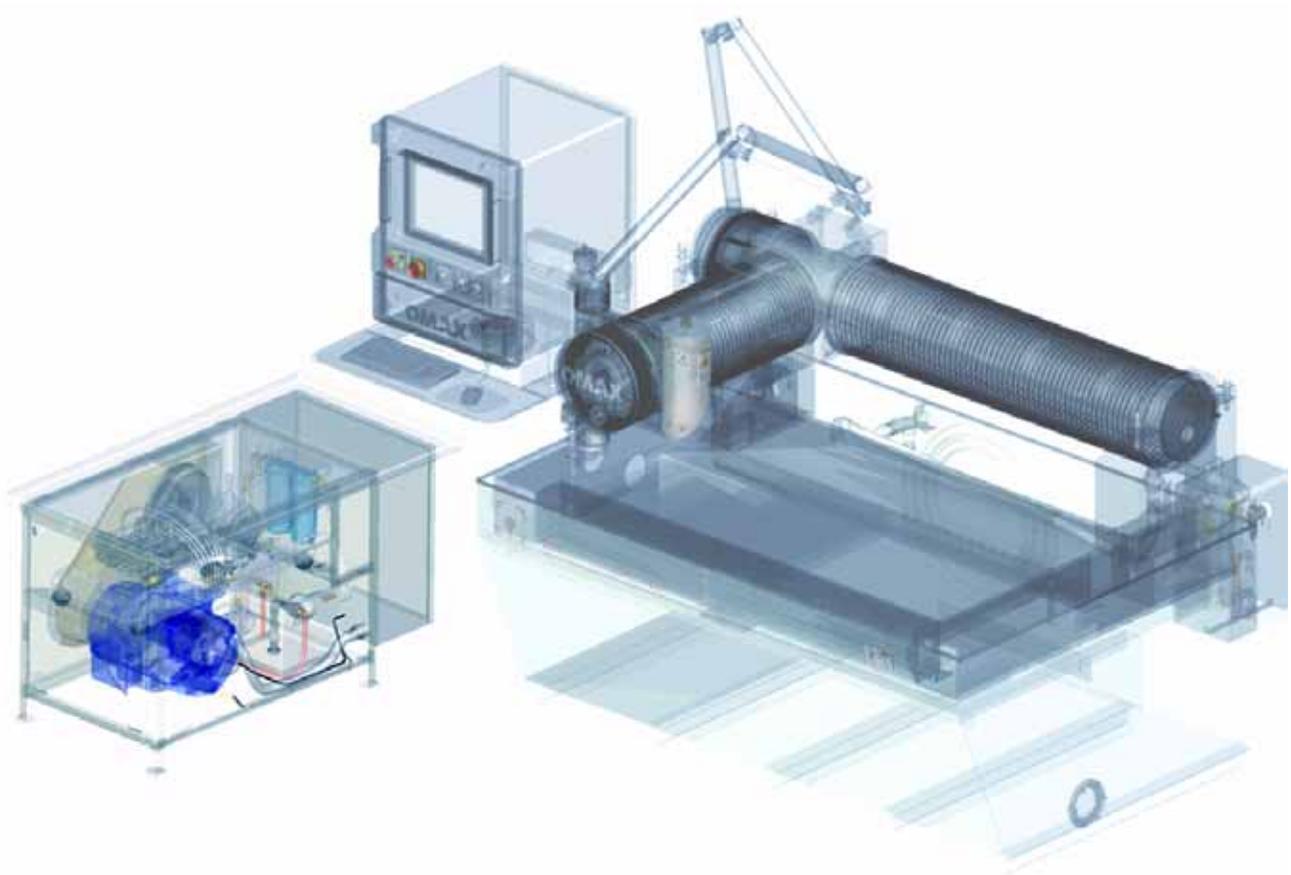


# The OMAX<sup>®</sup> JetMachining<sup>®</sup> Center

## Service and Maintenance Guide



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OMAX Corporation is continually improving their equipment to bring you the best in abrasivejet machining technology. For that reason, your OMAX JetMachining Center may differ slightly from what is described in this document. If you have any questions, please feel free to contact us at 1 800.838.0343 or e-mail us at [techsupport@omax.com](mailto:techsupport@omax.com). You can also receive technical support on-line at:  
<http://www.omax.com/support> (user name and password required for access)

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The OMAX Machine tool apparatus and linear motion track is covered by U.S. patent number 5,472,367.  
The OMAX motion control with precompilation is covered by U.S. patent number 5,508,596.  
Other patents pending.

September 2008  
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# About this Manual

## Purpose

This document provides technical information specific to the repair and maintenance of the OMAX JetMachining Center abrasive cutting tables, Models 2626, 2626|xp, 2652, 5555, 55100, 60120, 80160, and 80X.

## Audience

This document assumes the reader has basic mechanical skills and attended the service training classes provided by OMAX as part of the original equipment purchase.

## Supporting Documentation

For a complete and up-to-date list of all available OMAX documents, please visit the OMAX technical support Web site: <http://www.omax.com/support/customers/default.asp>.

**Note:** *A user name and password are required to access the OMAX technical support site. To set up a new user account, please contact OMAX Customer Service at 800.298.4036.*

## Organization

This service and maintenance guide for the OMAX JetMachining Centers provides the following content:

### Chapter 1: Safety First

- Identifies equipment labels designed to support safe equipment operation, shows their location, and explains their meaning.
- Lists important safety “do and don’ts” to follow that are essential in ensuring safe equipment operation.
- Explains the safety devices built into the OMAX equipment.

### Chapter 2: Introduction to OMAX Tables

- Identifies the available OMAX models and describes their major components.
- Provides basic equipment specifications.

### Chapter 3: Introduction to OMAX Pumps

- Identifies the major components of the OMAX pumps and breaks each down into their individual pieces, providing names and descriptions.
- Provides equipment specifications.
- Graphs pump operating characteristics
- Describes the pump control panel, explaining available operator control devices.

### Chapter 4: Servicing the OMAX Tables

- Provides servicing information for swivels and the dual on/off valve.
- Explains procedures for properly servicing the high-pressure plumbing system.
- Lists corrective steps to follow when the equipment fails to perform as expected.

### Chapter 5: Servicing the OMAX Pumps

- Provides procedures for disassembling/assembling the pump wet-end assembly for maintenance and repair.
- Documents general pump servicing procedures.

### Chapter 6: Table Maintenance

- Identifies and provides a recommended schedule for maintenance activities.
- Explains maintenance requirements for both the table components and the PC Controller.
- Provides forms for logging maintenance activities.

### Chapter 7: Pump Maintenance

- Identifies pump maintenance activities required based upon pump run-time in hours.

- Lists replacement parts and kits needed for specific maintenance objectives.

**Chapter 8: Customer Service**

- Provides contact information for OMAX Customer Service.
- Explains how to order and return purchased parts for your OMAX equipment.

**Appendix A: Access Control Circuit**

- Describes equipment components for the Access Control Circuit and provides operator instructions.

**Appendix B: Rebuilding the Bulkhead Swivel**

- Contains disassembly and assembly procedures for rebuilding the OMAX bulkhead swivel.

**Appendix C: Rebuilding the High-Pressure Swivel**

- Contains disassembly and assembly procedures for rebuilding the OMAX high-pressure swivels.

**Appendix D: Rebuilding the Dual On/Off Valve**

- Contains disassembly and assembly procedures for rebuilding the OMAX dual on/off valve.

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## Safety First

This chapter identifies, describes, and locates each safety label attached to the OMAX equipment. These labels provide information essential for safe equipment operation. In addition, this chapter emphasizes important safety precautions that must be observed while operating, servicing and maintaining this equipment, and identifies the safety devices built into this equipment.

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

## Safety Labels

Safety Label	Description
	<p><b>Wear Gloves</b></p> <p>Since bacteria in the tank water can build up, even a seemingly minor break in the skin could 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.</p>
	<p><b>Electrical Hazard</b></p> <p>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 present on circuits prior to maintenance activities, etc.</p>
	<p><b>Lock Out Power</b></p> <p>Never open or conduct maintenance on the OMAX equipment with the main power disconnect ON or unlocked, or while the pump unit is operating. Always follow standard lockout/tag-out procedures. Don't apply power to the equipment while maintenance work is in progress. Always lock the main power to the OMAX pump Off at its source.</p>
	<p><b>Eye Protection</b></p> <p>Always wear approved safety goggles whenever cutting. Regular glasses do not provide sufficient eye protection!</p>
	<p><b>Ear Protection</b></p> <p>Always wear hearing protection while in the vicinity of the OMAX. When cutting in air, noise levels can exceed 120 dB.</p>
	<p><b>Flying Debris/Loud Noise</b></p> <p>Eye and ear protection are required during operation.</p>
	<p><b>Emergency Stop Switch (E-stop)</b></p> <p>Pushing E-Stop in immediately shuts down both the pump and display. The E-Stop is disengaged (reset) by manually pulling it back to its original position. The pump cannot be restarted until E-Stop is reset.</p>

Safety Label	Description
	<p>Never operate the OMAX with any of its protective guards or covers removed or rendered inoperative.</p> <p>Never make unauthorized alterations to the equipment or components.</p>
	<p>Never operate the OMAX with any of its protective guards or covers removed or rendered inoperative.</p>
	<p>Never place your hands in the vicinity of the nozzle while cutting.</p> <p>Seek immediate medical attention in the event of a waterjet injury. Injuries caused by high pressure waterjets are serious. Do not delay!</p>
	<p>Never step, stand or walk on the support slats. They are weakened with continued cutting and may collapse under your weight.</p>
	<p>Never place your hands or fingers in areas where they are in danger of becoming pinched during equipment operation.</p>
	<p>Never operate the OMAX pump with any of its protective guards or covers removed or rendered inoperative.</p>
	<p>Removing the abrasive feed hose from the nozzle while still under pressure will blow abrasive particles into the room air, getting into eyes and contaminating tools and machines.</p>

# Placement of Safety Labels



Figure 1-1: Safety Labels 2626, 2626/xp, 2652, 5555, and 55100

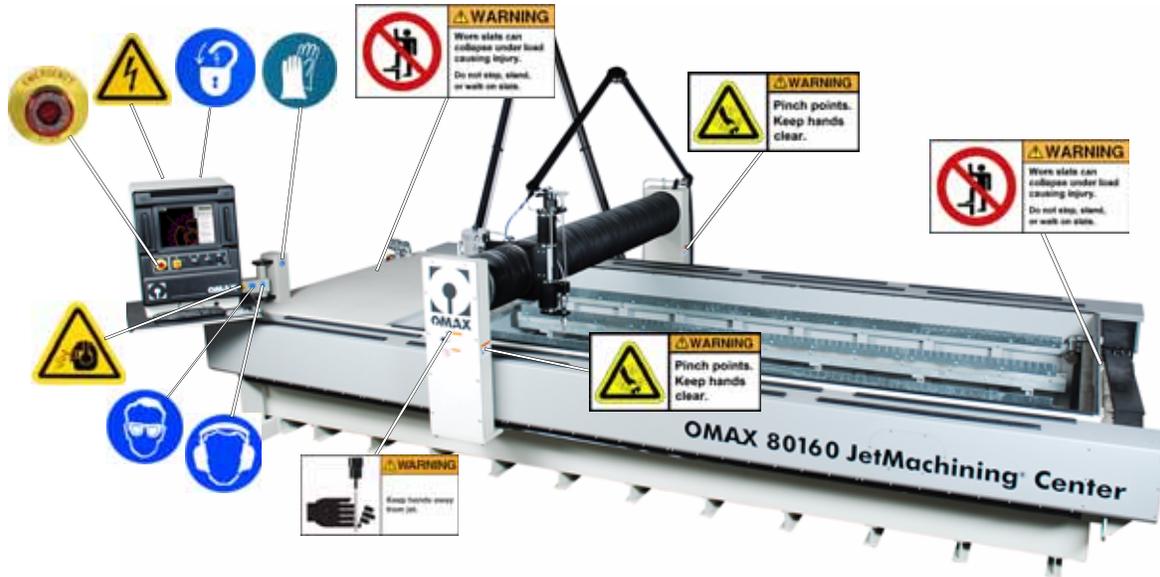


Figure 1-2: Safety Labels 80160





Figure 1-5: Safety Labels OMAX Pumps

## Safety Precautions

Always observe the following safety precautions while operating your OMAX equipment. Carefully operated, the OMAX is a safe, productive tool. When operated carelessly, serious injury can easily result.

### Table Safety Requirements

#### Do

- Be careful when handling materials in the tank. Fingers can be caught between heavy parts and the sharp edges of the support slats.
- Wear hearing protection while in the vicinity of the OMAX. When cutting in air, noise levels can exceed 120 dB.
- Cut under water whenever possible. When water covers both the material being cut and the nozzle tip, the noise level measured in the operator's area drops to approximately 80 dB.
- Wear approved safety goggles whenever cutting. Regular glasses are not sufficient eye protection!
- Have an eyewash station located near the OMAX in the event abrasive spray splashes into your eyes. The garnet abrasive is not a chemical irritant, but if not quickly washed out, it can injure an eye just as any sand would.
- Treat all injuries with caution. Because bacteria in the water can build up, even a seemingly minor break in the skin can introduce harmful bacteria into the wound. Any injury involving contact with the water should receive immediate attention. Use antibacterial chemicals in the tank water (an exception is with the EBBCO Closed Loop) to reduce this hazard, and always wear protective gloves if you have cuts or open wounds on your hands.
- Seek immediate medical attention in the event of a waterjet injury. Injuries caused by high pressure waterjets are serious. Do not delay! 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.
- When setting up material for cutting, wear gloves that provide protection against sharp metal edges and waterborne microorganisms.
- Dispose of cutting wastes properly and in accordance with all local and federal regulations. The OMAX 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.

- Because of inevitable water spills, cover the floor around the operator area with a nonslip material such as a textured rubber mat or nonslip paint.
- Use only approved work platforms. Never climb on or around the equipment using makeshift devices.
- Always use the muff on the abrasivejet nozzle. It helps keep the noise level low during machining and reduces splash and spray.
- Always use proper lifting techniques and equipment to handle heavy work materials.
- Always remove power from the equipment when through using the JetMachining Center for the day.

**Don't**

- Don't operate the OMAX JetMachining Center without first being adequately trained to operate it correctly and safely.
- Don't allow nozzle movement while handling material in the tank. Stop the abrasivejet before making any adjustments. Nozzle movement can exert up to 1,000 lbs (4.4 kN) of force, easily crushing any hands or fingers caught between it and another object.
- Don't stand on the support slats. They are weakened by continued cutting and cannot be expected to support your weight.
- Don't operate the OMAX with any of its protective guards or covers removed or rendered inoperative.
- Don't operate the OMAX in an explosive atmosphere. Machining titanium and certain other materials can produce sparks. Never allow explosive or flammable vapors to accumulate in the area of the OMAX.
- Don't allow unauthorized personnel access to the machining area without proper supervision.
- Don't switch tank chemicals for bacterial control without first reading the manufacturing warnings on the labels. Mixing different kinds of chemical pellets can create a hazardous situation.
- Don't use silica sand as a cutting abrasive. Fine silica dust produced by the cutting process can lead to silicosis, a serious lung disease.
- Don't operate the machine in close proximity to other machines as water can spray or splash out of the cutting table area.

## Pump Safety Requirements

**Do**

- Operate the OMAX pump only after reading this manual and receiving instruction from qualified personnel.
- Stay in a location within easy reach of the emergency stop switch.
- Start the pump only when all side panels are securely in place.
- Maintain all protective guards and shutdown devices around the OMAX pump.
- Immediately notify responsible repair personnel whenever leaks are detected in pump fittings or connections.
- Follow the manufacturer's recommendations for servicing the equipment and use only original manufacturer replacement parts.
- Follow a periodic maintenance schedule that ensures proper equipment operation.
- Following maintenance activities, clear all tools and rags from around the OMAX pump before starting.

**Don't**

- Don't start the OMAX pump unless you know how to stop it.
- Never open or perform maintenance on the OMAX pump with the main disconnect ON or unlocked, or while the pump unit is operating. Always follow standard lock-out/tag-out procedures.

- Don't apply power to this pump while maintenance work is in progress. Always lock the main power to the OMAX pump Off at its source.
- Don't make unauthorized alterations to the equipment or components.
- Never perform any electrical and maintenance work on this equipment unless you have received appropriate training and are qualified to service OMAX pumps.

## Equipment Safety Features

The OMAX equipment provides several built-in safety features.

### Emergency Stop Switch (E-Stop)

Both the pump unit and PC controller are equipped with an emergency stop switch. The E-Stop is engaged by pushing it in. Once engaged, it immediately shuts down the pump unit and abrasivejet. Refer to Figure 2-12 for an illustration of the E-Stop switch and its location on the controller front panel.

### Overpressure Protection

During operation, pump pressure is monitored to prevent an overpressure condition. If the pump exceeds the factory set maximum pressure limit, the control shuts down the pump unit and displays the message 'Dead Head of Pump'. In addition to the software maximum pressure limit, all OMAX pumps are equipped with a factory set "Safety Valve" to provide a hard-plumbed, over-pressure limit.

### Electrical Protection

The variable frequency drive (VFD) provides electrical protection as well as speed control for the pump's main drive motor. The DIN rail mounted contactor and circuit breaker provide short circuit protection to the charging pump motor. Circuit breakers protect the internal transformer and a 0.5 Amp fuse protects the pump keypad.

### Access Control Circuit

The OMAX Access Control Circuit (ACC) is designed to create a designated safety zone around an OMAX JetMachining Center that protects operators from injury when using the OMAX equipment. The access control circuitry continually monitors the closure status of two external switch contacts. The breaking of contact with either switch immediately trips the safety circuit, disabling the cutting process until the cause of the violation is corrected and the access control circuit reset.

Refer to Appendix A: Access Control Circuit for additional information

## Lock-out/Tag-out Procedure

When powering down your equipment to perform required maintenance and service activities, OMAX recommends that standard lock-out/tag-out practices and procedures be implemented that isolate the equipment from its energy source(s) and prevent the release of potentially hazardous energy.



# Introduction to OMAX Tables

This chapter provides an overview of the available JetMachining Center models. It identifies their major parts and explains their purpose. For information about operating this equipment, refer to the *OMAX JetMachining Center Operator's Guide*, P/N 304952.

## The OMAX JetMachining Centers

### Overview

The OMAX JetMachining Center is a precision abrasivejet machining tool operating under software control that cuts complex parts out of most materials including metal, plastic, glass, ceramics, stone and composites from standard CAD drawings.

Eight different Models of the OMAX JetMachining Center are currently available: the Models 2626, 2626|xp, 2652, 5555, 55100, 60120, 80160, and 80X.

#### Model 2626 JetMachining Center

Provides a smaller work envelope for the precise abrasivejet machining of small parts.



Figure 2-1: The OMAX Model 2626 JetMachining Center

Specifications: Model 2626 JetMachining Center:					
Position Accuracy	Table Size	Footprint	Weight (empty tank)	X-Y Cutting Travel	Ceiling Height Requirement
±0.003" (±0.08 mm)	46" x 31" (1168 mm x 787 mm)	116" L x 72" W (2946 mm x 1829 mm)	3,000 lbs - table only (1364 kg)	29" x 26" (737 mm x 660 mm)	8 ft (2.44 m)

#### Model 2626|xp JetMachining Center

Provides ultra-precision in the abrasivejet machining of small parts.



Figure 2-2: The OMAX Model 2626|xp JetMachining Center

Specifications: Model 2626 xp JetMachining Center:					
Position Accuracy	Table Size	Footprint	Weight (empty tank)	X-Y Cutting Travel	Ceiling Height Requirement
±0.001" (±0.025 mm)	46" x 31" (1168 mm x 787 mm)	116" L x 72" W (2946 mm x 1829 mm)	3520 lbs - table only (1600 kg)	29" x 25" (737 mm x 635 mm)	8 ft (2.44 m)

### Model 2652 JetMachining Center

Provides the precise abrasivejet machining of small to medium-sized parts.

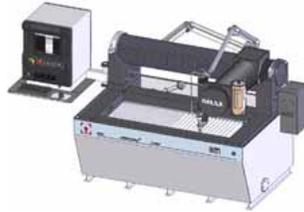


Figure 2-3: The OMAX Model 2652 JetMachining Center

Specifications: Model 2652 JetMachining Center:					
Position Accuracy	Table Size	Footprint	Weight (empty tank)	X-Y Cutting Travel	Ceiling Height Requirement
±0.003" (±0.08 mm)	69" x 30" (1753 mm x 762 mm)	139" L x 67" W (3531 mm x 1702 mm)	3,320 lbs - table only (1505 kg)	52" x 26" (1321 mm x 660 mm)	8 ft (2.44 m)

### Model 5555 JetMachining Center

Provides the precise abrasivejet machining of small to medium-sized parts.



Figure 2-4: The OMAX Model 5555 JetMachining Center

Specifications: Model 5555 JetMachining Center:					
Position Accuracy	Table Size	Footprint	Weight (empty tank)	X-Y Cutting Travel	Ceiling Height Requirement
±0.003" (±0.08 mm)	80" x 65" (2032 mm x 1650 mm)	131" L x 95" W (3327 mm x 2413 mm)	6291 lbs - table only (2854 kg)	55" x 55" (1397 mm x 1397 mm)	10 ft (3.05 m)

### Model 55100 JetMachining Center

Provides the precise abrasivejet machining of parts in sizes up to 5' by 10'.

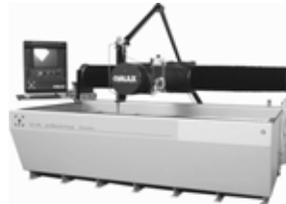


Figure 2-5: The OMAX Model 55100 JetMachining Center

Specifications: Model 55100 JetMachining Center:					
Position Accuracy	Table Size	Footprint	Weight (empty tank)	X-Y Cutting Travel	Ceiling Height Requirement
±0.003" (±0.08 mm)	126" x 65" (3200 mm x 1650 mm)	155" L x 94" W (3937 mm x 2388 mm)	8,000 lbs - table only (3629 kg)	100" x 55" (2540 mm x 1397 mm)	10 ft (3.05 m)

### Model 60120 JetMachining Center

Large scale precision machining for larger parts or multiple parts from large stock up to 5' x 10' (1.5 m x 3 m).



Figure 2-6: The OMAX Model 60120 JetMachining Center

Specifications: OMAX 60120 JetMachining Center:					
Position Accuracy	Table Size	Footprint	Weight (empty tank)	X-Y Cutting Travel	Ceiling Height Requirement
±0.003" (±0.08 mm)	144" x 77" (3656 mm x 1956 mm)	225" L x 110" W (5715 mm x 2794 mm)	6,200 lbs - table only (2818 kg)	126" x 62" (3200 mm x 1575 mm)	10 ft (3.05 m)

### Model 80X JetMachining Center

Designed for large scale precision machining of larger parts or multiple parts from stock up to 6' 8" x 13' 4" (2 m x 4 m).



Figure 2-7: The OMAX Model 80X JetMachining Center

Specifications: OMAX 80X JetMachining Center:					
Position Accuracy	Table Size	Footprint	Weight (empty tank)	X-Y Cutting Travel	Ceiling Height Requirement
±0.003" (±0.076 mm)	180" x 89" (4572 mm x 2261 mm)	265" L x 152" W (6731 mm x 3861 mm)	9,000 lbs - table only (4050 kg)	165" x 80" (4191 mm x 2032 mm)	12 ft (3.66 m)

Specifications: OMAX 80X-1 JetMachining Center:					
Position Accuracy	Table Size	Footprint	Weight (operational)	X-Y Cutting Travel	Ceiling Height Requirement
±0.003" (±0.076 mm)	259" x 89" (6579 mm x 2261 mm)	337" L x 152" W (8560 mm x 3861 mm)	44,000 lbs (20,000 kg)	240" x 80" (6096 mm x 2032 mm)	12 ft (3.66 m)

## Model 80160 JetMachining Center

Designed for the precise abrasivejet machining of large parts from stock in sizes up to 6' by 12'.

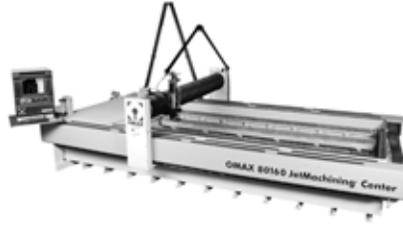


Figure 2-8: The OMAX Model 80160 JetMachining Center

Specifications: Model 80160 JetMachining Center:					
Position Accuracy	Table Size	Footprint	Weight (empty tank)	X-Y Cutting Travel	Ceiling Height Requirement
±0.003" (±0.08 mm)	174" x 89" (4419 mm x 2261 mm)	243" L x 134" W (6172 mm x 3403 mm)	10,000 lbs - table only (4536 kg)	168" x 80" (4267 mm x 2032 mm)	12 ft (3.66 m)

## Description of JetMachining Center Components

OMAX JetMachining Centers can be divided into four major sections:

- **PC Controller** (Figure 2-11, page 2-5)
- **X- Y-axis Motion System** (Figure 2-18, page 2-10)
- **Abrasivejet Delivery System** (Figure 2-21, page 2-11)
- **Catcher Tank** (Figure 2-25, page 2-14)



Figure 2-9: Components of the JetMachining Center Models 2626, 2626xp, 2652, 5555, and 55100 (55100 illustrated)



Figure 2-10: Components of the JetMachining Center Models 60120, 80160, and 80X (80X illustrated)

## PC Controller

The JetMachining Center PC Controller (Figure 2-11) is identical for all OMAX models. It contains a standard video monitor with a Windows-based computer (PC) running the OMAX software responsible for starting and stopping the high-pressure water pump, turning the water and abrasive flow On and Off, and maneuvering the abrasivejet nozzle along its precise cutting path. This internal PC is easily accessed by lifting up the controller's bottom access panel.

Directly below the monitor is the operator's control panel used in conjunction with the keyboard to run the JetMachining Center. The keyboard and mouse are designed specifically to withstand exposure to the water and abrasive particles presented in an abrasivejet environment. The controller's hinged arm allows it to be positioned according to an operator's viewing requirements.

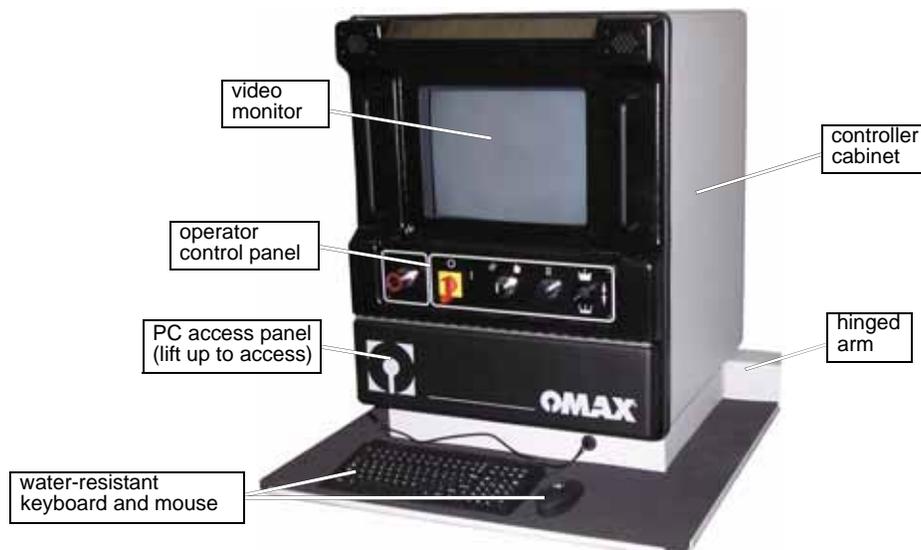


Figure 2-11: The JetMachining Center PC Controller

## Control Panel

The JetMachining Center's control panel provides five function switches for JetMachining Center operation (Figure 2-12):

- **Emergency Stop** (E-stop)
- **Power On/Off**
- **Reset/Override**
- **Pause**

• **Water Level Up/Down**

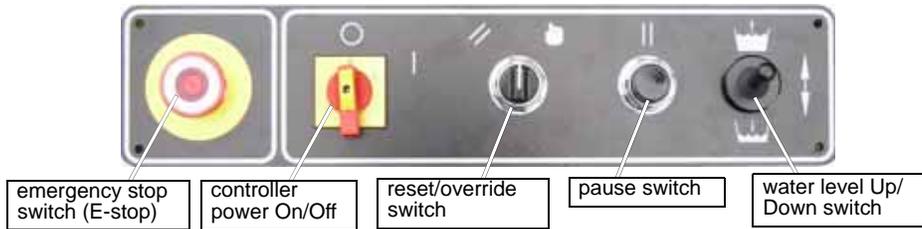


Figure 2-12: Control Panel Operator Switches

**Control Panel Operator Switches**



**Water Level Up/Down Control**

Raises (↑) and lowers (↓) the water in the catcher tank to cover/uncover the material being cut.



**Emergency Stop**

Immediately shuts down the high-pressure water pump and stops all abrasivejet operations. The emergency stop (E-stop) should be used only for real emergencies. When pressed, the OMAX not only stops cutting but also loses important machine positioning data.

**Caution:** *The abrasive feed line must always be cleaned out after an E-stop!*



**Pause**

Pauses the motion of the abrasivejet and shuts down the abrasivejet nozzle. Machining can be restarted without loss of machine positioning information.



**Power On/Off**

Turning the power switch to the On ( | ) position on the front of the controller after the pump has been powered up, automatically starts the computer.



**Reset**

Reset disables all servo axis drives and resets any faulted drive.



**Override**

Manual override is for diagnostic uses only and is not generally needed during normal operation.

**PC Controller Internal Components**

**WARNING!**



**The PC controller's electrical cabinet contains potentially lethal voltages. Prior to doing any service or maintenance activities inside this electrical enclosure, always turn Off and lockout the OMAX AC power source and verify no circuit voltage is present.**

Access to the PC controller's internal components is via the locked handle on the rear of the enclosure. Components inside the controller are divided into two basic sections: the electronic circuits installed inside the rear panel door (Figure 2-13), and the PC and monitor units mounted inside the controller cabinet itself (Figure 2-14). At the bottom of the controller is a filter (Figure 2-15) for the air being circulated to cool the internal components. See the Table Maintenance Chapter, page 6-18, for instructions on removing and replacing this filter.

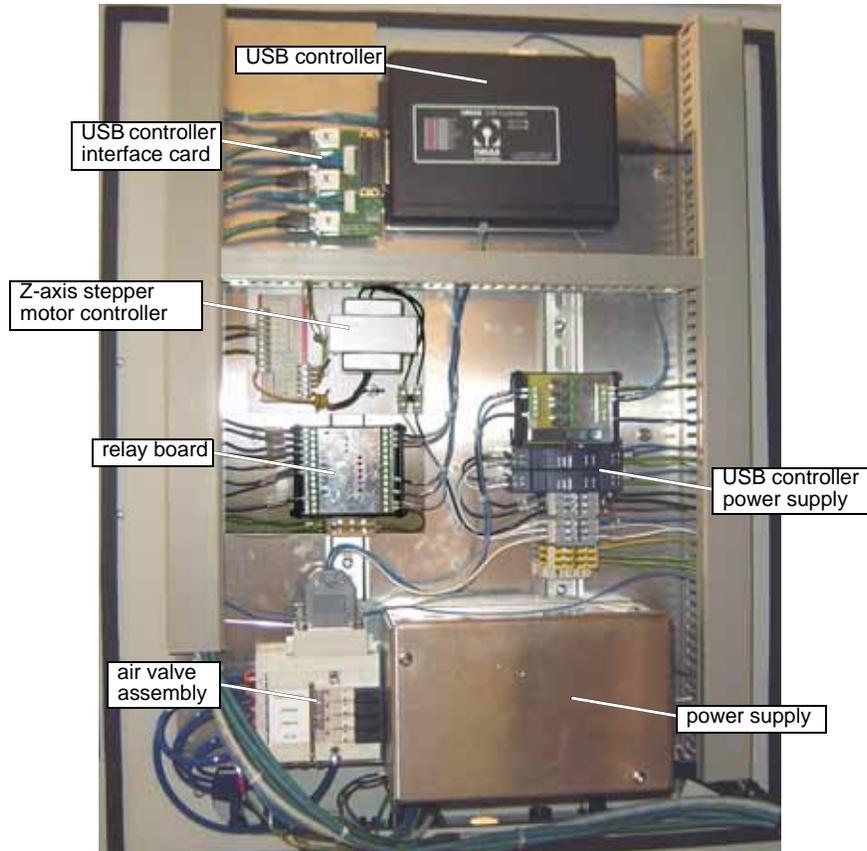


Figure 2-13: Controller Rear Door Internal Components

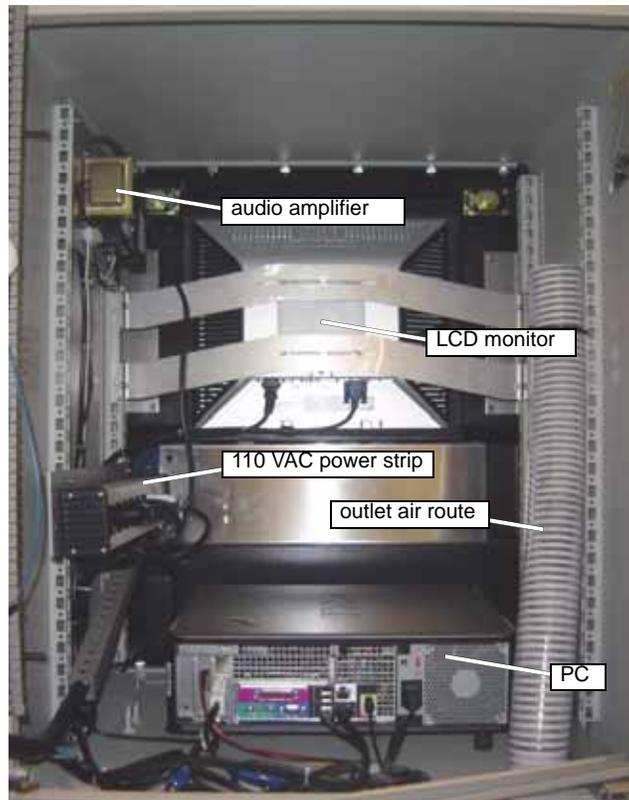


Figure 2-14: Controller Cabinet Internal Components

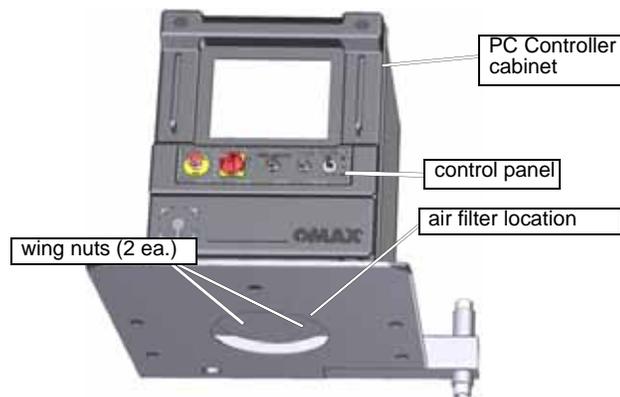


Figure 2-15: Air Filter Location Beneath the Controller Cabinet

### PC Controller

Inside the OMAX controller (Figure 2-14) is a standard PC with the Windows operating system running the OMAX Make and Layout software. To access the front of this PC, lift up the PC access panel (see Figure 2-11 for location). User access typically is required when inserting media into the CD/DVD drive or a flash drive memory into one of the two USB ports (Figure 2-16).

### PC Front Panel

The PC front panel presents the following devices to the OMAX operator (Figure 2-11):

- CD/DVD drive
- CD/DVD drive open/close button
- USB ports (2 ea.)
- Power On/Off button

**Note:** The PC automatically powers up when the controller On/Off switch (Figure 2-12) is On. Use of the PC front panel Power On/Off switch is not required.

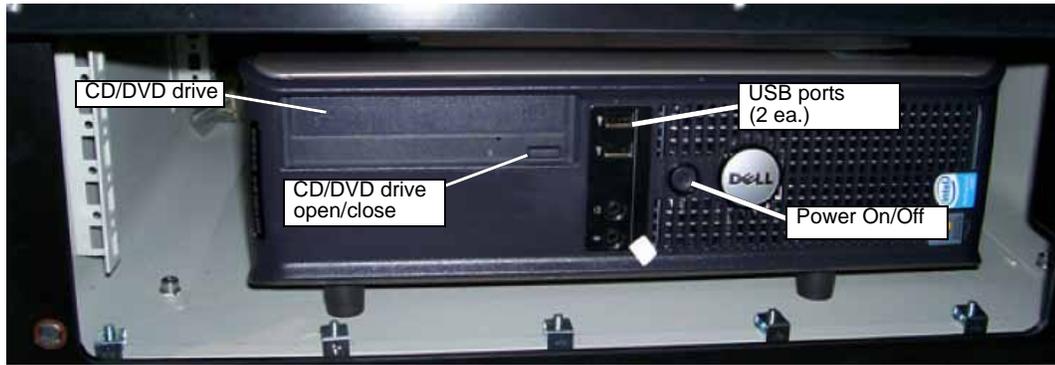


Figure 2-16: User Components on Front Panel of Controller PC

### PC Rear Panel

The back of the PC is accessible by opening the PC controller's rear door. During normal operation, there are few reasons for the user to access to the PC rear panel. Cabling to the PC rear panel is as follows:

- AC power cable from power strip (Figure 2-14)
- Audio cable to audio amplifier (Figure 2-14)
- USB cable to USB controller (Figure 2-13)
- Video cable to monitor (Figure 2-14)



Figure 2-17: PC Rear Panel Cable Connections

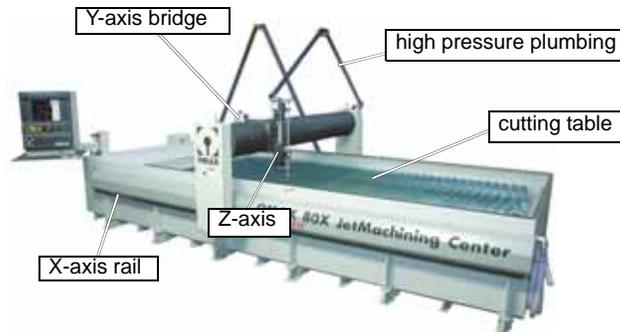
## X- Y- Z-axis Motion System

The precision X- Y-axis motion system installed on the OMAX models 2626, 2626|xp, 2652, 5555, and 55100 consists of a bridge X-axis and a cantilever Y-axis rigidly mounted to the cutting table (see Figure 2-18). Both X and Y carriages ride on rigidly mounted linear rolling bearings. The carriages are moved by preloaded ball screws driven by steel reinforced timing belts from brushless digital servo motors that provide position feedback. Each step command to a servo amplifier moves the carriage approximately 0.0005" (0.013 mm). The entire bearing and drive mechanisms are surrounded and sealed in urethane bellows that prevent water and abrasive particles from entering and severely damaging critical mechanical components.



*Figure 2-18: X-Y Carriage Components of the JetMachining Center Models 2626, 2626|xp, 2652, 5555, and 55100 (55100 illustrated)*

The 60120, 80160 and 80X motion systems consist of a Y-axis bridge attached to dual X-axis rails rigidly mounted to the catcher tank (see Figure 2-19).



*Figure 2-19: X-Y Components of the JetMachining Center Models 60120, 80160, and 80X (80X illustrated)*

The Y beam connects to the carriage that moves along the X-axis rail. X-axis movement for the 80160 is driven using the typical OMAX ball screw configuration. X-axis movement for the 60120 and 80X utilize a high precision traction drive coupled with position feedback from magnetic encoding tape. In addition, their X-axis rails do not require lubrication and are resistant to garnet contamination.

The OMAX Z-axis motion system is responsible for nozzle movement in the up/down direction. The design of the Z-axis is practically identical for all OMAX tables. A manually operated Z-axis is standard, using a hand crank for position control. The optional motorized Z-axis is more common, using a stepper motor under software control to drive a lead screw to obtain height adjustments in 0.001" (0.0254 mm) increments (Figure 2-20). Both the manual and motorized Z-axis units are completely protected against water and grit contamination using urethane bellows.

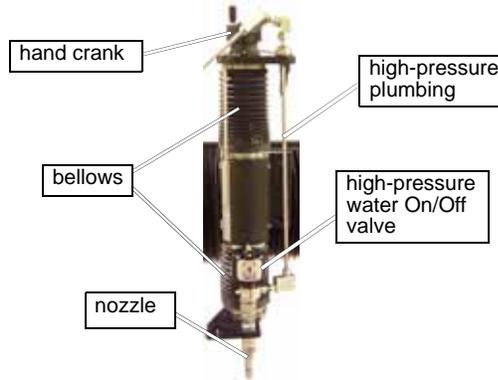


Figure 2-20: Motorized Z-axis

## Abrasivejet Delivery System

The abrasivejet delivery system consists of high-pressure plumbing, a high-pressure nozzle, and an abrasive feed system (hopper).

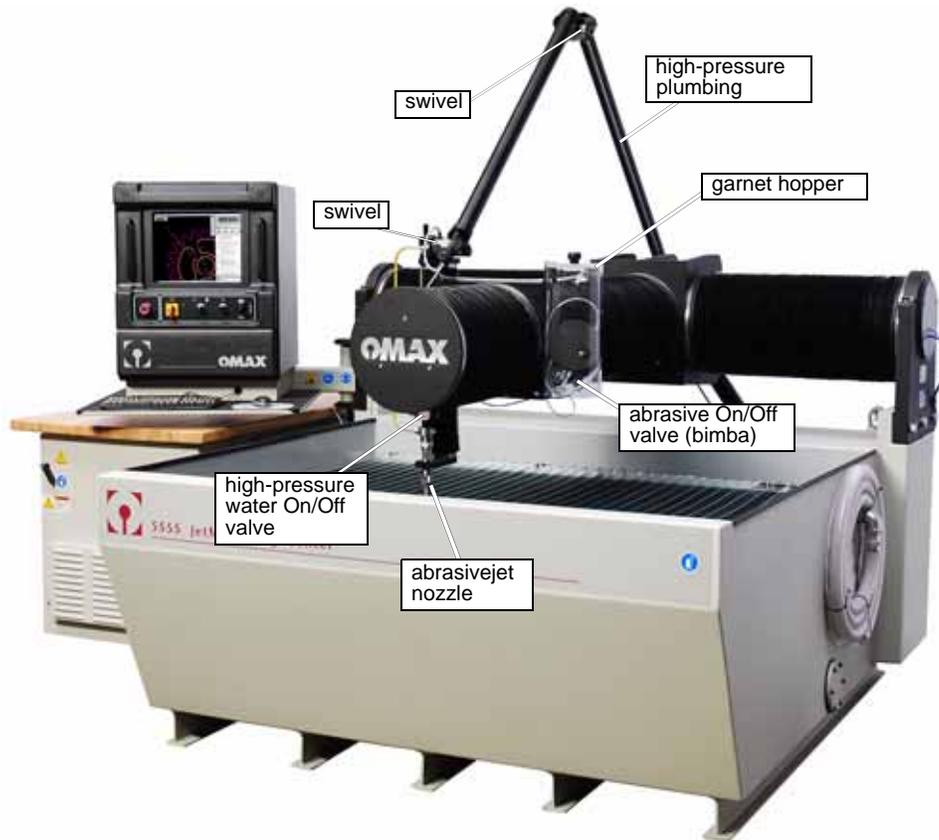


Figure 2-21: JetMachining Center Abrasivejet System Components (5555 illustrated)

### Abrasivejet Nozzle

In an abrasivejet nozzle (Figure 2-22), when the high-pressure water is allowed to pass by the On/Off control valve, it is forced through a small hole in a jeweled orifice typically composed of sapphire or diamond (Figure 2-23).

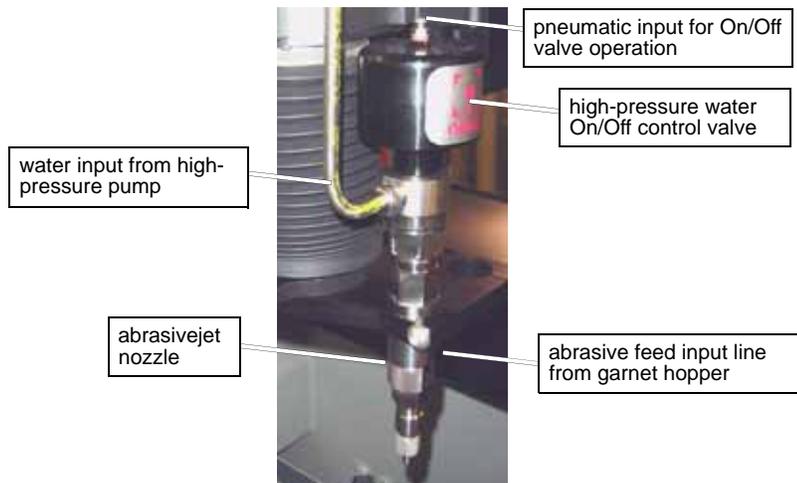


Figure 2-22: Components of an OMAX Abrasivejet Nozzle Assembly

This narrow stream of water exits the jeweled orifice travelling up to 2500 feet per second (760 m/s). As it moves into a larger chamber, the high velocity stream of water draws in the abrasive from the abrasive feed tube. This stream of water with the acquired abrasive then moves into a mixing tube where the water and abrasive combine to form the abrasivejet stream which exits the mixing tube at the bottom of the nozzle to strike the material being machined.

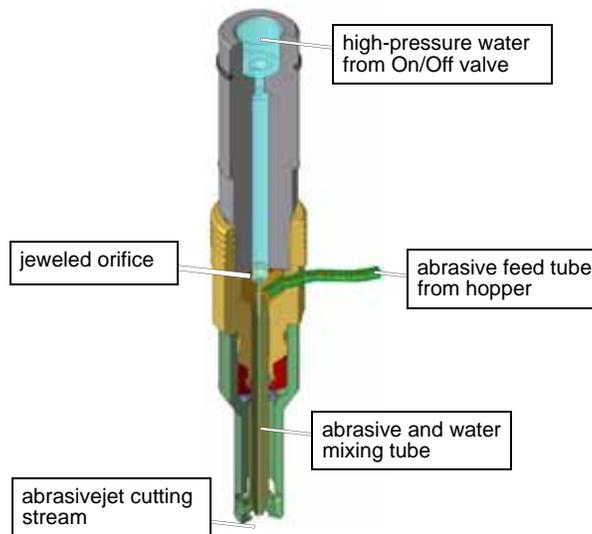


Figure 2-23: Internal Workings of the Abrasivejet Nozzle

## The Abrasive Hopper

The abrasive hopper mounts to the OMAX Y-carriage and holds up to 25 pounds (11 kg) of abrasive. A hinged top cover prevents dirt and other shop contaminants from entering and contaminating the abrasive. The abrasive rate of flow is regulated by a computer-controlled pneumatic valve (Bimba valve) and the Bimba valve orifice located at the bottom of the hopper.

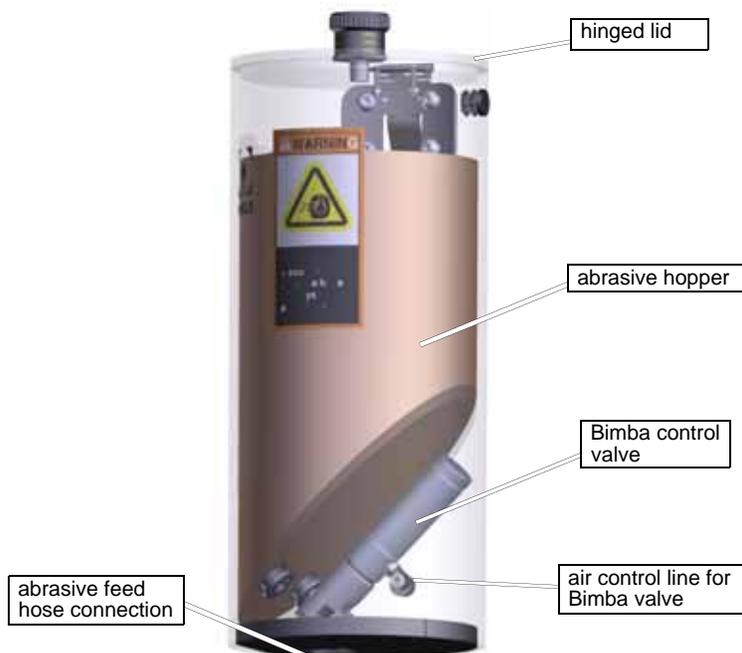


Figure 2-24: Abrasive Hopper Components

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

When choosing abrasives, always pick a high-quality abrasive for your OMAX JetMachining Center. High-quality abrasives are much more consistent in abrasive particle size. Inconsistency in particle sizes makes it difficult to maintain quality and precision when cutting and also increases the likelihood of your mixing tube becoming plugged. High-quality abrasives also contains less dust. When dust is present, static electrical charges can build up, causing the abrasive particles to clump together, hindering their flow.

## High-pressure Plumbing

The high-pressure plumbing routes the high-pressure water from the OMAX pump to the abrasivejet nozzle. This system of plumbing includes the tubing, high-pressure fittings, swivels, and On/Off valve. Properly prepared and connected ultra-high-pressure (UHP) tubing and fittings are critical in maintaining a safe and leak-free high-pressure system.

### Swivel

Swivels provide the flexibility in the plumbing system that allows the cutting nozzle and associated high-pressure plumbing to travel across the table surface while maintaining a watertight seal. There are two types of swivels used on the OMAX JetMachining Centers: bulkhead and high-pressure. See Figure 4-1, on page 4-1. The Model 2626 does not require swivels.

### Dual On/Off Valve

The Dual On/off Valve controls the water flow through the cutting nozzle and operates in conjunction with the high-pressure pump's dump valve. When water to the cutting nozzle is shut off, the software

automatically opens the dump valve, routing the high-pressure water through it instead. This allows continual pump operation during times when the nozzle is not cutting. Using this technique, the water pressure always remains the same, and the starting and stopping of the waterjet takes place without delay. In addition, dual pressure operations, such as needed for low-pressure glass piercing, are also possible. When dual pressure operation is desired, low pressure is automatically achieved by opening both the dual on/off valve and the pump dump valve simultaneously.

## Catcher Tank

The JetMachining Center's large catcher tank stores the water from the cutting nozzle and provides a settling tank for the spent abrasive material and removed material particles (see Figure 2-25). Excess water exits the catcher tank by traveling through a water outlet filter screen (Figure 6-1) that can be raised or lowered to determine the tank's water level.

A series of steel slats positioned above the catcher tank form a cutting surface that supports a part as it is being machined. The Model 2626|xp high precision JetMachining Center features a stainless steel tank, stainless steel slats, and stainless steel slats holders.



Figure 2-25: JetMachining Center Catcher Tank

Pressurized air is required to operate the On/Off valves controlling the level of the tank water and the water and abrasive flow. Tank water level is controlled using OMAX's Rapid Water Level Control (Figure 2-26):

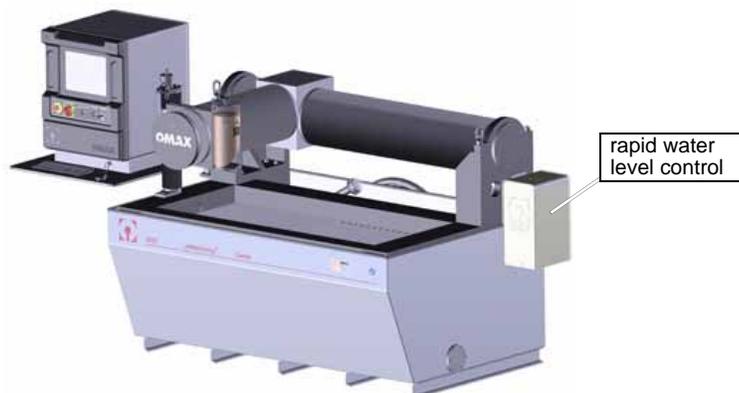


Figure 2-26: OMAX's Rapid Water Level Control

The Rapid Water Level Control requires the following performance from an auxiliary air source:

**Pressure:** 75 - 120 psi (517 - 827 kPa)

**Flow Rate:** 16.0 cfm (453 l/m) minimum

Internal air connections to the Rapid Water Level Control are identified in Figure 2-27:

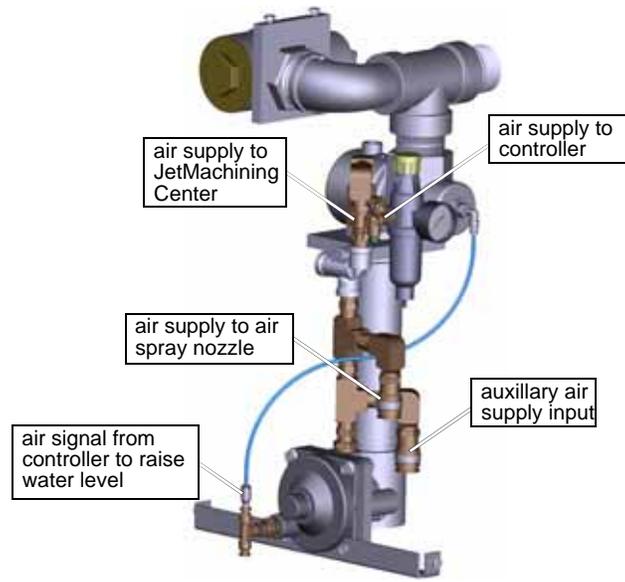


Figure 2-27: Rapid Water Level Control Internal Pneumatic Connections



# Introduction to the OMAX Pump

This section introduces the OMAX high-pressure water pump unit and provides the following information:

- Describes the OMAX pump unit
- Identifies the pump components
- Provides an overview of the water circuit
- Explains how the OMAX pump works
- Provides an overview of electrical circuit
- Lists specifications for all OMAX pump models



*Figure 3-1: OMAX High-Pressure Water Pump*

## Description of the OMAX Pump

The OMAX variable speed, high-pressure pump is an electrically driven, variable speed, positive displacement, crankshaft drive triplex pump that provides the high-pressure water required by the OMAX JetMachining<sup>®</sup> System to operate. It incorporates several features that make it less costly to operate and maintain:

- All water used to cool the pump is recycled for reuse when operated with an optional chiller or closed loop system.
- It contains its own charging pump and filter system, allowing it to be used with a low-pressure water source.
- The entire high-pressure wet-end assembly may be removed as a unit by removing only eight nuts.
- All pump components are designed for low noise operation (approximately 72 dB).
- The OMAX pump runs with low vibration, reducing wear and tear on components and surrounding connections.

The pump's major drive components include the variable frequency drive (VFD), the main electric motor, the belt drive between the motor and the high-pressure pump, and the crankshaft drive for the high-pressure pump. The electronic VFD varies the electric motor speed, and therefore the pump speed, by varying the frequency of the motor's electric power. The variable frequency drive accommodates slight variations in

nozzle flow characteristics, produces no current surge upon starting, and provides high power factors and VFD/motor efficiencies throughout the useful power range.

Pump components are mounted in a compact enclosure that occupies only 15 square feet (1.4 square meters) of floor space. All electrical control components and VFD are located in the electrical enclosure mounted on the right-hand end of the pump unit.

The main electric drive motor, belt drive, and OMAX high-pressure crankshaft drive pump assembly are mounted on a welded steel tray connected to a steel pump frame with anti-vibration mounts. The water module is mounted on a steel tray and consists of the water tank and charge pump.

Removable covers are provided on the front, back, and left-end of the pump unit. The pump's laminated wood top can be raised, allowing easy access to the water filters and pump high-pressure wet-end.

The charging pump brings water from the water tank to the filters. Cooling water is recycled back to the water tank.

## Pump Components

### Pump Viewed from Front and Right Side



Figure 3-2: OMAX Variable Speed High Pressure Pump Front View

### Front Pump View with Front Panel Removed



Figure 3-3: Pump with Top Lid Open and Front Panel Removed

### Rear Pump View with Rear Panel Removed

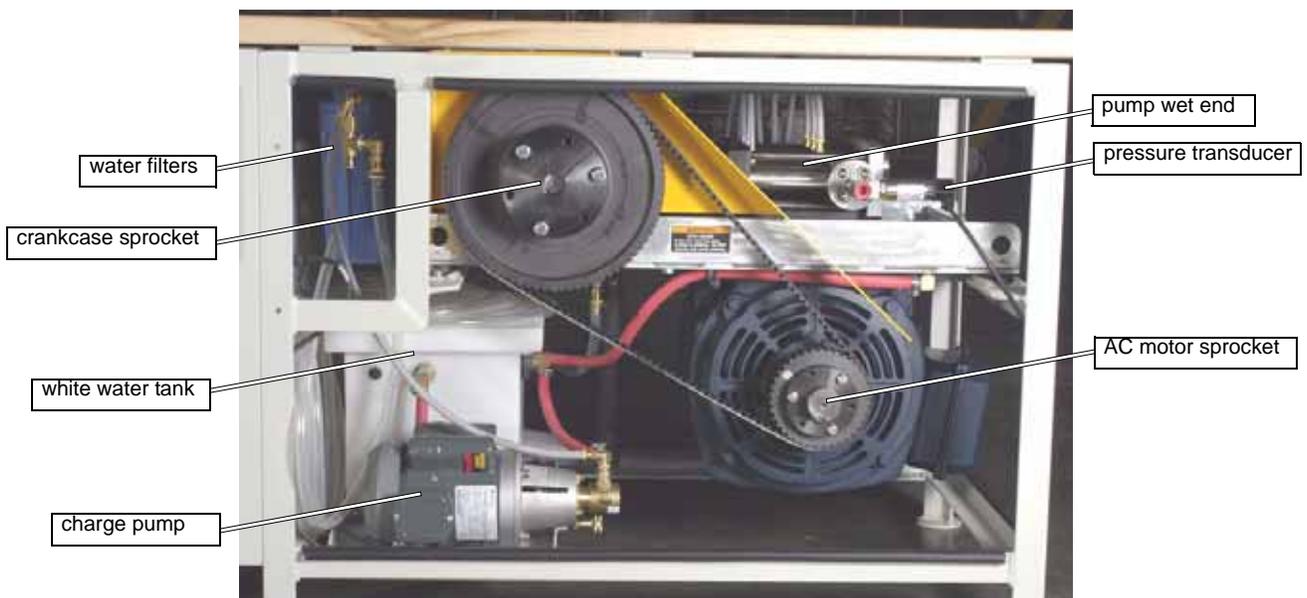


Figure 3-4: Pump with Rear Panel Removed

**Top Pump View with Lid Opened**

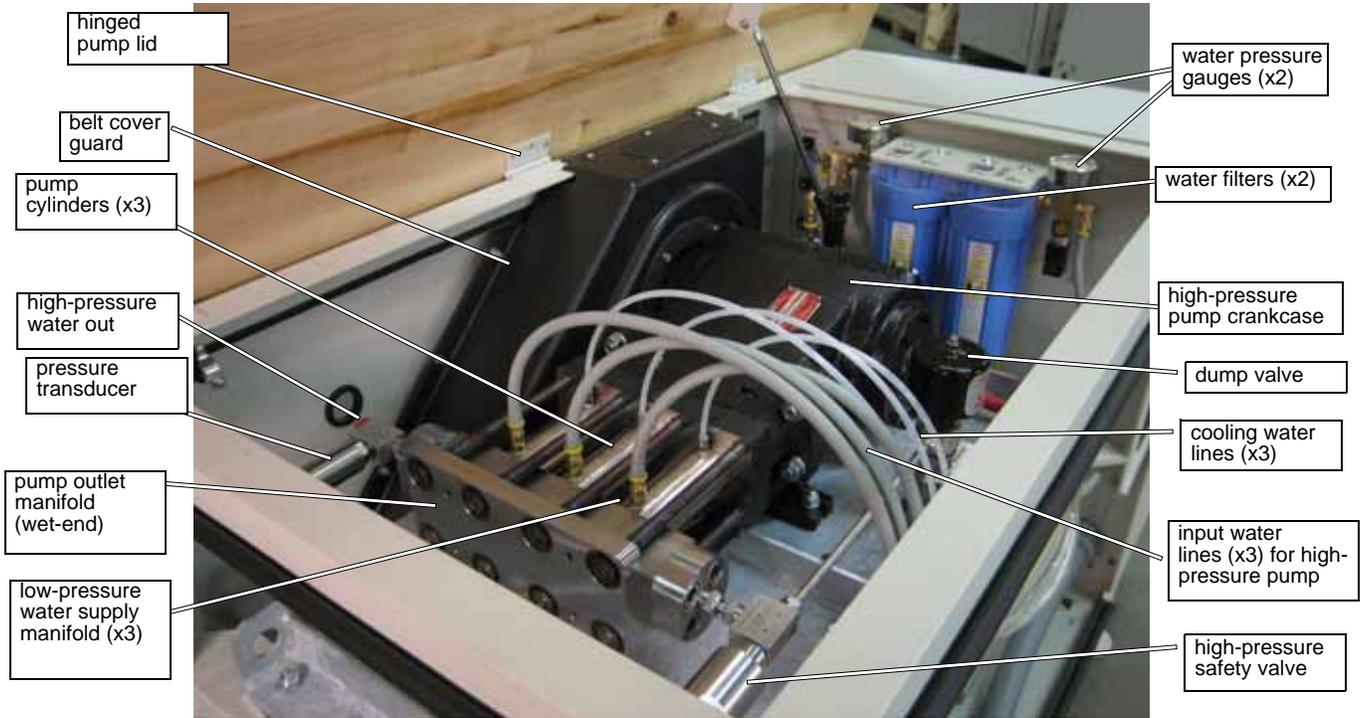


Figure 3-5: Top View of Pump with Lid Open

**Pump Side View with Right Panel Open**



Figure 3-6: Pump Internal Components on Right Side

## Pump Control Panel

The pump unit controls are located on the front of the panel at the right-hand end of the pump. See Figure 3-2, page 3-2, for illustration. The panel has a 5-button keypad with display, pump On/Off Switch, Manual Charge Pump Switch, and an Emergency Stop Switch (E-Stop).

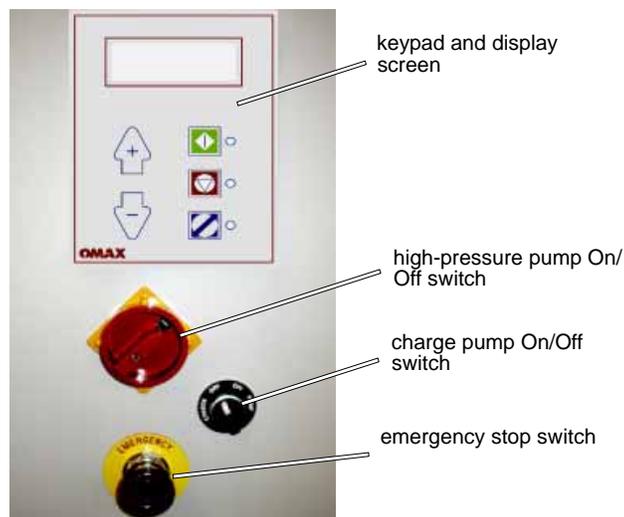


Figure 3-7: Pump Control Panel

The pump unit control has two modes of operation: Keypad and Remote. If the pump unit operates as a standalone pump, control is via the keypad only. If the pump unit operates with an OMAX JetMachining Center, control is shared between the JetMachining Center Controller and the Keypad.

### High-pressure Pump On/Off Switch

The pump On/Off switch controls power to the keypad and display. When switched Off, the keypad is disabled, the display goes blank, and the pump immediately stops. When switched On (turn clockwise), the keypad and display both become enabled; the pump is also enabled but starts only when either the **Run** button is pressed if the pump is in a standalone mode, or a remote command is received from the OMAX JetMachining Center.

**WARNING!** *The pump On/Off switch will not remain in the On position unless power to the pump unit is received from the AC main power disconnect. Whenever power at the main disconnect is On, there is always live AC power on the DIN rail and at the terminals inside the pump electrical enclosure even when the pump On/Off switch is Off.*

### Charge Pump On/Off Switch

The charge pump is responsible for the pre circulation of water through the pump reservoir tank and cooling lines. This flow purges warm water from the reservoir tank and the pump cooling lines before the high-pressure pump starts. Cooler water increases the life of the high-pressure pump seals.

The charge pump On/Off switch on the pump's front panel, controls power only to the charge pump; however, the charge pump must be On for the high-pressure pump to start. If an attempt is made to start the high-pressure pump from the PC Controller without the charge pump running, the high-pressure pump will not start and an error message appears on the front panel display.

### Emergency Stop Switch (E-stop)

Pushing E-Stop in immediately shuts down both the pump and display. The E-Stop is disengaged (reset) by manually pulling it back to its original position. The pump cannot be restarted until E-Stop is reset.

**Note:** If the pump is connected to an OMAX JetMachining Center, pushing E-Stop in at any time (either the E-Stop on the pump itself, or the E-Stop on the JetMachining Center) immediately shuts down both the pump and the JetMachining Center. If the computer and controls are being powered from an alternative 115 VAC source, the pump E-Stop stops only the pump and not the controller.

## Operator Keypad and Display Screen

The keypad provides five function buttons with a four-line message display screen. See Figure 3-8, below, for illustration.

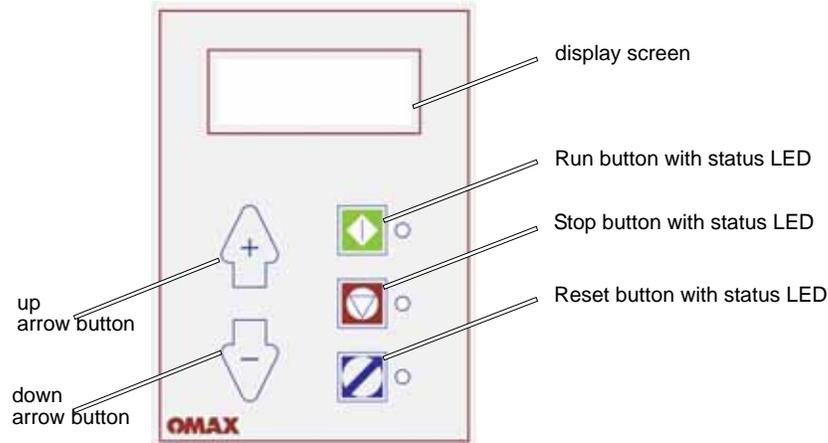


Figure 3-8: Front Panel Keypad and Display Screen

### Display Screen

When the pump is operating normally, these four lines of text appear:

Water Pres	xx.x KSI	- pump output pressure in KSI
High PreSet	xxxxx RPM	- preset drive motor high RPM
Low PreSet	xxxxx RPM	- preset drive motor low RPM
RunTime	xxx HRS	accumulative number of pump run hours

**Note:** A “T” appears with the water pressure information (Water Pres T) if a pressure transducer is connected and recognized by the pump controller card.

The five buttons on the OMAX Keypad function as follows



#### Run Button

Starts the pump when pressed if operating in a standalone mode (not being controlled by the OMAX JetMachining Center). When started, the motor RPM (pump pressure) will return to the last value of **Hi Pre-Set**. The red status LED to the right of this button is lit when the pump is in the “run” mode.



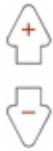
#### Stop Button

Immediately stops pump operation whenever pressed if in standalone keypad or remote mode. When held down for 3 seconds, displays the pump’s operational mode, the rated pressure, and software version. The red status LED to the right of this button is lit while the pump is stopped.



#### Reset Button

Clears a pump fault condition. Pressing either the **up** or **down arrow** while also pressing the **Reset** button, sets the **Low Pre-Set** pump motor RPM (low pressure). The red status LED to the right of this button is lit whenever the pump is in a fault condition. A reset is required for recovery.



### Up/down Arrow Buttons

Pressing the **up arrow** increases the pump's RPM which increases water pressure. Neither pressure nor RPM can be increased above their maximum allowable limits. Pressing the **down arrow** at any time decreases pump RPM and pressure down to the minimum RPM.

## Normal Operation Messages

When the pump is operating normally, the OMAX keypad screen displays four lines of information:

### Water Press T

Pump output pressure in kpsi - the "T" appears when the value displayed is from the pressure transducer

### Hi Pre Set

Preset drive motor high RPM

### Low Pre Set

Preset drive motor low RPM when low pressure mode is invoked by the OMAX JetMachining Center Controller.

### RunTime

Hour Meter, accumulative number of hours the drive motor/pump has run. It is not re-settable.

## Fault Messages

If a fault occurs, the pump shuts down, and one or more of the following messages will be displayed on the first three lines of the OMAX keypad screen:

**Note:** *The fourth line on the OMAX keypad display always monitors the cumulative pump hours.*

"Charge Pressure Low"  
 "Charging Pump Contactor"  
 "Dead Head"  
 "Variable Drive Fault"

- If the drive is shut down by a fault, the message "Variable Drive Fault" appears on the keypad display screen and the red LED next to the reset button lights.
- Before the pump can be restarted, the fault condition must be cleared from the pump control by pressing the RESET button. The LED next to the RESET button goes out and the LED next to the STOP button lights.
- Once the fault condition has been reset, the pump is again enabled and may be restarted.
- If all conditions triggering the fault have not been corrected, the uncorrected fault(s) reoccurs, the pump again shuts down, and a fault message reappears on the display.

**Note:** *Before resuming operation of the pump unit, the cause of the fault must be investigated and corrected. Refer to the procedures described in the "Troubleshooting" section of this document.*

## Overview of the Charge Pump Water Circuit

The OMAX pump unit contains a manually switched charge pump and filter system that must provide at least 80 psi (50 psi on earlier pumps) of inlet water pressure to the crankshaft drive high-pressure pump. Water pressure readings at the water filter gauges (see Figure 7-51) typically range from 90-120 psi.

The charge pump allows the OMAX pump unit to be connected to low-pressure water sources that may vary over a wide range of available pressures. Part of the water supplied to the OMAX pump unit functions as cooling water for the high-pressure seals and plungers. When a chiller is installed to cool the water source, this cooling water is recycled back through the white water tank for reuse rather than going to the waste water drain.

Manual control of the charge pump allows it to be run independently at any time to purge the tank and water lines with cooler water prior to starting the main high-pressure pump. This increases the life of the high-pressure seals.

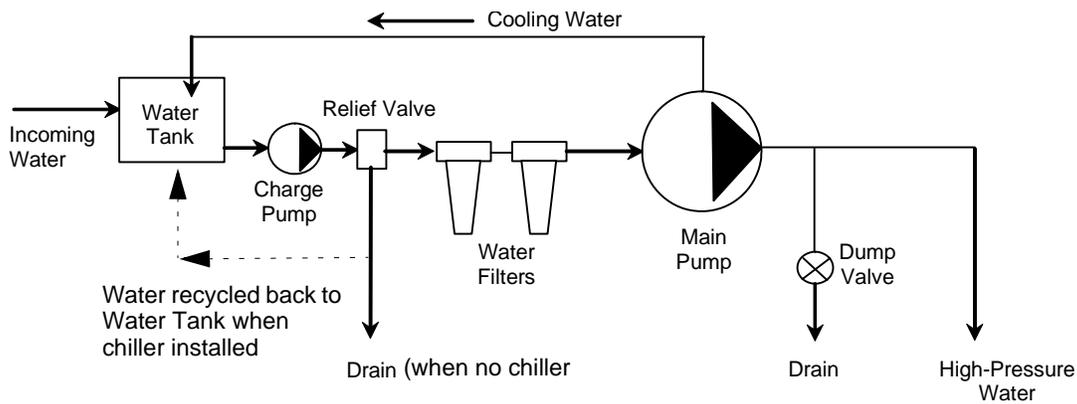


Figure 3-9: The Charge Pump Low-pressure Water Circuit

## How the OMAX High-pressure Pump Works

The OMAX pump works as follows:

1. The PLUNGER is drawn back (to the right in the figure) by motion of the crank.
2. This draws water in through the WATER INLET PORT, past the INLET CHECK VALVE BALL, and into the CYLINDER. During this suction stroke the OUTLET CHECK VALVE BALL prevents high-pressure water entering the CYLINDER from the OUTLET PASSAGE.

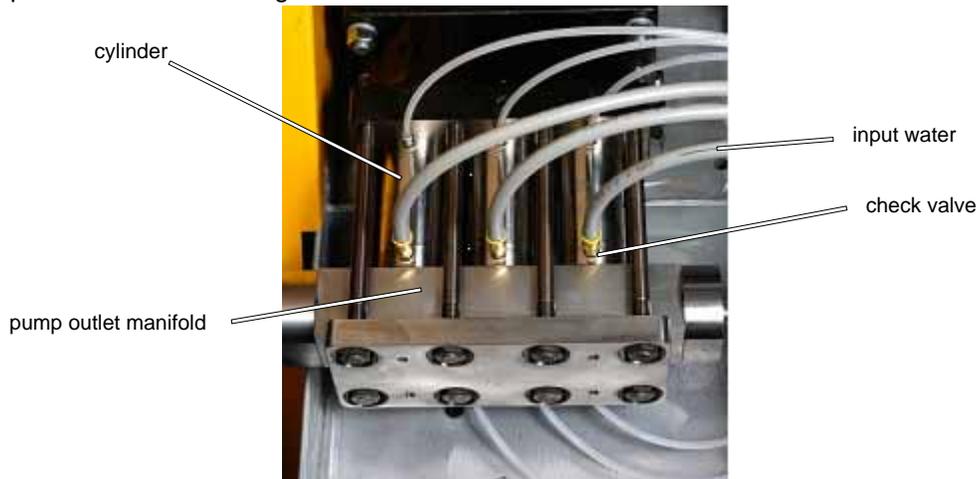


Figure 3-10: The High-pressure Wet-end of the OMAX Pump.

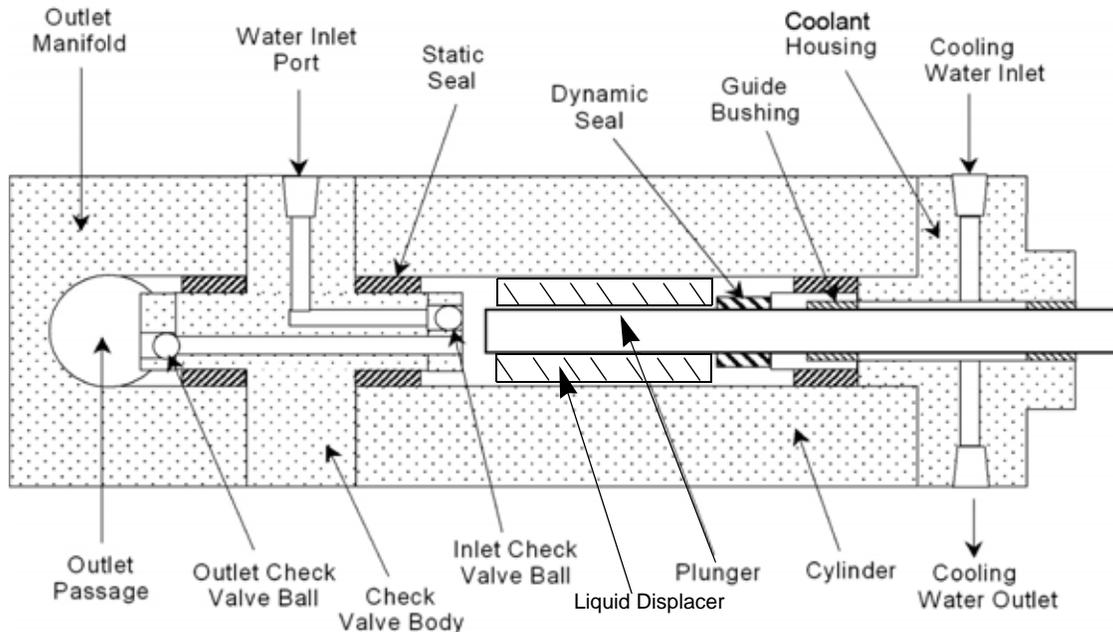


Figure 3-11: Details of the Pump Wet-end

3. At the bottom of the PLUNGER stroke, the CYLINDER fills with water.
4. As the PLUNGER moves back, pressure inside the CYLINDER increases as the water is compressed. The INLET CHECK VALVE BALL prevents the compressed water from flowing back out the WATER INLET PORT. The LIQUID DISPLACER occupies dead space within the cylinder and improves volumetric efficiency.
5. When pressure in the CYLINDER reaches the same pressure as in the OUTLET PASSAGE, the OUTLET CHECK VALVE BALL moves away from its seat, allowing the water to pass into the OUTLET PASSAGE.
6. When the PLUNGER slows and stops at its original top-dead center position (step 1), the pressure inside the CYLINDER falls, and the OUTLET PASSAGE closes off. This cycle then repeats.
7. High-pressure STATIC SEALS prevent water from leaking between the CYLINDER and the CHECK VALVE BODY, between the CYLINDER and the BUSHING HOUSING, and between the CHECK VALVE BODY and the OUTLET MANIFOLD.
8. A high-pressure DYNAMIC SEAL prevents water from escaping around the PLUNGER.
9. To prolong the life of the DYNAMIC SEAL, GUIDE BUSHINGS are used to maintain alignment of the PLUNGER through the DYNAMIC SEAL.
10. The BUSHING HOUSING has a COOLING WATER INLET port and COOLING WATER OUTLET port which allow water to flow through the BUSHING HOUSING to cool the PLUNGER and lubricate the GUIDE BUSHINGS. The cooling water also picks up any leakage from the DYNAMIC SEAL and recycles it back to the water tank.

# Overview of Electrical Circuit

The simplified diagram shown below provides an overview of the electrical components and electrical logic of the OMAX pump.

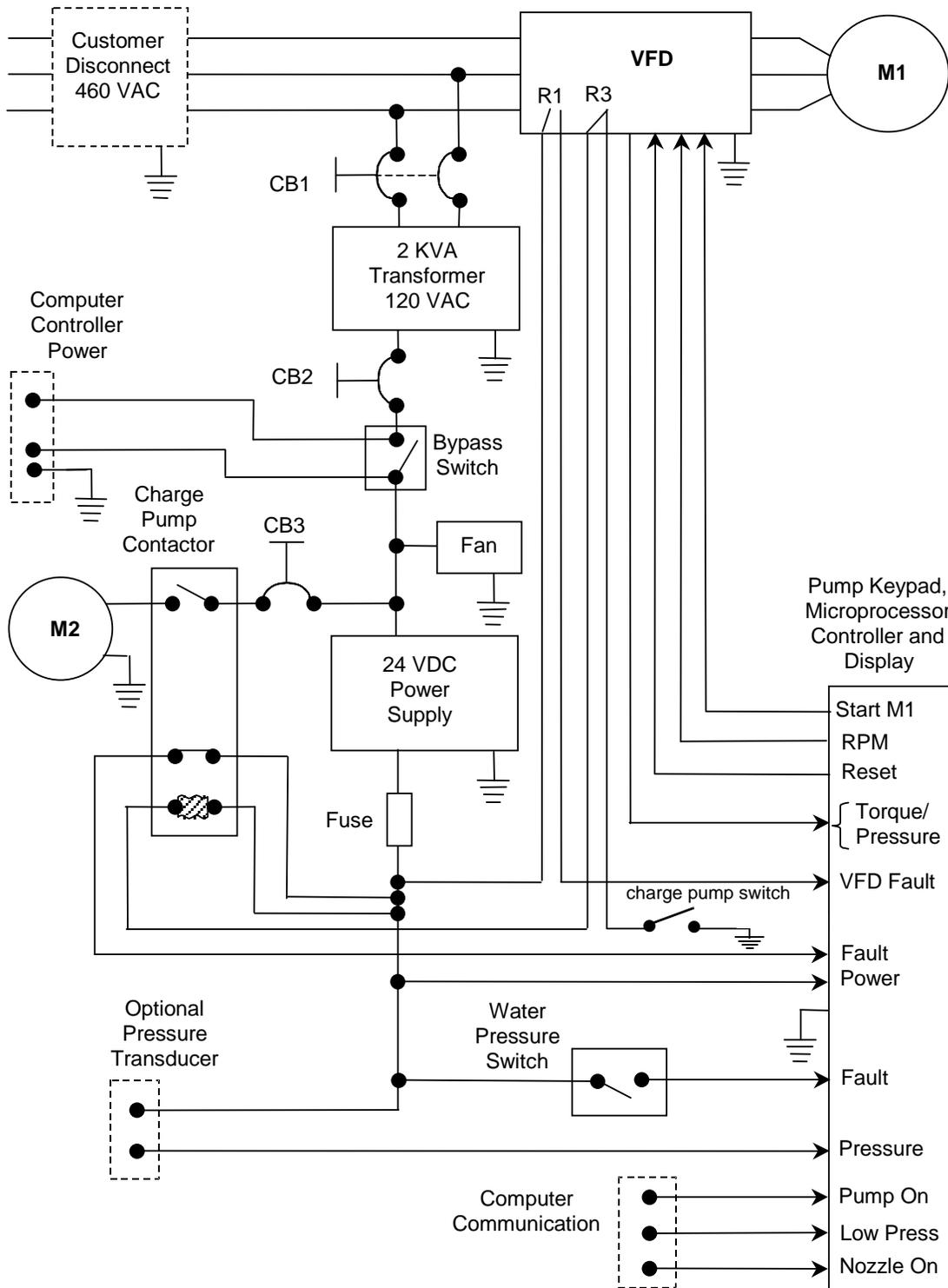


Figure 3-12: Simplified Pump Electrical Diagram

**Note:** When troubleshooting electrical or control problems with your OMAX pump, the detailed electrical schematics that are provided in addition to this document should be consulted.

1. The main 460 VAC three-phase power (380 or 415 VAC for international applications) comes into the OMAX electrical enclosure from the CUSTOMER DISCONNECT and supplies power directly to the VFD.
2. The VFD in turn, when given the command from the OMAX pump MICROPROCESSOR CONTROLLER, starts and runs the main pump motor, M1.
3. The VFD is protected from line voltage surges by internal transient voltage surge suppression.
4. Two legs of the 3-phase power the 2 KVA TRANSFORMER that steps the voltage down to 120 VAC.
5. The 2 KVA TRANSFORMER (and everything downstream of it) is protected by the two-pole circuit breaker, CB1. Turning Off CB1 kills the power to the 2 KVA TRANSFORMER and all the 120 VAC and 24 VDC power in the OMAX pump. The only component within the pump powered is the VFD. Immediately downstream of the 2 KVA TRANSFORMER is the single-pole circuit breaker, CB2. Turning CB2 Off kills all 120 VAC and 24 VDC power in the OMAX pump with the exception of the VFD and the 2 KVA TRANSFORMER.
6. The electrical enclosure cooling FAN, the Jet Machining Center COMPUTER CONTROLLER, the charge pump motor, M2, and the 24 VDC POWER SUPPLY are powered with 120 VAC from the 2 KVA TRANSFORMER.
7. Connecting the COMPUTER CONTROLLER of the OMAX Jet Machining Center externally, completes the 120 VAC circuit within the OMAX pump to power the FAN, the charge pump motor, M2, and the 24 VDC POWER SUPPLY.
8. Without the COMPUTER CONTROLLER connected, the BYPASS SWITCH must be closed to complete the 120 VAC circuit and power the FAN, the charge pump motor, M2, and the 24 VDC POWER SUPPLY.
9. Through the COMPUTER CONTROLLER power circuit, the emergency stop switches (not shown in the simplified diagram) on the COMPUTER CONTROLLER, and the OMAX pump are in series. Pressing either emergency stop shuts down both the OMAX pump and the COMPUTER CONTROLLER.
10. Manually closing the Charge Pump On/Off Switch starts the charge pump at any time.
11. Charge pump motor, M2, is protected by the circuit breaker, CB3. Turning Off CB3 prevents the charge pump motor, M2, from starting even though the CHARGE PUMP SWITCH may be On and the CHARGE PUMP CONTACTOR closed.
12. The entire 24 VDC portion of the electrical circuit is protected with the 0.5 amp FUSE immediately after the 24 VDC POWER SUPPLY.
13. The pump MICROPROCESSOR CONTROLLER and control circuit operate with 24 VDC power provided by the 24 VDC POWER SUPPLY.
14. The WATER PRESSURE SWITCH protects the OMAX pump from running without a water supply, or without sufficient charge pressure. It closes at charge pressures above 50 psi and provides a 24 VDC signal to the pump's MICROPROCESSOR CONTROLLER.
15. If a PRESSURE TRANSDUCER is installed on the OMAX pump, it is powered by the 24 VDC POWER SUPPLY and the pressure signal is sent directly to the pump MICROPROCESSOR CONTROLLER.
16. If an OMAX Jet Machining Center COMPUTER CONTROLLER is connected through the COMPUTER COMMUNICATION, control of the OMAX pump is via the Jet Machining Center COMPUTER CONTROLLER. It controls PUMP ON and OFF. It also commands the OMAX pump LOW PRESSURE mode, which can be commanded only from the OMAX Jet Machining Center COMPUTER CONTROLLER.
17. The OMAX pump MICROPROCESSOR CONTROLLER handles operation of the pump. It consists of a microprocessor, display, and keypad. It is powered by the 24 VDC POWER SUPPLY.

18. The OMAX pump MICROPROCESSOR CONTROLLER provides three commands to the VFD:
  - Start M1
  - Set the RPM for the main motor, M1
  - Clear a VFD fault
19. The pump MICROPROCESSOR receives two signals from the VFD: the main motor M1 torque (which is representative of pump pressure) and the VFD FAULT signal.
20. If for some reason the VFD faults, the VFD shuts Off the main motor M1, opens relay R2 which shuts Off the charge pump, and closes relay R1 which sends a VFD FAULT signal to the pump MICROPROCESSOR CONTROLLER. The MICROPROCESSOR CONTROLLER then reports on the pump DISPLAY that a VFD FAULT has occurred. To clear the fault, the MICROPROCESSOR CONTROLLER can be commanded to clear the fault condition of the VFD by pressing the RESET button on the keypad. The pump can then be restarted.
21. In addition, the pump MICROPROCESSOR CONTROLLER detects and reports a FAULT status of the CHARGE PUMP CONTACTOR if it should be closed but remains open. It also detects and reports a FAULT status if the charge pressure is less than 50 psi when the charge motor M2 is running.
22. When connected to the OMAX Jet Machining Center COMPUTER CONTROLLER, the pump MICROPROCESSOR CONTROLLER receives and interprets the PUMP ON or OFF, LOW PRESSURE, and NOZZLE ON or Off signals from the COMPUTER CONTROLLER.

## Pump Specifications

	<b>P3050V</b>	<b>P3055V</b>	<b>P4055V</b>
<b>Dimensions</b>			
Height	38.5 in (97.8 cm)	38.5 in (97.8 cm)	38.5 in (97.8 cm)
Width	66 in (167.6 cm)	66 in (167.6 cm)	66 in (167.6 cm)
Depth	36 in (91.5 cm)	36 in (91.5 cm)	36 in (91.5 cm)
Weight	1700 lb. (773 kg)	1700 lb. (773 kg)	1750 lb. (750 kg)
<b>Pump Unit</b>			
Type	Fixed displacement, triplex	Fixed displacement, triplex	Fixed displacement, triplex
Inlet water	1.1 gpm (4.0 lpm) at 3 to 150 psi (20-100 Kpa)	0.5 gpm (1.8 lpm) at 3 to 150 psi (20-100 Kpa)	1.3 gpm (4.9 lpm) at 3 to 150 psi (20-100 Kpa)
Charge water tank	5 gal. (18.9 Liter) with float valve	5 gal. with float valve	5 gal., with float valve
Filtration provided	0.2 micron	0.2 micron	0.2 micron
Output Pressure	50 KSI (345 MPa)	55 KSI (380 MPa)	55 KSI (380 MPa)
<b>Electric Motor</b>			
Type	Marathon Motors 30 hp (22 kW)	Marathon Motors 30 hp (22 kW)	Marathon Motors 40 hp (30 kW)
RPM	600 to 2000	600 to 2000	600 to 2000
Voltage	460 (380 or 415 International) VAC 3-phase *	460 VAC 3-phase *	Voltage 460 (380 or 415 International) VAC 3-phase *
Frequency	50/60 Hz	50/60 Hz	50/60 Hz
<b>Variable Speed Drive</b>			
Type	ABB ACS550 Pulse Width Modulated (PWD), variable frequency	ABB ACS550 Pulse Width Modulated (PWD), variable frequency	ABB ACS550 Pulse Width Modulated (PWD), variable frequency
Voltage	380-480 3-phase	380-480 3-phase	380-480 3-phase
Frequency	50/60 Hz	50/60 Hz	50/60 Hz
<b>Crankcase</b> (see Changing Crankcase Oil, page 7-35, for additional oil specifications)			
Oil	SAE 30 Non-detergent (ISO 100)	SAE 30 Non-detergent (ISO 100)	SAE 30 Non-detergent (ISO 100)
Capacity	2 quarts (1.9 L.)	2 quarts (1.9 L.)	2 quarts (1.9 L.)



# Servicing the OMAX Tables

This chapter provides information for servicing a JetMachining Centers' swivels, dual on/off valve, and high-pressure plumbing. Troubleshooting procedures are also provided that are useful when analyzing performance issue that may occur during operation of your OMAX equipment.

When service to an OMAX abrasive waterjet nozzle is needed, refer to the *OMAX JetMachining® Center Operator's Guide* (P/N 304952). To service OMAX pumps, refer to *The OMAX Pump Service and Maintenance Guide* (P/N 304757).

**WARNING!** *All service activities must be performed by OMAX qualified personnel.*

## Swivels

Swivels are a key component of the OMAX high-pressure plumbing system. They allow the abrasivejet nozzle to move across the table surface when cutting without allowing water to leak from the high-pressure plumbing system. Two different styles of swivels are used on OMAX JetMachining Centers (see Figure 4-1): the **bulkhead swivel** and the **high-pressure swivel**. Bulkhead swivels were used on earlier OMAX table models; currently, they have been replaced by high-pressure swivels in the scissor-style plumbing and are no longer found on new machines.



Figure 4-1: The OMAX Bulkhead and High-pressure Swivels

## Rebuilding Swivels

Although swivels are very durable, occasional servicing may be required. In particular, if a swivel begins to leak at a rate of more than one drop per minute, its seals and O-rings will require replacing by following the procedures provided in *Appendix B: Rebuilding the Bulkhead Swivel*, and *Appendix B: Rebuilding the High-Pressure Swivel*.

## The Dual On/Off Valve

The Dual On/Off Valve controls water flow through the cutting nozzle and operates in conjunction with a dump valve installed in the OMAX high-pressure pump. When water to the cutting nozzle is shut off, the software automatically opens the dump valve, routing the high-pressure water through it instead. Water routed to the dump valve is automatically cut off whenever the nozzle again resumes cutting. This allows a continual pump operation during times when the nozzle is not cutting. By using this dump valve in

conjunction with the dual on/off valve, water cutting pressure always remains close to the same (8 - 9 ksi drop), and the starting and stopping of the waterjet stream takes place without delay. This technique also allows dual pressure operations, such as needed for low-pressure glass piercing. Whenever dual pressure operation is required, low pressure is automatically achieved by opening both the dual on/off valve and the pump's dump valve simultaneously.

The orifice in the pump's dump valve plays a major role in maintaining the required cutting pressure. A worn or damaged orifice results in a lower than expected pressure while a partially clogged orifice results in pressures greater than desired. For efficient operation of both the dual on/off valve and the dump valve, their orifice sizes should be paired as follows:

Nozzle Cutting Orifice	Dump Valve Orifice
0.010"	P/N 302028-09
0.014"	P/N 302028-13
0.015"	P/N 302028-14

Refer to the *OMAX JetMachining Center Operator's Guide* for instructions on changing the nozzle orifice. Refer to the *OMAX Pump Service and Maintenance Guide* for instructions on changing the dump valve orifice.

Maintenance of the Dual On/Off Valve is required when any of the following symptoms appear:

- Water entering the abrasive feed tube when the nozzle first fires (leaky seal)
- Water is dripping from the mixing tube (leaky valve stem)
- Water leaks 180 degrees from where the UHP plumbing enters the dual on/off valve (bad valve seal)
- Water drips from the UHP nipple on the dual on/off valve (loose fitting, cracked body or fitting)

## Rebuilding the Dual On/Off Valve

Maintenance procedures for the Dual On/Off Valve are provided in the Appendix section located at the end of this document. Refer to *Appendix C: Rebuilding the Dual On/Off Valve*.

## Servicing the High-pressure Plumbing System

The high-pressure plumbing routes the water from the high-pressure pump to the abrasivejet nozzle. This system requires periodic inspection for leaks, etc. Inspection should include the tubing, all the high-pressure fittings, the swivels, and the Dual On/Off valve. When fitting leaks occur, power off the pump, release any remaining high pressure, and re-torque the leaky fitting. If the leak persists, verify that the collar (Figure 4-2) is backed off, allowing at least three threads to show which is necessary for proper seating. Whenever a leak continues, the sealing surface is probably eroded which requires that the fitting be disassembled and any eroded parts replaced.

**WARNING!** *Properly preparing and connecting ultra-high-pressure (UHP) tubing and fittings is critical in maintaining a safe and leak-free high-pressure system.*

The following components are typical in a high-pressure fitting:

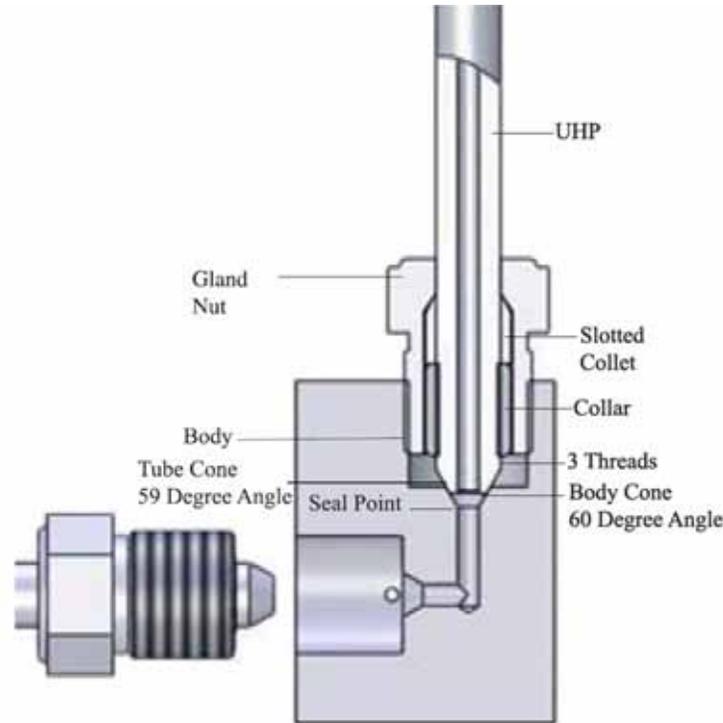


Figure 4-2: Components of the Ultra High-pressure Fitting

**Ultra High-pressure (UHP) Tube**

The tubing that transports the water under high pressure.

**Tube Cone**

The end of the tubing is coned at a 59° angle allowing it to seat with the 60° angle body cone.

**Tube Thread**

Tube threads are left-handed, allowing the tubing to mate with the collar during assembly.

**Body**

This is the female tubing receptacle. Examples are ELL (90°) fittings, TEE fittings, swivel fittings, and or on/off valve fittings.

**Body Cone**

The body is coned at a 60° angle, allowing it to seat with the 59° angle of the tube cone.

**Body Thread**

The body threads are right-handed.

**Slotted Collet**

The slotted collet provides the correct spacing between the collar and the gland nut. It also provides a slip capability when the gland nut is being tightened during installation.

**Collar**

The collar threads are left-handed and screw onto the end of the tubing to prevent the gland nut from slipping off the tube end.

**Weep Hole**

This is a designed leak point that allows fluid to escape whenever fitting pressure exceeds the maximum sealing point.

## Creating the High-Pressure Seal

Maintaining the proper cone angles on the body and tube is critical in creating a high-pressure seal (Figure 4-2). This seal is created when the angled (59°) metal edges of the tube cone seats press against the metal edges inside the body cone which has a slightly larger angle (60°). This slight difference in angles between the body and tube cones creates a tight metal-to-metal seal between both components.

## Assembling a UHP Fitting

**Caution:** *Always use two wrenches when torquing UHP Fittings!*

1. After the tubing and body have been properly coned and threaded, slip the **gland nut** (Figure 4-2) onto the **tubing**.
2. Screw the **collar** onto the threaded end of tubing, observing the following *Three Thread Rule*:

### Three Thread Rule

Always allow three screw threads to be exposed either on the end of the tubing or between the collar and coned end of the tubing. This allows the tube to fully seat inside the coned body and create the required seal.

3. Apply a small amount of **Blue Goop** to the **gland nut threads**.
4. Insert the **tubing** into the **body cone**.
5. Screw the **gland nut** into the connection until finger-tight.
6. Finally, tighten the **gland nut** (use two wrenches) to its specified torque value (see Table 4-1).

Description	Torque Value
1/4" tube, coning and threading, 60 Kpsi	25 lb-ft, 34 Nm
3/8" tube, coning and threading, 60 Kpsi	60 lb-ft, 68 Nm
M8 clamp bar screws	10 -12 lb-ft, 13.6 -16.3 Nm

Table 4-1: Torque Values for UHP Fittings

## Working with High-Pressure Systems

To properly install and maintain fittings and tubings in high-pressure systems, observe the following:

- **Do** thread the body and tube.
- **Do** observe the correct thread direction when threading the body and tube (body thread – right-handed; tube thread – left-handed).
- **Do** thoroughly clean fitting components prior to assembly. Any dirt or contamination can compromise the metal-to-metal seal, creating a path for the water to escape.
- **Do** apply Blue Goop to lubricate the gland nut threads prior to assembling the fitting. This prevents the metals from galling together and ensures that the fitting can be disassembled later.

**Caution:** *Applying too much Blue Goop can contaminate or foul other machine components. Applying just the correct amount of Blue Goop to your high-pressure components prevents the stainless steel componts from galling and avoid contamination problems. Apply Blue Goop sparingly.*

- **Do** follow the *Three Thread Rule* (see above).
- **Do** tighten the gland nut to their proper torque specification based upon connection size. Refer to Table 4-1. Fittings will leak if not sufficiently tightened.
- **Do** periodically inspect the UHP tubing and fittings for leaks. A hole in the tubing sprays as a fine mist.
- **Do** replace damaged or leaking components in the UHP fitting. **Always** replace and **never** repair damaged or leaking components. Damaged components generally fail once exposed to high pressure.
- **Don't** over-tighten the gland nut. This could obstruct the end of the tube and restrict flow.

- **Don't** apply a thread-sealer such as Loctite or Teflon tape to UHP fittings. The metal-to-metal contact between the coned tubing angle and the body cone angle creates the high-pressure seal, not the fitting threads.
- **Don't** try to adjust a fitting while still under high pressure. An injury and/or a damaged system component could result.

## Troubleshooting the JetMachining Center

This section presents possible problems that could appear during operation of your JetMachining Center and suggests ways to resolve them. If, after following the suggested corrective actions, a problem persists, please contact OMAX Customer Service as directed in the Customer Service chapter of this guide.

## Problems with Machine Motion

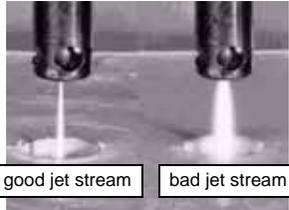
Abrasivejet Nozzle Doesn't Move	
Condition and Possible Causes	Corrective Action
The Emergency Stop button was pressed.	Turn the Emergency Stop Off and then On again and reset the homes and soft limits. Because your soft limits may be incorrect after using the emergency stop button, you can disable them by entering zero for the X- and Y-limits.
A soft limit has been reached.	Use the jog buttons to move up and down (if you have hit a soft limit, only one of those directions will be blocked). Auto homing should recover the soft limits. If the soft limits are lost, refer to the help menu in Make for instructions on setting new limits. <b>Note:</b> You may want to reset your soft limits if they are too small.
A babysit condition was triggered.	Refer to "Babysit Triggered" Message, page 4-15.
Wires or connections in the computer may have become loose.	Turn off the power and open the back of the electrical cabinet. Test each connection and make sure the connectors are firmly seated. Close the cabinet, turn the power back on and try again.
Servo motors stalled.	This condition could be caused by: <ul style="list-style-type: none"> <li>• Nozzle collision</li> <li>• Mechanical issue (sticky ball screw, etc.)</li> <li>• Incorrect servo tuning</li> <li>• Incorrect speed, acceleration, or jerk setting</li> </ul> Cycle power to the machine. Return the nozzle to Path Start Home. If Path Start Home is lost, auto homing should recover Path Start Home.
Machine stops running with no messages and unable to close Make.	Severe noise or noise spike on USB cable caused the device driver to lock. Rebooting the PC is necessary.

Parts are Too Short, or Flat Spots Appear When Cutting Curves	
Condition and Possible Causes	Corrective Action
The part was not held firmly enough.	The part moved during the cutting due to nozzle drag or upwelling of the water beneath the part. Make sure the part is securely fixtured. This is the most common reason for scrap parts.
The OMAX is reaching its hardware limits.	Move the work piece toward the table's center. Set soft limits that allow you to be warned before hardware limits are reached.

Home Position for Soft Limits are Lost	
Condition and Possible Causes	Corrective Action
The OMAX reached its hardware limits.	Move the work piece toward the center of the table. Set soft limits that allow you to be warned before hardware limits are reached. <b>Note:</b> Auto Homing should recover all positioning for the waterjet, including soft limits.
Wires or connections inside the controller may have loosened.	Turn Off the controller power and open the back of the controller cabinet. Verify each connection, making sure all connectors are firmly seated. Close the cabinet, turn the power back On and try again.



## Problems with Machining Quality

Poor Surface Finish	
Condition and Possible Causes	Corrective Action
Setup values in Make are not consistent with the actual physical values.	Check that the following data is correctly entered for setup in Make: <ul style="list-style-type: none"> <li>• Machineability—Thickness Click <b>Setup</b> in Make and choose <i>Pump and Nozzle Settings/Pump and Nozzle Configuration</i> and verify that the following parameters are set correctly:</li> <li>• Water Pressure</li> <li>• Orifice Diameter</li> <li>• Mixing Tube Diameter</li> <li>• Abrasive Flow Rate</li> </ul>
Standoff height is not set correctly.	Click Setup in Make and choose <i>Pump and Nozzle Settings/Motion</i> and verify the standoff is set at a height of 0.040 - 0.080" (0.1 - 0.2 cm).
Jet stream is too wide.	Raise the nozzle approximately 4 inches (10.2 cm) and initiate a high pressure, water-only test. Ensure that the jet stream is narrow and sharp. If the jet stream is wide, replace the orifice jewel assembly, the last chance filter, and inspect the mixing tube. If the mixing tube's outlet hole shows elliptical wear, or the diameter has grown approximately 0.005" (0.127 mm), it is recommended that the mixing tube also be replaced. <div style="text-align: center;">  </div>
An abrasive other than garnet is being used and the "Abrasive Index" value was not changed to compensate for its lesser cutting ability.  Refer to "Pump and Nozzle Configuration" in the OMAX interactive reference (OIR) for a list of abrasive index values to be used when cutting with abrasives other than garnet.	Other abrasives do not typically cut as well as garnet and require that the abrasive index value in the Pump and Nozzle Configuration screen be adjusted. OMAX recommends garnet as the abrasive because it provides a good cutting rate with relatively low mixing tube wear. Garnet is also non-hazardous and is easily disposed. Other abrasives may increase mixing tube wear and be a disposal hazard. <b>Warning!</b> Never use silica sand as a cutting abrasive. Fine silica dust inhaled during the cutting process can lead to silicosis, a serious lung disease. Silicosis is a type of pneumoconiosis, which includes black lung disease.
The mixing tube has worn excessively and is no longer capable of producing the required jet stream.	Wear occurs first at the inlet with a conical wear zone growing toward the exit end. Measure the tube bore at the two ends using a drill or gage pin. When the outlet has grown by 0.005" (0.13 mm), the mixing tube is near the end of its useful life for precise cutting.
The jewel that forms the jet is chipped, dirty, or out-of-tolerance.	Replace the jewel and the jewel holder.
The abrasive flow has stopped or has been reduced by dirt or wet abrasive.	Disassemble the plugged items and blow them clean and dry using an air hose.
The high-pressure water pump is not delivering the pressure called for in the setup screen.	Measure the pressure and if it is below specification, follow the directions in your pump service and maintenance manual to troubleshoot the problem.

Holes Too Large and Undersized Parts	
Condition and Possible Causes	Corrective Action
The tool offset is set incorrectly	If not enough material is being removed (hole too small or part too large), decrease the tool offset by half the dimensional error observed. If too much material is being removed, increase the offset by half the dimensional error. By measuring parts as they are finished, you can monitor the wear of the mixing tube and periodically reset the tool offset to achieve more precise parts.
Tool offset is on the wrong side of the path.	Switch the lead-in and lead-out and then use the Generate Tool Path command from Layout to order the part again. You can check your tool offset using <b>Preview to Screen</b> in Make.

Excessive Taper on Part Edges	
Condition and Possible Causes	Corrective Action
The cut was made with the Quality value set too low.	A Quality of 1 will just barely pierce the material and usually has significant taper. Both taper and surface finish should improve as the Quality number is raised (takes longer to cut the part). Remember that different Qualities can be set to cut different portions of the same part.
The standoff between the abrasivejet nozzle and the material is too high.	The standoff should be no more than 0.050" (1.3 mm) for best results.
The setup values entered in Make are not consistent with the actual physical values.	Check that the following items are correct for the material setup in Make: <ul style="list-style-type: none"> <li>• Machineability</li> <li>• Thickness</li> </ul> In setup for Make, verify that Pump and Nozzle settings are correct for the following parameters: <ul style="list-style-type: none"> <li>• Water pressure</li> <li>• Orifice diameter</li> <li>• Mixing tube diameter</li> <li>• Abrasive flow rate</li> </ul>
An abrasive other than garnet is being used and the "Abrasive Index" value was not changed to compensate for its lesser cutting ability.  Refer to "Pump and Nozzle Configuration" in the OMAX interactive reference (OIR) for a list of abrasive index values to be used when cutting with abrasives other than garnet.	Other abrasives do not typically cut as well as garnet and require that the abrasive index value in the Pump and Nozzle Configuration screen be adjusted. OMAX recommends garnet as the abrasive because it provides a good cutting rate with relatively low mixing tube wear. Garnet is also non-hazardous and is easily disposed. Other abrasives may increase mixing tube wear and be a disposal hazard. <b>Warning!</b> Never use silica sand as a cutting abrasive. Fine silica dust inhaled during the cutting process can lead to silicosis, a serious lung disease. Silicosis is a type of pneumoconiosis, which includes black lung disease.
The mixing tube has worn with use and can no longer form an adequate jet.	Wear occurs first at the inlet with a conical wear zone growing toward the exit end. Measure the tube bore at the two ends using a drill or gage. When the outlet has grown by 0.005" (0.13 mm), the mixing tube is near the end of its useful life for precise cutting.
The sapphire jewel that forms the jet is chipped, dirty or out of tolerance.	Replace the jewel and the jewel holder.
Wide Jet Stream	Refer to the corrective actions provided for Wide Jet Stream in <i>Poor Surface Finish</i> , page 4-7.



Holes are Not Round	
Condition and Possible Causes	Corrective Action
The part was not securely fixtured, allowing movement.	The part moved during the cutting because of nozzle drag or upwelling of the water beneath the part. Make sure the part is securely fixtured.
The jet is elliptical rather than round due to wear in the mixing tube or a slightly imperfect sapphire orifice.	Change the sapphire. If the jet still remains elliptical, change the mixing tube. Refer to the corrective actions provided for Wide Jet Stream in <i>Poor Surface Finish</i> , page 4-7.

Abrasivejet Not Piercing Material	
Condition and Possible Causes	Corrective Action
The setup values entered in Make are not consistent with the actual physical values.	Check that the following items are correct for the material setup in Make: <ul style="list-style-type: none"> <li>• Machineability</li> <li>• Thickness</li> </ul> In setup for Make, verify that Pump and Nozzle settings are correct for the following parameters: <ul style="list-style-type: none"> <li>• Water pressure</li> <li>• Orifice diameter</li> <li>• Mixing tube diameter</li> <li>• Abrasive flow rate</li> </ul>
An abrasive other than garnet is being used and the “Abrasive Index” value was not changed to compensate for its lesser cutting ability.  Refer to “Pump and Nozzle Configuration” in the OMAX interactive reference (OIR) for a list of abrasive index values to be used when cutting with abrasives other than garnet.	Other abrasives do not typically cut as well as garnet and require that the abrasive index value in the Pump and Nozzle Configuration screen be adjusted. OMAX recommends garnet as the abrasive because it provides a good cutting rate with relatively low mixing tube wear. Garnet is also non-hazardous and is easily disposed. Other abrasives may increase mixing tube wear and be a disposal hazard. <b>Warning!</b> Never use silica sand as a cutting abrasive. Fine silica dust inhaled during the cutting process can lead to silicosis, a serious lung disease. Silicosis is a type of pneumoconiosis, which includes black lung disease.
The standoff between the abrasivejet nozzle and the material is too great.	For best results, the standoff should be no more than 0.050" (1.3 mm).
The abrasive flow has stopped or has been reduced by dirt or wet abrasive.	Disassemble the plugged items and blow them clean and dry using an air hose.
The mixing tube has worn with use and is no longer capable of forming an adequate jet.	Wear occurs first at the inlet and a conical wear zone grows toward the exit end. Check the tube bore at the two ends using a drill or gage pin. When the outlet has grown by 0.005" (0.13 mm), the mixing tube is near the end of its useful life for precise cutting.
The sapphire jewel that forms the jet is chipped, dirty or out of tolerance.	Replace the jewel and the jewel holder.
The high-pressure water pump is not delivering the pressure called for in the setup screen.	Measure the water pressure. If it is below specification, follow the directions in your pump manual to troubleshoot the problem.

Abrasivejet Quit Cutting	
Condition and Possible Causes	Corrective Action
The abrasive flow has stopped or has been reduced by dirt or wet abrasive.	Disassemble the plugged items and blow them clean and dry using an air hose. Do not blow air into the abrasive inlet of the nozzle. This this will unseat the jewel.



The mixing tube in the abrasivejet nozzle is plugged.	Use the software in Make to turn the water On and Off trying to dislodge the plug. If this does not work, you may need to disassemble the nozzle for cleaning, or replacing the mixing tube.
The jewel orifice is plugged with foreign material in the water line.	Remove the nozzle and flush the lines. Replace the jewel with a new one.
The high-pressure water pump is not delivering the pressure called for in the setup screen.	Measure the pressure. If it is below specification, follow the directions in your pump service and maintenance manual to troubleshoot the problem.

**80160 Not Cutting Square Parts**

Condition and Possible Causes	Corrective Action
The Y-axis is no longer exactly perpendicular to the X-axis.	Square the Y-axis bridge against the hard stops on the right controller side of the machine. You should resquare (home) the Y-axis whenever: <ul style="list-style-type: none"> <li>• The X-axis drive motor faults</li> <li>• The Y-axis bridge crashes</li> </ul>

**Accuracy Errors**

Condition and Possible Causes	Corrective Action
The material being cut is improperly secured.	Always have firm anchoring in X, Y, and Z directions, even if the material is heavy. Never anchor directly to slats. These are insecure and can easily vibrate.
The nozzle is inadequately secured.	Ensure that the nozzle is firmly attached.
The material being cut has internal stresses.	Material stresses can cause huge part errors. As the part is machined, these stresses can cause the material to move and stretch.
Temperature caused the material to expand.	The material is stored in a different temperature than the tank water and changes size during or after cutting.
The nozzle and material collided.	Avoid traversing over previously cut features. Watch for parts or slugs that tip or float around.
The nozzle is worn out-of-round.	Uneven wear on the nozzle can result in a square box being cut as a rectangle, or similar errors of up to approximately 0.010" (0.0254 cm).

**Problems with the Nozzle and Abrasive System**

**Water is Forced Up the Abrasive Tube**

Condition and Possible Causes	Corrective Action
Nozzle body is loose.	Tighten the nozzle body.
The on/off valve is leaking.	Repair the on/off valve using the appropriate repair kit.
The mixing tube in the abrasivejet nozzle is plugged.	Use the software in Make to turn the water On and Off, trying to dislodge the plug. If not unplugged, install the mixing tube on upside down and try again. If not unplugged, replace the mixing tube.
The inlet body or valve body is damaged.	Inspect both parts for signs of a crack. Replace part whenever damage is noted.
The standoff distance is so small that the nozzle is plugged by the work piece before it starts cutting and water is deflected to the abrasive tube.	Increase the standoff to between 0.040" (1.0 mm) and 0.050" (1.3 mm).



The high-pressure pump is not delivering the pressure called for in the setup screen.	Measure the water pressure. If it is below specification, follow the directions in your pump manual to troubleshoot the problem.
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**The Jet Looks Wide and Fuzzy**

Condition and Possible Causes	Corrective Action
The sapphire jewel that forms the jet is chipped, dirty or out of tolerance.	Replace the jewel and the jewel holder.

The mixing tube has worn with use and is no longer capable of forming an adequate jet	If changing the jewel does not improve the quality of the jet, then the mixing tube needs to be checked and possibly replaced. Wear occurs first at the inlet and a conical wear zone grows toward the exit end. Check the tube bore at the two ends using a drill or gage pin as a gage. When the outlet has grown by 0.005" (0.13 mm), the mixing tube is near the end of its useful life for precise cutting.
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**Abrasive Has Stopped Flowing**

Condition and Possible Causes	Corrective Action
The abrasive flow is stopped or has been reduced by dirt or wet abrasive	Disassemble the plugged items and blow them clean and dry with an air hose. <b>Caution:</b> Do not point the air stream toward a person or toward any item you want to keep free of abrasive
The standoff distance is so low that the nozzle is plugged by the work piece before it starts cutting and water is deflected to the abrasive tube	Increase the standoff to between 0.040" (1.0 mm) and 0.050" (1.3 mm).
The shop air pressure is insufficient to open the abrasive valve	The abrasive valve requires 70 to 95 psi (5 to 7 bars) shop air.
Warped Material	Verify that the standoff height is at least 0.040 - 0.080" (0.1 - 0.2 cm) above the material being cut.
Clogged Mixing Tube	Use the high pressure water test to dislodge the clog. If this does not work, remove the mixing tube and clean it in an ultrasonic cleaner.
Leaky On/Off Valve	Contact OMAX Technical Support for details on troubleshooting a leaky On/Off valve assembly. Refer to Rebuilding the Dual On/Off Valve, page C-1, for repair instructions.

**Abrasive Material Pours Out the Top of the Abrasive Tube**

Condition and Possible Causes	Corrective Action
The abrasive flow has stopped or has been reduced by dirt or wet abrasive.	Disassemble the plugged items and blow them clean and dry using an air hose. <b>Caution</b> Do not point the air stream toward a person or toward any item to be kept free of abrasive.
Foreign material in the water line has plugged the jewel.	Remove the nozzle and flush the lines. Replace the jewel with a new one.
The standoff distance is so small that the nozzle is being plugged by the work piece before it starts cutting and water is deflected to the abrasive tube.	Increase the standoff to between 0.040" (1.0 mm) and 0.050" (1.3 mm).



## Water Leaking from the Nozzle Assembly

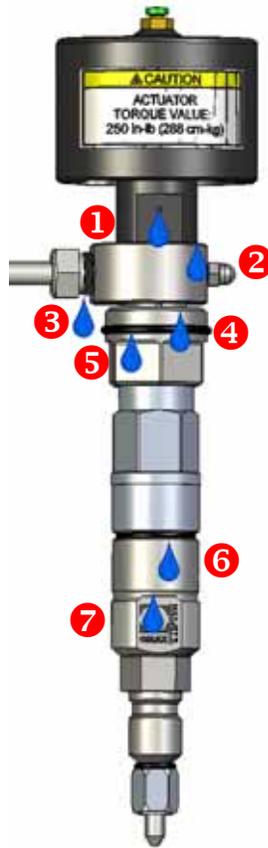


Figure 4-3: Sources of Water Leaks in the Nozzle Assembly

**Troubleshooting Leaks in the Nozzle Assembly:**  
(refer to Figures 4-3 above and C-6 for assembly drawing)

Leak Point	Leak/Other Point Description	Suspected Causes	Recommended Action
1	air actuator weep hole	leaky seal	Verify air actuator torqued at 250 in-lbs (28.2 Nm); replace seal
2	between air actuator and fitting ring	leaky seal	replace seal
3	between fitting ring and gland nut	cracked body, bad UHP tubing, loose gland nut	replace defective component; verify gland nut torqued at 60 lb-ft (68 Nm)
4	between fitting ring and valve gland nut	cracked body; loose nut	replace defective component; tighten nut
5	valve body	cracked inlet or valve body; loose nut	replace defective component; tighten nut
6	between nozzle body and inlet body	cracked inlet or nozzle body; leaky O-ring	replace defective component
7	weep hole on nozzle body	chipped jewel, cracked body, leaky seal	replace defective component

### Water Leaking from the On/Off Valve

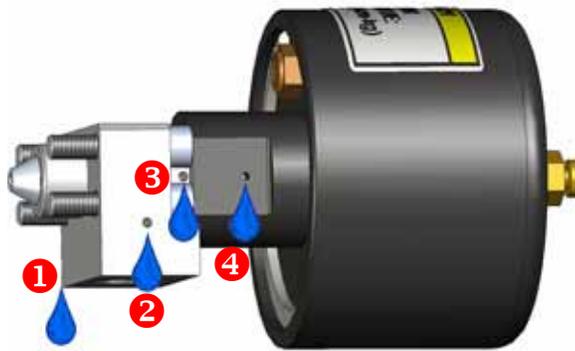


Figure 4-4: Sources of Water Leaks in the On/Off Valve

**Troubleshooting Leaks in the On/Off Valve:**  
(refer to Figure 4-4)

Leak Point	Leak/Other Point Description	Suspected Causes	Recommended Action
1	Leaking around the plate and not from any weep hole	cracked inlet or valve body; loose bolts	replace defective component; tighten loose bolts
2	weep hole	UHP adapter to body leak; cracked body	replace defective component
3	weep hole	Cracked body or leaky seal	replace defective component
4	weep hole	leaky UHP seal	replace leaky seal

## Miscellaneous Problems

Water Spurts Out of the Tank	
Condition and Possible Causes	Corrective Action
The part is positioned on top of a slat and the jet is piercing the material, causing the jet to reflect upwards.	Contain the spray using the muff. A disc cut from a 2" (5 cm) thick sponge makes an effective muff.
The abrasivejet is not piercing the material.	See the earlier item "Abrasivejet Not Piercing Material" under <b>Machining Quality</b> .

Abrasive Material Piles Up on the Work Piece	
Condition and Possible Causes	Corrective Action
Silt buildup at the tank bottom tank is excessive.	Remove the slats and clean out the tank.

The OMAX has an Unpleasant Odor	
Condition and Possible Causes	Corrective Action
Bacteria are growing in the tank.	Check the floating chlorine dispenser to ensure it still contains the bacteria-killing pool chemicals supplied with the OMAX.

Keyboard and/or Mouse Failure	
Condition and Possible Causes	Corrective Action
No mouse movement	Verify that the mouse cable has not worked itself loose and is fully plugged into the USB port at the rear of the PC. Also, unplug the cable and inspect the USB connector for bent or damaged pins. Verify that the optical sensor on the bottom of the mouse is not blocked with dirt buildup. Try rebooting the PC to see if this corrects the problem. Swap the mouse with a known good mouse to see if the problem goes away, verifying that mouse itself is at fault.
Keyboard not responding	Verify that the keyboard cable has not worked itself loose and is fully plugged into the USB port at the rear of the PC. Also, unplug the cable and inspect the USB connector for bent or damaged pins. Try rebooting the PC to see if corrects the problem. Swap the keyboard with a known good keyboard to see if the problem goes away, verifying that keyboard itself is at fault.

## Software Problems

Please refer to "Troubleshooting" in the OMAX Interactive Reference (OIR) for help with software issues. For PC problems, refer to the Dell Customer Support web site:  
[http://support.dell.com/support/edocs/systems/Op745/en/UG\\_en/solving.htm#wp1296962](http://support.dell.com/support/edocs/systems/Op745/en/UG_en/solving.htm#wp1296962).

Blue Screen Errors	
Condition and Possible Causes	Corrective Action
Loose USB cable. If the USB cable is unplugged while Make is running, the monitor will blue-screen.	Ensure that the USB cable is plugged in adequately. Reboot the PC.
Using older version of Windows 2000	Update to Service Pack #2 or newer version of Windows 2000.



Corrupt device driver	Simply re-installing OMAX software can fix this. Be sure to fully power down the controller, wait 10 or more seconds, then turn it back on for all driver related changes to refresh.
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**“Babysit Triggered” Message**

**Note:** The OMAX has several switches monitoring machine operation. When any of these switches are triggered, the abrasive jet nozzle immediately stops operation and no longer continues machining or is able to be moved. When an attempt is made to restart operation, a “Babysit Triggered” error message appears. To recover from a babysit condition, first, correct the cause that triggered the babysit, then hold down the Override switch on the controller front panel.

**Caution:** Ensure that you know what triggered the condition before attempting a babysit override. Continuing to operate the OMAX by overriding these switches may damage the OMAX. If you are unable to determine what triggered a babysit condition, contact OMAX Customer Support.

Condition and Possible Causes	Corrective Action
Low air pressure	Verify that system air pressure is 70 - 95 psi (5 to 7 bars).
Fault in a servo circuit	<p>Check the fault relays on the controller back door for a light identifying which axis faulted (Figure 2-13). Check the faulted servo card’s LED status indicators. Refer to figures that follow for card locations.</p> <p>LED indicators for both Teknic and Teknic Eclipse Servo Drives:</p> <ul style="list-style-type: none"> <li>• Green LED On steady or blinking at fast rate - normal operation</li> <li>• No LEDs lit - power failure</li> <li>• Red LED steady On - blown fuse</li> <li>• Green LED slowly flashing - servo fault</li> <li>• Green LED On steady - servo not enabled</li> </ul> <p>Whenever any of the above faults are indicated, contact Technical Support.</p>



Figure 4-5: Servo Card Locations for Y and X-axis for Bridge-style Tables

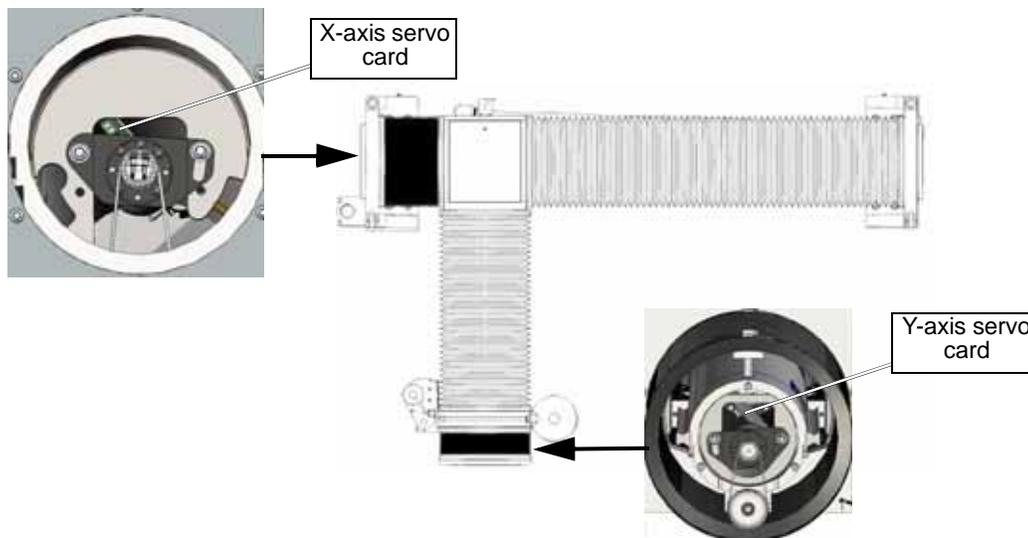


Figure 4-6: Servo Card Locations for Y- and X-axis 2626, 2626|xp, 2652, 5555, 55100 Servo Motors

Condition and Possible Causes	Corrective Action
Pause button pressed	Release Pause button.
Access Control Circuit triggered. (European Market only)	Refer to "Re-arming the Circuit Following an Access Violation", page A-4.

# Servicing the OMAX Pump

This section describes how to rebuild the high-pressure wet-end of the OMAX pump. It is strongly recommended that the OMAX pump be serviced at regular intervals according to the maintenance schedules documented in Chapter 7, Pump Maintenance. It is important to inspect various parts for wear or damage and to replace worn or damaged parts to promote the longest life possible with each build of the high-pressure pump. It is also recommended that the procedures be followed in the order given each time the pump is rebuilt.

**WARNING!** *All electrical and maintenance work described in this chapter should be undertaken only by qualified service personnel. The Safety instructions presented in the first chapter of this manual must be followed.*

## Resealing the Safety Valve

The safety valve (P/N 300756) in the OMAX pump functions to prevent an excessive build up of water pressure in the system plumbing.

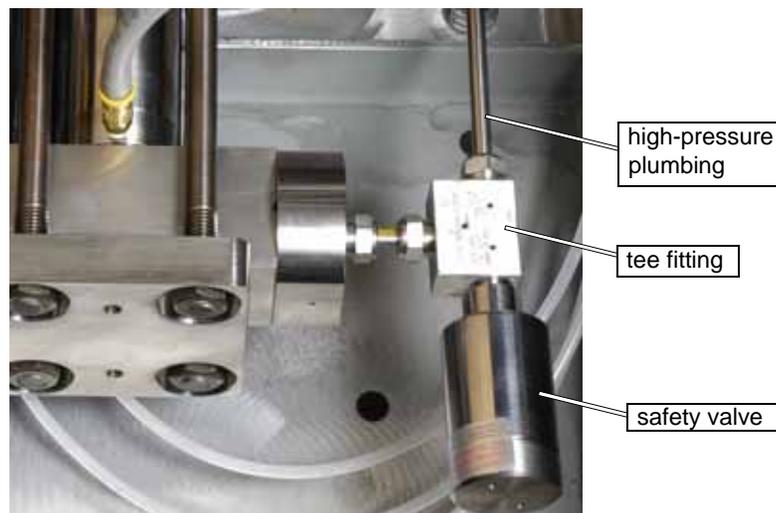


Figure 5-1: OMAX Pump High-pressure Safety Valve

During normal operation, the pump will reach pressures up to 57 KSI. At this pressure, the VFD slowly lowers the motor's RPM to prevent overpressuring the system. If lowering the RPM does not prevent an overpressure condition, the safety valve will activate when a pressure of 63 KSI is reached. An activated valve should reseal itself OK, but could begin to leak after resetting itself a number of times. When leaking occurs, resealing the safety valve is required.

When the safety valve activates, there probably is another issue going on with your machine. It may simply be a deadhead during either a cut or traverse - indicating a plugged orifice in the cutting head or the dump valve. Harder issues to identify are pressure spikes created at the moment of shift between the cut and a traverse.

The high-pressure water seal occurs between the seat and the first ball (Figure 5-2). The body contains a large spring that pushes on the ball and seat creating a water seal up to 63,000 PSI (+ or - 2K). When leaks occur in the safety valve, they will be observed at the 4 holes in the large body, which normally are dry with no water inside.

**Note:** *The pump is designed to shut off when pressure reaches 60 ksi or above. If the pressure rises too rapidly, it may exceed 60 ksi. The safety valve is designed to activate at 63 ksi ( $\pm 2$  ksi).*

**WARNING! Never attempt to adjust the safety valve, doing so creates a safety hazard!**

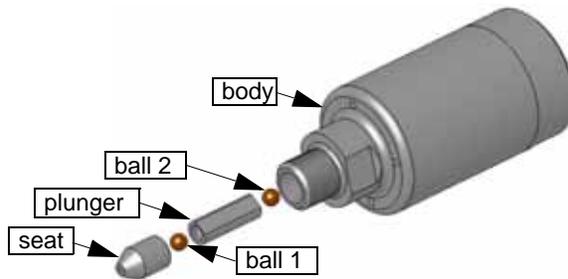


Figure 5-2: Safety Valve Internal Components

### To Reseal the Safety Valve:

#### Tools and Materials Needed

- Blue Goop
- LPS lubrication
- 1" open end wrench, 2 ea.
- ball, 2 ea. (P/N 200904)
- seat (P/N 301583)
- Torque wrench (capable of reading 50-75 ft. lbs) with 1" crows foot.

1. Use the two 1" open end wrenches to unscrew the safety valve from the tee fitting.

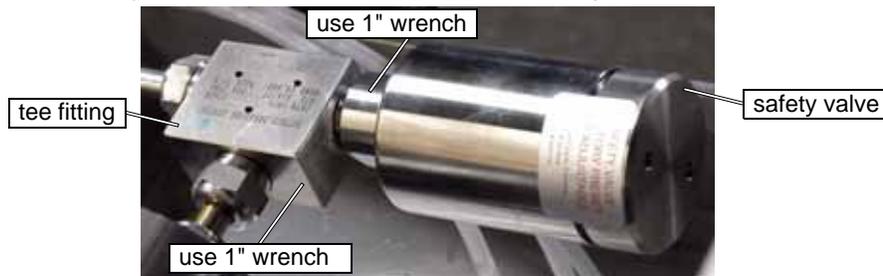


Figure 5-3: Safety Valve Removal

2. Remove and discard the two balls and seat (Figure 5-2).
3. Clean the plunger and safety valve body with water, using air to flush the water out of the spring chamber.
4. Spray some LPS lubrication into the holes and blow out with air to prevent rusting of the valve.
5. Rub Blue Goop onto both ends of the replacement seat, the two replacement balls, and the threads of the safety valve body.
6. Stack the parts together (refer to Figure 5-2) and screw the assembled body into the tee fitting by hand.
7. When screwed in as far as possible by hand, torque the body to the tee fitting using the 1" open end wrench on the tee fitting and the 1" crows foot and torque wrench on the Safety Valve (refer to Figure 5-3). Tighten to 50 - 75 foot pounds.
8. Lower the RPM at startup for a few minutes to ensure no pressure spikes occur that will fail the valve again.
9. With the pump running at high pressure, inspect the safety valve closely for any signs of water leakage.

# Troubleshooting the OMAX Pump

This section provides troubleshooting procedures for the OMAX pump. Most pump operations are controlled and monitored via the OMAX keypad. All fault messages, except those related specifically to the Variable Frequency Drive (VFD), appear on the OMAX keypad display. The VFD provides power, protection, and speed control for the pump motor. If the VFD itself faults for whatever reason, the message “Variable Drive Fault” appears on the OMAX Keypad.

**WARNING!** *All electrical and maintenance work described in this chapter should be undertaken only by qualified service personnel. The safety instructions presented in the first chapter of this manual must be followed.*

Problems covered in this troubleshooting section include:

- Low Pump Output Pressure
- Water Leak in the Wet-end Assembly
- No Power at Pump Unit
- Pump Does Not Start
- No Keypad Display
- Pump Runs but Keypad Display Reads “0.3 KSI”, or “0 KSI
- Circuit Breakers CB1/CB2 Tripping
- Circuit Breaker CB3 (Charge Pump) Tripping
- Fault Message “Charge Pressure Low”
- Fault Message “Charging Pump Contactor”
- Fault Message “Dead Head”
- Fault Message “Variable Drive Fault”

Following each problem is a list of possible causes. If you continue to have problems with your OMAX pump after following these procedures, contact OMAX Customer Service by telephone, or by fax. Refer to Chapter 8, Customer Service.

## Low or Fluctuating Pump Output Pressure

**Caution:** *Never run the OMAX pump once pressure at a given RPM for a given nozzle drops more than 2000-4000 psi. Continued operation with damaged check valve seats or failed dynamic seals can further damage components in the pump’s wet-end, resulting in higher rebuild costs.*

1. Check the high-pressure plumbing for leaks, loose fittings, or split tubing.
2. Verify that the water level in the white water tank (Figure 7-53) is sufficient, that the water source is turned On, and the inlet filter to the charge pump in the white water tank is not blocked.
3. Check the pressure gauges on top of the water filters. Reduced output pump pressure can result from clogged filters. If the pressure difference between water filter pressure gauge readings is more than 20 psi, replace the filter cartridges (see Changing Water Filter Cartridges, page 7-32). If both gauges on top of the water filters show lower than normal pressure, clean the screen on the end of the charge pump suction inlet inside the pump water tank.

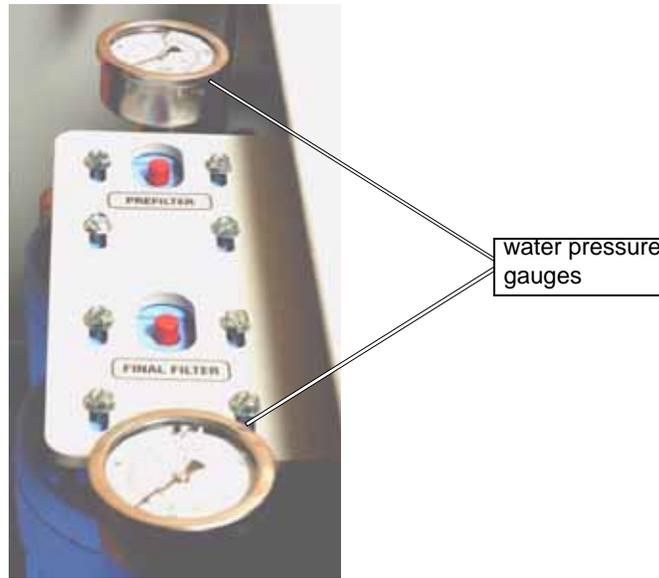


Figure 5-4: Pressure Gauges for Water Filters

4. Check the pressure safety valve for leakage. If the valve leaks more than 1 drop per minute, rebuild or replace the safety valve as soon as possible.

**WARNING! Never attempt to adjust the safety valve, doing so creates a safety hazard!**

5. Check for water leakage between the manifold and check valve bodies, and between the cylinders and check valve bodies (refer to Figure 5-5). If leaking, remove and disassemble the wet-end, inspect and clean all parts, and replace seals.
6. Check the temperature of the high-pressure cylinders. If a cylinder is hot and no external leaks or excessive flow back to the water tank is observed, the check valve body on that cylinder may have a crack between the inlet and outlet passages. Remove and disassemble the wet-end, inspect and clean all parts, and replace seals.
7. If the abrasive jet orifice is damaged or chipped, it may pass the full flow of the high-pressure pump without developing its rated pressure. Check by replacing with a new orifice.
8. Check the output pressure gauge (if so equipped) to determine if it registers low pressure, but the machine still cuts quality parts with the software set at high pressure. If this is the case, the gauge may be inaccurate or defective.
9. While the high-pressure pump is running at high pressure in **Test** mode, check the cylinders and the three white hoses (Figure 7-53) that run into the white water tank for heat. Also, check if the hoses are expelling hot and/or pulsing water. This indicates worn high-pressure seals (dynamic) that must be replaced by rebuilding the pump wet-end. If a hose has no water flow, check for a plugged orifice in the pump outlet manifold. When air bubbles are observed in the returning water, check for a leaky suction line.

**Caution: Do not run the OMAX pump once the pressure at a given RPM for a given nozzle drops more than 2000-4000 psi. Continued operation with damaged check valve seats or failed dynamic seals can result in further damage to components in the wet-end and may result in higher rebuild costs.**

10. If there is low pressure with high vibration, a plunger may be loose or broken. Immediately, power Off the pump. Turn the pump by hand to locate the bad plunger. If a plunger is broken or scored, contact OMAX for a replacement plunger assembly. Replace all the high-pressure seals before reassembling the pump.

## Water Leaks in the Wet-end Assembly

This section identifies the location of possible water leaks in the wet-end assembly (Figure 5-5) and suggests possible ways to correct them.

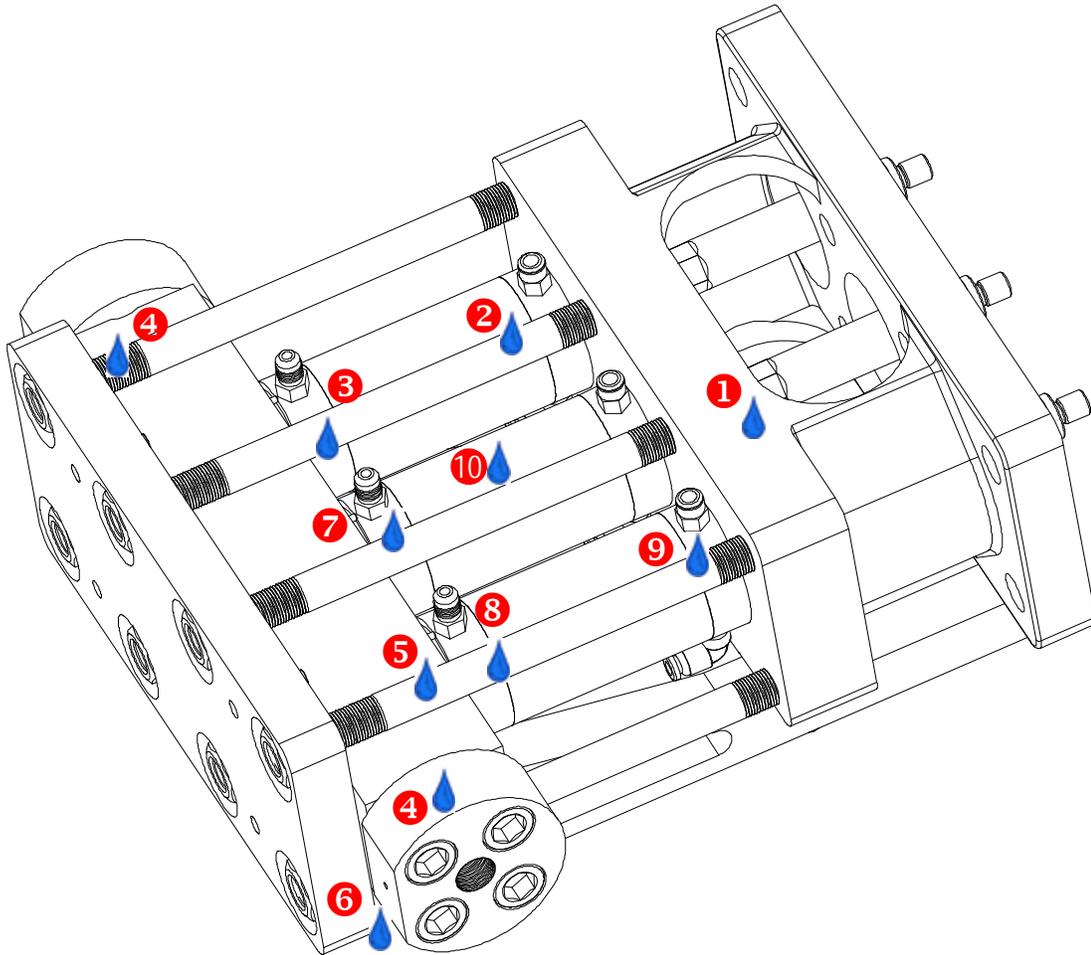


Figure 5-5: Sources of Water Leaks in the Wet-end Assembly

### Troubleshooting Leaks in the Pump Wet-end Assembly: (refer to Figure 5-5)

Leak Point	Leak/Other Point Description	Suspected Cause	Recommended Action
1	Leak from Coolant Housing Seal	<ul style="list-style-type: none"> <li>Coolant Housing Seal failure</li> </ul>	<ul style="list-style-type: none"> <li>Replace Coolant Housing Seal at next rebuild (this is coolant water and will not affect output pressure or pump life)</li> </ul>
2	Leak(s) between Cylinder Body and Coolant Housing and/or between Cylinder Body and Check Valve Body (immediately after rebuild)	<ul style="list-style-type: none"> <li>Insufficient torque on Clamp Plate Nuts</li> <li>Insufficient anti-seize on Clamp Plate Nuts</li> </ul>	<ul style="list-style-type: none"> <li>Check torque on Clamp Plate Nuts</li> <li>Apply fresh anti-seize to face of Clamp Plate Nuts and threads and tighten to 175 ft. lbs.</li> </ul>
	Leak between the Cylinder and Coolant Housing	<ul style="list-style-type: none"> <li>Cracked Support Ring</li> <li>Damage to the Support Ring that supports the Ring Seal</li> <li>Cracked Cylinder</li> </ul>	<ul style="list-style-type: none"> <li>Rebuild Wet-end Assembly</li> <li>Inspect Support Rings for damage</li> </ul>

Leak Point	Leak/Other Point Description	Suspected Cause	Recommended Action
3	Leak between Check Valve Body and Cylinder Body (immediately after rebuild)	<ul style="list-style-type: none"> <li>Liquid Displacer installed upside down</li> </ul>	<ul style="list-style-type: none"> <li>Rebuild Wet-end Assembly</li> <li>Inspect Liquid Displacer for damage and to ensure it is within tolerance before re-installing in the Cylinder. If damaged, replace.</li> </ul>
	Leak between the Check Valve Body and Cylinder	<ul style="list-style-type: none"> <li>Cracked Check Valve Body</li> <li>Cracked Support Ring</li> <li>Damage to Support Ring that supports the Ring Seal</li> <li>Cracked Cylinder</li> </ul>	<ul style="list-style-type: none"> <li>Rebuild Wet-end Assembly</li> <li>Inspect Support Rings for damage</li> <li>Inspect Check Valve Body for cracks and replace if cracked/damaged</li> </ul>
4	Leak between Port Adapter and Manifold	<ul style="list-style-type: none"> <li>Port Adapter Seal failure</li> </ul>	<ul style="list-style-type: none"> <li>Replace Port Adapter Seal</li> </ul>
5	Leak between the Check Valve Body and the Manifold	<ul style="list-style-type: none"> <li>Cracked Check Valve Body</li> <li>Cracked Manifold</li> <li>Seal is loose fit to stem of the Check Valve</li> <li>Damaged O-ring</li> <li>Extrusion of Static Ring Seal</li> </ul>	<ul style="list-style-type: none"> <li>Rebuild Wet-end Assembly</li> <li>Inspect Manifold and Check Valve Body for damage/cracks</li> <li>Inspect O-rings and Seals for excessive extrusion, fit, and/or damage</li> </ul>
6	Leak from Weep Hole on Port Adapter	<ul style="list-style-type: none"> <li>Possible damage to Seal surface of the Port Adapter</li> <li>Possible damage to Tubing seat</li> </ul>	<ul style="list-style-type: none"> <li>Replace Port Adapter and Seal</li> <li>Replace Tubing</li> </ul>
7	Warm Fitting on Check Valve	<ul style="list-style-type: none"> <li>Damaged Check Valve Inlet Seat or Ball</li> </ul> <p><b>Note:</b> There can be a damaged Check Valve Inlet Seat/Ball with no noticeable heat.</p>	<ul style="list-style-type: none"> <li>Rebuild Wet-end Assembly</li> <li>Inspect for damaged Check Valve Inlet Seat or Ball/ replace as needed</li> </ul>
8	Warm Cylinder at Check Valve end	<ul style="list-style-type: none"> <li>Damaged Check Valve Outlet Seat or Ball</li> </ul>	<ul style="list-style-type: none"> <li>Rebuild Wet-end Assembly</li> <li>Inspect for damaged Check Valve Outlet Seat or Ball/ replace as needed</li> </ul>
9	Cylinder Body warm at Dynamic Seal end only	NORMAL	NONE
10	Sudden loss of pressure and Cylinder Body very warm or hot.	<ul style="list-style-type: none"> <li>Cracked Check Valve Body between the High and Low Pressure ports</li> </ul>	<ul style="list-style-type: none"> <li>Rebuild Wet-end Assembly</li> <li>Inspect for cracks/damage in the Check Valve Body (internal cracking – inspect viewing through the low pressure port – may require magnification)</li> </ul>



## No AC Power at Pump Unit

1. Have a certified electrician verify that AC power is available at the main power disconnect by measuring the voltage between all three legs.

**WARNING!** *It is the customer's responsibility to ensure that all components and conductors, as well as grounding and wiring methods, comply with the most recent version of the NEC, IEC or JIC, whichever is applicable, as well as all regional and local codes and standards. Wiring must be performed by a certified electrician and conform to national, state, and local requirements.*

2. Check the fuses at the main power disconnect.
3. Check that the main power is On.
4. Check that the On/Off switch on the pump unit is On and that the On/Off switch on the controller is On.
5. Check that the E-stop switches on the pump unit and the computer controller are reset.
6. Check that 460 VAC  $\pm 10\%$  (380 or 415 VAC  $\pm 10\%$  for international) is present on L1, L2, and L3 at the bottom of the DIN rail inside the pump control enclosure (refer to Figure 5-6).

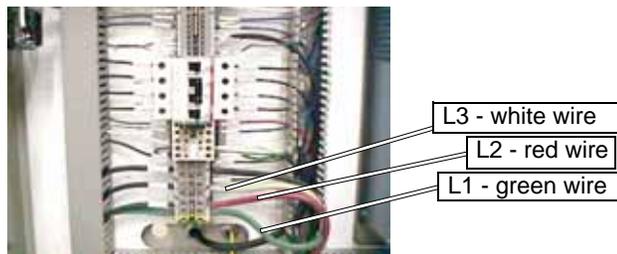


Figure 5-6: AC Power Legs L1, L2, and L3.

**Note:** *Power between the three legs L1, L2, and L3 can vary by up to 6% from the average of all three. A variation that exceeds more than 6% causes a phase unbalance VFD fault.*

## Pump Does Not Start

1. Check that the main power is On.
2. Check that the On/Off switch on the pump unit is On.
3. Check that the E-stop switches are reset. The E-stop on the pump shuts down both the pump and X-Y table (if connected). Likewise, the E-stop on the Controller shuts down both the X-Y table and the pump. To reset either E-stop switch, simply pull it out.
4. Check the "FAULT" condition displayed on the OMAX keypad display. If the display indicates a fault (Figure 5-7), refer to the section of this document dealing with the specific fault. More than one fault may be reported. Usually, the fault that shut down the pump is the first reported and appears on the line of the display closest to the pump hours. After correcting the conditions that created the fault(s), press the reset button on the OMAX keypad to clear the display and re-enable the pump unit.



Figure 5-7: Example of Pump Fault Condition Appearing on Keypad Display

5. Check if the pump keypad display is lit. If it is not, go to "No Keypad Display."

6. Check the display on the VFD keypad inside the electrical enclosure. It should display the condition "REM" in the upper left corner of the display. If the VFD does not show "REM", press the LOC/REM button on the VFD display panel to put the drive into remote control mode (REM). In local mode (LOC) the drive does not respond to commands from the OMAX keypad, or from the OMAX controller. Refer to Figure 5-8.

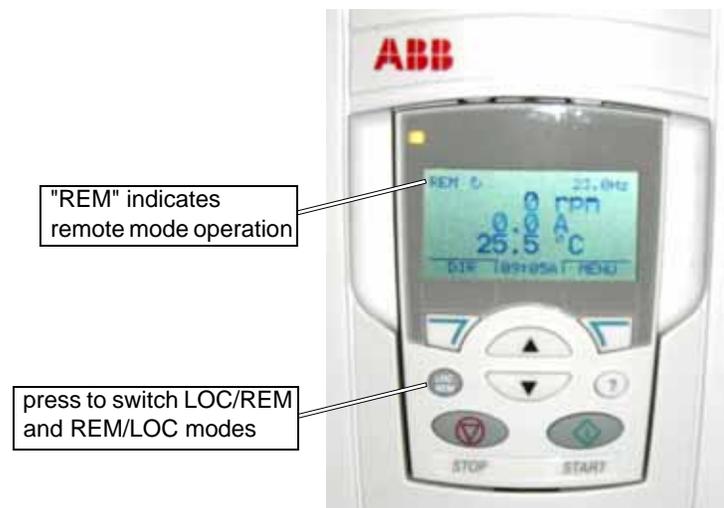


Figure 5-8: VFD Remote (REM) Mode

## No Keypad Display

The display on the OMAX Keypad is blank and/or no red LED's next to the buttons are lit.

1. Check that no E-stop switches are engaged.
2. Check that the On/Off switch on both the controller and pump unit are in their On positions.
3. Verify that 460 VAC  $\pm 10\%$  (380 or 415 VAC  $\pm 10\%$  International) is present across terminals L1, L2, and L3 located at the bottom of the DIN Rail inside the electrical enclosure of the pump (Figure 5-6). If no power is present across these terminals, see "No AC Power at Pump Unit" on page 5-7.
4. Check that 460 VAC  $\pm 10\%$  (380 or 415 VAC  $\pm 10\%$  International) is present across the primary terminals H1 and H4 (H3 for international units) of the 2KVA transformer.
5. Check that 110 VAC is present at the output, secondary terminals X1 and X3 or X4 of the 2KVA transformer. Refer to Figure 3-6 for location.
6. Check that the 24 VDC power supply located on the DIN rail inside the pump electrical enclosure is producing 24 VDC by checking DC voltage between L+ and ground on the right hand side.
7. Check for and tighten any loose wires on the input and/or output side of the 24 VDC power supply.



Figure 5-9: 24 VDC Power Supply

**Note:** *If the power supply's green LED is not lit, no 120 VAC is present as measured across terminals L and N on top of the 24 VDC power supply. If 120 VAC is present, the power supply has failed and must be replaced.*

8. Check for a blown fuse or no fuse in the fuse holder on the DIN rail located below the 24 VDC power supply. If there is power from the 24 VDC power supply and the fuse holder's red LED is lit, a blown fuse is indicated. See Figure 5-12, 24 VDC Power Supply Fuse Location on page 5-12.

**Note:** *A box of 0.5 Amp replacement fuses is supplied with every new pump unit and is stored in a plastic container attached to the bottom of the enclosure.*

9. Check that the 34-pin connector cable is not loose and/or defective. Ensure that the connector is fitted tightly onto the keypad by disengaging and then re-engaging the connector, it should feel snug. If that does not solve the problem detach the 34-pin cable from the keypad and visually inspect the female connector to make sure all of the female pins are fully locked into the housing. See Figure 5-11, Keypad Ribbon Cable and 34-Pin Connector Location on page 5-12.

**Caution:** *If a pin is not locked into the housing gently pull it out of the connector being sure to note what socket it fits in. The pin has a locking tab that should be bent outward such that when correctly inserted into the housing the tab "locks" into place. The locking tab should always be outward facing from the housing in order to "lock" it in place. When correctly installed the pin cannot be withdrawn from the housing without first pushing the tab in tight against its pin.*

10. Verify that the ribbon cable between the display and keypad is not loose. Ensure that the connector is fitted tightly onto the keypad and display. Ensure that the connector is properly fitted onto the correct pins. If red LEDs are lit on the keypad, and the connector is tightly fitted against the keypad and display, the ribbon cable may be bad. Before replacing the ribbon cable, also check the 34-pin connector on the keypad. See Figure 5-11, Keypad Ribbon Cable and 34-Pin Connector Location on page 5-12.
11. Check if Circuit Breakers CB1 and/or CB2 have tripped. If either of these circuit breakers have tripped or are tripping regularly. See Figure 5-10, Circuit Breakers CB1, CB2 and CB3 Location on page 5-10.

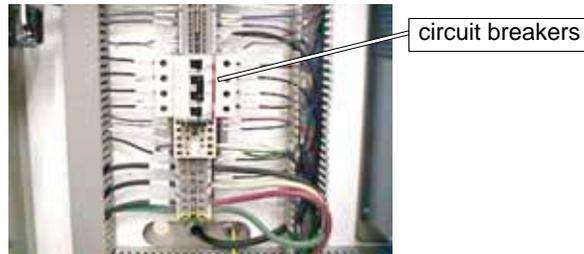


Figure 5-10: Circuit Breakers CB1, CB2 and CB3 Location

## Pump Runs but Display Reads “0.3 KSI”, or “0 KSI”

1. See if the 34-pin connector cable is loose and/or defective. Ensure that the connector is fitted tightly onto the keypad. If this does not solve the problem, detach the 34-pin cable from the keypad and visually inspect the female connector to ensure all of the female pins are fully locked into the housing.

**Caution:** *If a pin is not locked into the housing, gently pull it out of the connector, noting what socket it fits in. The pin has a locking tab that should be bent outward so when correctly inserted into the housing, the tab “locks” into place. The locking tab should always face outward from the housing. When correctly installed, the pin cannot be withdrawn from the housing without first pushing the tab against its pin.*

2. If the RPM is displayed correctly, but the displayed pressure is “0.3 KSI” or “0 KSI”, the pump control circuit board may not be receiving the pressure signal.
3. The pressure signal for OMAX pumps comes from the pressure transducer. A “T” appears on the OMAX display for the pressure reading if the transducer is connected and recognized by the pump control card. If the “T” is present but the pressure readout does not respond, the transducer may have failed, requiring replacement.
4. The transducer is a 4-20 ma transducer excited with 24 VDC from the 24 volt power supply located within the pump enclosure. Check the transducer itself, the connection to the transducer, a bulkhead connection through the back of the enclosure, a connection on the DIN rail inside the electrical enclosure, and the 34-pin connection on the pump control card.
  - a. Check that the transducer cable is connected securely to the bulkhead connector on the back of the pump electrical enclosure.
  - b. Check that the connector on the end of the transducer is securely attached to the transducer.
  - c. Loosen the screw holding the transducer connector and remove the connector from the end of the transducer. Refer to Figure 3-5 for pressure transducer location.
  - d. With a DC voltmeter, verify that the 24 VDC exciting voltage is present between terminal 1 and the ground terminal in the connector. If 24 VDC is not present, check and tighten all of the 2181 and 2182 terminals on the DIN rail of the enclosure. Check again for 24 VDC between terminals 1 and ground. Verify that the wires inside the enclosure are inserted correctly into the bulkhead connector through the back of the enclosure. There should be 24 VDC between the dark blue wire, 2181, on pin 2 at the bulkhead connector and any ground. The white/blue wire, 2182, should have continuity with any ground and should be connected on pin 4 of the bulkhead connector.
  - e. Check that the signal lead, wire 3030, is connected correctly on pin 2 of the bulkhead connector inside the enclosure.
  - f. Check and tighten the wire in terminals 3030 on both sides of the DIN rail.
  - g. Check the 34-pin connector to verify the pressure transducer signal appears on pin 26.

## Circuit Breakers CB1/CB2 Tripping

1. Throw the circuit breaker slower.
2. Check for loose wires between the 2 KVA transformer and circuit breakers. Tighten any found.

3. Determine if the transformer is defective by switching breakers CB1 and CB2 Off and disconnecting the red wire, # 1170, from transformer terminal X1. Switch circuit breaker CB1 back On. If CB1 trips, the transformer is shorted and must be replaced. Refer to Figure 5-10 for circuit breaker locations.
4. Inspect the fan motors, keypad, transformer, DC power supply, etc., to see if any components have shorted or burned out. Replace any burned out components and re-test the circuit breakers.

## Circuit Breaker CB3 Tripping

Circuit breaker CB3 may trip when the charging pump is overloaded or the motor is shorted. Refer to Figure 5-10 for circuit breaker locations.

1. Check that the water filters are not plugged or damaged, causing the charge pump to overheat. Replace the filters if needed.
2. Check the charge pump water inlet in the water tank, ensuring the screen is not blocked or plugged.
3. Verify the charging pump is not jammed with foreign material, causing the motor to lock up. Remove the inlet and outlet water hoses on the charging pump to see if the circuit breaker continues to trip.
4. If no loose wires are found, the expected voltages are present on all terminals, and the circuit breaker continues to trip, the charge pump motor may need replacing.

## Fault Message – “Charge Pressure Low”

This fault message appears on the OMAX pump’s display when the water pressure at switch (S1) immediately downstream of the water filters is less than 50 psi.

1. Verify that the charge pump’s ON/OFF switch is in the On position.
2. Check the water level in the white water tank (Figure 7-53) for an adequate water supply. Verify that the water source is turned On, and the inlet screen to the charge pump in the white water tank is not blocked.
3. Check the pressure gauges before and after the water filters. If the downstream gauge (final filter) exceeds 50 psi (typically 12- psi), the pressure switch (S1) may be defective. If the upstream gauge (pre-filter) does not exceed approximately 70 psi, the charge pump may be partially plugged or defective.
4. Verify that all air has been bled from the water filters.
5. Check that the water filters are not plugged or damaged. If the pressure difference between the two pressure gauges is more than 20 psi, replace the filter cartridges. See Changing Water Filter Cartridges, page 7-32.
6. Verify that the water pressure switch is operating properly. This switch must be closed for the pump to operate. Operation of the switch may be checked by using a voltmeter to see if the switch closes when the pump is running and sufficient pressure is indicated on the downstream pressure gauge on the filters. If the switch is closed, the voltage on the DIN rail between wires 2181 (brown) and 2440 (white) should show 0 VDC, or very little voltage. If the switch does not close, the voltage should be about 24 VDC. Inspect the wire connections on the switch, ensuring the plug connector has not come loose. If the switch appears to be faulty, contact OMAX customer service.

## Fault Message – “Charging Pump Contactor”

This message appears on the OMAX pump’s display when the charge pump contactor (C1) did not close as expected. It generally appears along with the message “Charge Pressure Low.”

1. Verify that the charge pump manual On/Off switch is in its On position.
2. Check the water level in the white water tank (Figure 7-53) for an adequate water supply. Verify that the water source is turned On, and the inlet to the charge pump in the water tank is not blocked.

3. Check that the ribbon cable between the display and keypad is not loose and/or defective. Ensure that the connector is fitted tightly onto the keypad and display. If red LEDs are lit on the keypad, and the connector is tightly fitted against the keypad and display, the ribbon cable may be bad. Before replacing the ribbon cable, first inspect the 34-pin cable on the keypad. See Figure 5-11, Keypad Ribbon Cable and 34-Pin Connector Location on page 5-12.

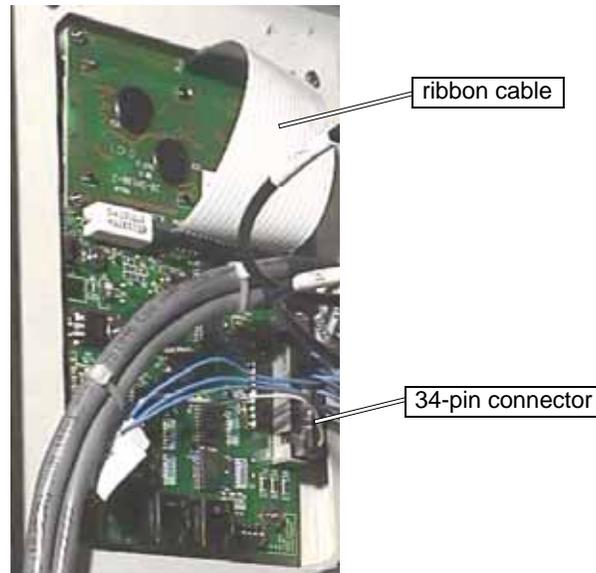


Figure 5-11: Keypad Ribbon Cable and 34-Pin Connector Location

4. Check that the 34-pin connector cable is not loose and/or defective. Ensure that the connector is fitted tightly onto the keypad by disengaging and then re-engaging the connector; it should feel snug. If that does not correct the problem, detach the 34-pin cable from the keypad and visually inspect the female connector, ensuring all pins are fully locked into the housing. See Figure 5-11, Keypad Ribbon Cable and 34-Pin Connector Location on page 5-12.

**Caution:** *If a pin is not locked into the housing, gently pull it out of the connector, noting what socket it fits in. The pin has a locking tab that should be bent outward so when correctly inserted into the housing, the tab “locks” into place. The locking tab should always face outward from the housing. When correctly installed, the pin cannot be withdrawn from the housing without first pushing the tab against its pin.*

5. Check for a blown fuse (or no fuse) in the fuse holder on the DIN rail located directly below the 24 VDC power supply. When there is power from the 24 VDC power supply, the fuse holder’s red LED lights to indicate a blown fuse. When blown, use an equivalent 0.5 Amp replacement. See Figure 5-12, 24 VDC Power Supply Fuse Location on page 5-12.

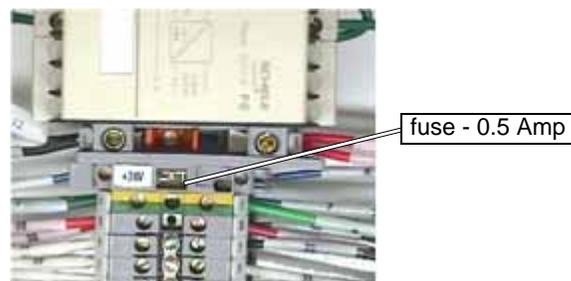


Figure 5-12: 24 VDC Power Supply Fuse Location

**Note:** *A box of 0.5 Amp fuses is supplied with every new pump unit, stored in a plastic container attached to the bottom of the enclosure.*

6. Tighten any loose wires on the input and/or output side of the 24 VDC power supply.

**Note:** *If the power supply's green LED fails to light, there is no 120 VAC being delivered, as measured across L and N. If 120 VAC is present, the power supply has failed and must be replaced.*

7. Check that a wire has not come loose on the contactor. Using a voltmeter, check for 120 VAC between wires 2130 and 1201 at terminals 1L1 and 3L2. Verify that these wires are tight and making good metal-to-metal contact at terminals 1L1 and 2T1. Follow these wires all the way to the charging pump. Check wires 2131 and 1201 between the contactor and the charge pump motor. Strip and/or tighten any wire that may be a problem.
8. Verify that 460 VAC  $\pm 10\%$  (380 VAC  $\pm 10\%$  International) is present across terminals L1, L2, and L3, located at the bottom of the DIN rail inside the electrical enclosure of the pump. If power is not present across these terminals, refer to "No AC Power at Pump Unit", page 5-7.

## Fault Message – “Dead Head”

This message appears on the OMAX pump's display when pump output pressure equals or exceeds 60,000 psi. After determining the cause of the overpressure, also check the pressure safety valve on the pump to ensure it's not damaged.

1. Verify that the high-pressure orifice and nozzle are not plugged, or partially plugged.
2. Verify that the orifice in use is not too small, particularly if it has just been installed.
3. If equipped with dual On/Off valves, check that air is being supplied to the On/Off valves (70 - 80 lbs. of air pressure required).
4. Verify that the orifice in the “dumping” On/Off valve is not too small, or is not plugged, or partially plugged.
5. Check that none of the high-pressure tubing is blocked or plugged.

## Fault Message – “Variable Drive Fault”

This message appears on the OMAX pump's display when there is a fault with the variable frequency drive (VFD). If a VFD fault occurs:

- The problem that created the fault must be corrected;
  - The RESET button on the OMAX pump keypad must be pressed to clear the fault condition; and
  - If the fault reoccurs, troubleshooting the cause of the fault must be resumed.
1. If a VFD fault message occurs on the OMAX keypad display, check the fault message reported on the ABB drive display panel inside the pump electrical enclosure.
  2. When a VFD fault stops the drive, the fault code number and fault description are displayed on the VFD display panel located inside the pump electrical enclosure.

**Note:** *For faults not listed, refer to the ABB User's manual. If a VFD fault persists, contact OMAX Customer Service.*

3. To restart the OMAX pump, the fault condition must be “cleared” by pressing the Reset button on the OMAX keypad. The display returns to the display present prior to the fault trip. If the condition that caused the VFD fault was not corrected, the VFD continues to fault, preventing operation of the pump unit.



## Table Maintenance

This chapter covers the maintenance normally required to ensure reliable operation of your OMAX JetMachining Center. For maintenance of your OMAX pump, please refer to *The OMAX Pump Service and Maintenance Guide* (P/N 400407).

**WARNING!** *All maintenance activities must be performed by qualified personnel.*

### Maintenance Schedule

Use of the maintenance schedule and the maintenance log (page 6-21) provided in this chapter is important in ensuring proper equipment performance and accuracy. Typically, the frequency of most maintenance activities is based upon the length of time that the equipment has been in operation; however, harsher than normal environmental factors can require that maintenance activities be scheduled at a frequency greater than indicated in the table below.

	Activity	See Page	Frequency
<b>Tank Maintenance</b>	Wash away the abrasive accumulation from the equipment and work area	6-2	Daily and as often as required to maintain a clean working environment
	Remove all garnet, sludge, and slugs from the tank bottom	6-2	Whenever abrasive particles begin to excessively accumulate on the material being machined
	Inspect individual slats for wear. Replace and rotate	6-4	Inspect and rotate monthly. Replace when excessively scored and no longer stable.
	Clean the outlet water filter	6-3	Check monthly (Figure 6-1)
	Run tank cleaning program		As needed when using the OMAX Solids Removal System (SRS)
	Add anti-bacterial chemicals to the tank water controlling tank odor and bacteria growth	6-3	Before chemicals in the floating device become depleted and bacteria growth can thrive. Check monthly.
<b>Table Maintenance</b>	Lubricate carriage components	6-9	Yearly
	Lubricate X-axis components	6-11	Yearly
	Lubricate the Motorized Z-axis	6-12	Yearly
	Inspect the timing belts	6-4	Yearly
	Inspect the high-pressure plumbing	4-2	Yearly
	Rebuild the abrasivejet nozzle	6-18	As required to maintain cutting quality
<b>PC Controller Maintenance</b>	Clean Keyboard and Mouse	6-18	As required
	Replace air filters	6-18	Every three months or sooner when necessary
	Clean monitor screen	6-18	As necessary for sharp viewing
	Update OMAX Software	6-19	As soon as updates are released by OMAX
	Reboot PC Controller	6-19	Daily
	Run Windows Defragmenter program	6-19	Monthly
	Replace CMOS battery in the PC Controller	6-19	as needed (normally will last approximately 5 years or more)

# Tank Maintenance

It's good practice to wash all abrasive particles and grit from exposed JetMachining Center surfaces at the end of each shift or work day. A clean machine lasts longer and requires less maintenance. The OMAX is designed to prevent abrasive from contaminating bearings and other critical parts, but it's also important to keep a clean working area to minimize abrasive exposure to your machine. In general, you should keep the OMAX clean and wiped down by having plenty of sponges available in the machining area and regularly washing down the table surfaces.

**Caution:** *When washing down the equipment, hold the hose at a distance of at least 18 inches (46 cm) from the washing surface to prevent possible damage to exposed seals. Air may also be used to blow away grit if the same distance is maintained.*

## Cleaning Tips

### Keep water away from the controller

Never spray water directly at the controller cabinet, keyboard, or mouse. Wipe down the outside of the controller with a sponge regularly.

### Keep the bellows clean

Spray the X, Y and Z-axis bellows as needed to keep them free of abrasive material accumulation. If abrasive particles get inside and onto the bearings, they will no longer function as precision bearings. Check regularly to make sure there are no rips or tears in the bellows. Inspect the bellow cuff and bellow adapters ensuring that everything is properly sealed. Once bellows damaged is detected, repair it immediately. Refer to *Maintaining the X-Y Carriage Bellows*, page 6-4.

**Note:** OMAX supplies a repair kit for bellows rips and tears, P/N 302393.

### Use a splash shield during machining

You can purchase a splash shield from OMAX or construct one yourself from clear plastic.

A splash shield allows you to view the machining process and at the same time keeps the spray inside the tank, which is important in maintaining a clean working area.

Keep material surfaces clean while machining. When cutting thick materials, abrasive particles build up on top of the material. Make sure that you wash off this accumulation. Otherwise, large accumulations of abrasive tend to pile up on the cutting path which can affect machining accuracy.

### Clean garnet flows better

Even small particles of paper allowed to mix in with your abrasive material can clog the nozzle, costing downtime and possibly a ruined part. It's much easier to start with clean abrasive and keep it that way.

**Caution:** *Ensure that your garnet remains dry. Always store it in a location removed and protected from the typical wet, abrasivejet environment. Damp garnet will lump together and not flow properly.*

### Check the Tilt-A-Jet bellows daily

If your JetMachining Center uses the Tilt-A-Jet option, keep its bellows clean and check them daily for rips and tears. If a hole develops in one of these bellows and allows garnet in, the precision bearings will suffer. A rip or tear in a Tilt-A-Jet bellows cannot be repaired. Contact your distributor or OMAX Customer Service for replacement.

## Removing Garnet Accumulation

Since garnet abrasive and metal particles are constantly accumulating in the tank, a regularly scheduled removal of accumulated deposits is necessary. Usually, when large quantities of abrasive particles quickly settle on the material being machined, it's an excellent indicator that the tank is holding too much abrasive and removal is necessary.

When removing abrasive material from the bottom of the tank, it's best to completely drain water from the tank before attempting to remove the abrasive waste. The drier the abrasive, the easier it shovels out. Using a pointed shovel is probably the most effective way of emptying the tank by hand.

**Note:** *The OMAX Solids Removal System (SRS) is an effective alternative to manually cleaning the tank. Contact your OMAX sales representative for details.*

Used garnet abrasive by itself is not toxic and may be taken to a dump site or disposed of normally. However, if any hazardous materials were cut, the abrasive waste becomes subject to a number of environmental regulations. Contact your local resources for proper disposal methods.

### Solids Removal System Clean Out Software

The Solids Removal System (SRS) system prevents garnet from accumulating in your tank. To keep your SRS running at its best, it's important that twice a week you run the SRS Sweep Program that's included with your OMAX software. This program stirs up residue that is at the bottom of the tank and distributes the accumulated abrasive evenly throughout. Once the water has been churned up and the abrasive is circulating through the tank, the SRS is able to suck out the excessive material.

The SRS Sweep Program is located on your PC in the OMAX Corporation > OMAX\_Layout\_and\_Make > Samples > Useful\_Tools directory. This drawing is written for the size of the 55100 tank, so you should resize the drawing to accommodate the size of your OMAX JetMachining Center. From beginning to end, the sweep process takes about 15 minutes. Run the program twice a week to keep your SRS working at its best.

### Cleaning the Filter Screen for the Tank's Water Outlet

Water accumulated in the catcher tank exits through a water outlet filter (Figure 6-1). This filter should be periodically inspected to determine if cleaning the screen is required. This filter screen may be removed for cleaning using a 1.5" open end wrench. Once removed, scrub it clean using a mixture of mild soap and water.

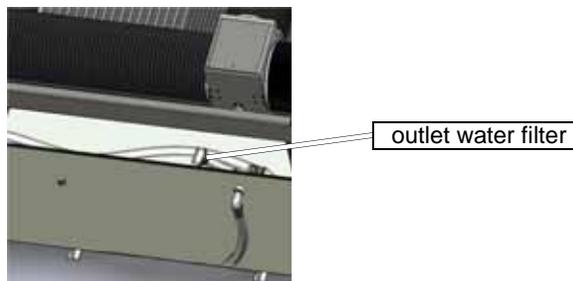


Figure 6-1: Outlet Water Filter Screen at Back of Tank

### Controlling Tank Odor

Like any untreated open water in a storage container, the catcher tank can become a home for bacteria growth, creating an offensive odor and infection source for any open wounds. To control bacteria, the JetMachining Center uses anti-bacterial chemicals such as those used in swimming pools or hot tubs that reside in a plastic floating device inside the tank.

**WARNING!** *Untreated tank water supports bacteria growth that can infect open wounds. Use the bacteria control materials provided with the OMAX odor control kit and keep tank water away from any open wounds by wearing appropriate gloves for protection.*

*Periodically check the chemical content inside the floating device. Refer to the instructions included with the anti-bacterial chemicals. The JetMachining Center comes with sufficient chemicals to last approximately one year. When reordering chemicals, use Pace Pool Chlorinating Tablets manufactured by Olin Chemicals, or an equivalent product. If you switch to a different brand, be sure to read any warning labels. Mixing different brands of chemicals could create a hazardous situation.*

**Caution:** *Do Not add chlorine tablets when using an EBBCO Closed Loop System to treat your tank water. Chlorine will ruin your filter system. The EBBCO Closed Loop System has its own ozone generator that controls bacteria growth.*

### Slat Replacement

In time, table slats can become scored with deep abrasivejet cuts and will be unable to provide the stability and support required for precision cutting. Slats should be inspected for wear at least once a month. Those weakened and worn should always be replaced.

**Note:** *The working life of a slat can be greatly improved by periodically rotating them to different table locations.*

When replacing a defective slat, also inspect the slat holder for excessive wear. When worn too much, they no longer prevent slats from rocking back and forth which can interfere with cutting precision. Worn slat holders should also be replaced.

New sets of galvanized steel slats can be ordered from OMAX. Stainless steel slats are also available through special order (stainless steel slats are standard on the 2626|xp). It's also possible to cut your own slats using your JetMachining Center. Each slat should be 1/8" (3 mm) thick and 4" (10 cm) tall. To provide a level support surface, ensure that the 4" (10 cm) slat dimension remains within 0.005" (0.1 mm). Make the length equal to the existing slat length.

## Table Maintenance

### Maintaining the X-Y Carriage Bellows

The bellows protecting the precision bearings of the X-Y carriages on your OMAX are often overlooked, yet they are vital components of your machine. By shielding the X-Y bearings, the bellows make possible smooth and precise movements of the cutting nozzle. If the bellows or their seals are damaged, operation of the bearings and ball screws can be compromised by the presence of grit, water, and other contaminants. Even the smallest tear in the bellows can cause major component damage. The resulting problems can go beyond imprecise cuts: they can even shut down your shop while critical parts of your OMAX are replaced or repaired by your OMAX Customer Service technician.

To keep the X-Y bearings in top-notch condition, regularly inspect the bellows for tears and cracks. Keep the bellows clean and supple using a conditioner such as Armor All® and repair any holes or tears by using the OMAX Bellows Repair Kit (P/N 302393). If the bellows become damaged beyond repair, replace them: you'll save a lot of time and money in the long run by protecting the precision linear bearings and ball screws. In addition to inspecting the exterior condition of the bellows, remove the bellow cuffs from the bellow adapters and look inside.

**Caution:** *Always clean the outside of the bellows before looking inside to avoid the introduction of grit and dirt into the bearings or ball screws.)*

With the bellows open, wipe down and lubricate the rails, bearings, and ball screw nut. Use only Arctic Grease (P/N 304368) and follow the instructions provided in *Lubricating the JetMachining Center*, page 6-9.

Before resealing the bellow cuffs to the bellow adapters, check the condition of the adapter rings. If you find the factory-installed foam backing degraded or see evidence of water intrusion, carefully and completely remove the foam using a razor blade. Before closing and resealing the bellows, apply a generous, continuous bead of silicone sealant (P/N 203339) to the rim of any bellow adapter surfaces where the foam was removed. Put the bellow adapters back on, secured in place with the fastening hardware. Wipe off any excess sealant, leaving behind smooth surfaces for the bellow cuffs to seal against. Use a flashlight to make sure the bellow adapters have sealed against their mating component faces, then reattach the bellows. The silicone sealant will perform as well as the original foam backing material.

By regularly cleaning, conditioning, and repairing the bellows on your OMAX, the precision bearings in your X-Y assemblies can stay dry, clean, and problem-free.

## Timing Belt Inspection and Tensioning

Steel-reinforced timing belts are used by JetMachining Center to transmit power from the servo control motors to the ball screws for nozzle movement (Figure 6-2). These belts should not wear out with ordinary use, but must be checked annually as part of your routine maintenance schedule for cracks, tears, and proper tension.

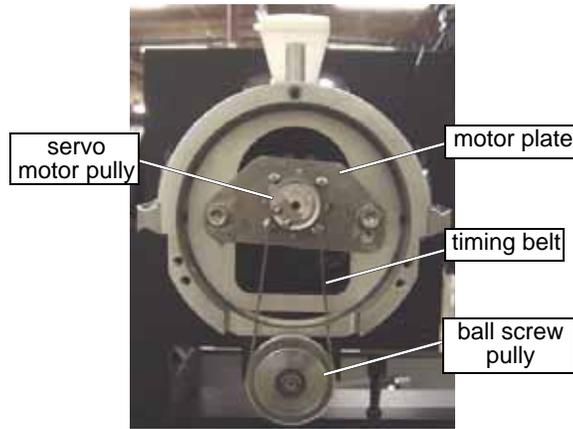


Figure 6-2: Example of Typical OMAX Servo Motor/Ball Screw Timing Belt Connection

### Timing Belts for Cantilever-style Tables

**Note:** Cantilever tables include the Models 2626, 2626|xp, 2652, 5555, and 55100. OMAX recommends that timing belts for the Model 2626|xp not be removed or adjusted. Doing so could greatly affect its cutting precision. Please contact Customer Service for additional 2626|xp timing belt information.

#### Locating Timing Belt

Timing belts connecting the servo motor with the carriage movement ball screws are found at one end of the X- and Y-carriages as identified in Figure 6-3:

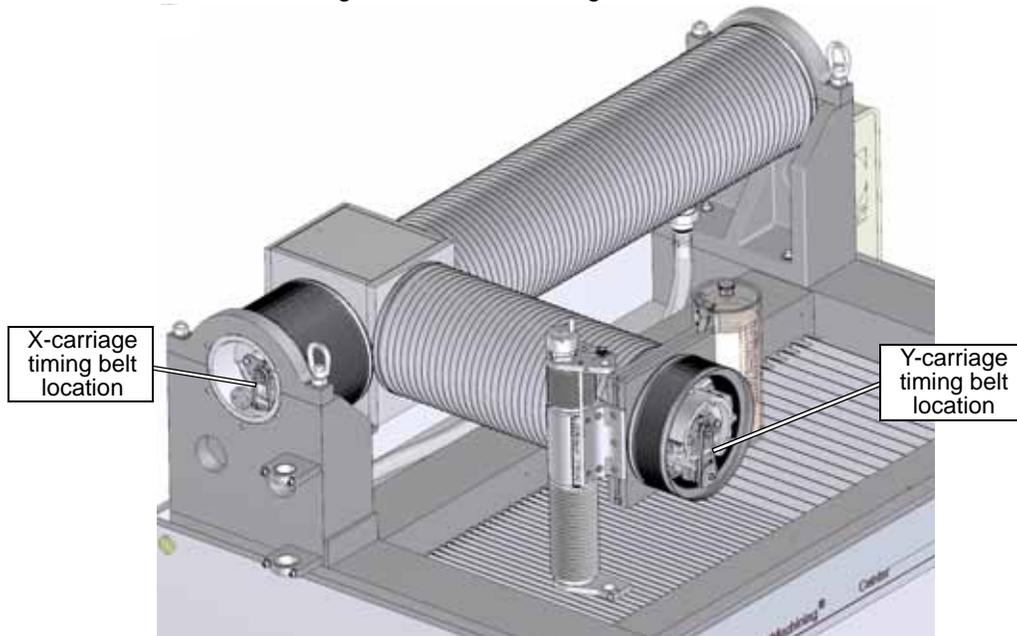


Figure 6-3: Timing Belt Locations Typical of OMAX Cantilever Tables

#### Inspecting and Adjusting Timing Belts

1. Switch the Main AC Power Switch for the JetMachining Center to Off.
2. Lock-Out and Tag-Out the Main AC Power Disconnect Switch.

3. Verify that AC power to the OMAX JetMachining Center was properly disconnected.

**Caution:** *Ensure that both the X- and Y-carriage end covers and the adjacent bellows areas are scrubbed clean using soap and water followed by completely drying with towels. Abrasive grit cannot be allowed to enter the carriage mechanisms once the timing belt cover plate is removed.*

4. Expose the timing belt by removing the carriage cover plate. Remove the 6 screws from the X-axis cover plate or the 3 screws from the Y-axis cover plate:

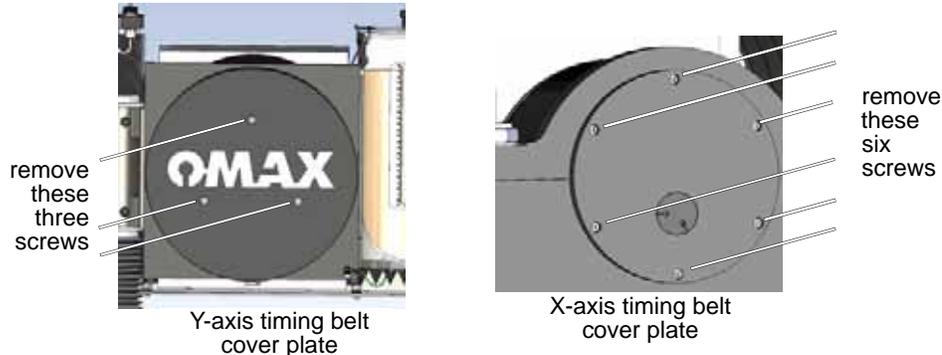


Figure 6-4: Carriage End Cover Screws Removed to Access Timing Belt

5. Set the cover plate and all removed screws aside for safekeeping.
6. Remove each timing belt and inspecting it for tears, cracks, missing teeth, and other defects as follows:
  - a. Loosen the motor plate's pivot screw. Refer to Figure 6-5.
  - b. Loosen the tension adjustment screw.
  - c. To release belt tension, push the motor plate down from directly above the adjustment screw.
  - d. Once tension is released, the belt should lift easily from the pulleys.
  - e. Inspect the timing belt for tears, cracks, missing teeth, and other issues indicating replacement. If defects are noted, replace the belt.

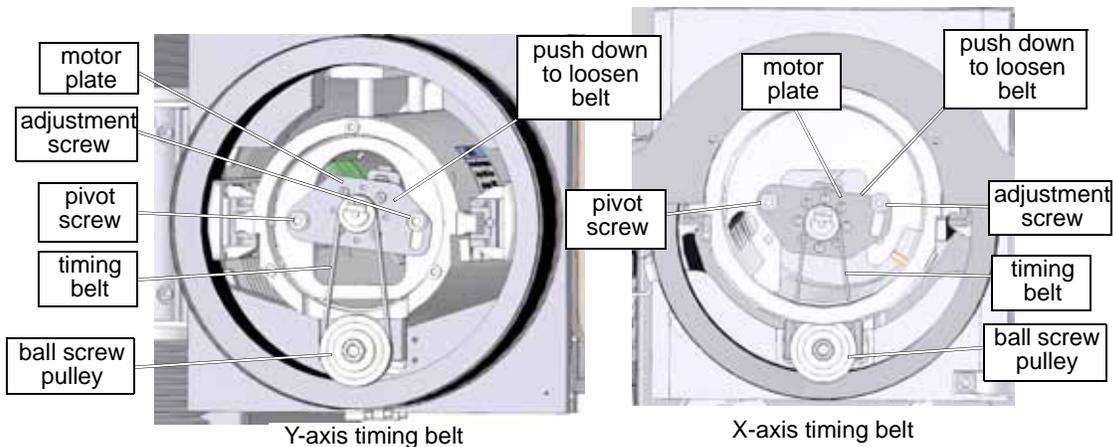


Figure 6-5: Components Involved in Adjusting the Timing Belt Tension

7. Re-install and re-tension the timing belt as follows:
  - a. Slip the timing belt over both the upper and lower pulleys.
  - b. With both the pivot and adjustment screws loosened, push up on the motor plate with your thumb placed on it directly beneath the tension adjustment screw.
  - c. Push hard and hold a steady pressure while tightening the tension adjustment screw.

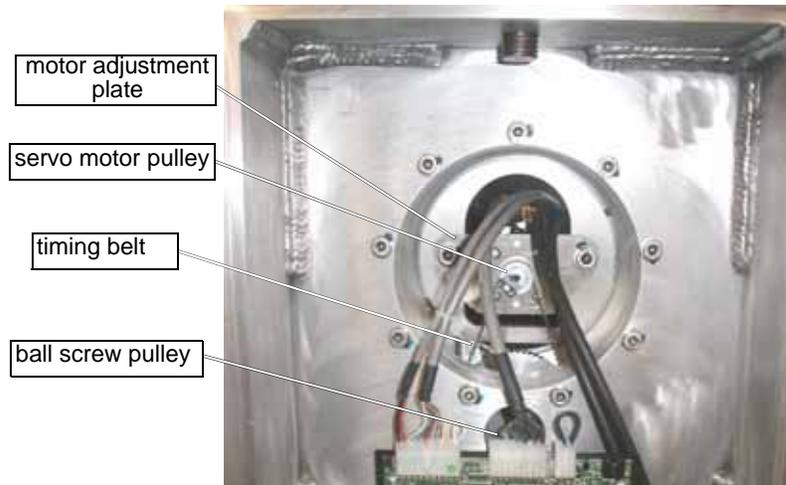
**Caution:** *Do not use anything except your thumb to push on the motor plate while tightening. Belts that are over-tightened become noisy during operation. When pressing in on a properly tensioned timing belt, it should deflect approximately 1/8 to 1/4 of an inch (0.30 to 0.64 cm).*

- d. Once the motor plate is securely held in place with the adjustment screw, release thumb pressure and also tighten the pivot screw. Finish by tightening both motor plate screws securely.
- e. Replace the carriage cover plates and screws.

**Caution:** *When re-installing the X-axis motor cover, ensure that the electrical cables do not come into contact with the drive belt. Eventually, the constant contact with the moving belt could sever the cable.*

### Timing Belts for Bridge-style Tables

Y-axis movement for the Bridge tables use the identical servo motor/ball screw configuration as described previously in Timing Belts for Cantilever-style Tables. Bridge-style tables include the 80X, 60120, and 80160. See Figure 6-6:



80160 Y-axis timing belt

Figure 6-6: Y-axis Servo Motor/Ball Screw Timing Belt Connection for Bridge Tables

### Locating Timing Belts

Timing belt locations for bridge tables are identified in the figure which follows:

**Note:** *X-axis designs for the Models 60120 and 80X use traction drives with linear encoders. These models do not require use of timing belts for X-axis movement.*

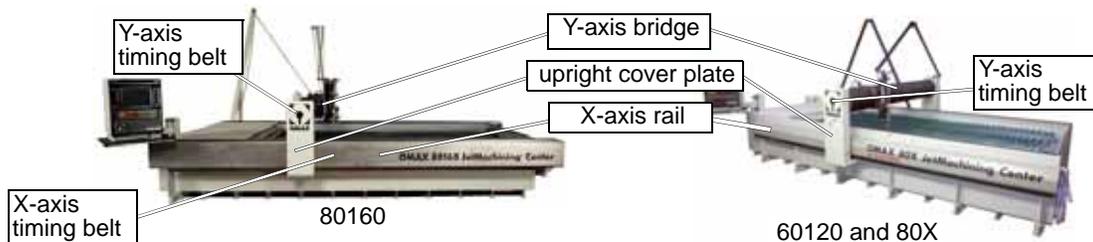


Figure 6-7: Timing Belt Locations for Bridge-style Tables

**Adjusting Timing Belts: Y-axis**

Timing belt removal and adjustment for bridge tables is identical to the procedures previously provided for cantilever table systems.

1. Switch the Main AC Power Switch for the JetMachining Center to Off.
2. Lock-Out and Tag-Out the Main AC Power Disconnect Switch.
3. Verify that AC power to the OMAX JetMachining Center was properly disconnected.

**Caution:** *Ensure that the upright cover plate and surrounding housing are scrubbed clean using soap and water followed by completely drying with towels. Abrasive grit cannot be allowed to enter the carriage mechanisms once the upright cover plate is removed.*

4. Expose the timing belt by removing all screws (10 ea.) holding the upright cover plate.
5. Set the upright cover plate and removed screws aside for safekeeping.
6. Adjust the timing belt following the procedures provided in Inspecting and Adjusting Timing Belts, page 6-5, beginning with step #4a.
7. When complete, replace the upright cover plate.

**Adjusting Timing Belts: 80160 X-axis**

**Note:** *X-axis designs for the Models 60120 and 80X use traction drives with linear encoders. These models do not require use of timing belts for X-axis movement.*

The 80160 uses the standard OMAX servo motor/ball screw design for its X-axis movement (Figure 6-9). Two ball screws are used for X-axis movement, one on each side of the table (Figure 6-7).

1. Locate the timing belt access covers available on both sides of the 80160 frame (Figure 6-8):



*Figure 6-8: Remove Cover Plate to Access the 80160 X-axis Timing Belt*

**Caution:** *Ensure that the access cover plates and surrounding frame are scrubbed clean using soap and water followed by completely drying with towels. Abrasive grit cannot be allowed to enter the protected ball screw area once the access cover plates are detached.*

2. From **Make** on the PC Controller, move the Y-axis assembly down the table until it just reaches the front of the access cover plates. This will position the servo/ball screw assembly alongside the access cover plate, allowing timing belt maintenance when the cover plate is removed.
3. Shutdown Make and power Off the PC Controller
4. Switch the Main AC Power Switch for the JetMachining Center to Off.
5. Lock-Out and Tag-Out the Main AC Power Disconnect Switch.
6. Verify that AC power to the OMAX JetMachining Center was properly disconnected.

- Remove the six screws securing the access covers to the frame. Set the all screws and both access cover plates aside, exposing the ball screws and timing belts (Figure 6-9):

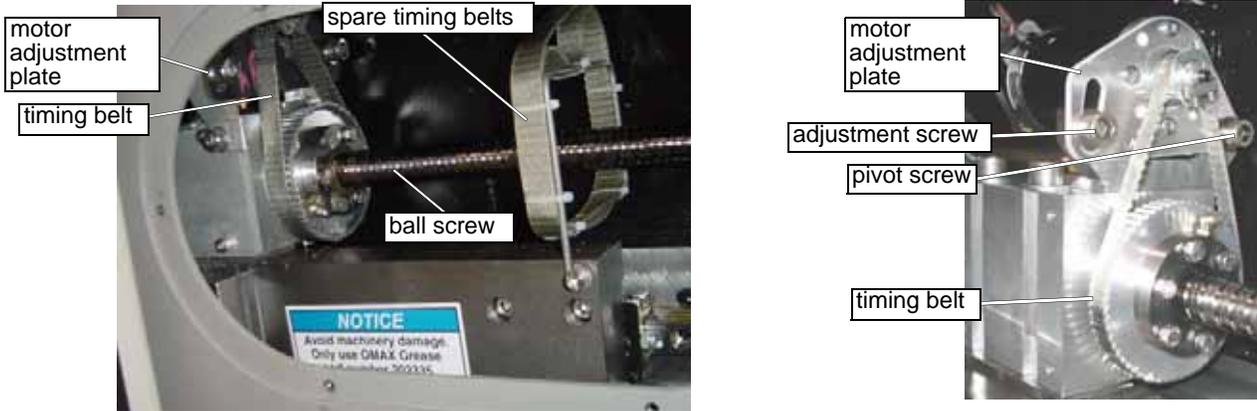


Figure 6-9: View of 80160 Timing Belt With Access Plate Removed

- Adjust each timing belt following the procedures provided in Inspecting and Adjusting Timing Belts, page 6-5, beginning with step #6a.
- When inspection and adjustment are complete, replace access covers for both sides.

## Lubricating the JetMachining Center

Like all machines, your OMAX requires regular lubrication to keep its moving parts running smoothly and to protect them from drying out. To preserve the life of your system, be sure to lubricate ball screws, ball nuts, linear rails, and the bearings on an annual basis. When lubricating, it is extremely important to use grease approved by OMAX Customer Service. OMAX recommends Jet-Lube’s Arctic Grease (Anhydrous, calcium 12-hydroxystearate - OMAX P/N 202335) due to its superior lubrication qualities and excellent performance over a wide temperature range. While there are many excellent greases commercially available, you cannot be sure that they will be compatible, particularly if you are simply pumping a few squirts into the Zerk fittings during your routine maintenance inspection.

**Caution:** *If the grease used is not compatible with Arctic Grease (or another brand), a chemical reaction can occur that separates both grease types and impairs the lubrication qualities of both. Once this happens, a premature failure of a bearing or associate device is probable. If you have been mixing greases on your ball screws/nuts, X and Y-axis rail bearings, etc., even if you have not had any issues, we highly recommend that you fully purge the mixture of greases with 100% Arctic Grease.*

## Grease Fittings and Couplers

Lubrication requires the use the correct grease and correct grease gun fitting that matches the installed grease fitting. Two different types of grease fittings are current in use on OMAX tables: a standard **Zerk** fitting, and a **grease cup** fitting (on motorized Z-axis only). Refer to the following table for an illustration of each:

Grease Fitting	Required Coupler	Where Used
Zerk nipple 	Standard grease gun with Zerk coupler (provided with OMAX machine) 	x, y linear bearings, ball screws, and ball screw bearing housings

Grease Fitting	Required Coupler	Where Used
grease cup 	blunt-tip grease needle (P/N 202633) 	Motorized Z linear bearings

### Identifying Lubrication Points

Use the following table to identify lubrication points for specific OMAX table models:

**Note:** *Jet-Lube's Arctic Grease should be used for all lubrication points except for the Motorized Z lead screw bearing (Figure 6-16) which uses 30 weight oil.*

OMAX JetMachining® Center Models	Lubrication Points		Locations
2626, 2626 xp, 2652, 5555, 55100	Y-axis carriage	4 linear bearings 1 ball screw nut 1 ball screw tail bearing	Figure 6-10 Figure 6-11
	X-axis carriage	4 linear bearings 1 ball screw nut 1 ball screw tail bearing	Figure 6-10 Figure 6-11
	X-axis carriage	1 ball screw bearing housing (55100 and 5555)	Figure 6-10 Figure 6-11
80160	Y-axis	4 linear bearings 1 ball screw nut 1 ball screw tail bearing	Figure 6-10 Figure 6-11
	X-axis	2 linear bearings 1 ball screw nut 1 ball screw bearing housing (on each side of the 80160)	Figure 6-18 Figure 6-19 Figure 6-20
60120	Y-axis	4 linear bearings 1 ball screw nut 1 ball screw tail bearing	Figure 6-10 Figure 6-11
	X-axis	lubrication not required	
80X	Y-axis	4 linear bearings 1 ball screw nut 1 ball screw tail bearing	Figure 6-10 Figure 6-11
	X-axis	lubrication not required	
Motorized Z-axis	Z-axis	4 linear bearings 1 lead screw bronze bearing (30 weight oil)	Figure 6-14 Figure 6-16

## Lubrication Points for Cantilever Style X, Y Carriages

Figure 6-10 below identifies lubrication points for the OMAX models 2626, 2626|xp, 2652, 5555, and 55100. All grease fittings on the carriages are Zerk style.

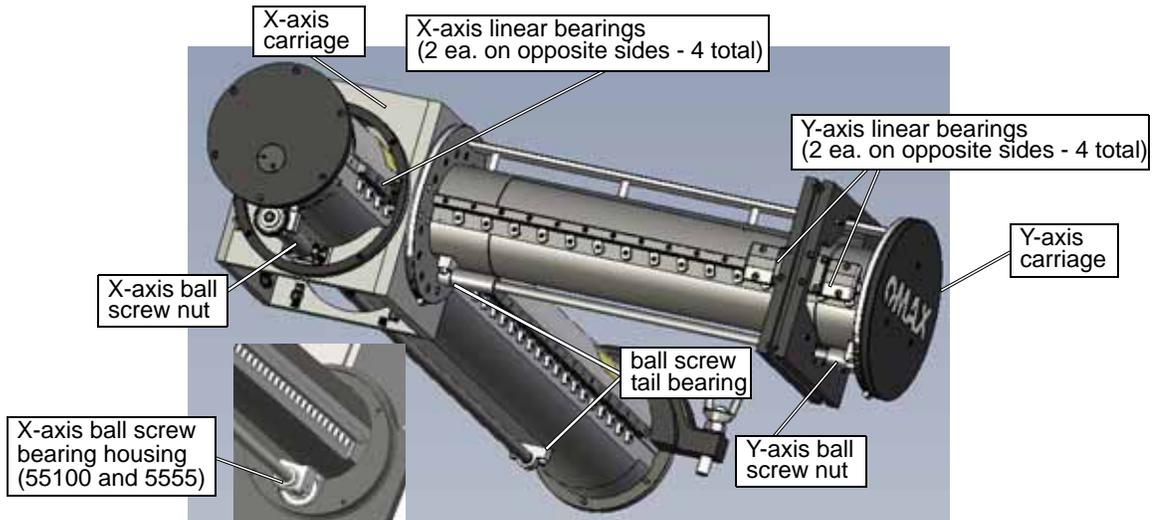


Figure 6-10: Lubrication Points on OMAX Cantilever Style X, Y Carriages

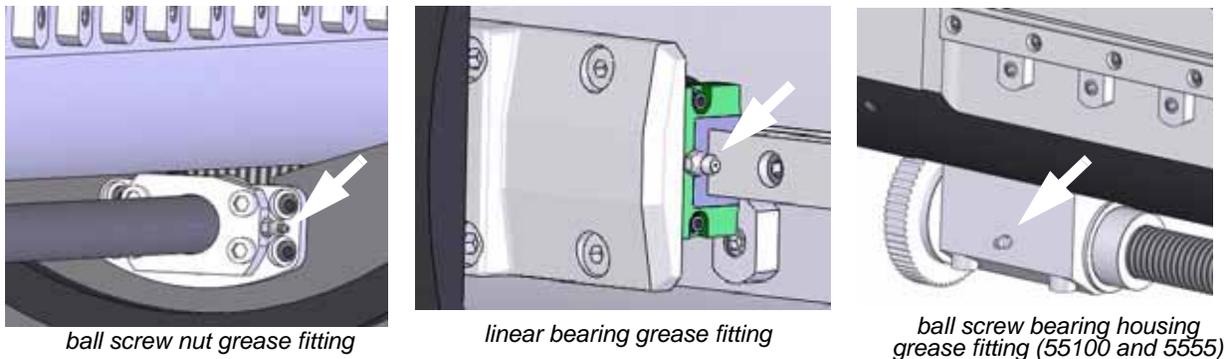


Figure 6-11: Lubrication Fittings for Cantilever Style X, Y Carriages

### Greasing the X and Y Carriages

1. Move both the X- and Y-carriages to their mid-positions.
2. Using soap and water, clean the bellows on both carriages to remove all abrasive particles and other contaminants. Dry the cleaned bellows with a towel.

**Caution:** *To prevent abrasive from falling inside the carriages and damaging the bearings, never remove the bellows before they are cleaned thoroughly. Even the smallest amount of abrasive contamination can severely reduce the life of lubricated carriage components.*

3. Loosen the bellow clamp at the end with the timing belt (see Figure 6-6), leaving the bellows attached on the opposite end.
4. Pull the loosened end of the bellows back, exposing the carriage, bearings, and ball screw.

**Note:** *This is an excellent time to conduct a thorough inspection of the internal carriage components to detect and correct any bellows tears, garnet contamination, worn bearings, pitted bearing track, etc.*

5. Locate the grease fittings on the **ball screw** and the **linear bearings** (Figures 6-10 and 6-11). For a 55100, also locate the ball screw bearing housing.

**Note:** *It may be necessary to loosen the bellows clamps at both ends of the carriage to access these tail bearings. The ball screw tail bearings do not provide grease fittings. These needle bearings are easily lubricated by forcing grease with your finger into the end of the bearing until grease squeezes out the opposite end.*

6. Pump grease into the carriage fittings until grease begins to squeeze out (at most, requires three strokes with the grease gun). The grease will emerge at some location away from the area of the grease fitting.
7. Slide the bearing assemblies back and forth on the rail at least ten times to distribute the grease adequately on all components. Wipe excess grease from the rails when finished.
8. After sliding the bearing assemblies, again connect the grease gun and pump grease until it begins to squeeze out from under the assembly.
9. Locate and grease the two ball screw tail bearings (Figure 6-10).
10. Replace the bellows after carefully inspecting them for tears or cuts. Before tightening the bellows clamps, ensure that the bellows fully cover the internal carriage components and are not being pinched. Moving the nozzle to compress a stretched bellows will make clamping easier.

**Caution:** *If tears are noted in a bellows, replace the bellows immediately or repair the tear using the Bellows Repair Kit (OMAX Part #302393). Running the OMAX with an opening in the bellows allows garnet and grit to enter and damage the precision mechanisms, causing serious damage and requiring replacement of the entire assembly. Do not use the OMAX until the bellows are repaired or replaced.*

### Lubrication Points for the Motorized Z-axis

Once a year, the four bearings in the Z-axis require greasing. You do not need to remove the Z-axis to grease these bearings. A fitting extension (blunt tipped grease needle) that couples with standard grease guns is included with your OMAX.

#### Greasing the Z-axis Bearings

1. Both raise and lower the Z-axis while carefully cleaning the bellows using soap and water to remove all loose garnet and grit.

**Note:** *Raising and lowering the Z-axis stretches the bellows and allows for a more thorough cleaning. It also makes it easier to remove the bellows.*

2. Carefully inspect the bellows for any tears or rips.

**Caution:** *If tears are noted, replace the bellows immediately or repair the tear using the Bellows Repair Kit (OMAX Part #302393). Running the OMAX with an opening in the bellows allows garnet and grit to enter and damage the precision mechanisms, causing serious damage and requiring replacement of the entire assembly. Do not use the OMAX until the bellows are repaired or replaced.*

- Using a 5/16" (8 mm) socket, unscrew the two clamps holding the bellows in place that are identified in Figure 6-12 below:



Figure 6-12: Z-axis Assembly

**Note:** This is an excellent time to conduct a thorough inspection of the internal components to detect and correct any bellows tears, garnet contamination, worn bearings, pitted bearing track, etc.

- Lift up the bellows to expose the grease points on the Z-axis mechanism.



Figure 6-13: Lift Bellows to Expose Grease Points

- There are four bearings in the Z-axis housing that require lubrication using Jet-Lube's Arctic Grease - OMAX P/N 202335 (see Figure 6-14).

**Note:** It is not necessary to remove the Z-axis to lubricate these bearings. The figure below shows a disassembled Z-axis for clarity.

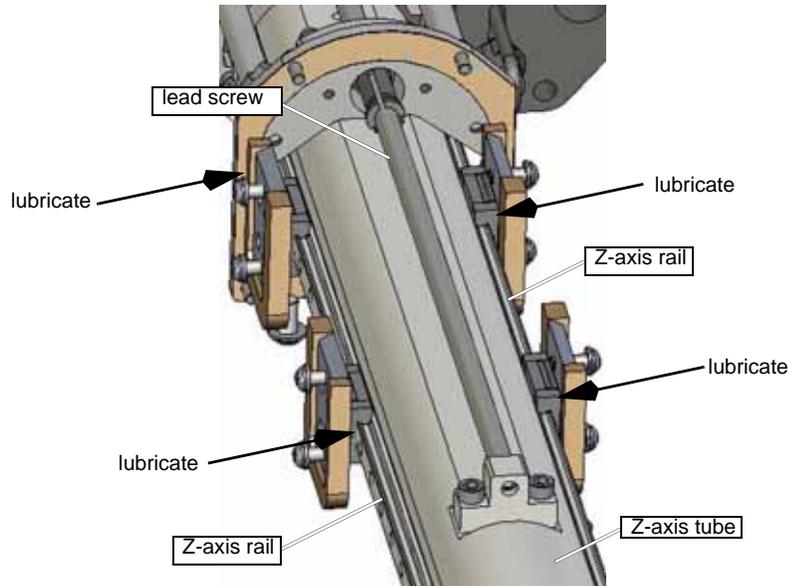


Figure 6-14: Z-axis Bearing Locations Requiring Lubrication

6. Attach the blunt-tip needle extension (P/N 202633) to the grease gun to lubricate each of the four bearing assemblies. There is a small grease cup at the end of the bearing that this needle extension fits against.

**Note:** In the following figure, the bellows adapter plate has been removed for picture clarity. It is not necessary to remove this part to lubricate the Z-axis bearings.



Figure 6-15: Use the Blunt-tip Grease Needle to Lubricate the Four Z-axis Bearings

**Note:** Using a flashlight makes it easier to locate each bearing and grease cup.

7. Once greased, slide the bearing assemblies up and down the rail at least ten times to distribute the grease adequately on all components.
8. After sliding the bearing assemblies, again add grease to the four Z-axis bearing assemblies.
9. Remove the top Z-axis bellows clamp and drop down the bellows to expose the lead screw bearing (Figure 6-16):

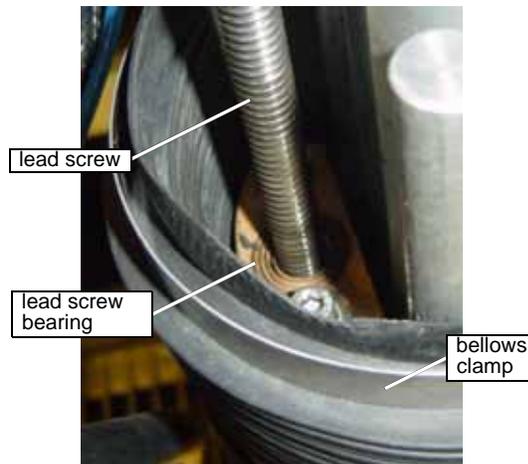


Figure 6-16: Motorized Z Lead Screw Bearing Location

10. Place at least two drops of 30 weight oil onto the grooved part of the lead screw bearing surface.
11. Following lubrication of all five motorized Z bearings, reclamp both ends of the bellows to the Z-axis by raising the Z-axis as high as possible, making reclamping easier. Tighten the clamp, ensuring that it holds the bellows securely in place and verify that the bellows is not being pinched.
12. Once the bellow is clamped in place, run the Z-axis all the way up and down a few times to distribute the lubrication all along the screw and rails.

### Lubrication Points for the 80160

The ball screws and bearings on the 80160 must be greased and inspected at least once per year.

#### Greasing the 80160 Y-axis Carriage

1. Move the Y-axis to its mid-position; move the X-axis to the end at the far right (the Home position).
2. At this time, carefully inspect each bellows for any tears or cuts.

**Caution:** *If tears are noted, replace the bellows immediately or repair the tear using the Bellows Repair Kit (OMAX Part #302393). Running the OMAX with an opening in the bellows allows garnet and grit to enter and damage the precision mechanisms, causing serious damage to the entire assembly. Do not use the OMAX until torn bellows are repaired or replaced.*

3. Clean the bellows with soap and water. Dry the bellows with a towel.

**Caution:** *To prevent grit from getting inside and damaging critical components, never open the bellows until they are thoroughly cleaned and dried.*

4. Loosen the bellows clamp on the Y-axis carriage. Leave the bellows attached on the other end.
5. Pull the loosened bellows back, exposing the four linear bearings and the ball screw nut (refer to Figure 6-11).

**Note:** *This is also an excellent time to conduct a thorough inspection of the internal components to detect and correct any bellows tears, garnet contamination, worn bearings, pitted bearing track, etc.*

6. Attach the grease gun to the 80160 fittings and pump grease (three strokes at the most) into each of the five lubrication points (four linear bearings and one ball screw nut) until they fill and the grease just begins to emerge.
7. Slide the bearing assemblies back and forth on the rail a few times to distribute the grease adequately on all components. Wipe excess grease from the rails when finished.
8. Locate and grease the ball screw tail bearing at the end of the Y-axis ball screw (Figure 6-10).

**Note:** It may be necessary to also loosen the bellows clamps at both ends of the carriage to access these tail bearings. The ball screw tail bearing does not provide a grease fitting. These needle bearings are easily lubricated by forcing grease with your finger into the end of the bearing until grease squeezes out the opposite end.

9. Inspect the bellows adapter ring for any signs of water intrusion inside the bellows. If leakage is detected, refer to *Maintaining the X-Y Carriage Bellows* on page 6-4 for repair instructions.
10. Replace the bellows after carefully inspecting them for tears or cuts. Before tightening the bellows clamps, ensure that the bellows fully cover the internal carriage components and are not being pinched. Moving the nozzle to compress a stretched bellows will make clamping easier.

**Caution:** *If tears are noted in a bellows, replace the bellows immediately or repair the tear using the Bellows Repair Kit (OMAX Part #302393). Running the OMAX with an opening in the bellows allows garnet and grit to enter and damage the precision mechanisms, causing serious damage and requiring replacement of the entire assembly. Do not use the OMAX until any torn bellows are repaired or replaced.*

11. When finished greasing, slide the bellows back over the carriage components, reinstall and retighten each bellows clamp.

### Greasing the 80160 X-axis Rails

1. Remove the oval access covers from both sides of the 80160. Set the 6 removed screws and cover aside for safekeeping.



Figure 6-17: Remove 80160 Access Covers to Reach Rail Lubrication Points

**Note:** Inside the rail covers and on each side of the tank are two linear bearing grease fittings, one ball nut grease fitting, and one ball nut bearing box grease fitting. To access these fittings, it is necessary to move the Y-axis until each fitting is positioned in front of the oval access hole.

2. Position the Y-axis until the ball screw nut appears inside the oval access hole (Figure 6-18):

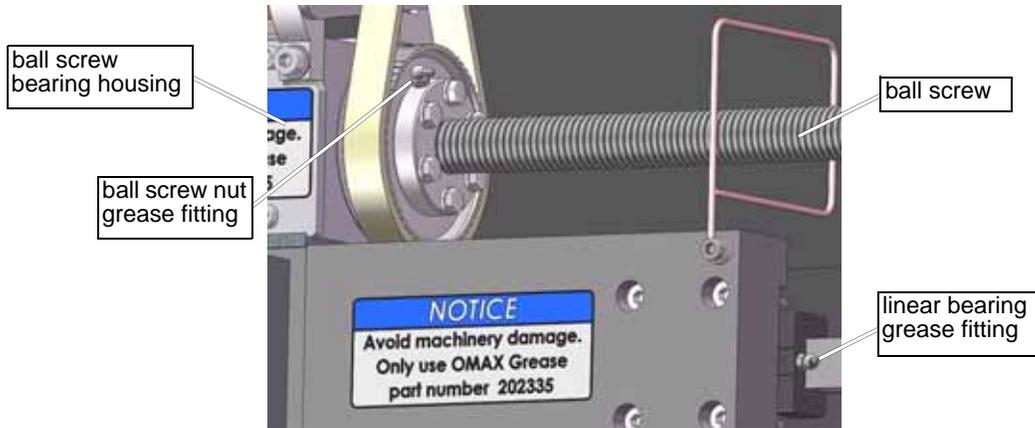


Figure 6-18: Grease Fittings for the 80160 Ball Screw Bearing Housing and Linear Bearing

3. Pump grease into each fitting until grease begins to emerge from each bearing (at most three strokes with the grease gun). Repeat this for the same bearings on the opposite side of the tank.

**Note:** The ball screw nut provides a Zerk grease fitting; the linear bearing provides the flush style grease fitting.

4. Again, move the Y-carriage until the other end of the ball screw bearing housing (Figure 6-18) is positioned in front of the access window with its Zerk grease fitting accessible (Figure 6-20).

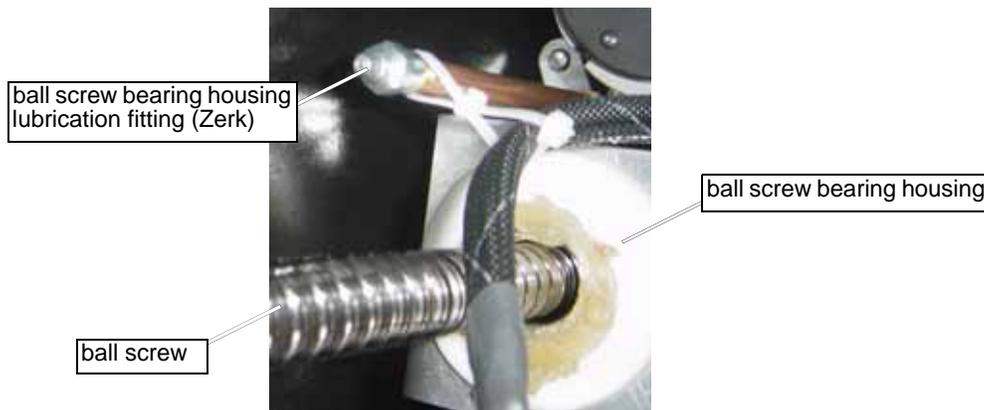


Figure 6-19: Grease Fitting for Lubricating the X-axis Ball Screw Bearing Housing

5. Pump grease into this fitting as described earlier; repeat this for the same fitting on the opposite side of the tank.

**Note:** It is normal to see large amounts of grease on the outside of the ball screw bearing housing.

6. Locate the second linear bearing for the X-axis rail (Figure 6-20) and grease it appropriately. Repeat this for the same bearings on the opposite side of the tank.

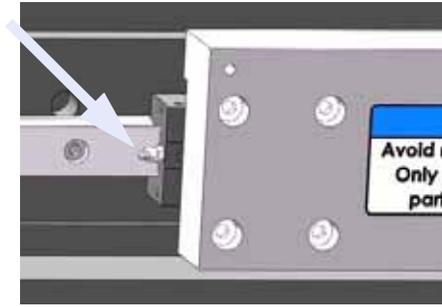


Figure 6-20: Grease Fitting for Lubricating the 2nd X-axis Linear Bearing

7. After applying the grease to all the 80160 X-axis grease fittings, move the Y-carriage along the 80160 rail for the full length of the machine at about 25 inches (64 cm) per minute to distribute the grease along the rail
8. Complete the X-axis lubrication process by replacing each oval access plate.

## Rebuilding the Abrasivejet Nozzle

**Note:** For nozzle repair and maintenance procedures, refer to *The OMAX JetMachining Center Operator's Guide*, P/N 400433-EN that is provided with your JetMachining Center. This document is also available for downloading at [http://www.omax.com/tech\\_support.php](http://www.omax.com/tech_support.php) (password required). To set up a user account, contact OMAX Customer Service at 800.298.4036.

## PC Controller Maintenance

### Cleaning the OMAX Industrial Keyboard and Mouse

The OMAX keyboard and mouse are industrial components designed specifically to withstand exposure to the water and abrasive particles presented in an abrasivejet environment.

The OMAX mouse is water-resistant, but not water-proof. To prevent water from getting inside the LED lens, don't operate the mouse on a wet surface. If the mouse does get wet, spray it with a soft blast of air to help dry it out. If you get dirt on the bottom LED lens, use a clean Q-Tip to remove it.

The surface of the OMAX keyboard may be cleaned by brushing off the abrasive or wiping it clean using a soft rag lightly dipped in mild soap and water. When cleaning, always unplug the keyboard first and, if cleaning with water, prevent the water from entering the disconnected keyboard connector. Wipe the keyboard dry using a dry cloth, or allow it to dry in room air. When finished, be sure to reconnect the keyboard cable.

### Cleaning the LCD Monitor Screen

Do not use a glass cleaner (Windex, ammonia based, etc.) to clean an LCD monitor screen. It can damage the screen surface. The screen should be wiped off using a lint-free cloth. To remove any particles or stains from an LCD screen, ensure that the monitor is first turned Off. Gently wipe its surface using a lint-free cloth dampened with a small amount of distilled water.

**Note:** *Distilled water shouldn't leave streaks behind after drying.*

### Replacing the Cabinet Air Filter

Beneath the OMAX Controller is an air filter (Figure 2-15) on the intake fan that prevents the controller cabinet from overheating. This filter blocks room dust and dirt from entering the computer along with the cooling air. Once this filter becomes plugged, air flow into the controller is restricted, causing the computer and associated PC Controller components to overheat. Under normal shop conditions, you should clean or change this air filter every three months. If your OMAX is operating in an excessively

dusty environment, check the filter at least monthly. Checking it should become part of your routine maintenance program. This filter is an easily obtained automobile air filter (Fram CA 327 or equivalent).

## Rebooting Windows

Microsoft Windows 2000 and Windows XP are complicated operating systems. They manage all memory, disk reading and writing, and memory operations for every program that run on your computer. While Windows 2000/XP are considerably more stable than earlier versions of Windows, they can still run into problems.

For example, if a program “misuses” memory (or has a “memory leak”), Windows may not be able to recover the memory. Each time the program is run, a little more memory is lost, and eventually this memory loss begins to affect other programs.

The following guidelines will help minimize operating system problems:

- **Reboot Windows at least once a day**  
Even if everything seems to be fine, reboot Windows at least once per day. If any memory problems have crept in, this will clear them.
- **If a program crashes, always restart Windows**  
If any program behaves weirdly, or crashes, restart Windows. This clears out memory and makes sure that you start “fresh.” Once Windows becomes “confused,” it rarely fixes itself, and usually causes more problems.
- **Wait for Windows to finish booting**  
Windows takes awhile to boot, and it may be tempting to get started before it's finished loading. This is a particular temptation with Windows XP, which displays the desktop up to one minute before it's actually finished loading everything. Wait until all disk activity is done before you launch any programs. You can also monitor activity in Windows XP using Task Manager (press Ctrl+Alt+Del) to check when CPU usage has dropped to zero.

## Running the Disk Defragmenter Utility

When Windows saves a file on the hard drive, it stores this file in whatever memory locations are currently available. If, for example, a five megabyte file is saved, and there are only five one megabyte spaces available, this file would be broken down and stored in five different locations. As time goes by, the available storage spaces could even get smaller and smaller, forcing Windows to use smaller and smaller storage locations. Soon, this original five megabyte file becomes stored in hundreds of individual locations. Reassembling a file stored in this fashion takes a lot longer than it would for a file stored in a single memory location. In extreme cases, it may take several minutes to load a large file that has become “fragmented” into hundreds of separate pieces.

A disk defragmenter utility goes through the entire hard drive, combining all the file fragments into a single location which greatly speeds up the file assembly process.

To run the Windows Disk Defragmenter utility:

1. Click the **Start** icon.
2. Select **All Programs**.
3. Select **Accessories**.
4. Select **System Tools**.
5. Select **Disk Defragmenter**.
6. Select the drive to defrag and click **Defragment**.

**Note:** *Depending on how badly fragmented your hard drive is, it can take anywhere from ten minutes to a few hours to finish. Do not run other programs while it is working – just leave it alone until finished. This is a good utility to run overnight, or while you're at lunch.*

## Upgrading Your OMAX Software

The OMAX Technology Guarantee entitles you, as the original owner, to free OMAX software upgrades for the life of your machine. You may acquire as many software seats as needed for off-line programming. Always keep your OMAX software up-to-date by checking [www.omax.com/support](http://www.omax.com/support) for the latest updates. Software updates are always free!

**Note:** A user name and password are required to access the OMAX technical support site. To set up a user account, contact OMAX Customer Service at 800.298.4036.

**Caution:** Before upgrading your OMAX software:

- **Do not uninstall your existing OMAX software! If you do, you may lose important machine and material settings as well as history files.**
- **Always reboot Windows before installing software updates. This ensures that existing software copies are not running and Windows is properly initialized.**
- **After rebooting Windows, do not run other programs prior to installing your OMAX software update. Other programs could conflict with the software installer.**
- **Do not change the suggested installation settings. In particular, you should use the suggested installation location unless you have a good reason not to. If you don't use the default settings, future upgrades must be installed to the same non-standard directory to work correctly.**
- **If you are upgrading a computer connected to an OMAX, be sure to shut down the computer and turn it off after the installation is completed (you will be reminded to do this by the install program). Otherwise, the software may not correctly control the OMAX.**

## Replacing the CMOS Battery

A small, coin-sized battery in your computer powers the PC's CMOS memory. It's important to include changing this battery in your long-term maintenance schedule. If your battery fails and your CMOS memory stops running, the computer will reset its BIOS settings to their default values. Fortunately, CMOS batteries typically can last for 5-10 years.



Figure 6-21: Typical CMOS Lithium Battery

### The role of the CMOS battery

The BIOS is the program that starts a computer up, and the CMOS memory is where the BIOS stores the date, time, and system configuration details needed to start the computer. The computer's CMOS memory is always running. Even when the computer is "turned off," a small amount of current still runs through the PC. This current is responsible for maintaining the CMOS settings. When the power to the OMAX is turned off at the power source, the flow of current to the PC stops. That's when the CMOS battery takes over; the CMOS always needs a power source.

### What happens when the CMOS battery fails

If the battery fails and the computer isn't receiving power from an electrical outlet, the CMOS memory quits and important BIOS settings are lost. When lost, the date and time settings reset to the manufacturer's date and time which is usually years from the current date and time. Because the registration for the OMAX software is date and time-dependant, it's especially important for OMAX users to make sure the CMOS always maintains a power source. Should the BIOS settings be lost, and your computer loses track of the correct date and time, your OMAX software becomes unregistered. In addition, some hardware built into the motherboard may become disabled due to the BIOS default settings.

### Clues to a CMOS battery failure

According to Dell Support, the Windows XP Pro computers informs you with a text warning when CMOS battery power is low; this message displays during the initial boot sequence. This warning should provide enough time to replace the battery. If the battery is dead, all is not lost. The computer typically continues to boot from the hard drive installed in the computer. But why wait for a warning? Keep your hardware and software interface intact. Change the battery at least once every three years. Before you change the battery, please contact OMAX Customer Service for specific details.





# Pump Maintenance

The following maintenance activities and schedules are provided to aid in the development of a successful pump maintenance program. Refer to Chapter 4, Servicing the OMAX Tables, for detailed maintenance procedures.

**Note:** *The hours listed in this chapter for recommended pump maintenance scheduling are NOT warranty hours. Please refer to the OMAX Two Year Limited Warranty on page 8-4 for warranty information about pump consumable and wear parts.*

## General Maintenance

Recommended Hours	Power-end Maintenance Performed
50	Change oil, check belt tension
Every 300	Change oil, check belt tension
Variable	Clean white water tank, remove debris from screen
Variable	Change water filters whenever the difference in pressure between the inlet and outlet gauges is equal to, or larger than 20 psi.
Variable	Replace electrical-enclosure air filters approximately once per month, or more frequently if required.
6 Months	Lubricate the main electric motor bearings: refer to Lubricating the Electric Motor, page 7-37, for grease specifications.

## Consumable Parts

The table below identifies the consumable parts/accessories for OMAX pumps that wear out or otherwise need replacement on a predictable basis as part of normal system operation. For assistance in ordering consumable parts, contact OMAX Technical Support.

Description	P/N
Fuse, Time Delay, 250 VAC, .5 A, 5mm x 20mm, Glass	201704
20" Cartridge, Coarse, Wall Pre-filter	202466
20" Cartridge, Fine, Wall Pre-filter	202465
200 Mesh Strainer, Charge Pump Tank, Reservoir	200935
10" Cartridge, Coarse, Charge Pump Pre-filter	202533
10" Cartridge, Fine, Charge Pump Pre-filter	202532
Air Filter, 11.5" x 3.5", inside pump enclosure	202736

# High-pressure Wet-end Maintenance

## Routine Maintenance Schedule

Wet-end Maintenance	Recommended Hours	
	P3050/3055V	P4055V
Install Minor Maintenance Kit (P/N 302700)	500	-
Install Major Maintenance Kit (P/N 302701)	1000	500
Install Minor Maintenance Kit (P/N 302700)	1500	-
Install Major Maintenance Kit (P/N 302701)	-	1000
Install Minor Maintenance Kit (P/N 302700)	-	-
Install Major Maintenance Kit (P/N 302701)	-	1500
Install Overhaul Kit (P/N 305098)	2000	2000

**Note:** Repeat the above sequence for the corresponding pump after every Overhaul Kit installation.

## Less Frequent Maintenance Schedule

Wet-end Maintenance	Recommended Hours	
	P3050/3055V	P4055V
Replace Plunger Assemblies (P/N 304885)	Every 2000	Every 2000
Replace Liquid Displacers (P/N 303294)	Every 2500	Every 2500
Replace Cylinders (P/N 300737)	Every 4000	Every 3500
Replace Manifold (P/N 301350)	Every 5000	Every 4500

## Minor Maintenance Detail

Task	P/N	Description
Replace	200377	O-ring
	200905	O-ring
	200909	O-ring
	202398	U-cup seal
	300726	Static seal
	300733	Static seal
	301635	Ring seal
	301639	Ring seal
	302244	Back-up ring assembly, with support ring
	302950	Seal assembly
	304104	Filter assembly, manifold
Inspect	200904	Ball
	300640	Seat, check valve
	300735	Static back-up ring
	301873	Check valve retainer, outlet
	302981	Seal, housing assembly
	303251	Body, check valve
	303252	Retainer, check valve, inlet
	303274	Ring support
	303294	Displacer, liquid

**Kit  
302700**



## Major Maintenance Detail

Task	P/N	Description
<b>Replace</b>	200377	O-ring
	200904	Ball
	200905	O-ring
	200909	O-ring
	201277	Washer, flat
	202398	U-cup seal
	300640	Seat, check valve
	300726	Static seal
	300733	Static seal
	300734	Screw, soc hd cap, 4-48
	301635	Ring seal
	301639	Ring seal
	301873	Check valve retainer, outlet
	302244	Back-up ring assembly, with support ring
	302950	Seal assembly
303274	Support ring, seal	
304104	Filter assembly, manifold	
<b>Inspect</b>	300735	Static back-up ring
	302981	Housing assembly
	303251	Body, check valve
	303252	Retainer, check valve, inlet
	303274	Ring support
	303294	Displacer, liquid

**Kit  
302701**

## Overhaul Detail

Task	P/N	Description
<b>Replace</b>	200377	O-ring
	200905	O-ring
	202398	U-cup seal
	300726	Static seal
	301635	Ring seal
	302244	Back-up ring assembly, with support ring
	302950	Seal assembly
	303401	Check valve assembly, internal inlet
304104	Filter assembly, manifold	
<b>Inspect</b>	300727	Back-up ring
	303294	Displacer, liquid

**Kit  
305098**



# Maintaining the Wet-end Pump Assembly

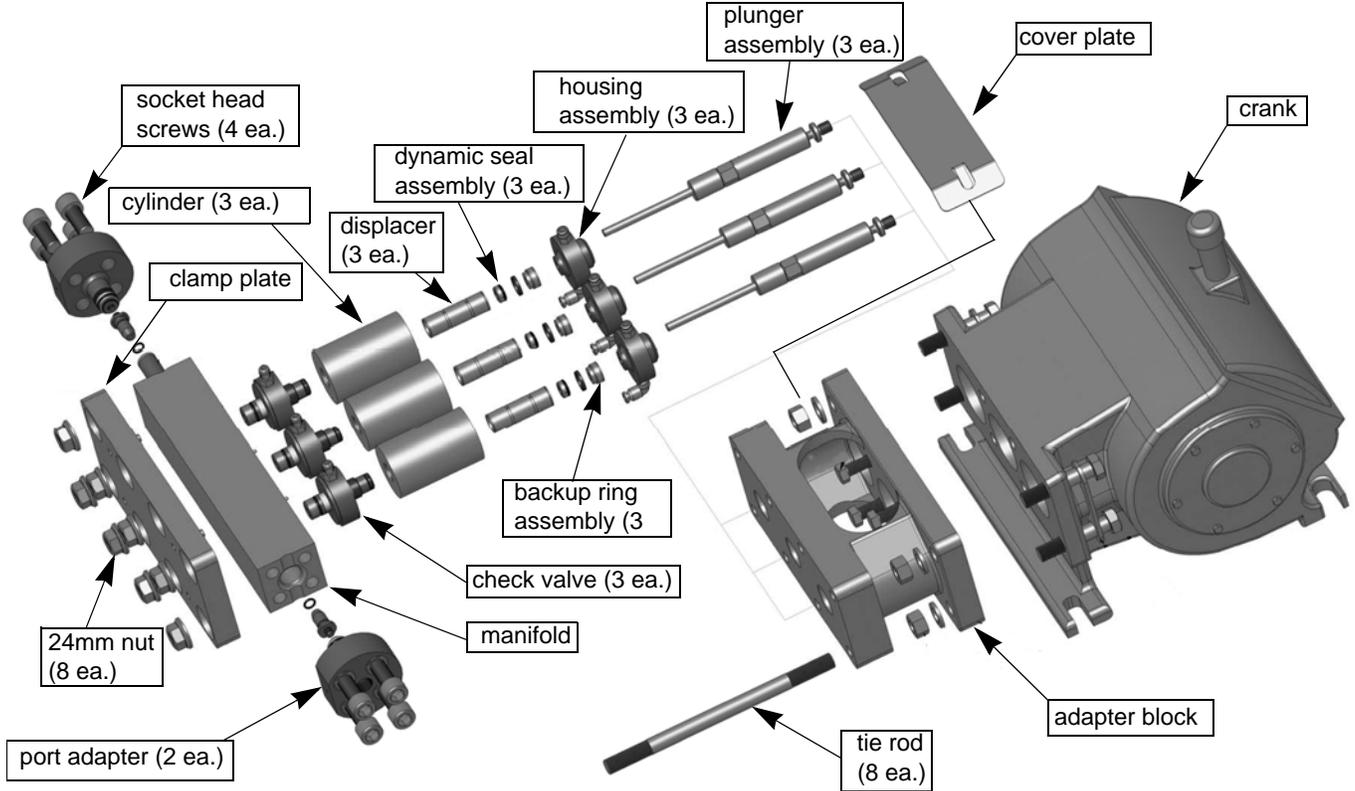


Figure 7-1: Major Components of the Wet-end Pump Assembly

## Removing the High-pressure Wet-end Assembly

The high-pressure wet-end assembly consists of those pump parts which are bolted to the crankcase and are directly involved in providing high-pressure water. Refer to Figure 7-2. When disassembling this assembly, keep all parts together in related sets, noting the original position of each set.

The following tools are necessary for removal of the wet-end assembly:

- ½" open-end wrench
- 9/16" open-end wrench
- 13/16" open-end wrench
- 1" open-end wrench
- 24 mm metric socket, ½" drive (or substitute 15/16" socket)
- ½" drive breaker bar
- torque wrench capable of 175 ft.-lb. (235 N-m)

**Caution:** *Never use a pipe wrench on any OMAX equipment!  
Do not disassemble the pump wet-end unless a torque wrench capable of 175 ft.-lb. (235 N-m) is available for reassembly.*

**To remove the high-pressure wet-end assembly:**

1. Turn power to the Pump Off at the main AC disconnect. Place a "lock-out tag" on the power disconnect to alert others that maintenance is in progress.
2. Disconnect the Hard Plumbing from the Port Adapter, using the 13/16" and a 1" wrench. See Figure 7-2:

**WARNING!** *Before disconnecting the hard plumbing, ensure that the pump has been shut down, allowing the system to depressurize.*

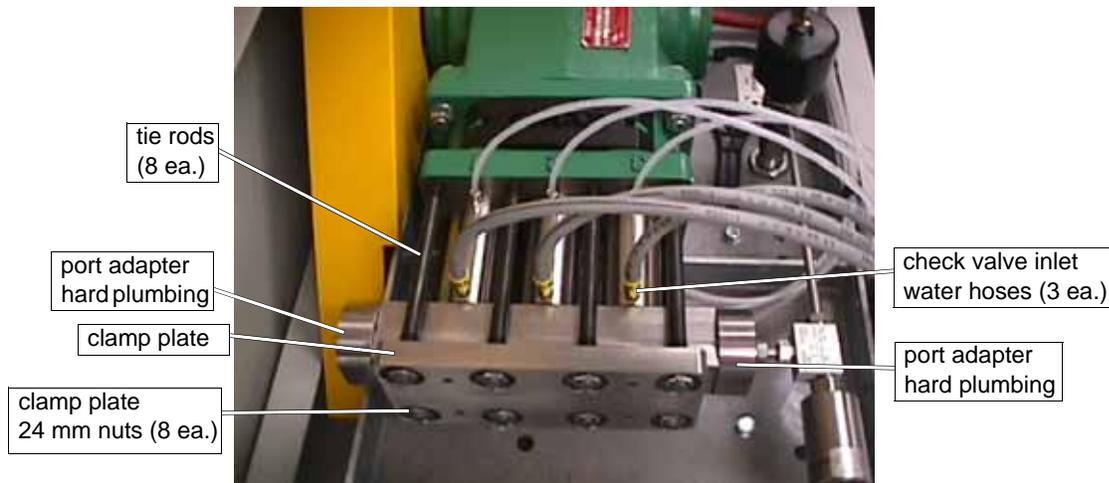


Figure 7-2: High-Pressure Wet-end Assembly

3. Remove the three Water Hoses from the Check Valve Inlets using the 9/16" open-end wrench. Hold the fitting with the 1/2" open-end wrench to avoid unscrewing it from the Check Valve Body.
4. Using the 24 mm socket (or 15/16" socket) and 1/2" breaker bar, remove the eight 24 mm Nuts from the Clamp Plate (Figure 7-2), being careful to remove the load on the Tie Rods evenly. Break loose the Nuts at the ends of the Clamp Plate first, then use a crisscross pattern when breaking the remaining four Nuts loose (Figure 7-3). Using the same pattern, back each Nut off ½ turn until the load is removed from the Tie Rods.

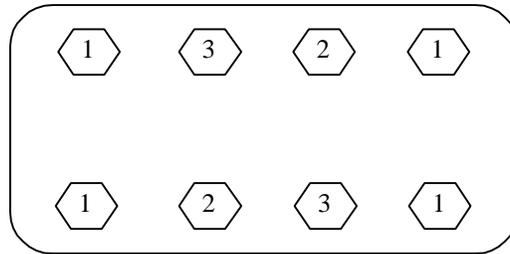


Figure 7-3: Nut Loosening Sequence for Removing Clamp Plate from High Pressure Assembly.

- Remove the clamp plate and set it aside:

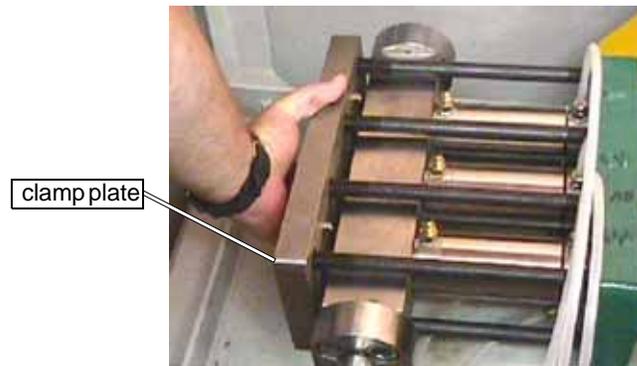


Figure 7-4: Clamp Plate Removal

- Slide the Wet-end Assembly away from the Coolant Housings. See Figure 7-5. Keep the assembly level and square, being careful not to bind the internal Plungers. All components typically stay in the Cylinders as the Wet-end Assembly is removed.



Figure 7-5: Removing the Wet-end Assembly

- When a Coolant Housings sticks to the Wet-end Assembly, stop and disconnect the Hoses, top and bottom, from each Coolant Housing. Proceed as in step 6, above.

**Note:** If a coolant housing sticks to the cylinder and cannot be removed by hand, disconnect the coolant hoses and allow the coolant housing to remain attached to the cylinder.

- Set the Wet-end Assembly on a workbench with the Manifold down and the Cylinders standing upright.

**Caution:** *If one cylinder has problems and the wet-end assembly has been removed, all three cylinders must be removed and rebuilt using these procedures for disassembling and reassembling the high-pressure wet-end. If the wet-end was fully assembled, torque applied and then removed, the ring seals are not reusable and must always be replaced.*

## Disassembling the High-pressure Wet-end Assembly

The following OMAX disassembly tools are available to aid in the assembly and disassembly of the wet-end assembly's high-pressure seal components:

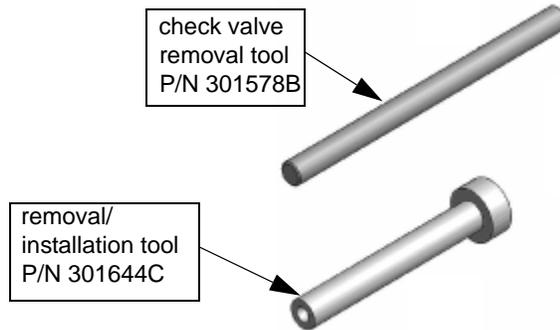


Figure 7-6: OMAX Special Disassembly Tools

### Tools needed for disassembling the wet-end assembly:

- OMAX Special Disassembly Tools (Figure 7-6)
- Arbor Press (provided by OMAX with pump)
- Two large, flat-blade screwdrivers
- Magnifying glass

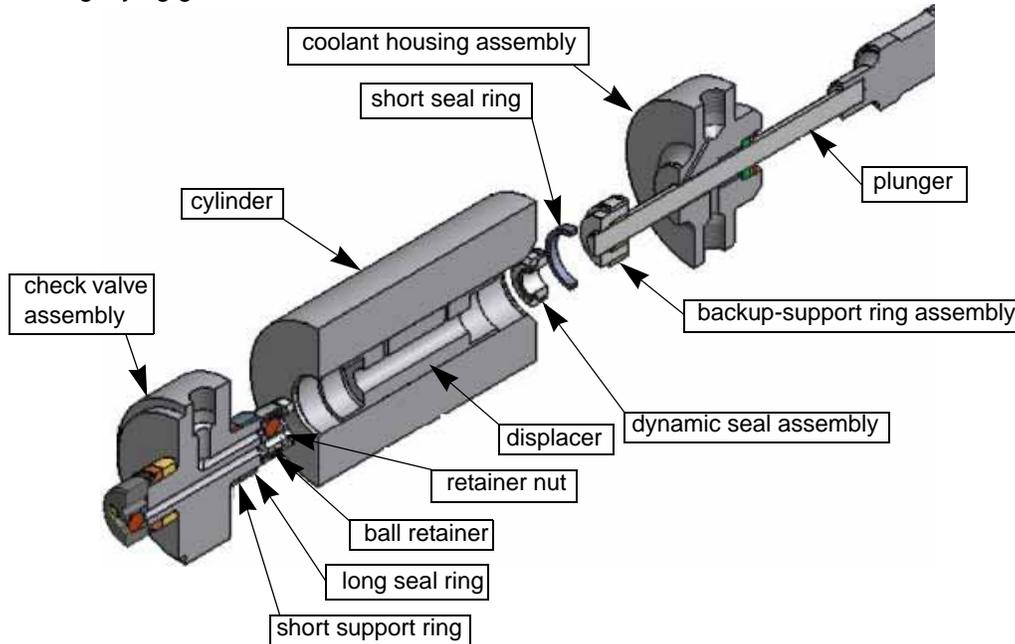


Figure 7-7: High-Pressure Wet-end Assembly Components

**Note:** *Remember to maintain all removed parts in related sets, noting the original position of each set.*

**To disassemble the high-pressure wet-end assembly:**

1. Remove the Cylinders (3 ea.) and the Check Valve Assemblies (3 ea.) from the Manifold using two flat-blade screwdrivers to lift the Check Valve Assembly and Cylinders out of the pressure Manifold:



Figure 7-8: Removing the Cylinder and Check Valve Assembly

**Note:** If the coolant housing assemblies remained fixed to the cylinders when removing the wet-end assembly, clamp the outside diameter of the coolant housing into the soft jaws of a vise and strike the side of the cylinder with a soft blow mallet to remove the coolant housings from the cylinders. The close tolerance fit of the coolant housing into the cylinder bore extends only into the bore of the cylinder approximately 0.050" and should remove easily.

2. Insert the Check Valve Removal Tool (Figure 7-9) through the Backup-support Ring Assembly (Figure 7-7) of the first Cylinder until it contacts the check valve Retainer Nut inside the Cylinder:

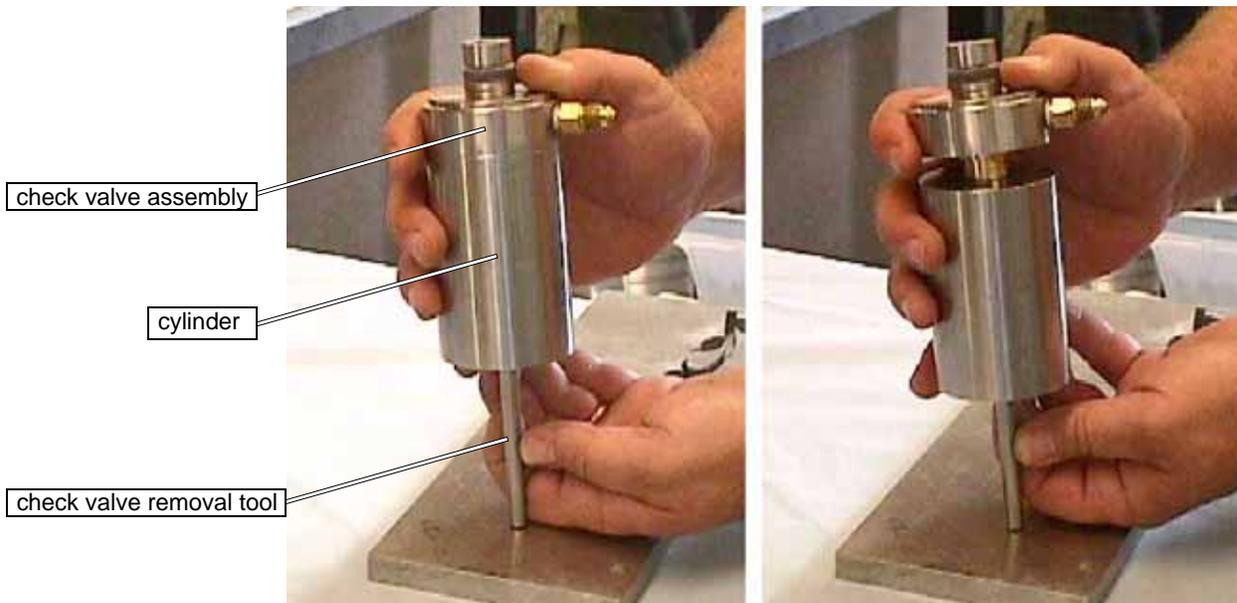


Figure 7-9: Using the Check Valve Assembly Removal Tool

3. Strike the tool firmly against a solid surface to remove the Check Valve Assembly from the Cylinder Assembly. Set the Check Valve Assembly aside until later. Repeat for the remaining two cylinders.
4. Using the Removal/installation Tool (Figure 7-6), push the Sealing Assembly (Displacer, Retainer and Seal Assembly, Short Seal Ring, and Backup-support Ring Assembly - Figure 3-10) out of the Cylinder from the Check Valve Assembly end toward the Coolant Housing Assembly end using an Arbor press (Figure 7-11). Repeat for the remaining two cylinders.

**Note:** The long seal ring on the inlet side of the check valve assembly usually remains in the cylinder bore and can be easily removed by hand.

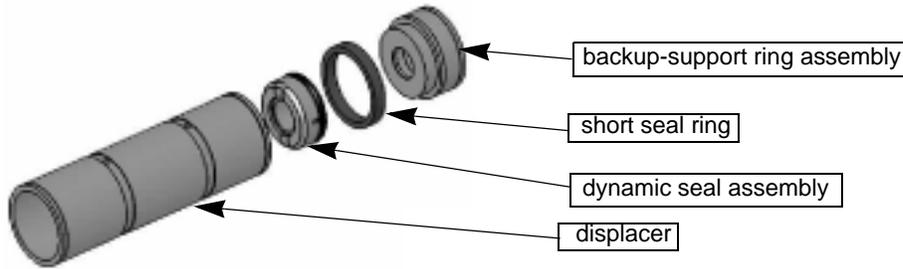


Figure 7-10: Sealing Assembly Components

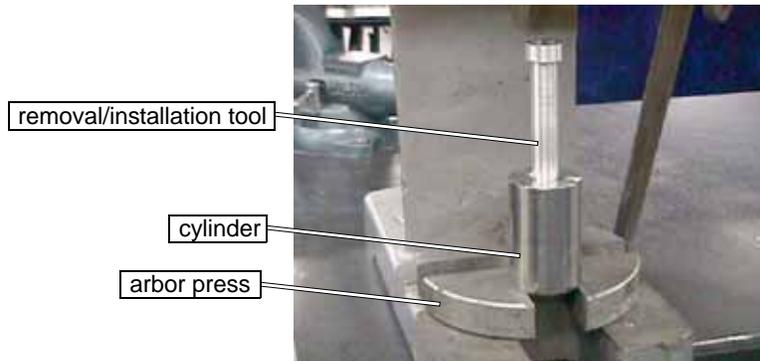


Figure 7-11: Removing the Sealing Assembly using an Arbor Press

5. Separate the Backup-support Ring Assembly (Figure 3-10) from the Displacer by placing the large end of the Removal/installation Tool (Figure 7-12) over the Backup-support Ring Assembly and breaking the Short Seal Ring loose from the Displacer.



Figure 7-12: Separating the Backup-Support Ring Assembly from the Displacer.

6. The Backup-support Ring Assembly (Figure 7-15) is machined together as one assembly. The outer Support Ring is pressed onto the inner Backup Ring. These parts should not be separated. The Short Seal Ring (Figure 7-10) should be easily removed by hand. Remove the Short Seal Ring from all three Backup Ring Assemblies.
7. Before removing the Dynamic Seal Assembly (Figure 7-10) from the displacer, inspect the Dynamic Seal for extrusion (Figure 7-13). Extrusion of seal material around the edges of the bore in the dynamic seal is to be expected. Uneven, excessive extrusion and/or missing material from one side across the face of the Dynamic Seal indicates a failed seal with possible plunger damage caused by the plunger rubbing on the bore of the backup ring. If uneven or excessive material is extruded or missing, then a close inspection of the Backup-support Ring Assembly should be made for signs of rubbing.

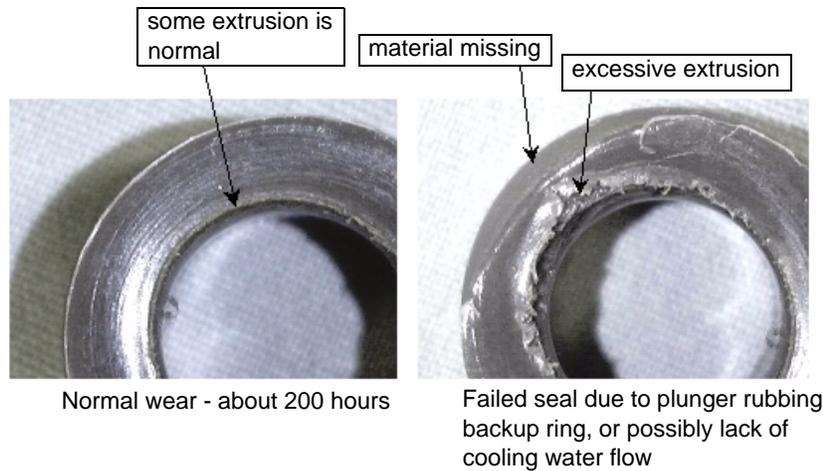


Figure 7-13: Dynamic Seal Inspection

8. Remove the Dynamic Seal Assembly from inside the end of the Displacer. Remove the Large O-ring from the outside of the Dynamic Seal. Separate the components of the Dynamic Seal Assembly by pushing the Dynamic Seal out of the Retainer. Remove the Small O-ring from inside the Retainer.

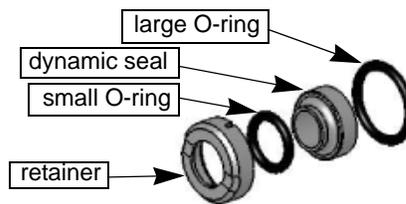


Figure 7-14: Dynamic Seal Assembly Components

9. Repeat steps 4-8 for the remaining two Backup Ring and Displacer Assemblies.
10. Since they are not reusable, discard the O-rings, the plastic ring seals, and the plastic Dynamic Seal of the Dynamic Seal Assembly. The metal Retainer is reusable.

## Inspecting the Backup Ring Assembly

If uneven dynamic seal extrusion or a dynamic seal failure occurred, the backup ring should be examined in detail to determine if plunger rubbing has occurred and if the associated plunger assembly needs to be replaced.

### Tool needed for inspection:

- magnifying glass

**To inspect the backup support ring assembly:**

1. With the magnifying glass, examine the edges and interior of the metal lip in the bore of the Backup Ring (Figure 7-16) adjacent to where the Dynamic Seal was positioned, especially if uneven or excessive extrusion of the Dynamic Seal was observed. The exterior edge of the short lip should be sharp and square with no nicks or gouges. There should be no evidence of rubbing on the lip.

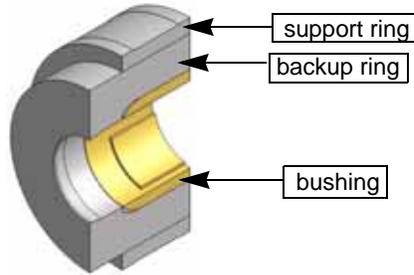


Figure 7-15: Backup Support Ring Assembly Components

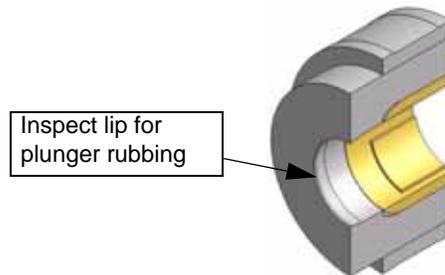


Figure 7-16: Backup Ring Inspection

2. Refer to the below illustration that shows both an undamaged and a severely damaged Backup Ring. The short lip should appear to be uniform in width all the way around. Any area where the width appears to be wider, or darker, or where the machining marks are scraped away, indicates where the lip has been rubbed by the plunger.

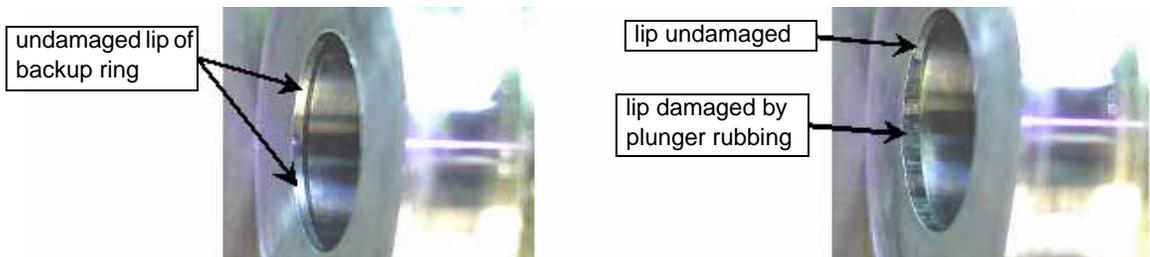


Figure 7-17: Example of Lip Damage to Backup Ring

**Note:** Whenever plunger rubbing has occurred, the plunger assembly must be replaced along with the dynamic seal and backup support ring assembly.

**Inspecting the Liquid Displacers**

**Tool needed for inspection:**

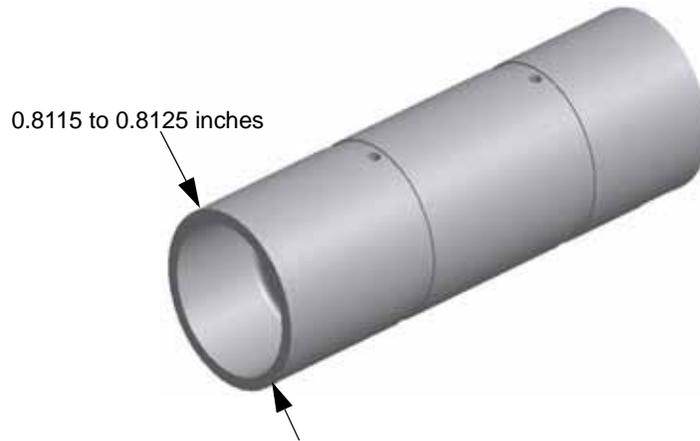
- 1-inch micrometer

The small flanges on each end of the liquid displacer should be 0.8115 to 0.8125 inches (20.61 to 20.64 mm) in diameter. If these diameters are undersized, leakage between the coolant housing and the cylinder could result.

**To inspect the liquid displacers:**

1. Clean the Liquid Displacers (Figure 7-18) and use the micrometer to measure the outside diameters of each Displacer end.
2. Any Displacer that measures less than 0.8115 inches (20.61 mm) in diameter on either end should be replaced.
3. Inspect the displacer edges on the ends to determine if the edges are sharp, free of any missing material, nicks, gouges, or burrs. Score marks from the cylinder bore are normal.

**WARNING!** *Do not attempt to smooth score marks by sanding, as this makes the diameter undersized.*



*Figure 7-18: Liquid Displacer Measurements*

## Disassembling and Inspecting the Check Valve Assembly

The following explains how to inspect the check valve components in a check valve assembly and replace the valve seats.

It is important to inspect the seats and mating surface of the check valve body. Worn or damaged seats must be replaced. Inspection is best performed with the aid of a magnifying glass. Water leaking past check valves can form jets that damage the check valve body.

**Caution:** *Do not run the OMAX pump if the output pressure begins to drop by more than 4-6 KSI from the original RPM. If the check valve seats are worn, continued pump operation can damage the check valve body.*

**Note:** *Replacing the check valve seats in all three cylinders at the same time is a good practice. Once one check valve seat has worn to the point of replacement, the others are quick to follow. To reduce overall downtime, replace the high-pressure seals and the check valve seats whenever the wet-end has been disassembled.*

### Tools needed to disassemble and inspect the Check Valve Assembly:

- 3/32" Allen wrench
- Magnifying glass
- 5/8" crows foot
- 1/2" wrench
- Propane torch
- Channel lock pliers
- Needle nose pliers
- OMAX removal tools (Figure 7-6)
- Soft-jawed vise

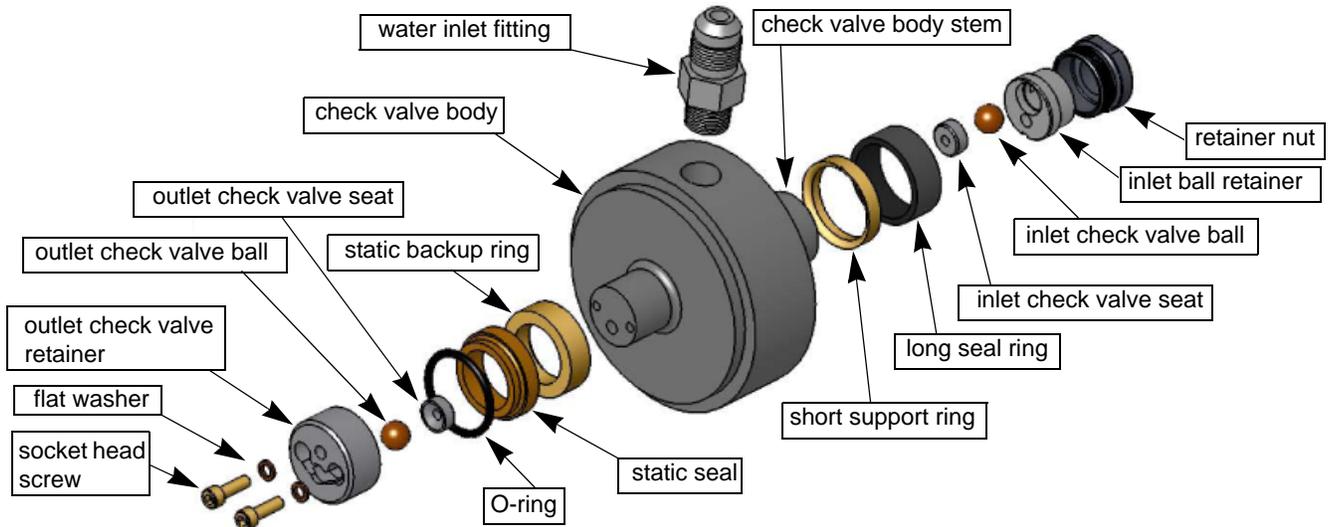


Figure 7-19: Check Valve Assembly Components

**To disassemble and inspect the check valve assembly:**

1. Begin disassembly of a Check Valve Assembly from the inlet (Cylinder) side. Clamp the Check Valve Body into the soft-jaws of a vise and, using the 5/8" crows foot, remove the Retainer Nut (Figure 7-20).

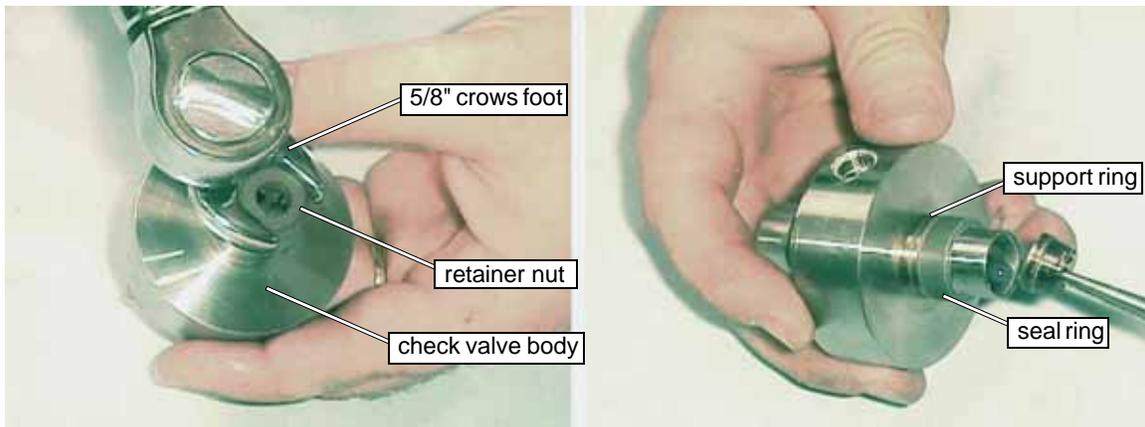


Figure 7-20: Removing the Retainer Nut from the Check Valve Body

2. Referring to Figure 7-19, remove the Inlet Ball Retainer, the Inlet Check Valve Ball, and the Check Valve Seat. A pair of needle nose pliers can be helpful when removing the Inlet Ball Retainer.
3. If the Seal Ring did not remain in the end of the Cylinder (Figure 7-1), remove it from the Check Valve Body Stem and discard it.
4. Inspect the Support Ring for cracks, chips or damage, particularly in the area around the center where it contacts the edge of the Cylinder. If no damage is found, there is no need to remove it, except at the recommended rebuild intervals. Minor scoring marks are permitted.

**Caution:** *Never attempt to remove scoring marks by sanding.*

5. If the Support Ring does not pass inspection or has reached its recommended replacement time, proceed to step #6.

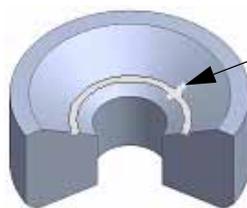
6. A small amount of the Short Seal Ring may have extruded under the Short Support Ring, locking it to the Check Valve Body Stem. To remove the Short Support Ring from the Check Valve Body Stem, use a propane torch to heat it slightly (20-30 seconds). This softens the plastic between the Check Valve Body Stem and the Short Support Ring, allowing it to be removed by hand using a rag or a pair of channel lock pliers.

**Caution:** *Once the short support ring has been heated, do not reuse it; the material softens and can no longer support the ring seal compression. Take care not to scratch the check valve body stem surface with pliers during this process.*



*Figure 7-21: Using a Propane Torch to Remove the Support Ring*

7. Inspect the outer diameter of the Check Valve Body Stem for indications of erosion.
8. Inspect for erosion on the surface that was against the Inlet Check Valve Seat. This may indicate leakage between the flat side of the Inlet Check Valve Seat and the Check Valve Body Stem, or leakage between the Inlet Check Valve Ball and Inlet Check Valve Seat.
9. Using the magnifying glass, inspect the Inlet Check Valve Ball for pitting or chipping. If pits, chips, or frosted spots are observed on the Ball surface, replace it.
10. Inspect the Inlet Check Valve Seat for erosion across the Inlet Check Valve Ball and on the flat sealing surface that contacts the Check Valve Body Stem. If erosion or damage is observed, replace the seats.



A polished band on the seat under the ball is normal. An erosion mark across the band is a leakage path.

*Figure 7-22: Inspecting the Valve Seat for Erosion Marks*

11. Turn the Check Valve Body over and remove the Socket Head Screws using the 3/32" Allen wrench. Also remove the Flat Washers and the Outlet Check Valve Retainer. The socket head screws and washers should be replaced according to the maintenance schedule.
12. Perform the same inspection of the Outlet Check Valve Ball and Outlet Check Valve Seat (See steps 7-11 above).
13. Carefully inspect the Check Valve Body Stem for indications of erosion on the surface contacting the Outlet Check Valve Seat. This may indicate leakage between the flat side of the Outlet Check Valve Seat and the Check Valve Body Stem, or leakage between the Outlet Check Valve Ball and Outlet Check Valve Seat.
14. Remove and discard the O-ring and Static Seal. Inspect the Static Backup Ring, ensuring that the edges are sharp and square with no nicks or gouges. Also, see if it is cracked near the notch and replace it whenever damage is apparent.
15. Clean the Check Valve Body Stem and the radius at its base.

16. If leaking was observed between either the Check Valve Body or the Manifold and Cylinder (Figure 7-1), check the radius at the base of the Check Valve Body Stems for fine cracks using the magnifying glass.

**Note:** Be careful not to confuse lines of discoloration with actual cracks.

17. If a pressure loss occurred without any external leakage, but the high-pressure cylinder runs very hot, the Check Valve Body is cracked internally, requiring replacement.
18. Always discard any damaged or eroded parts and replace them with new ones.
19. Repeat this procedure for the two remaining Check Valve Assemblies.

## Reassembling the Check Valve Assembly

The following procedure explains how to reassemble the Check Valve Assemblies (Figure 7-23).

### Tools needed:

- 3/32" Allen wrench
- 5/8" crows foot
- 0.124" diameter anti-rotation pin drill blank, 1/8" x 2 3/4" (OMAX P/N 202094)
- 250 in-lb. torque wrench
- 0.124" diameter anti-rotation pin
- Anti-seize compound (OMAX P/N 202563)
- Lubriplate (OMAX P/N 201304)
- Soft-jawed vise

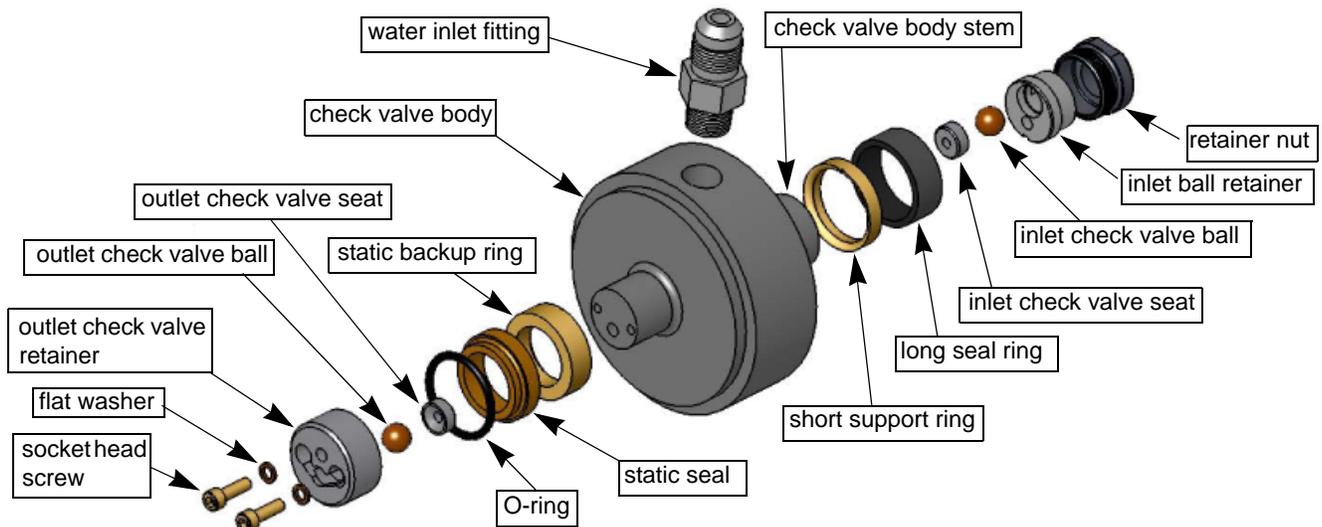


Figure 7-23: Check Valve Assembly Components

### To reassemble the check valve assembly:

1. Assemble the outlet side of the Check Valve Assembly first.
2. Apply Lubriplate to the O-ring. Place the Static Backup Ring, then the Static Seal, and then the O-ring onto the outlet side of the Check Valve Body.

**Note:** The outlet side of the Check Valve Body has three holes in the end of the stem (Figure 7-24). The notch and chamfer on one side of the Static Backup Ring faces toward the Check Valve Body.

3. Apply anti-seize lubricant to the threads of the two Socket Head Screws. Install the Flat Washers and the two Socket Head Screws through the Outlet Check Valve Retainer (Figure 7-24):

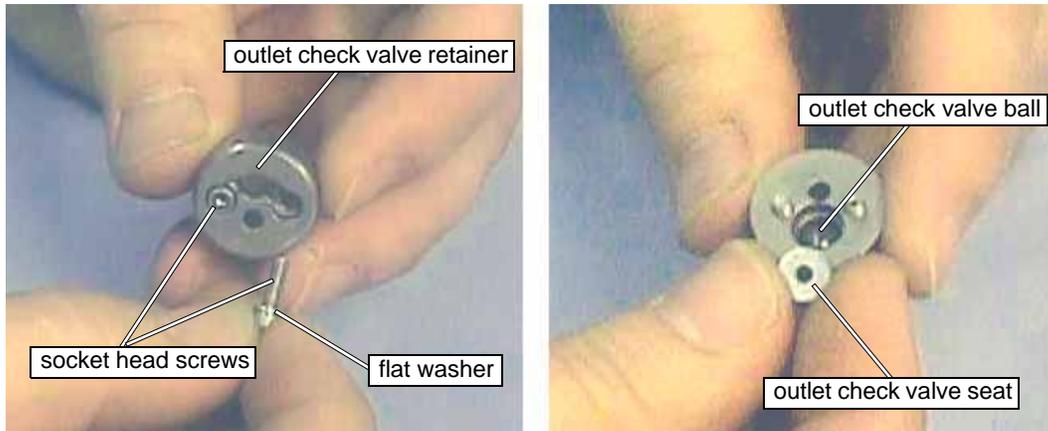


Figure 7-24: Inserting the Socket Head Screws

4. Place the Outlet Check Valve Ball followed by the Outlet Check Valve Seat in the Outlet Check Valve Retainer. Be sure that the flat side of the Outlet Check Valve Seat faces away from the ball. The Outlet Check Valve Seat should be flush, or no more than 0.001" (0.0254 mm) above, the surface of the Outlet Check Valve Retainer.
5. Place the assembled Outlet Check Valve Retainer on the outlet end of the Check Valve Body Stem with the Outlet Check Valve Seat up against the end of the stem (Figure 7-25).

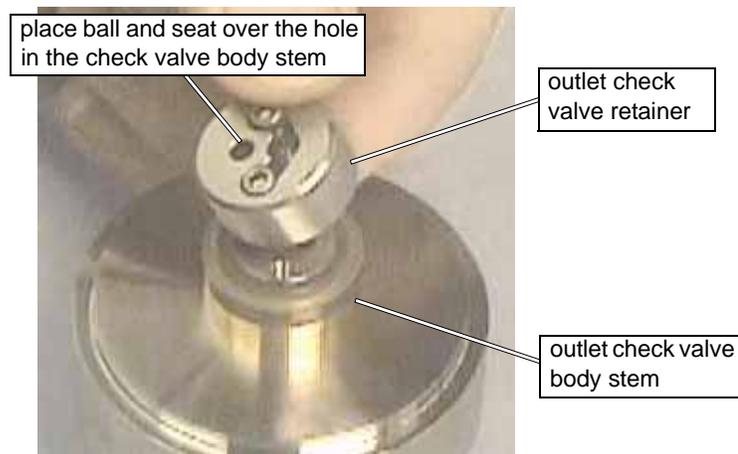


Figure 7-25: Placing the Outlet Check Valve Retainer on the Check Valve Body Stem

**WARNING!** *Ensure that the hole through the outlet check valve seat lines up with the hole in the outlet check valve body stem. The outlet retainer can inadvertently be installed 180 degrees out of its required position. Always ensure that the hole through the outlet check valve seat lines up with the hole in the end of the check valve body stem.*

6. Using the 3/32" Allen wrench, tighten the two Socket Head Screws from 3 to 5 in-lbs (.34 to .57 N-m). Holding the Allen wrench as shown in Figure 7-26 prevents over tightening the screws.

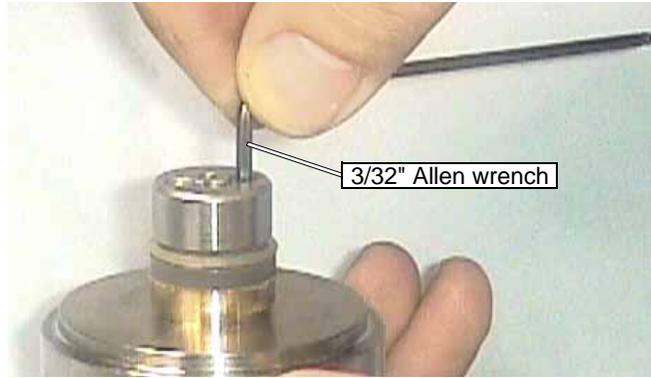


Figure 7-26: Tightening the Socket Head Screws

7. Repeat steps 1 through 6 for the remaining Check Valve Body Assemblies.
8. Next, begin assembling the inlet side of the Check Valve Body Assembly. This is the side with the threaded pocket and two holes (Figure 7-27).
9. Install the Short Support Ring, with the small notch facing down, over the outside of the Check Valve Body Stem on the inlet side.

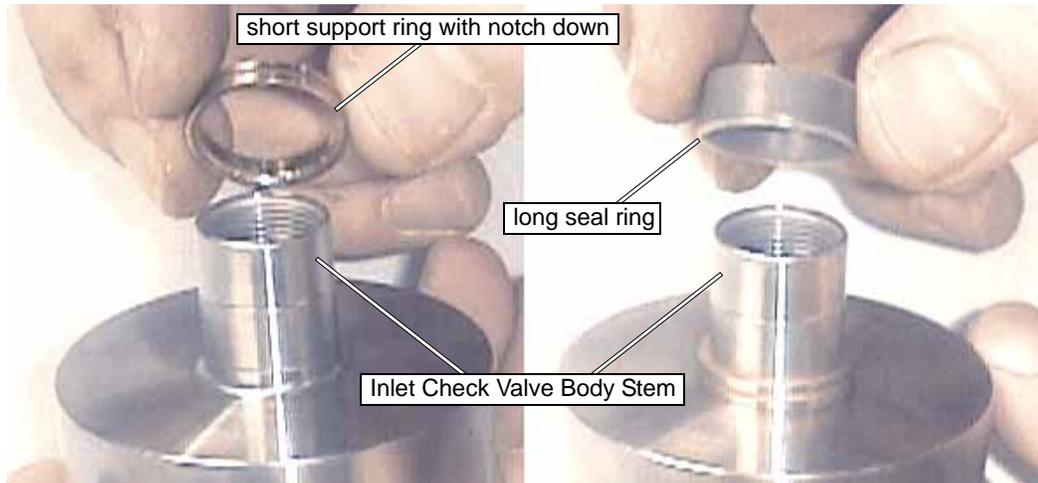


Figure 7-27: Installing the Short Support Ring

10. Install the Long Seal Ring over the outside of the Stem (Figure 7-27).
11. Next, insert the Inlet Check Valve Ball followed by the Seat into the Inlet Ball Retainer (Figure 7-28). Be sure the flat side of the Seat faces away from the ball.

**Note:** The inlet check valve seat normally protrudes well above the face of the ball retainer.

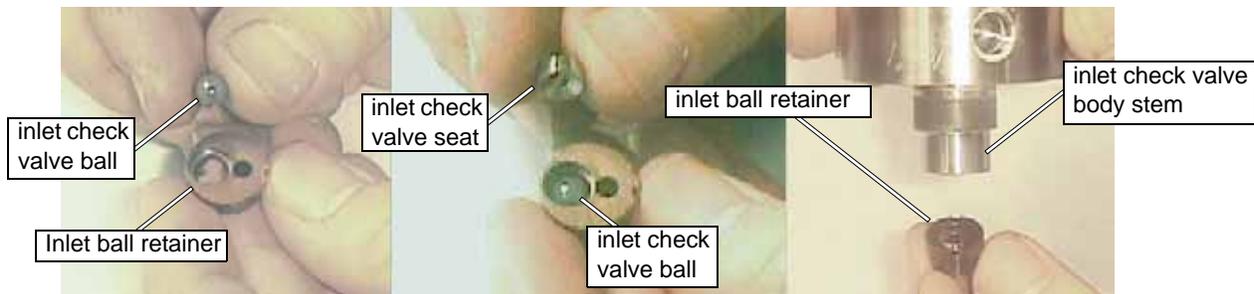


Figure 7-28: Inserting the Check Valve Ball and Check Valve Seat into the Inlet Ball Retainer

12. Hold the Check Valve Body so its stem is facing down to enable insertion of the assembled Inlet Ball Retainer (Figure 7-28).

**Note:** An alignment pin inside the pocket of the check valve body is designed to fit into a slot machined on the outside of the retainer. Be sure to engage the alignment pin into this slot. Do not turn the assembly over until the retainer is fully engaged into the slot. When correctly installed, the inlet ball retainer will be almost flush with the end of the check valve body stem.

13. Apply anti-seize compound to the threads of the Retainer Nut and to the bottom face that contacts the Inlet Ball Retainer (Figure 7-29).

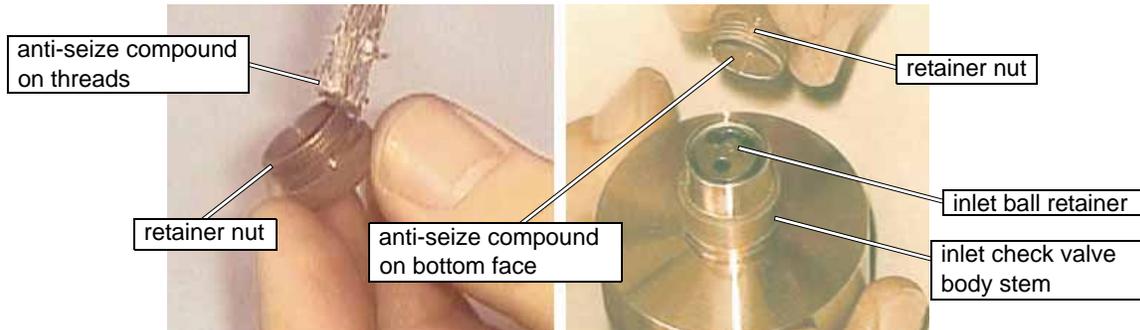


Figure 7-29: Applying Anti-seize Compound to Threads and Bottom Face of Retainer Nut

14. Screw the Retainer Nut over the Inlet Ball Retainer and into the threaded Inlet Check Valve Body Stem. Hand tighten.
15. Apply a light coat of Lubriplate to the 0.124" diameter anti-rotation pin and insert it through the outlet port of the Check Valve Retainer and into the Check Valve Body. Clamp the outside diameter of the Check Valve Body in the soft-jaws of a vise and torque the Retainer Nut to 200 in-lbs (22.6 Nm) using a 5/8" crows foot (Figure 7-30):



Figure 7-30: Installing the Inlet Retainer Nut

16. Remove the anti-rotation pin.

**Note:** This may require clamping the pin in a vise and pulling on the check valve body.

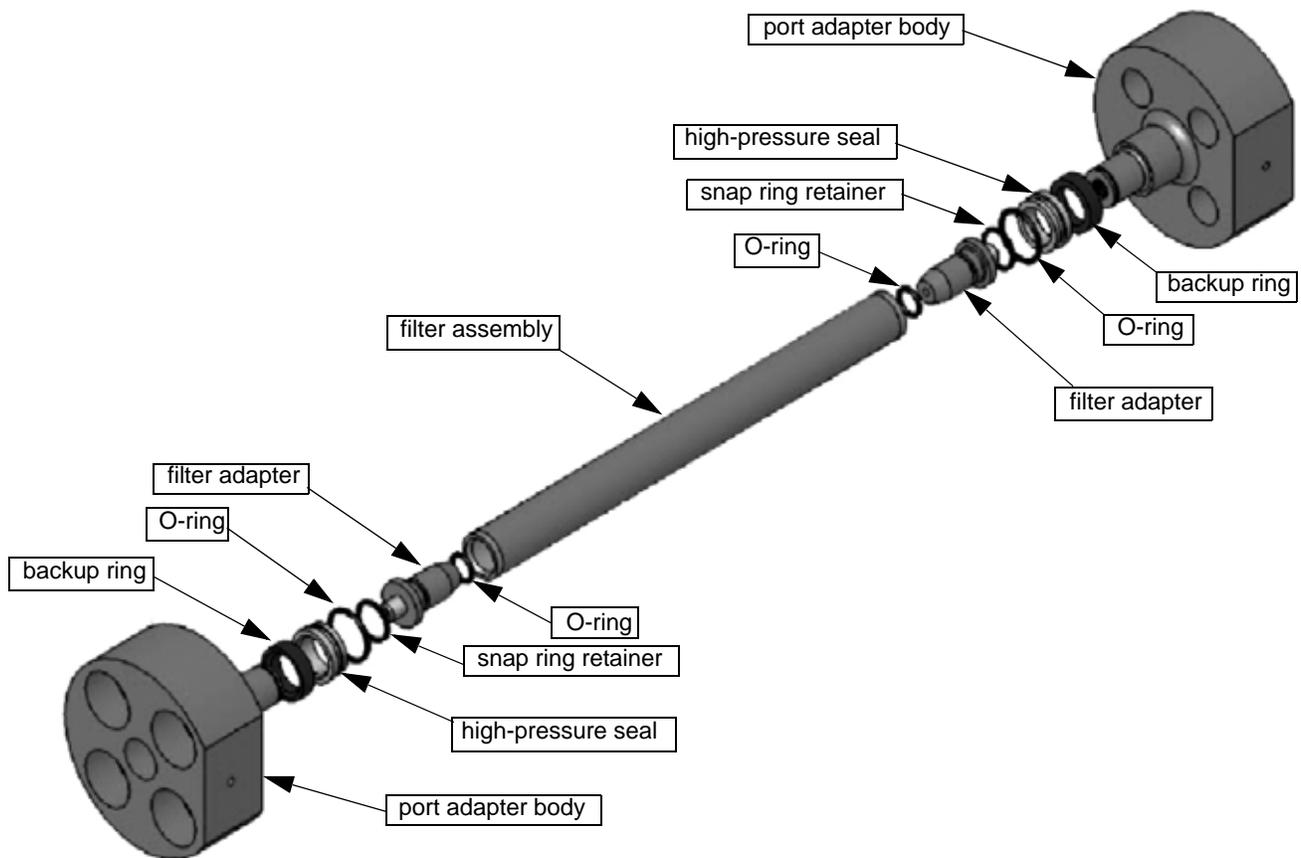
17. Repeat the above assembly procedures for the remaining two Check Valve Assemblies.

## Replacing the High-pressure Port Adapter Seals and Filter

The port adapter high-pressure seals should be replaced at each pump rebuild, or at any time excessive leakage occurs between the manifold and port adapters. The pump in-line filter provides additional protection for the orifice assembly in the nozzle and dump valve. This filter should be replaced at every pump rebuild.

**Tools required to replace the high-pressure port adapter seals and filter:**

- 14 mm Allen wrench
- 5/8" open-end wrench
- Soft-blow mallet
- Two large flat-tipped screwdrivers
- Small flat-tipped screwdriver
- External snap ring pliers
- Torque wench capable of 100 ft-lbs
- Lubriplate (OMAX P/N 201304)
- Anti-seize compound (OMAX P/N 202563)
- Soft-jawed vise



*Figure 7-31: Port Adapter and Filter Assembly Components*

**To replace the High-pressure Port Adapter Seals and Filter**

1. Place the Manifold body (Figure 7-1) into a vise.
2. Using the 14 mm Allen wrench, remove the four Socket Head Screws (Figure 7-1) from both Port Adapters.
3. With the soft-blow mallet, strike the Port Adapter on each side until a gap opens between the Manifold and Port Adapter.
4. With two flat-tipped screwdrivers, pry the Port Adapter out of the Manifold. Follow the same procedure to remove the second Port Adapter.

**Caution:** *Avoid scoring the metal components or damaging the filter.*

5. Remove the Filter Assembly. Using the 5/8" open-end wrench, remove the Filter Adapters from each Port Adapter.
6. Remove the Snap Ring Retainer from the end of the Port Adapter stem using the snap ring pliers. Slide the High-pressure Seal, O-ring, and Backup Ring off the stem of the Port Adapter Body. Discard the High-pressure Seal and O-ring.
7. Clean the Backup Ring and Port Adapter. Examine the edges of the Backup Ring to determine if the edges are square and sharp. Check the Backup Ring for cracks near the notch. Replace the backup ring whenever problems are apparent.
8. Install the Backup Ring onto the stem of the Port Adapter with the chamfer on the inside of the backup ring facing toward the Port Adapter Body.
9. Place a small amount of Lubriplate on the new O-ring and install it on a new High-pressure Seal. Slide the High-pressure Seal onto the stem of the Port Adapter Body such that the large diameter portion of the High-pressure Seal is next to the Backup Ring.
10. Install the Snap Ring Retainer.
11. Place a small amount of Lubriplate on the O-ring and install it into the O-ring groove on the Filter Adapter. Thread the Filter Adapter into the stem of the Port Adapter body. Tighten until just snug using the 5/8" open-end wrench.
12. Repeat the above rebuild procedure for the remaining Port Adapter Assembly.
13. Install the Filter Assembly on one of the Port Adapters by sliding it over the end of the Filter Adapter until the Filter Adapter rests against Filter Adapter shoulder.
14. Apply a small amount of Lubriplate into the bores on the Manifold.
15. Position the Port Adapters with its flat side of the body facing away from the direction of the Cylinders (Figure 7-1).

**Note:** *Either Port Adapter can be installed first. As the second one is being installed, ensure that it engages into the filter assembly properly without being forced and causing damage. Tapping the end of the port adapter lightly with a soft-blow mallet may be required to seat it completely into the manifold.*

16. Place the Manifold assembly onto a flat surface with the Check Valve (Figure 7-1) ports facing up. Apply a small amount of anti-seize lubricant to the threads of the four Socket Head Screws (Figure 7-1) and tighten them sufficiently to hold the Port Adapters in place. Secure the Manifold assembly into a vise and torque each Socket Head Screw to 100 ft.-lbs (135 N-m).

## Reassembly of the High-pressure Wet-end Assembly

**Note:** This section provides procedures for the complete reassembly of the pump wet-end. It is very important that all parts are kept clean. In general, all the high-pressure wet-end parts for the OMAX pump may be cleaned by simply wiping them with a clean lint-free rag and blowing them off with shop air. Remember, any dirt left in the pump can pass through the nozzle, possibly damaging it. Clean all parts and assemble the pump components in a clean environment.

Whenever the high-pressure wet-end of the pump has been disassembled:

- Prior to starting the pump, always remove the nozzle assembly from the plumbing to prevent debris from damaging or plugging the orifice. Run the pump for ten minutes without the nozzle to clear out any debris after reassembly.
- Always inspect all parts and replace the high-pressure seals as a set.
- Carefully wipe each part clean with a lint-free rag and blow them out with compressed air.
- Never tighten or loosen plumbing while under pressure.

**Tools needed for reassembly of the high-pressure wet-end assembly:**

- Soft mallet
- Lubriplate (OMAX P/N 201304)

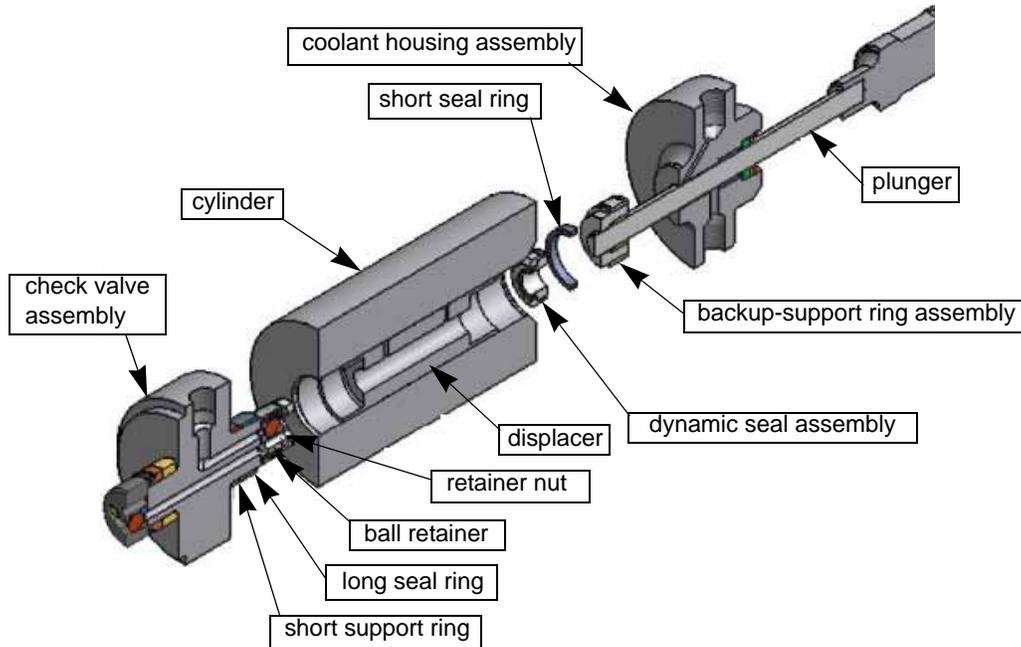


Figure 7-32: High-pressure Wet-end Assembly Components

**To re-assemble the high-pressure wet-end assembly:**

1. Apply a light coat of Lubriplate (#201304) to the interior of the holes on the pressure Manifold (Figure 7-1) and to the Check Valve Body (Figure 7-23) outlet side O-ring and Static Seal.
2. Install all three assembled Check Valve Bodies into the pressure Manifold.

**Note:** Because of pins in the pressure manifold, check valve bodies can be installed in only one position.

3. Place the Displacer over the Inlet Check Valve Retainer (Figure 7-23) until it contacts the Long Seal Ring (Figure 7-32). Repeat this for all three Check Valve Assemblies.

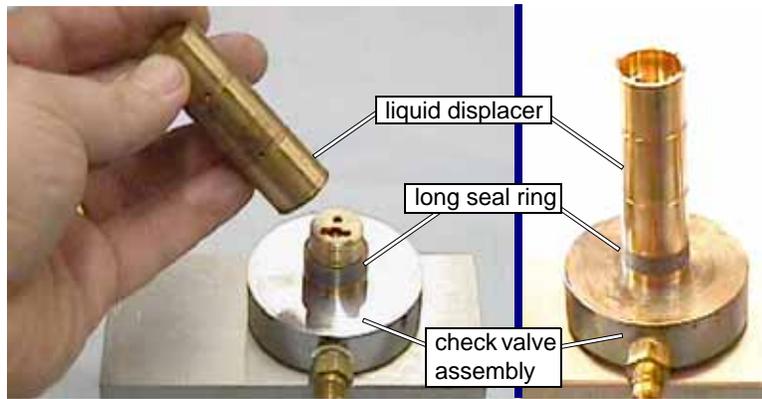


Figure 7-33: Installing the Liquid Displacer on the Check Valve Assembly

**Caution:** *If the wrong end of the liquid displacer is installed on the check valve assembly, a large gap appears between the displacer and the seal ring. See Figure 7-34. The end of the displacer must make contact with the seal ring.*

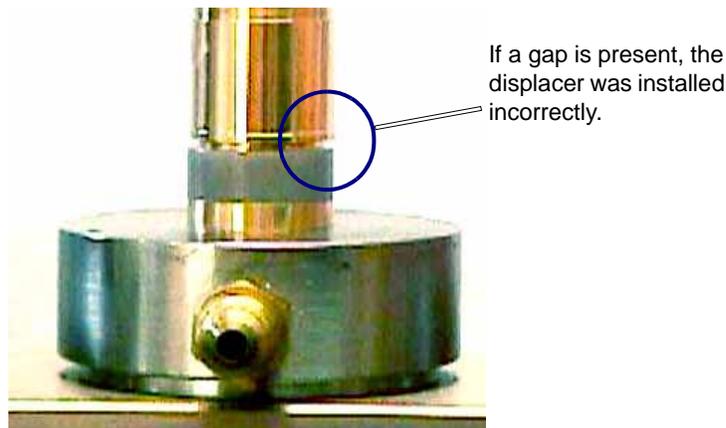


Figure 7-34: Reversed Displacer Example

4. Apply a light coat of Lubriplate (#201304) just inside the bore of the Cylinder and on the end of the cylinder without the large chamfer (Figure 7-35). Slide the Cylinder over the Displacer, Long Seal Ring, and Short Support Ring until it comes in contact with the Check Valve Body.
5. Verify that the end of the Cylinder **without** the large chamfer is against the Check Valve Body.

**Caution:** *The liquid displacer provides a close tolerance fit inside the bore of the cylinders; however, the cylinder should slide easily over the displacer if the cylinder is kept square with the displacer. It may be necessary to press firmly on the cylinder to push it over the seal ring. If the support ring was not removed during maintenance, the cylinder may not slide over it by hand. In this situation, place a rag over the open end of the cylinder and tap it into place with a soft mallet.*



Figure 7-35: Sliding the Cylinder over the Displacer

6. Repeat steps #3 through #5 for the remaining cylinders.
7. Set the Wet-end Assembly aside until it is time to reassemble the Pump.

## Replacing the Water Coolant Housing Seal

The low-pressure seal in the coolant housing should be replaced at every rebuild of the pump.

### Tools needed to replace the water coolant housing seal:

- internal snap ring pliers
- small screwdriver
- Lubriplate (OMAX P/N 201304)

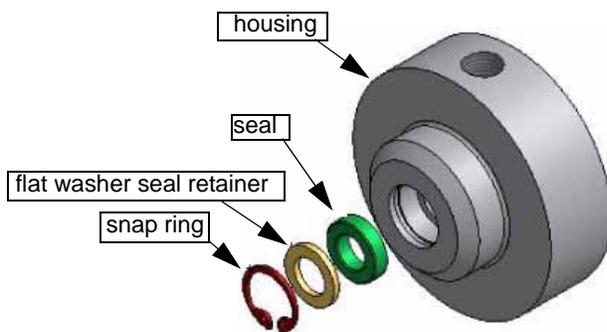


Figure 7-36: Coolant Housing Assembly Components

**To replace the water coolant housing seal:**

1. Remove the Coolant Housing Assemblies (Figure 7-37) by sliding them forward until they clear the end of the Plungers. The Coolant Housing fits snugly to the bore in the Adapter Block (Figure 7-37) and may be difficult to remove. Use the two Fittings, top and bottom, of the Coolant Housing to rotate the assembly while removing it. During removal, keep it aligned with the bore.

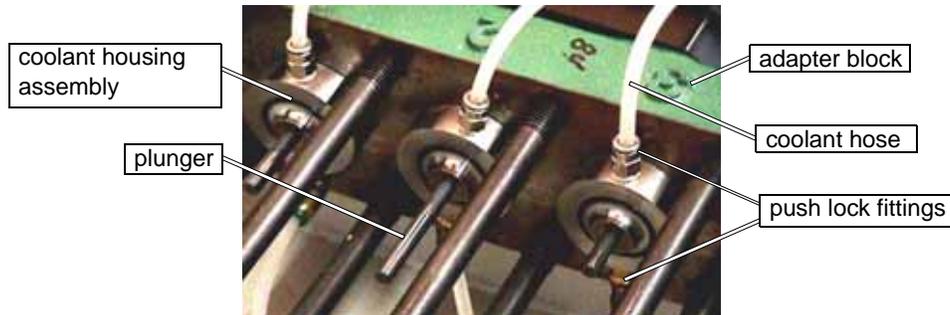


Figure 7-37: Removing the Coolant Housing Assemblies

2. After removing the Coolant Housing, pull the Coolant Hoses out of the Push Lock Fittings by pulling back on the outer ring of the fitting to release the locking device within the Fitting while pulling on the Coolant Hose.
3. Remove the Snap Ring (Figure 7-36) with the set of internal snap ring pliers. Use the small screwdriver to lift the Flat Washer Seal Retainer out of Housing bore. Remove the Seal in the same fashion.
4. Apply a small amount of Lubriplate to the lip of the new Seal and install it with the pressure lip, or cup, facing into the Coolant Housing, followed by the Flat Washer Seal Retainer and the Snap Ring.

**Caution:** *The snap ring must be fully engaged in the snap ring groove. If not fully engaged, it can contact the plunger, damaging its surface.*

5. Set the Coolant Housing Assemblies aside for later pump assembly.

## Removing Plunger Assemblies

Removal and inspection of the pump plungers is necessary only if plunger rubbing of the backup ring occurred. Rubbing may be expected if the dynamic seal indicates the plunger was out of alignment, or if the backup ring indicates plunger rubbing.

**Caution:** *Damaged plungers ALWAYS cause premature dynamic seal failure.*

Plunger damage can easily be seen with the naked eye, or with a low-power magnifying glass. It is usually caused by the plunger rubbing on the backup ring or by foreign material in the pump. Whenever a plunger rubs the backup ring, metal adheres to the plunger surface. With extreme rubbing, a rough area showing discoloration of the plunger surface develops.

**Note:** *Once plunger rubbing has occurred, the plunger assembly must be replaced along with the dynamic seal and backup ring. If material is missing from the plunger surface, the plunger assembly, backup ring and coolant housing seal must also be replaced along with the dynamic seal.*

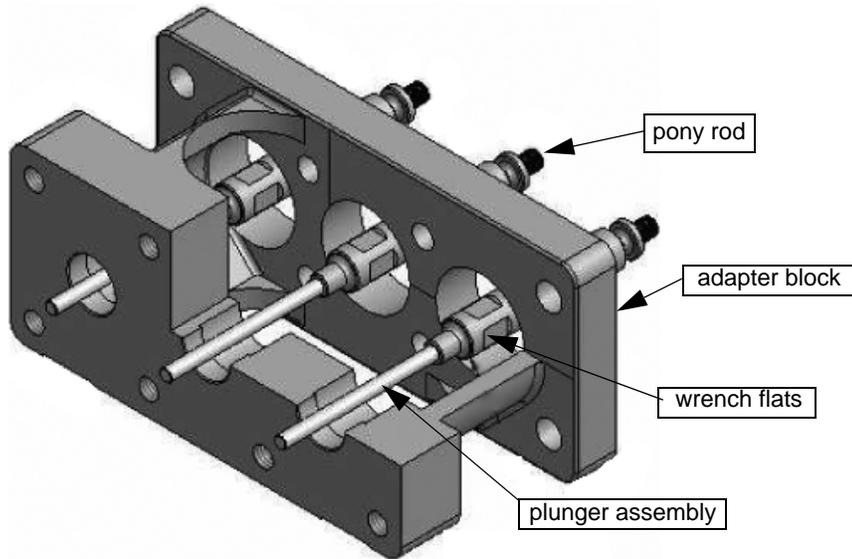


Figure 7-38: Adapter Block, Pony Rod and Plunger Assembly

**Tools needed to remove the plunger assemblies:**

- 3/4" crows foot, 3/8" drive
- 3/8" drive breaker bar

**To remove the plunger assemblies:**

1. Remove the Coolant Housings (Figure 7-37), if not already removed.
2. Access to the Wrench Flats on the Plunger Assemblies is through an opening in the top of the Adapter Block. Remove the metal Cover Plate (Figure 7-1) on top of the adapter block and set it aside.
3. Remove the Access Cover Plate on the vertical end of the Belt Guard to gain access to the pulley on the pump crankshaft.



Figure 7-39: Access Cover Plate on Top of Pump Belt Guard

4. Use the belt pulley to rotate the pump crankshaft by hand until the plunger being removed is positioned at bottom dead-center (fully retracted). Only two of the plunger assemblies are accessible at a time.
5. Use the 3/4" crows foot on a 3/8" drive breaker bar with a steady pull to loosen the Plunger Assembly. Avoid jamming the wrench and permanently bending the Plunger Assembly.

## Reinstalling Plunger Assemblies

### Tools needed to reinstall plunger assemblies:

- 3/4" crows foot, 3/8" drive
- 250 in-lbs (28 N-m), 3/8" drive torque wrench
- Anti-seize lubricant (OMAX P/N 202563)

### To reinstall the pony rod and plunger assemblies:

1. Ensure that the threads on the Plunger Assemblies (Figure 7-38) and the face and threads of the pistons in the crankcase are clean.
2. Apply the anti-seize lubricant to the mounting face and threads of the Pony Rods.
3. Install the Plunger Assemblies into the crankcase and hand tighten.
4. Rotate the pump crankshaft so the Plunger is at bottom dead-center.

**Caution:** *The plunger must be at bottom dead-center (fully retracted) when being tightened to avoid bending the plunger assembly.*

5. Using a 3/4" crow's foot and torque wrench, tighten each assembly to a torque of 225 in-lb, or 19 ft.-lb (25 N-m).

## Assembling the Dynamic Seal Assembly

The high-pressure dynamic seal assembly is assembled as follows.

### Tools needed to assemble the dynamic seal assembly:

- Arbor press
- Lubriplate (OMAX P/N 201304)

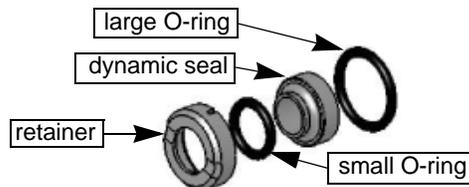


Figure 7-40: Dynamic Seal Assembly Components

### To assemble the dynamic seal assembly:

1. Place the Small O-ring on the extended lip of the Dynamic Seal.
2. Apply a small amount of Lubriplate to the outside of the Small O-ring.
3. Snap the metal Retainer over the Small O-ring onto the Dynamic Seal. The Retainer must be held square and may require some force to snap into place. An Arbor press may be used to lightly press the retainer onto the dynamic seal.
4. Place the Large O-ring over the outside of the back of the Dynamic Seal.

## Reassembling the Pump

This section provides procedures for reassembling the OMAX pump.

**WARNING!** *After the pump is reassembled, the crankcase should be turned over by hand to verify all plungers reach their full stroke without contacting the check valve retainers. BE CAREFUL NOT TO CATCH ANY FINGERS BETWEEN THE DRIVE BELT AND SPROCKETS.*

### Tools needed to reassemble the pump:

- ½" wrench
- 9/16" wrench
- 13/16" wrench
- 1" open end wrench
- 24 mm metric socket or 15/16" socket, ½" drive
- ½" drive ratchet wrench
- Torque wrench capable of more than 175 ft.-lbs (235 N-m)
- Extreme pressure lube (OMAX P/N 202496)
- OMAX Removal/Installation Tool (see Figure 7-6)

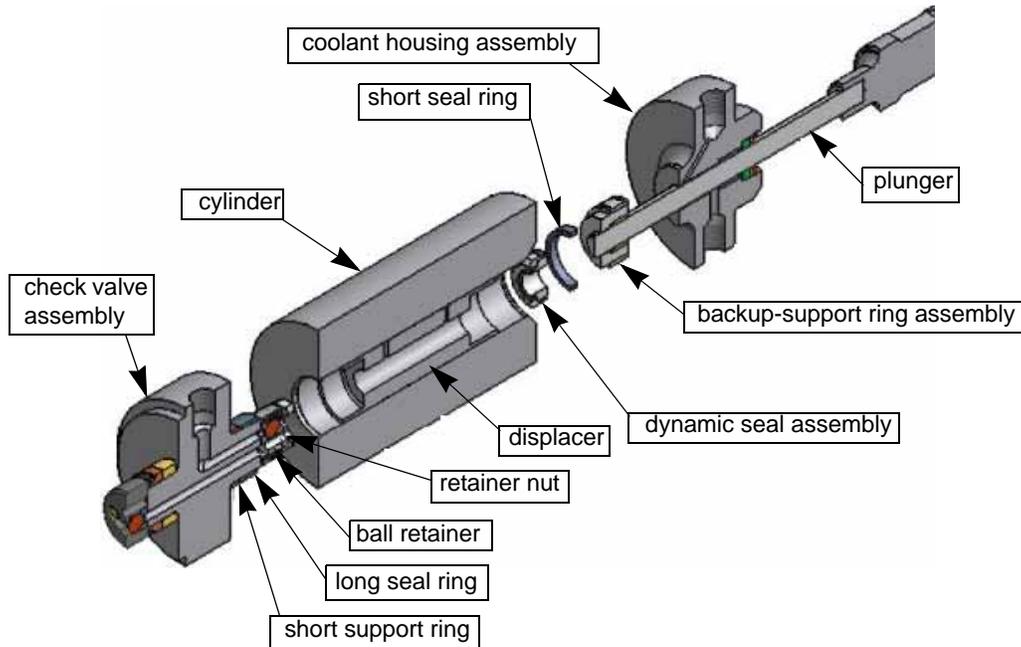


Figure 7-41: High-pressure Wet-end Assembly

### To reassemble the OMAX pump:

1. For convenience, rotate the pump Crankshaft until the center Plunger is at top dead center (maximum extension). The ends of the other two Plungers should then be even and extend out far enough for assembly of the wet-end without further rotation of the crankshaft.
2. Apply a light coat of extreme pressure lube (or Blue Goop) to the area of the Coolant Housing Assembly that engages into the Cylinder bore.
3. Slide the Coolant Housing Assembly over the Plunger until it is fully engaged into the bore in the Adapter Block (Figure 7-42). Note that the plunger is not rigidly held and can be moved slightly for alignment with the Coolant Housing Assembly.

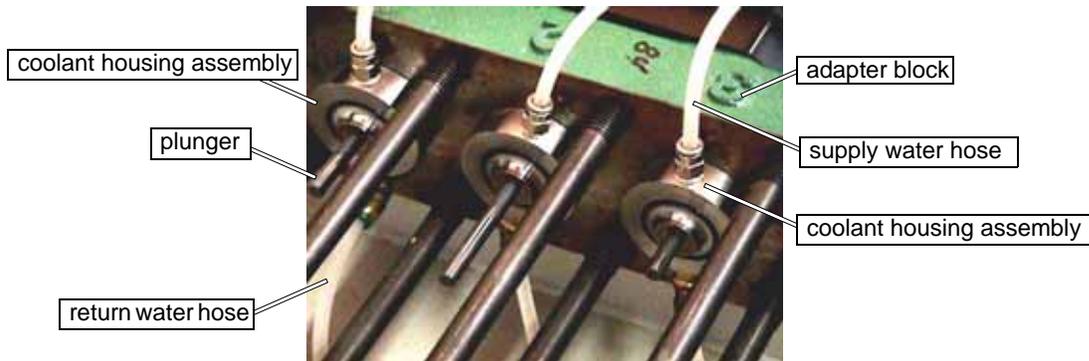


Figure 7-42: Coolant Housing Assembly Installation and Hose Connections

- Trim the ends of the low-pressure water supply and return hoses square and back about ¼". Install them into the push lock fitting on the coolant housing assemblies.

**Note:** Hoses from the low-pressure supply manifold block should be connected to the upper fittings on the coolant housings. The hoses connected to the lower fittings should return water to the water tank.

- Slide the Short Seal Ring onto the Backup-support Ring Assembly and up against the support ring.



Figure 7-43: Installing the Short Ring Seal onto the Backup-Support Ring Assembly

- Slide the Backup-support Ring Assemblies onto the Plungers with the black bushing inside the Backup-support Rings toward the Coolant Housing Assembly. Push the Backup-support Ring Assembly down the Plunger until it rests against the Coolant Housing Assembly:

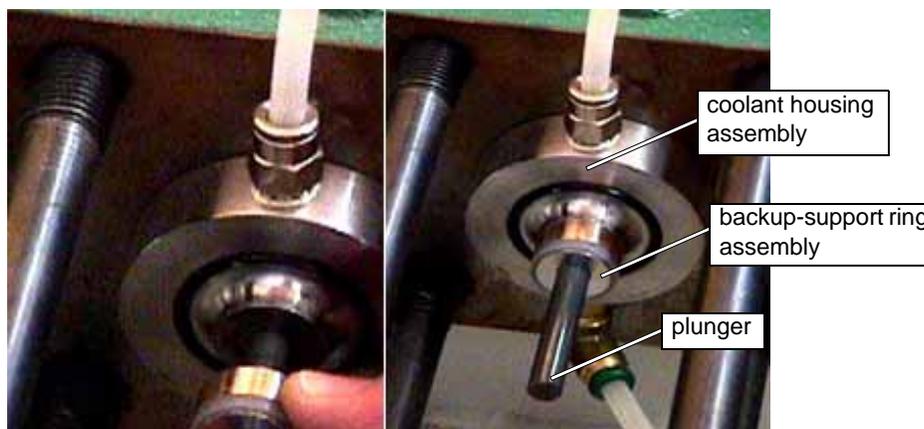


Figure 7-44: Sliding the Backup-support Ring Assembly onto the Plunger

7. Slide the assembled Dynamic Seal Assembly onto the Plunger until it rests against the Backup-support Ring Assembly. The flat end of the Dynamic Seal Assembly must be against the Backup-support Ring Assembly, and the metal retainer must be on the side away from the Backup-support Ring Assembly.

**Note:** The dynamic seal assembly is an interference fit on the plunger. It can be difficult to install at times. You may find it helpful to use the OMAX installation and removal tool (Figure 7-6) as a push tool to install the dynamic seal assembly.

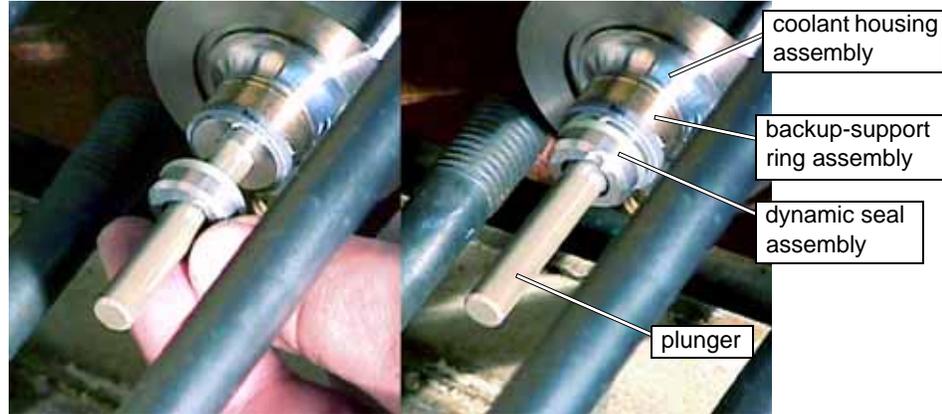


Figure 7-45: Sliding the Dynamic Seal Assembly onto the Plunger

8. Apply a light coating of Lubriplate to the exterior surface of the outer ring on the Backup-support Ring Assemblies.
9. Slide the Wet-end Assembly previously set aside over the Plungers. After starting to slide the Wet-end Assembly into position, do not pull the Wet-end Assembly back or cock it as this could cause internal components to dislodge from their assembled position. As the Cylinders begin to slide over the Short Seal Rings (Figure 7-46), they may, or may not go on all the way by hand. The small gap that occurs between the end of the Cylinders and the Coolant Housings Assemblies closes when the Wet-end Assembly is correctly torqued.



Figure 7-46: Sliding the Wet-end Assembly over the Plungers

10. Install the Clamp Plate and two Nuts on the Studs numbered 1 and 2 in Figure 7-47, using a generous amount of anti-seize compound on both the Stud threads and the side of the Nuts that face the Clamp Plate. Tighten the two Nuts evenly until they are snug. An even gap of approximately 0.070" (1.78 mm) should remain between the end of the Cylinders and the Coolant Housing Assemblies. Install the remaining Nuts hand tight, again using a generous amount of anti-seize on the Stud threads and Nut faces.

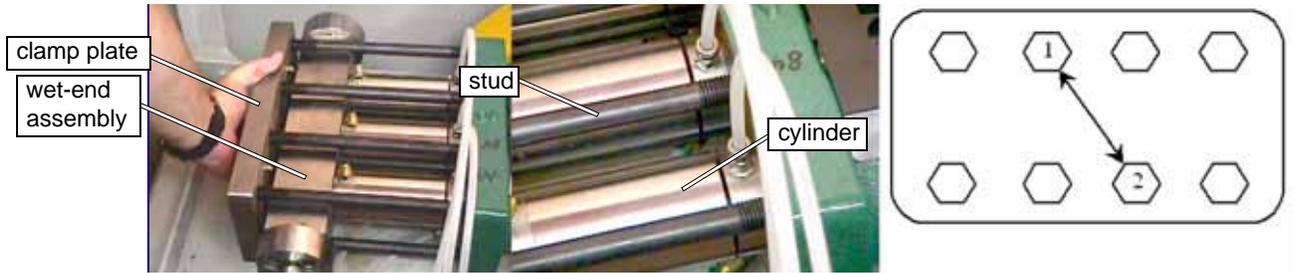


Figure 7-47: Installing the Clamp Plate

**Caution:** *It is extremely important that sufficient anti-seize compound be used to lubricate the threads and surface between the nut and clamp plate so that the torque applied properly loads the ring seals and studs.*

- To ensure that an evenly distributed load is developed on the Clamp Plate and Cylinders, torque each Nut one-half turn in succession, using a torque wrench and following the tightening sequence specified below, until a torque of 175 ft.-lb. (237 N-m) is achieved on each Nut.

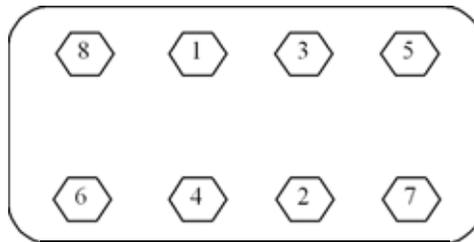


Figure 7-48: Clamp Plate Torque Sequence for Clamp Plate Nuts

**Caution:** *Verify that all nuts are tightened evenly in the order specified in Figure 7-48 to avoid internal component damage and to achieve an even loading of the ring seals and studs.*

- Rotate the pump Crankshaft by hand until each Plunger crosses top dead-center to ensure the Plungers clear the inlet retainers and no binding exists in the Wet-end assembly that prevents a smooth rotation.
- Reinstall the access cover onto the belt guard (Figure 7-39).
- Complete the Pump assembly by connecting the outlet high-pressure tubing and low-pressure inlet hoses.

# Maintaining the Water Filtration System

Proper maintenance of the four water filters in your OMAX low-pressure water system directly impacts the performance of your OMAX machine.

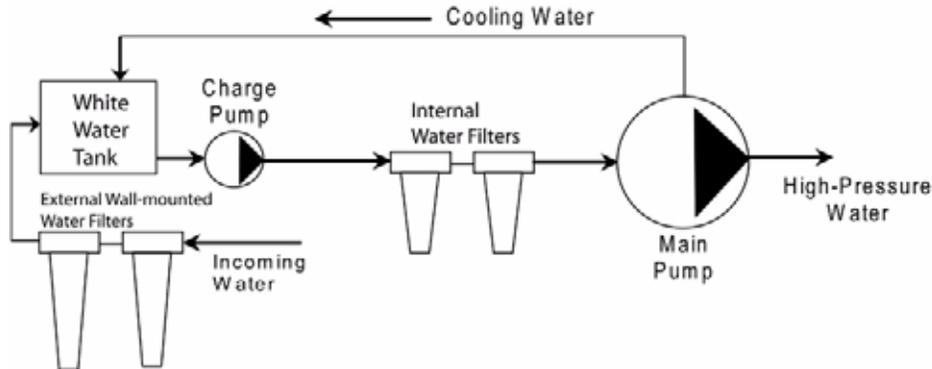


Figure 7-49: The Low-pressure Water Filtration System

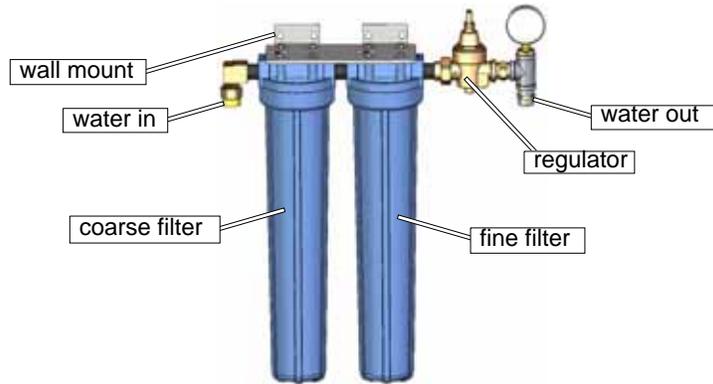


Figure 7-50: Incoming Water Filters - Wall Mounted

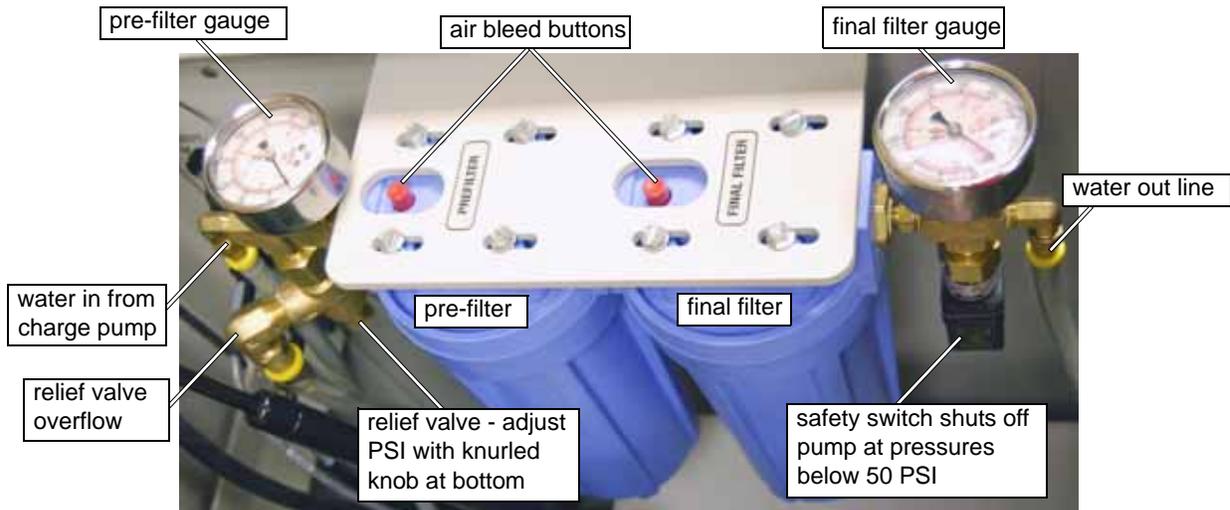


Figure 7-51: Pump Internal Water Filtration System

**How the low pressure water system filtration works:**

1. Water from your local source is piped into your building and is plumbed to two OMAX wall-mounted pre-filters (a 20 micron “course” filter and a 5 micron “fine” filter). See Figure 7-50.

**Note:** *Additional systems such as a Reverse Osmosis, a water softener, or an EBBCO closed loop system may be installed at this point for additional water treatment when needed.*

2. This filtered water then flows to the white reservoir tank (Figure 7-53) located under the crankcase in the pump cabinet.
3. When the Charge Pump is turned On, water from the white tank reservoir feeds the preconditioned water to the 10” blue filters in the pump cabinet (Figure 7-51).

**Note:** *The pre-filter gauge (Figure 7-51) reads the pressure of the charge pump before the filters (Pressure should read higher than 75 psi and can be adjusted up to 120 psi)*

4. Water is pulled by the charge pump from the white tank reservoir through a 200 mesh strainer (OMAX P/N 200935) and pumped to the pre-filter (1 micron), through the 2nd final filter (.45 microns), and then into the pump.
5. The final filter gauge reads the pressure after both filters have filtered the water.

**Note:** *The difference in pressure between the gauges when the pump is running at high RPM determines filter status. When the pressure difference between the gauges is more than 20 psi with the pump running at high RPM, the filters are becoming clogged and should be replaced. Always change both filters. When filters are new, the difference in pressure between the two gauges is close to zero.*

**Preventing problems in the low-pressure water system:**

When the low-pressure water system is not maintained properly, the following error message can appear: “Charge pump pressure low.” This message is typically caused by the charge pump not being able to develop sufficient water pressure, triggering the 50 PSI low pressure switch, causing the high-pressure pump to shut down and the “Charge pump pressure low” message to appear.

This situation can be prevented by following these suggestions for filter maintenance:

- When one filter requires replacement, change all four filters.
- Change the 20” wall filters monthly or until a specific replacement interval can be determined.
- Increase the interval between wall filter changes until the 10” blue pump filter interval starts to fall (when running at high RPM). Use this as a baseline for the interval for the wall filter changes.
- If the pressure difference between the gauges is more than 20 psi when running the pump at high RPM, change the pump’s 10” blue filters.
- Record the time between all filter changes.
- Clean the 200 mesh strainer in the Charge Pump reservoir every 3 months or more frequently if needed.

**Note:** *If problems with your water supply are suspected, send a sample of water from the white reservoir tank in the pump to OMAX for a water test. Take the sample after running the pump for approximately 20 minutes. This sample will let you know if additional water treatment may be required.*

**Changing Water Filter Cartridges**

The OMAX pump uses two filters for the low-pressure water from the water tank (Figure 7-52). Pressure gauges mounted on top of these water filters monitor the water pressure both before and after the two filters. When the pressure differences between these two gauges becomes greater than 20 psi (140 kPa), the filter cartridges need replacing.



Figure 7-52: Low-pressure Water Filters with Pressure Gauges

**To replace the water filter cartridges:**

1. Position the waterjet nozzle in a safe location, or remove the nozzle.
2. Turn Off the charge pump.
3. Lift the pump's cover lid and remove the front panel cover.
4. Unscrew each filter housing, using the spanner wrench provided (OMAX P/N 200773).
5. Remove and discard the filter elements.
6. Wash and rinse the filter housing to remove all sediment and coatings from inside the housing.
7. Rub a thin coating of oil (Lubriplate or equivalent) on the ends of the coarser 1 micron filter element. Install it upstream. Reinstall the upstream filter housing.
8. Rub a thin coating of oil (Lubriplate or equivalent) on the ends of the finer .45 micron filter element. Install it downstream. Reinstall the downstream filter housing.
9. After replacing the two elements, turn On **only** the charge pump.
10. Hold down the red buttons on top of the filters next to the pressure gauges (Figure 7-52) to bleed air from the filters.

**Note:** *If all the air is not purged from the filters, the charge pump cannot develop sufficient pressure and the main pump unit will shut down, displaying the fault message "Charge Pressure Low" on the keypad screen. To recover from this fault, press the "RESET" button on the keypad. Start the charge pump and bleed any remaining air from the water filters.*

11. Turn Off the charge pump.
12. Replace the front panel cover and lower the lid.
13. Reinstall the nozzle.

## Cleaning the Pump White Water Tank

Seal debris and particles will accumulate over time in the small, white water tank in the pump unit. The tank and charge pump suction screen should be cleaned at every pump rebuild, or more frequently when necessary.

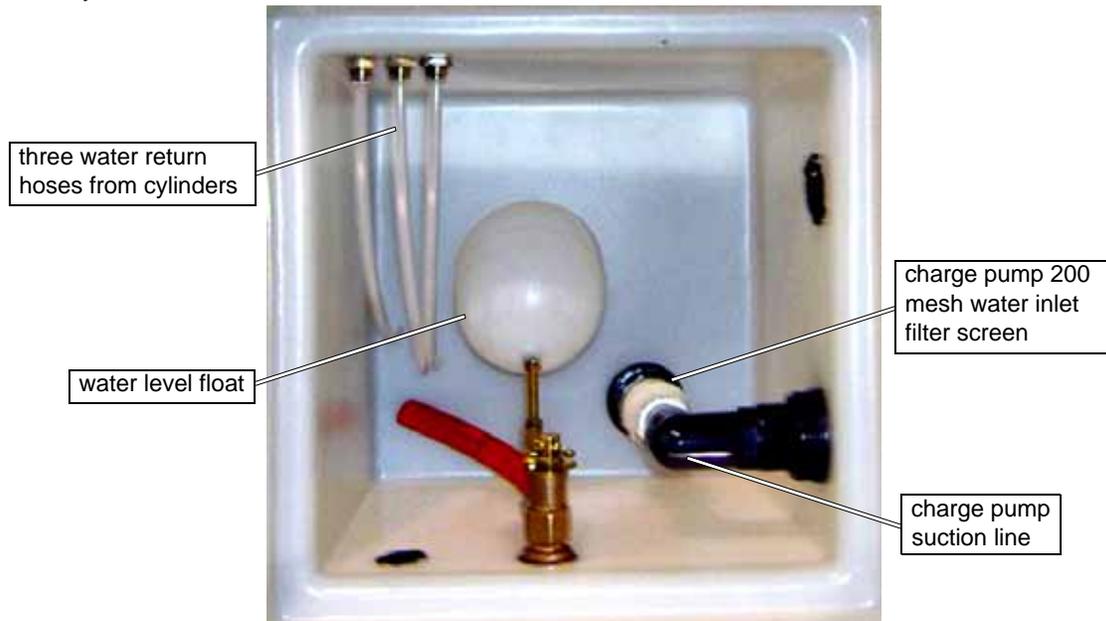


Figure 7-53: White Water Tank

### To clean the water tank and charge pump suction screen:

1. Ensure that power to the Charge Pump is Off.
2. Remove the pump's front panel allowing access to the Water Tank (see Figure 7-53).
3. Remove the water tank lid.
4. Shut the water supply to the Pump unit Off.
5. Empty the tank water by powering the charge pump On.
6. Once the water level is at or below the charge pump suction inlet, power the charge pump Off.
7. Remove the remaining tank water by mopping it up using a clean rag.
8. Once tank water has been removed, wipe the interior of the tank clean.
9. Remove the charge pump water inlet filter screen from the end of the suction line.
10. Clean the water inlet filter screen by flushing it backwards with water and blowing it dry with shop air.
11. Reinstall the cleaned filter screen and firmly tighten it in place by hand.
12. Turn the water supply ON, allowing the water tank to fill.
13. Power On the charge pump and bleed any air from the two filters by holding down the red buttons on top of the filters to bleed air from the filters (see Figure 7-52).
14. Power the change pump Off.
15. Replace the water tank lid.
16. Replace the pump's front panel.

# Changing Crankcase Oil

To avoid excessive wear and damage to the crankcase bearings, it is important to change the crankcase oil according to the intervals specified in the maintenance schedule. The oil must also be changed anytime it becomes contaminated with water or other debris.

Always use SAE 30 (ISO 100) non-detergent motor oil. Use of other types of oil may shorten pump life. If the temperature in the pump’s physical environment exceeds 90° F (32° C), use SAE 40 (ISO 150) non-detergent motor oil. The crankcase holds two quarts (1.9 L) of oil.

**Note:** *Whenever extended periods of pump operation at a motor RPM that is less than shown below are anticipated, you should add one additional quart (3 total) of oil to the pump crankcase.*

Pump Model	Add additional quart of oil if RPM is less than
P3050V	750
P3055V	850
P4055V	650

### To change the oil in the pump crankcase:

1. Disconnect the pump’s AC power source.
2. Lift the pump’s cover lid and remove the front panel cover.
3. Place a drain pan at the end of the red Oil Drain Hose to catch the oil when the Plug is removed from the Fitting.
4. Allow the oil to drain.
5. To force out remaining oil, apply a small amount of shop air to the hole in the oil filler tube with the filler cap still in place.
6. Replace the plug at the end of the red drain hose.
7. Refill the oil through the filler pipe.
8. Replace the filler pipe cap.
9. Replace the front cover.



Figure 7-54: Pump Crankcase, Oil Drain Hose, Filler Pipe

# Belt Maintenance

The heavy-duty belt connecting the OMAX pump with the electric motor occasionally requires re-tensioning or replacement. Periodically inspect the belt, looking for cracks, frays, or other wear spots. If you see cracks, frays, or damaged/missing teeth, replace the belt immediately.

The belt should deflect 1/4" - 5/8" (6.5 -16 mm) when pushed with a force of approximately 34 - 37 pounds (15 - 17 Kg) midway between the pulleys. If the belt deflects more or less than 1/4" - 5/8" (6.5 -16 mm) when pushed, adjust the belt tension using the following procedure.

**Caution:** *Never tighten the belt to remove all deflection. This shortens the belt life.*

**Tools needed to service the pump belt:**

- Two 3/4" wrenches
- 3' straight edge
- 10 mm socket

**To service the pump belt:**

1. Disconnect the pump's AC power source.
2. Lift the pump's cover lid and remove the pump's front and rear panel covers.
3. Disconnect the high-pressure plumbing from the pump and remove the pump's rear cover panel.
4. Remove the belt guard cover using the 10 mm socket.



*Figure 7-55: OMAX Pump Belt Guard Cover*



*Figure 7-56: OMAX Pump Belt with Belt Guard Cover Removed*

5. Loosen the pump crankcase mounting bolts. Loosen nuts on the two eye-bolts located at rear of crankcase. If the belt is being replaced, loosen it until to increase the slack, allowing it to be removed from the sprockets.
6. Install the replacement belt, ensuring the teeth mesh properly.

7. Using the eye-bolt outside nuts, tighten the belt to the tension specification provided above.
8. Tighten the securing nuts until snug, then check the pulley alignment with a straightedge, adjusting it as needed.
9. Tighten the security nuts.
10. Fully tighten all crankcase mounting bolts.
11. Reconnect all the high-pressure plumbing to the pump.
12. Replace the belt guard cover.
13. Replace the pump's front and rear covers.
14. Close the cover lid.

## Lubricating the Electric Motor

The pump's main electric motor comes with pre-lubricated ball bearings. The motor's ball bearings should be lubricated at intervals according to the pump's hours of service per year as follows:

Hours of Service Per Year	Relube Interval
5000	3 years
Continuous	1 year
Seasonal (Idle 6 months or more)	1 year (beginning of season)
Continuous High Ambient Temp. Dirty or Moist Locations High Vibrations	6 months

**Use these recommended high-quality ball bearing lubricants:**

Consistency	Type	Typical Lubrication
Medium	Polyurea	Shell Dolium R and/or Chevron SR1 2
	Sodium-Calcium	Lubriko M6

**Tools needed to lubricate the electric motor:**

- Grease gun
- screwdriver, 3/16" flat tip

**To lubricate the motor's ball bearings:**

1. Disconnect the pump's AC power source.
2. Remove the pump's front and rear panel covers.
3. Access the shaft-end of the motor (refer to Figures 7-55 and 7-56):
  - a. Remove the outside belt guard cover.
  - b. Remove the inside shaft guard.
  - c. Remove the lower portion of the belt guard.
4. Locate the grease fittings located on each of the motor ends.
5. Remove the pipe plugs located opposite the grease fittings.



Figure 7-57: Location of Front and Rear Motor Grease Fittings and Pipe Plugs

6. Wipe the tip of each grease fitting clean and connect the grease gun.
7. Apply 2-3 full strokes from the grease gun to each grease fitting.
8. Wipe up any grease forced out the hole and replace the pipe plugs.
9. Replace the belt guard components.
10. Replace the pump's front and rear panel covers.
11. Close the pump's cover lid.
12. Run the motor for 20 minutes before opening up the panel covers and replacing the pipe plugs removed previously.

**Caution:** *Keep the lubricant clean. Always lubricate at motor standstill. Always remove and replace the pipe plugs at motor standstill. Never mix petroleum lubricants and silicone lubricants in motor bearings.*

## Replacing the Electrical Enclosure Air Filters

The two air filters located on the inside of the electrical enclosure door should be replaced every month, or more often, depending upon environmental conditions. In excessively dirty or dusty environments, it may be necessary to replace the air filters weekly.

**Caution:** *Failure to maintain clean air filters can result in overheating of the electrical enclosure, resulting in an over-temperature shutdown of the variable frequency drive (VFD).*

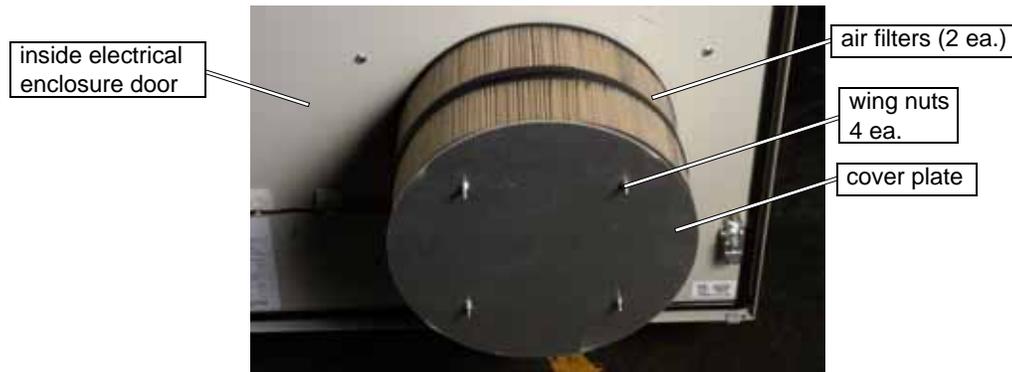


Figure 7-58: Electrical Enclosure Air Filters

### To replace the air filters:

1. Disconnect the pump's AC power source.
2. Open the door to the pump's electrical enclosure.
3. Remove the four wing nuts and the round cover plate.
4. Remove the two air filters.
5. Replace the air filters with FRAM #CA326, or equivalent.
6. Replace the cover and wing nuts.
7. Close the door to the electrical enclosure.



# Customer Service

This chapter explains how to reach OMAX Customer Service and provides instructions for the ordering and returning of parts.

## Contacting OMAX Customer Service

OMAX Customer Service personnel can be reached throughout the workday for technical questions or ordering parts as follows:

**8am – 8pm EST Monday through Friday**  
**8am – 5pm EST Saturday and Sunday**

**Voice:** 253.872.2300 x3 or 800.298.4036

**International:** 01 253.872.2300 x3

**Fax:** 253.872.7446

**E-mail:** [techsupport@omax.com](mailto:techsupport@omax.com)

**Ordering parts:** [parts@omax.com](mailto:parts@omax.com)

## Ordering Parts

OMAX parts can be ordered from Customer Service either by calling **800.298.4036** (international **01 253.872.2300 x3**), faxing **253.872.7446**, or emailing **parts@omax.com**.

When ordering parts, please provide the following information:

- part name
- part number
- quantity needed
- date required
- your shipping information
- purchase order number

Parts in stock are shipped within 3 working days from receiving the order. When not in stock, OMAX provides an estimated shipment date. Same-day shipments for system-down emergencies can be accommodated if the requested part is in stock and the order received before 12:00 noon, Pacific Time.

## Returning Parts

All parts returned to OMAX Corporation, for any reason, are handled according to the Returned Material Procedure described below. Return procedures vary, depending upon the reason for the return. The normal process for returned parts takes approximately ten working days once the part is received. All returned parts must have an RMA number and be returned within 30 days of the shipping date with proof of purchase to be considered for credit.

## Returned Material Procedures

The following procedures are used by OMAX Corporation to handle part returns. OMAX issues credit for returned parts if received in their original condition, or had failed under conditions covered by the OMAX warranty.

**Please follow these steps when returning parts:**

1. Contact the Customer Service Department to obtain a Return Material Authorization number (RMA).
2. Please provide the following information:
  - your company name and address
  - your name and telephone number
  - OMAX sales order number
  - original purchase order number
  - itemized list of all parts being returned, including quantity, part number, and description
  - reason for return (defective, ordered in error, repair, etc.)
  - any additional helpful information
3. Write the RMA number at the top of the packing list and on the shipping label and include a copy of your sales order.

**Note:** *Each RMA number is different. This number must appear on the shipping label and on all shipping documentation. All inquiries concerning the returned parts should also refer to this number.*

4. Ship your returned parts prepaid to:

**OMAX Corporation  
Attn: Customer Service Department  
21409 72nd Avenue South  
Kent, WA 98032 USA**

**Parts Ordered in Error**

Returned parts ordered by a customer in error are subject to a testing and restocking charge of 15% of the list price. Parts returned for restocking must be returned prepaid to OMAX Corporation within 30 days of the original parts order ship date.

**To return a part ordered in error for credit:**

1. Obtain an RMA number. Return your ordered in error parts prepaid to OMAX Corporation within 30 days of the date the part was originally shipped.
2. Returned parts are examined by the Customer Service Department to ensure they are unused, in new condition, and free of handling damage.
3. If the parts are determined to be new and received within the 30-day limit, you receive full credit for the amount charged, minus the 15% restocking fee. A copy of the credit memorandum will be forwarded to you for use on future orders.
4. You must issue a new purchase order for any replacement parts.
5. Parts are shipped to you FOB Kent, Washington, USA.
6. If the returned parts are not new, or if OMAX receives them after the 30-day limit, the OMAX Customer Service Coordinator determines their proper disposition.

**Unused Parts****To return unused parts for credit:**

1. Obtain an RMA number. Return your unused parts prepaid to OMAX Corporation within 30 days of the shipping date the part was originally shipped.
2. All parts are examined by the Customer Service Department to ensure they are unused, in new condition, and free of handling damage.
3. If the parts are determined to be new and are received within the 30-day limit, you receive full credit for the amount charged, minus the 15% restocking fee.
4. A copy of the credit memorandum will be forwarded to you for use on future orders.

## Parts Shipped in Error

### To return parts shipped in error for credit:

1. Obtain an RMA number. Return your shipped in error parts prepaid to OMAX Corporation within 30 days of the shipping date when the part was initially sent.
2. All parts are examined by the Customer Service Department to ensure they are unused, in new condition, and free of handling damage.
3. If the parts are determined new and are received within the 30-day limit, you receive full credit for the amount charged, and the part originally ordered is shipped.
4. If the returned parts are not new, or are received by OMAX after the 30-day limit, the OMAX Customer Service Coordinator determines the proper disposition.
5. If the replacement parts are needed sooner than 10 working days, issue a new purchase order and clearly label it with the RMA number and a tag that reads "Shipping Error."
6. If in stock, the replacement part will be shipped within three working days (same-day for urgent requests).
7. If the claim is approved, a credit memorandum for the originally shipped parts is forwarded to you. This credit can be used on future orders.

## Parts Returned for Repair

### To return parts for OMAX Repair Services:

1. Obtain an RMA number. Ship the parts along with a purchase order to OMAX Corporation.
2. Repair charges are based on standard rates for labor plus the currently listed price for any replacement components required.
3. You will be notified if the repair charge exceeds 50% of the cost for a new part.
4. The OMAX Repair Department completes the repair. If the parts are either not repairable, not cost effective to repair, or not approved for repair, they are either returned to you or scrapped upon your request.

## Parts Returned for Warranty Repair or Replacement

### To return parts for warranty repair or replacement:

1. The Customer Service Department evaluates all parts returned to ensure that they are covered by the OMAX Corporation warranty.
2. When a part is under warranty, OMAX determines if the part should be repaired or replaced.
3. When a part is not under warranty, it will either be repaired at your expense, returned to you without repair, or scrapped at your request.
4. When a part is urgently needed while the equipment is still under warranty, OMAX suggests that you issue a new purchase order for the required part.
5. Write the RMA number on the purchase order, and also note that the parts ordered are to replace parts sent in for warranty consideration.
6. If the part is in stock, it is shipped within three working days. If it is not in stock, the part will be sent as soon as possible.
7. If the warranty claim is approved, OMAX issues a credit memorandum for the parts.
8. A copy of the credit memorandum is sent to you for use on future orders.

## Two Year Limited Warranty

OMAX Corporation (“OMAX”) warrants its OMAX JetMachining® Center and all components of its manufacture (the “Products”), to be free of defects in workmanship and material for a period of two years from the date of shipment or 4,000 operational hours, whichever comes first. This warranty covers all machinery and electronics equally, however, it does not include wear parts and consumable parts such as seals, valves, abrasive-jet nozzles, mixing tubes, orifices, high-pressure hose or high-pressure pump components. Further, Buyer is strongly cautioned that poor water quality and high inlet water temperature will significantly affect operational life of Products. This warranty specifically excludes coverage of any claims for the effects of corrosion, erosion, adverse water conditions and temperature, normal wear and tear, or component failures caused by (i) accident, (ii) negligence, misuse, improper installation or abuse, or (iii) unauthorized repair or alteration, or failure to maintain the OMAX JetMachining® Center that contains the affected components in accordance with the technical bulletins and specifications provided by the OMAX.

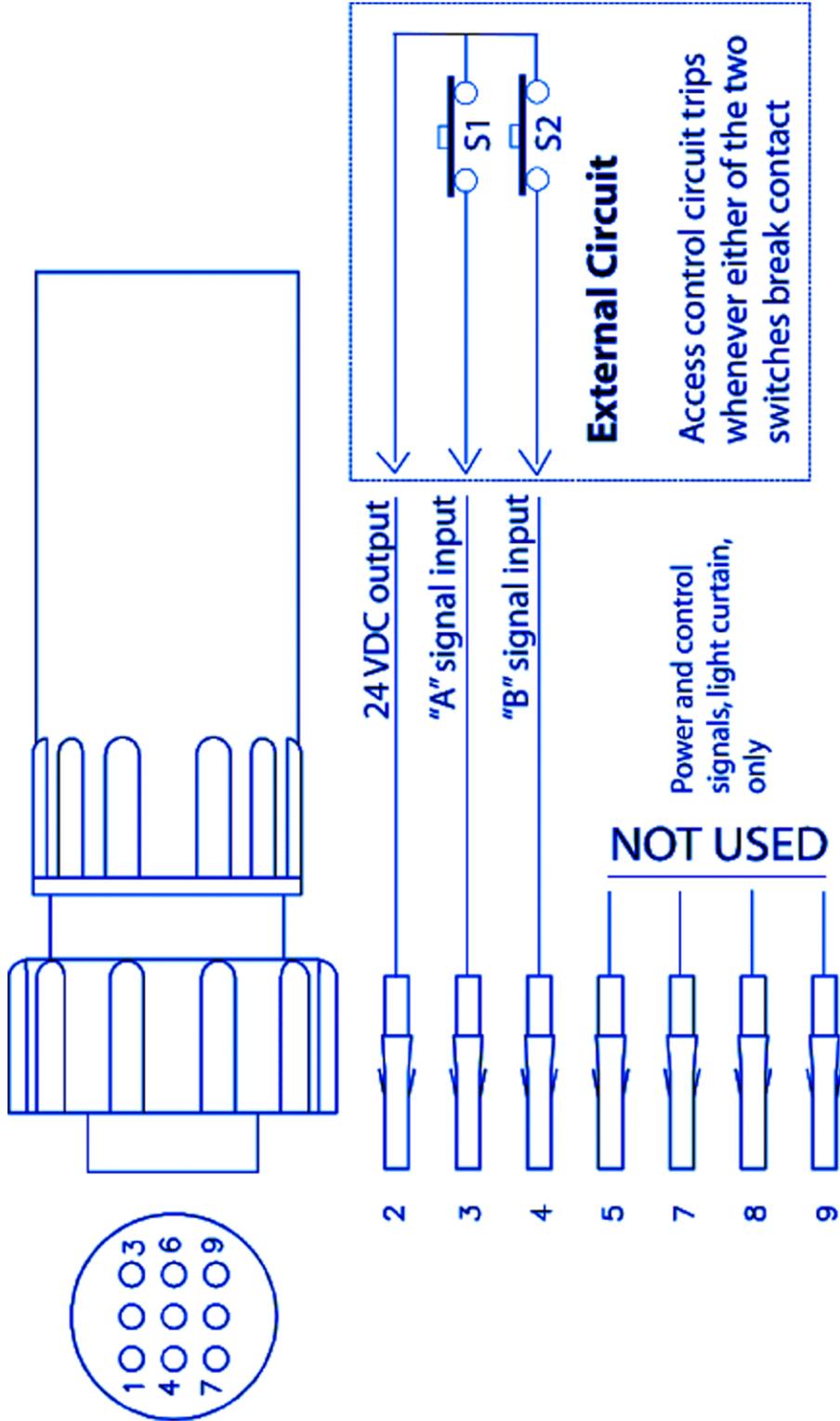
All labor is the responsibility and expense of the Buyer. The liability of OMAX under this warranty is limited, at OMAX’s exclusive option, solely to repair or replacement with equivalent items or refund of the purchase price upon return of the subject nonconforming Product. Replacement parts may be either new or reconditioned, at OMAX’s option. Freight charges, brokerage charges, duties and taxes for return of parts and for parts or components provided by OMAX under this warranty, will be the responsibility of the Buyer. This warranty is conditioned upon (a) OMAX being notified in writing by Buyer within 30 days after discovery of defects; (b) the return of presumed defective components to OMAX within 30 days of notification, transportation charges, brokerage charges, duties and taxes prepaid by Buyer, and (c) OMAX’s examination of such components disclosing to its satisfaction that such defects were not caused by negligence, misuse, improper maintenance, abuse, improper installation, accident, or unauthorized repair or alteration. Accessories or equipment manufactured by others but furnished by OMAX shall carry the warranty conveyed by the manufacturer to OMAX, which may be passed on to the Buyer. The original warranty period of any component that has been repaired or replaced by OMAX shall not thereby be extended.

OMAX will indemnify Buyer for any damages and costs finally awarded against Buyer on the grounds that a Product, (but not any items manufactured by third parties), infringe any valid United States patents or copyrights of any third party, provided that Buyer notifies OMAX in writing of any such claim within ten days after learning thereof and that Buyer gives OMAX full control over the defense and settlement of the claim, and fully cooperates with OMAX with respect thereto. If any such claim is brought or appears to OMAX likely to be brought, OMAX may at its option replace or modify the Products to make them non-infringing, or refund to Buyer, upon return of the Products at issue, the price paid therefor, less twenty percent for each year which has passed since the date of delivery hereunder. Buyer shall discontinue all use of any portion of the Products that has been replaced or modified or for which a refund has been tendered. OMAX’s obligations hereunder shall not apply to any claim based on: i) OMAX having followed Buyer’s specification or requests; ii) the use of Products to practice a process not recommended by OMAX, or iii) in conjunction with items or modifications not supplied by OMAX, and the Buyer shall similarly indemnify OMAX with respect to such claims. **THE FOREGOING STATES OMAX’S SOLE RESPONSIBILITY AND BUYER’S SOLE REMEDY FOR ANY INFRINGEMENTS OF PROPRIETARY RIGHTS.**

OMAX MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, OF ANY KIND, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR USE OR THOSE ARISING FROM COURSE OF PERFORMANCE, COURSE OF DEALING OR USAGE OF TRADE. IN NO EVENT SHALL OMAX BE LIABLE TO BUYER OR TO ANY THIRD PARTY FOR INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES INCLUDING WITHOUT LIMITATION, LOSS OF USE, DELAYS OR LOST PROFITS OR SAVINGS RELATED TO THE PRODUCTS, THE USE OR LOSS OF USE THEREOF, THE PERFORMANCE OR BREACH OF THIS AGREEMENT BY OMAX, OR OTHERWISE, EVEN IF OMAX IS AWARE OF THE POSSIBILITY OF SUCH DAMAGES, AND EVEN IF THE EXCLUSIVE REMEDIES STATED HEREIN FAIL OF THEIR ESSENTIAL PURPOSE. BUYER’S RIGHTS AS STATED HEREIN ARE ITS EXCLUSIVE REMEDIES.

Buyer agrees that regardless of the form or action, whether in contract or tort, including negligence, OMAX’s liability for damages hereunder or otherwise with respect to the Products or their use shall not exceed the total sum paid by Buyer to OMAX for the Products causing such damages. (R/02/21/06)

# Appendix A: Access Control Circuit





# Access Control Circuit

This document describes technical requirements of the OMAX Access Control Circuit and explains its operation.

## Contents

Introduction .....	page A-1
Access Control Operation .....	page A-4
Initial Equipment Power Up .....	page A-4
Stopping the JetMachining Center to Allow Operator Access .....	page A-4
Re-arming the Circuit Following an Access Violation .....	page A-4

## Introduction

The OMAX Access Control Circuit (ACC) is designed to create a designated safety zone around an OMAX JetMachining Center that protects operators from injury when using the OMAX equipment. The access control circuitry continually monitors the closure status of two external switch contacts. The breaking of contact with either switch immediately trips the safety circuit, disabling the cutting process until the cause of the violation is corrected and the access control circuit reset.

It is the customer's responsibility to install some type of fencing or other device that restricts access to the open sides of the JetMachining Center table. Typical devices could be a light curtain, a fixed enclosure with switches attached, or a safety mat using an external relay connection.

Electrically, the Access Control Circuit requires inputs from two normally-closed switching devices that break contact whenever access to the protected cutting area is attempted. Switches S1 and S2 in the figure that follows illustrate the required external circuit connections for the two switch inputs:

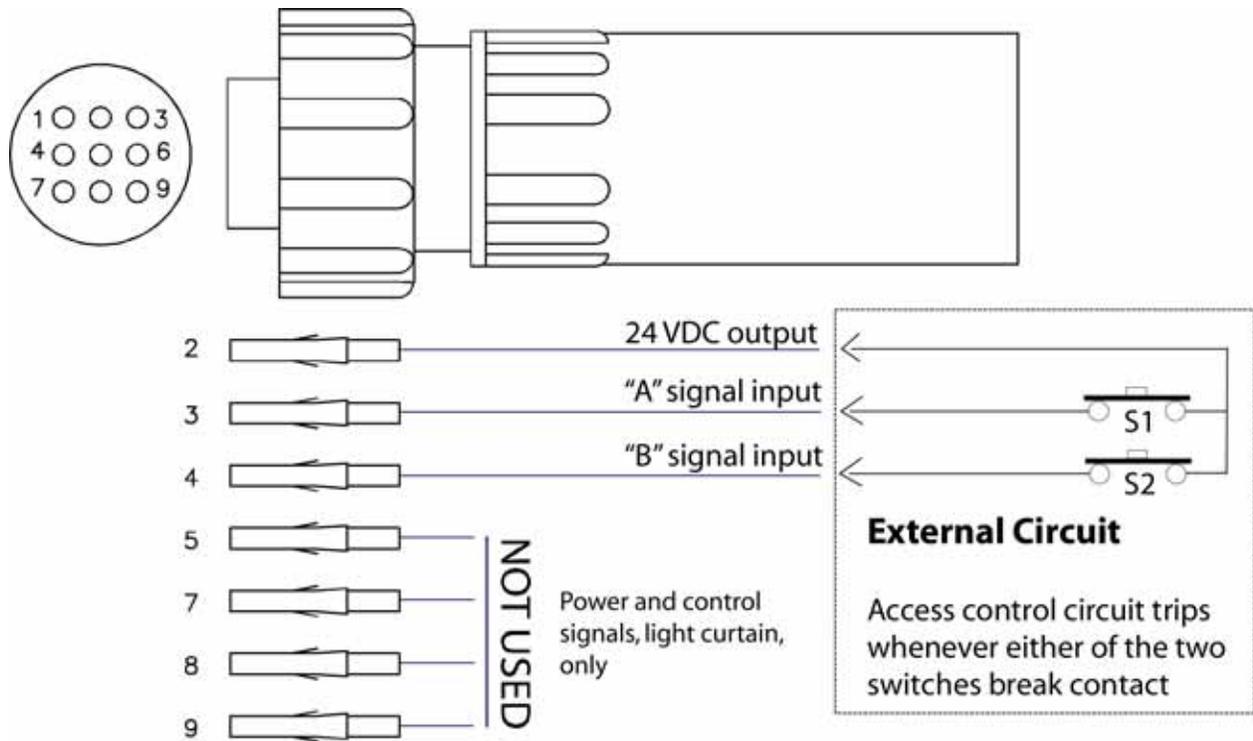


Figure A-1: External Electrical Circuit Requirement for the ACC

The Access Control Circuit is enclosed in an electrical enclosure with a hinged lid and attached to the left side of the OMAX controller. See Figure A-2.

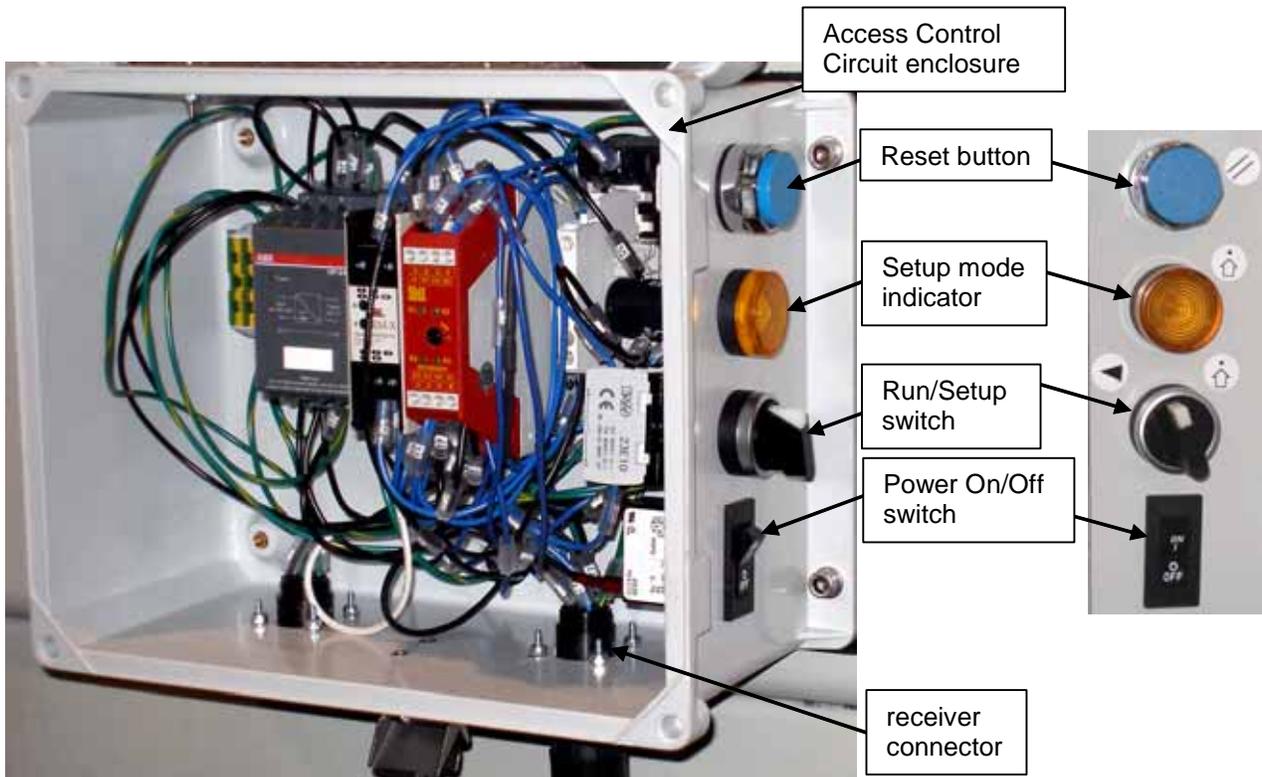


Figure A-2: Access Control Enclosure Attached to Side of OMAX Controller

**Access Control Circuit Enclosure**

Electrical box fastened to the OMAX controller with transparent lid allowing operator to view provided status LEDs.

**Reset Button**

Rearms JetMachining Center back to its normal operating mode, allowing recovery from a triggered safety violation or setup request.

**Setup Mode Indicator**

When lit, indicates access control circuit is currently in the Setup mode.

**Run/Setup Switch**

Switches ACC operation to either the Setup or Run mode. Setup allows access into the protected zone without triggering a complete shutdown of the JetMachining Center (babysit). During Setup, a slow speed control of nozzle motion is allowed, but pump and nozzle operation is not permitted. Run enables operation of the JetMachining Center if both safety switches (S1, S2) are closed and the Reset button was pressed following an alarm shutdown.

**Power On/Off Switch**

Switches AC power for the ACC enclosure OFF when in the "0" position; switches AC power ON when in the "1" position.

**Receiver Connector**

Provides 24VDC for external safety switches and input connections for signals from the two safety switches. (Figure A-1).

Three status LEDs are available inside the ACC enclosure that are useful in determining various equipment functions. Refer to Figure A-3.

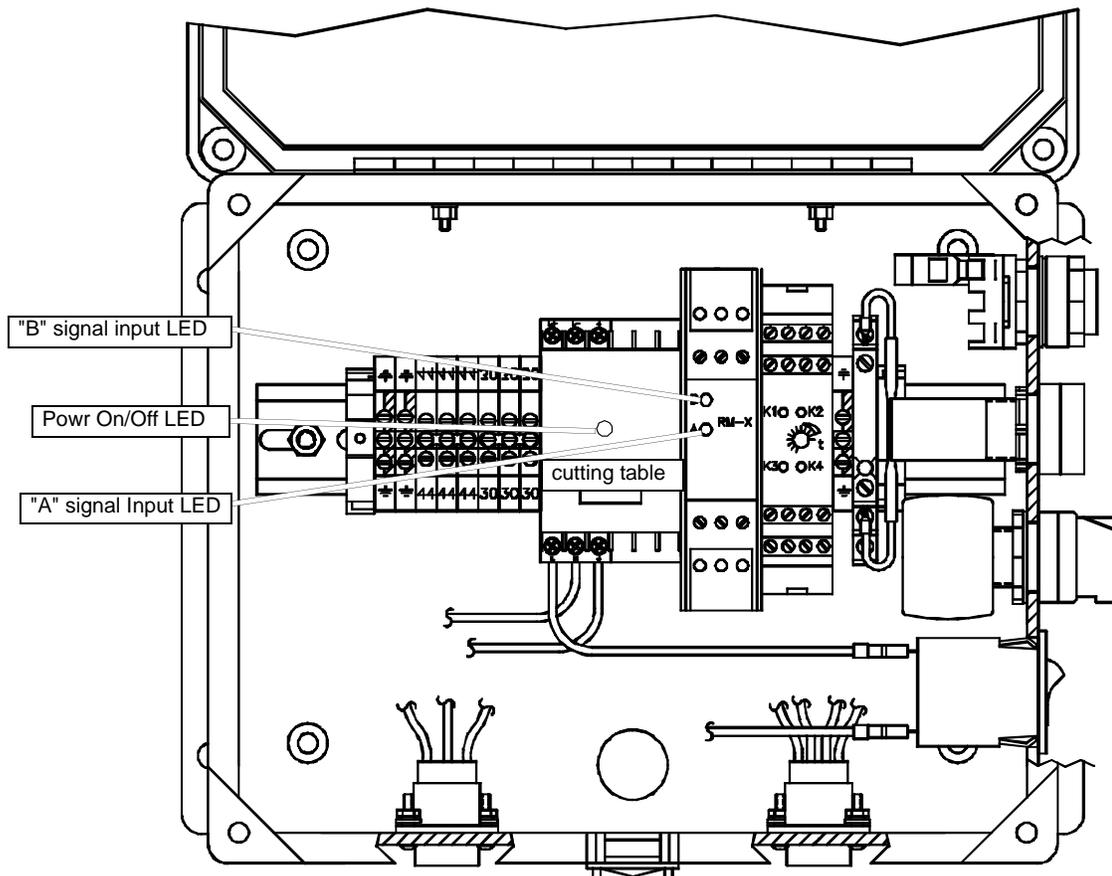


Figure A-3: ACC Status LEDs

**“B” Signal Input LED**

A green LED that indicates safety switch S2 (Figure A-1) is closed when ON. When OFF, it indicates S2 is open.

**Power On/Off LED**

A green LED that's ON when the ACC is powered ON, and OFF when it is powered OFF.

**“A” Signal Input LED**

A green LED that indicates safety switch S1 (see Figure A-1) is closed when ON. When OFF, it indicates S1 is open.

## Access Control Operation

### Initial Equipment Power Up

1. Switch the **Pump AC power** ON.
2. Switch the **Controller AC power** ON.
3. Once Windows is ready, **launch OMAX Make**.
4. When Make starts, verify that the status line below the OMAX logo flashes the message **“Babysit Triggered.”**
5. Switch the **Access Control Circuit's AC power switch** ON (“1”).
6. Verify that the green ACC power On/Off LED lights, indicating output from the 24 VDC supply (Figure A-3).
7. Verify that both the A and B signal input LEDs are ON (Figure A-3).
8. If these LEDs are ON, push the Reset button (Figure A-2).
9. Verify that the message “Babysit Triggered” disappears.
10. The JetMachining Center is now ready for cutting.

### Stopping the JetMachining Center to Allow Operator Access

When it's necessary to enter the protected cutting area to remove and replace material:

1. Raise and move the nozzle away from the cutting material, allowing ample room for the material to be removed or replaced.
2. With the nozzle out of the way, switch the Run/Setup switch on the ACC enclosure to its SETUP position (turn clockwise) and verify that the amber Setup mode light turns ON (Figure A-2).
3. With the Setup light ON, you can now enter the protected area and break the safety switch circuits.
4. When finished, leave the protected area, ensure that the safety switches are again closed, and verify that LEDs A and B are both ON.
5. Press the Reset switch (Figure A-3).
6. Switch the Run/Setup switch to its Run position.
7. The machine is now ready to resume cutting.

### Re-arming the Circuit Following an Access Violation

Whenever the safety circuit is triggered by an access violation, the message “Babysit Triggered” appears on screen, the OMAX pump shuts Off, and all nozzle activity immediately ceases.

**Note:** *Abrasives will typically flow for a short time following a shutdown which may plug the nozzle. Following a “Babysit Triggered” condition, always inspect the abrasive line and blow out any abrasive that is present.*

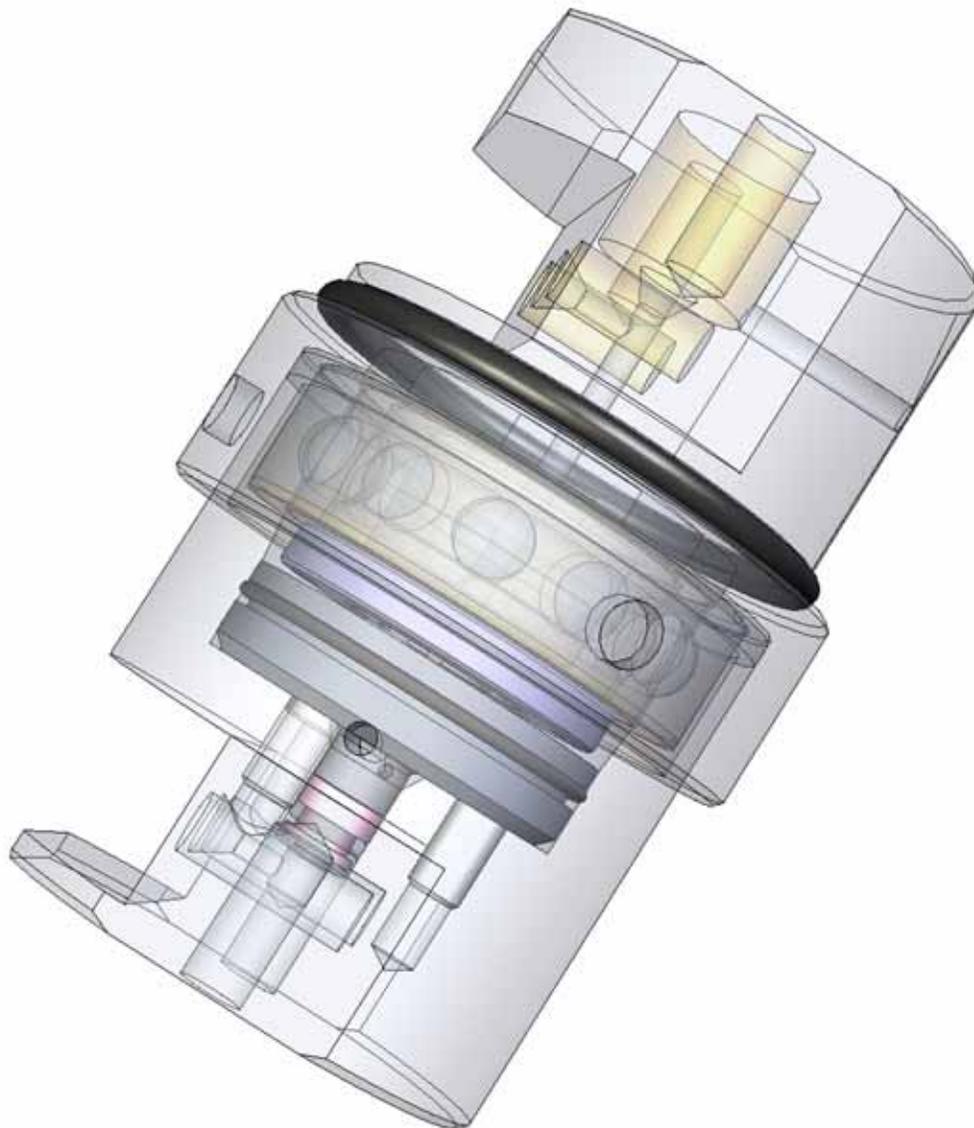
To recover from a “Babysit Triggered” condition following an access violation:

1. Correct the situation that triggered the shutdown (switch opened, etc.).
2. Verify that both A and B status LEDs are lit (Figure A-3).
3. Press the blue Reset button.
4. Verify that the “Babysit Triggered” message disappears.
5. Re-home the nozzle.
6. If a Tilt-A-Jet is installed, auto-square it.
7. The machine is again ready for cutting.



# Appendix B:

## Rebuilding the High-pressure Swivel





# Rebuilding the High-Pressure Swivel

Use the following procedure to disassemble and replace worn components in a high-pressure swivel.

## Contents

Tools and Materials Needed.....	page C1
Removing the High-pressure Swivel.....	page C1
Disassembling the High-pressure Swivel.....	page C2
Replacing the Seals and O-Rings.....	page C4
Replacing the Bearing.....	page C6
Reassembling the High Pressure Swivel Halves.....	page C10
Installing the High-pressure Swivel.....	page C10



Figure B-1: High-pressure Swivel used in OMAX JetMachining Centers

## Tools and Materials Needed

- Lubriplate grease (P/N 201304)
- Soft-jawed vice
- 5 and 6 mm Allen wrenches
- Arctic Grease (P/N 202335)
- inch/pound torque wrench
- Spanner wrench (P/N 304512)
- Seal removal tool (P/N 201726)
- Blue Goop anti-galling compound (P/N 200365)
- Seal Replacement Kit (P/N 305088)

### Additional Requirements for Bearing Removal:

- Arbor press
- Bearing puller
- Bearing assembly (P/N 202964)
- Pry bars

## Removing the High-pressure Swivel

Figure B-2 illustrates a typical high-pressure swivel installation.

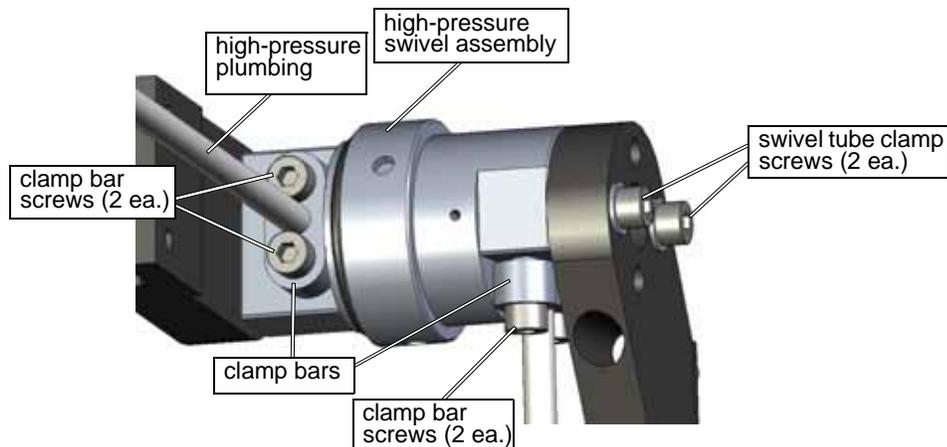


Figure B-2: Typical High Pressure Swivel Installation

**To remove a high-pressure swivel:**

1. As necessary, move the **nozzle** to a location providing easy access to the swivel(s) being serviced.
2. Switch Off the AC power for both the pump and table. Disconnect their main AC power breakers. Attach an “Out of Service” tag on each breaker and observe all applicable electrical safety requirements.
3. Prior to removal, carefully wash off the entire high pressure swivel assembly using water and compressed air. Be especially careful to remove all grit and abrasive.
4. Use the 6 mm Allen wrench to remove both clamp bars (4 screws) from the swivel assembly, releasing the plumbing tubes.

**Caution:** *Be very careful while removing swivel components! The high-pressure support structure will become unsupported and can fall once key components are removed.*

5. Remove the four screws securing the swivel tube clamps (Figure C-2) and the four clamp bar screws.
6. Remove the high-pressure swivel assembly from the table and take it to a clean room environment for rebuilding.

**Caution:** *The swivel assembly and the rebuild location must be thoroughly cleaned prior to rebuilding.*

**Disassembling the High-pressure Swivel**

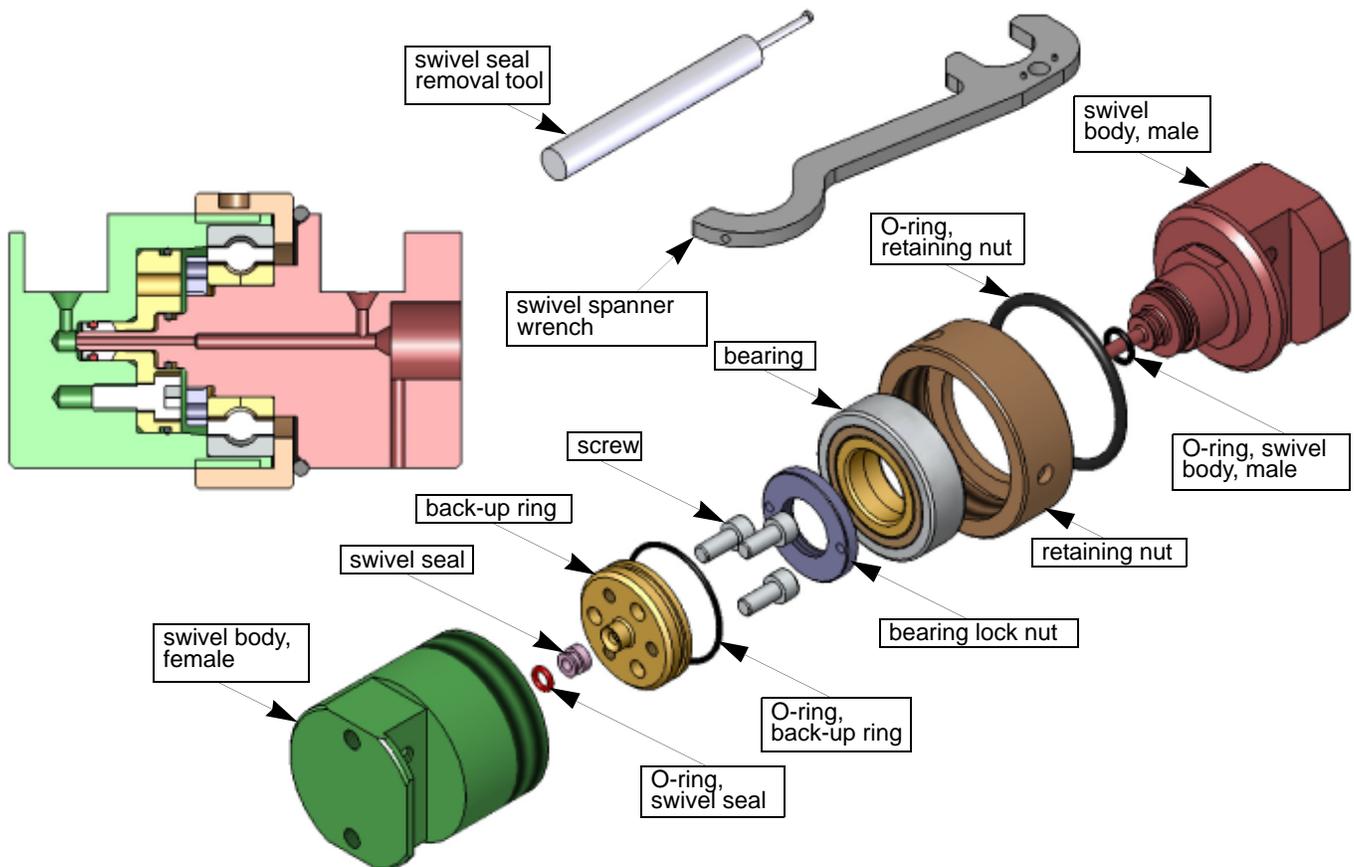


Figure B-3: Components of the High-pressure Swivel Assembly

### To disassembly the High-Pressure Swivel

1. Clamp the cleaned **swivel assembly** in a soft-jawed vice as illustrated in Figure B-4:

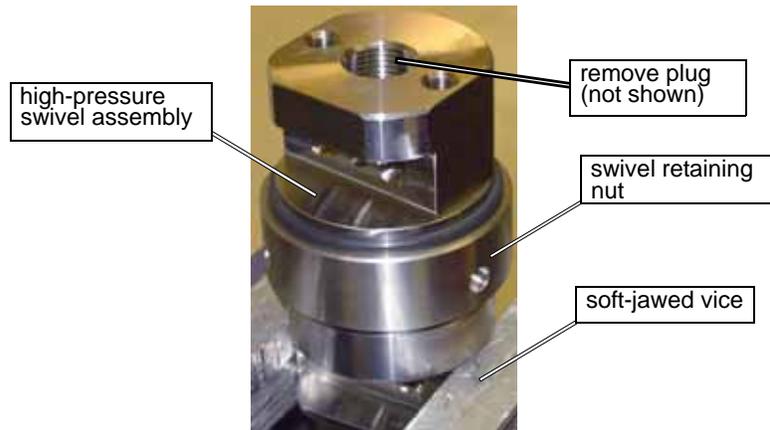


Figure B-4: Clamp the Swivel Assembly in a Soft-jawed Vice

**Note:** When clamping the assembly, ensure that the two flat sides of the female swivel body are aligned flush to the jaws of the vice.

2. If present, remove the top plug on the swivel assembly (Figure B-4).
3. Unscrew the **swivel retaining nut** using the swivel spanner wrench (Figure B-5) by rotating it counterclockwise:



Figure B-5: Use the Swivel Spanner Wrench to Unscrew the Swivel Retaining Nut

4. Separate the **swivel assembly** into its two halves: a **male** and the **female** half.



Figure B-6: Separate the Swivel Assembly into its Male and Female Halves

## Replacing the Seals and O-Rings

1. Clamp the **female half** of the swivel assembly into the soft-jawed vice and use the 5mm Allen wrench to remove the three internal screws:



Figure B-7: Remove the Three Swivel Assembly Screws with the 5mm Allen Wrench

2. Once all three screws are removed, use one of the removed screws as a “jacking screw” to help remove the swivel backup ring and O-ring seal by screwing it down into one of the threaded holes in the back-up ring. This will lift the backup ring for easy removal:

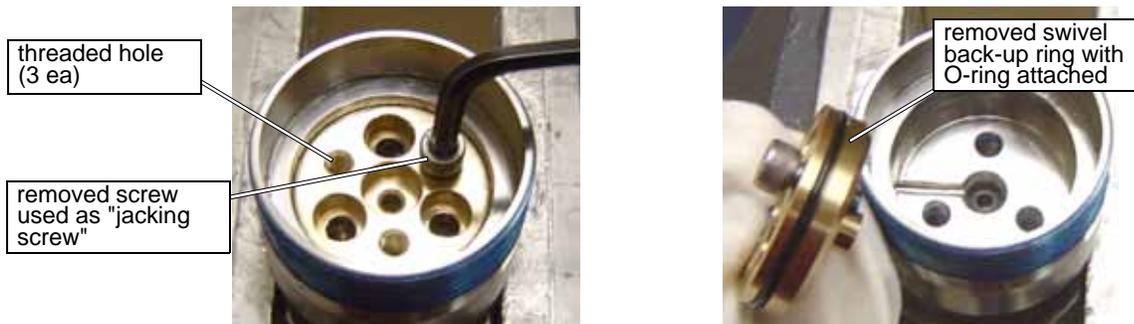


Figure B-8: Remove the Swivel Back-up Ring from the Swivel Assembly

3. Remove the **swivel seal** with the attached **O-ring**, using the swivel seal removal tool (Figure B-9). Insert the tool into the hole in the swivel seal and catch the bottom side of the seal with the tool. When caught, pull the tool upwards, removing the swivel seal and O-ring.

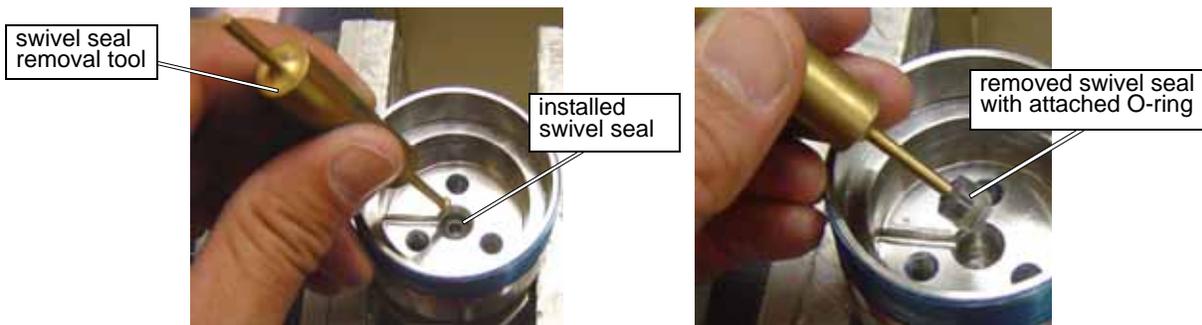


Figure B-9: Use the Removal Tool to Take Out the Swivel Seal and O-ring

4. Clean the **backup ring** and female **swivel body** in an ultrasonic cleaner.

5. Lubricate the new **swivel seal** and **O-ring** with Lubriplate and insert them into the **swivel body** (Figure B-10). Ensure that the O-Ring end of the seal goes into the hole first.



Figure B-10: Insert the Swivel Seal with New O-ring into the Swivel Body

6. Lubricate with Libriplate and install the new **O-ring** onto the **swivel back-up ring**. Press the swivel backup ring into the **swivel body** (Figure B-11), aligning the three screw holes in the swivel back-up ring with those in the swivel body.



Figure B-11: Insert the Swivel Back-up Ring with a New O-ring Installed into the Swivel Body

7. Insert and tighten the **three screws** (removed earlier in step #1) to 48.7 inch pounds (5.5 Nm) using the 5mm Allen wrench (ensure that the screws were inserted into the three countersunk holes, not the threaded holes):



Figure B-12: Tighten the Three Screws to the Swivel Back-up Ring

## Replacing the Bearing

**Note:** It is not necessary to remove the swivel bearing assembly if only the swivel seals require servicing. Bearing removal is necessary only when the bearing itself must be replaced, cleaned, or regreased.

1. Place the male half of the **swivel body** into the soft-jawed vice and place a 9/16" or 14 mm deep well socket over the **swivel body shaft** and onto the **swivel seal**.

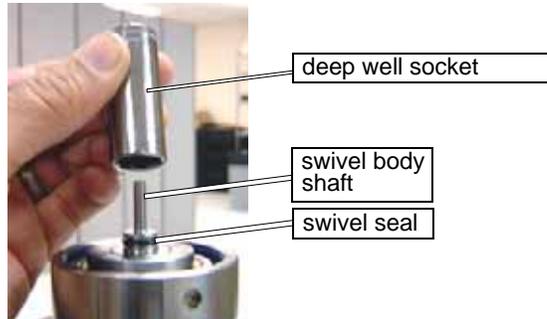


Figure B-13: Place a Deep Socket over the Swivel Body Shaft

2. Center the socket over the **swivel body shaft** to provide a uniform contact with the surface of the swivel body and protect the swivel body shaft.

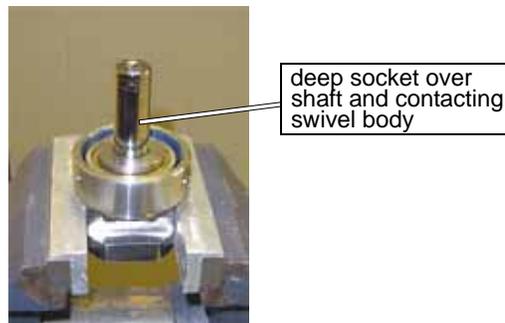


Figure B-14: Center the Socket Over the Surface of the Swivel Body

3. Attach the **bearing puller** as illustrated below and pull the **bearing assembly** free from the swivel body.

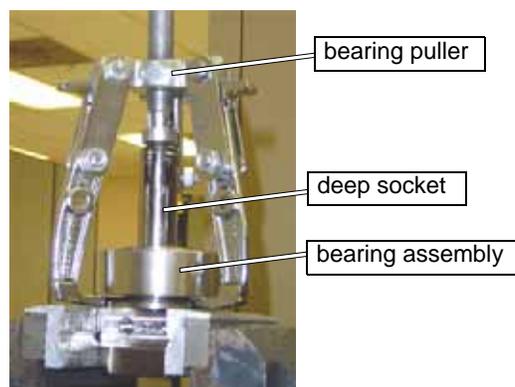


Figure B-15: Use the Bearing Puller to Remove the Bearing Assembly

4. The bearing's **inner race** may not pull out with the bearing. If this happens, two **pry bars** can be used to remove the inner race as follows:

- a. Reposition the **swivel body** in the soft-jawed vice to allow a better leverage as shown below:



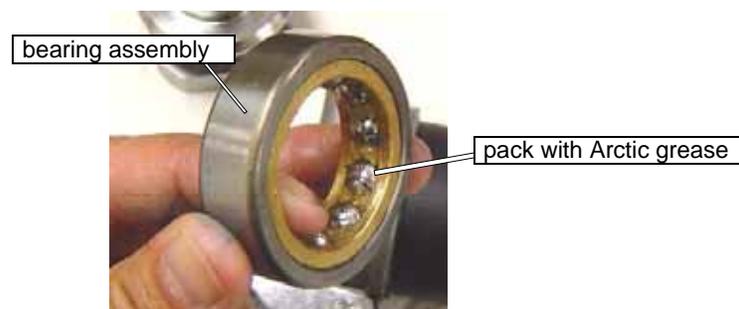
*Figure B-16: Use Pry Bars to Remove the Inner Race from the Swivel Body*

- b. Slide the two pry bars under the flat surface on the swivel body just below the race (Figure B-16 above). Evenly and carefully pry the race free from the swivel body.
5. Gather the replacement bearing components as illustrated below:



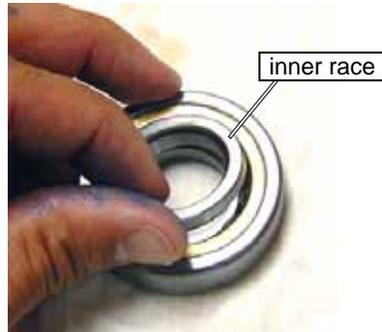
*Figure B-17: Male Swivel Body Bearing Components*

6. Thoroughly clean grease and foreign debris from all parts being reused using an ultrasonic cleaner.
7. With both **inner bearing races** removed, pack the **bearing assembly** with OMAX Arctic Grease (PN 202335).



*Figure B-18: Pack the Bearing Assembly with Arctic Grease*

8. After packing the **bearing assembly** with **Arctic grease**, re-install the two inner races:



*Figure B-19: Reinstalling the Bearing Inner Race*

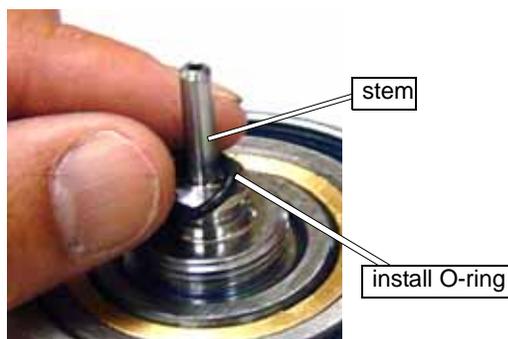
9. Install the **bearing assembly** onto the male **swivel body**:
- Place the **male swivel body** in the **arbor press**.
  - Place the **swivel retaining nut** onto the male swivel body.
  - Lightly grease the **swivel body bearing mount** where the bearing assembly installs.
  - Position the **bearing assembly** onto the swivel body shaft. Place a 1 inch (2.54 cm) deep well socket on top of the bearing assembly (Figure B-20). This will be used to press the bearing assembly into the swivel body. Make sure the socket presses against only the inside bearing race:



*Figure B-20: Installing the Bearing Assembly with the Arbor Press*

- Press the **bearing assembly** onto the **swivel body** using the **arbor press** until fully seated.
  - Remove the **swivel body** from the **arbor press**.
10. Lightly coat the **O-ring** with Lubriplate. Install the **O-ring** onto the **swivel body**.

**Caution:** *Be careful to not scratch or damage the stem!*



*Figure B-21: Replace the O-ring on the Swivel Body*

11. Apply a light coat of **Blue Goop** and thread the **bearing lock nut** onto the swivel body by hand until tight.



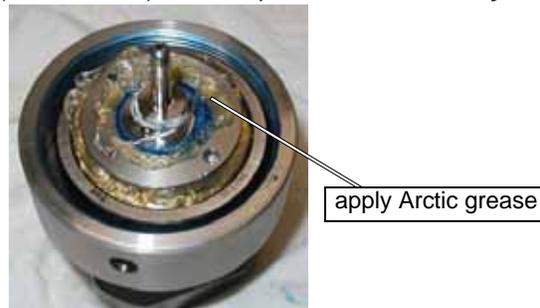
*Figure B-22: Hand Tighten the Bearing Lock Nut*

12. Use the **swivel spanner wrench** to tighten the bearing lock nut securely.



*Figure B-23: Fully Tighten the Bearing Lock Nut using the Swivel Spanner Wrench*

13. Apply OMAX **Arctic Grease** (P/N 202335) to the top of the **swivel body bearing assembly**:



*Figure B-24: Apply Arctic Grease to Top of Bearing Assembly*

## Reassembling the High Pressure Swivel Halves

1. Place the female half of the **swivel body** in the soft-jawed vice (Figure B-25), apply **Blue Goop** and assemble the two **swivel body halves**.

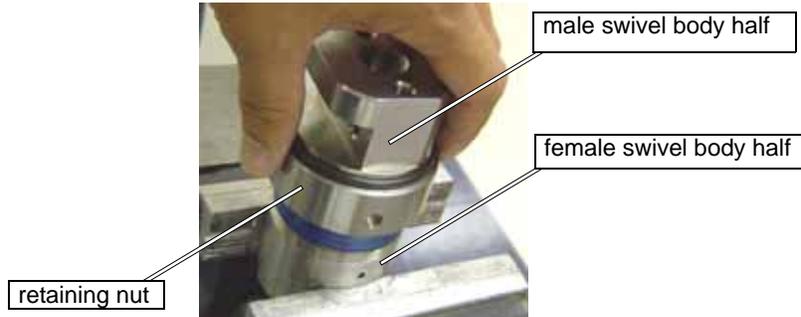


Figure B-25: Assemble the Two Swivel Body Halves

**Note:** When clamping the assembly in the vice, ensure that the two flat sides of the female swivel body are aligned flush to the jaws of the vice.

2. Use the swivel **spanner wrench** to tighten the **retaining nut**:

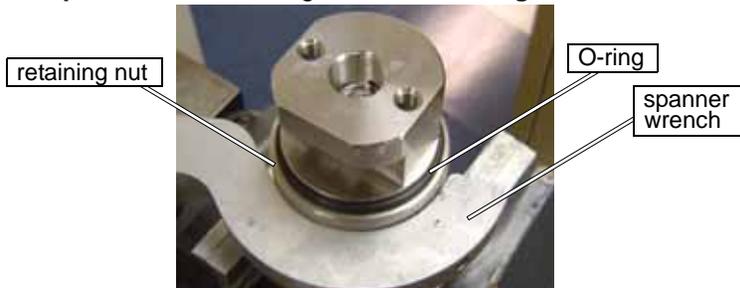


Figure B-26: Tightening the Retaining Nut with the Spanner Wrench

3. Remove the large **O-ring** (Figure B-27), replacing it with a new O-Ring:

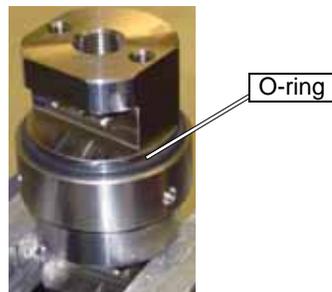


Figure B-27: Replace the O-ring with New One

4. Wipe off any excess grease from the swivel. The high-pressure swivel rebuild is finished.

## Installing the High-pressure Swivel

Once rebuilt, swivel installation is the reverse of the removal instructions. During installation, it is important to torque gland nuts as follows:

1/4" tube, coning and threading, 60 Kpsi:	25 lb-ft, 34 Nm
3/8" tube, coning and threading, 60 Kpsi:	60 lb-ft, 68 Nm
M8 clamp bar screws	10 -12 lb-ft, 13.6 -16.3 Nm

## For Assistance

**Contact:**

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Kent, WA 98032 USA

Phone: (800) 838-0343  
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techsupport@omax.com  
<http://www.omax.com>



# Appendix C:

## Rebuilding the Dual On/Off Valve





# Rebuilding the Dual On/Off Valve

Use the following procedure to repair a faulty Dual On/Off Valve.

## Contents

Tools and Materials Needed.....	page C-1
Removing the Dual On/Off Valve .....	page C-1
Disassembling the Dual On/Off Valve .....	page C-4
Reassembling the Dual On/Off Valve.....	page C-5
Installing the Dual On/Off Valve .....	page C-7

## Tools and Materials Needed

- Repair Kit (P/N 301927)
- Blue Goop anti-galling compound (P/N 200365)
- Open end wrenches: ¼", 13/16", 1", 1½"
- Torque wrench capable of reading at least 50 ft. lbs. (68 Newton-meters)
- Lubriplate grease (P/N 201304)
- Pliers, needle nose
- Allen Wrench, 3 mm
- 1 1/8' crows foot for torquing air actuator

## Removing the Dual On/Off Valve

Figure C-1 below illustrates an OMAX Dual On/Off Valve connected to a MAXJET 5 Nozzle:

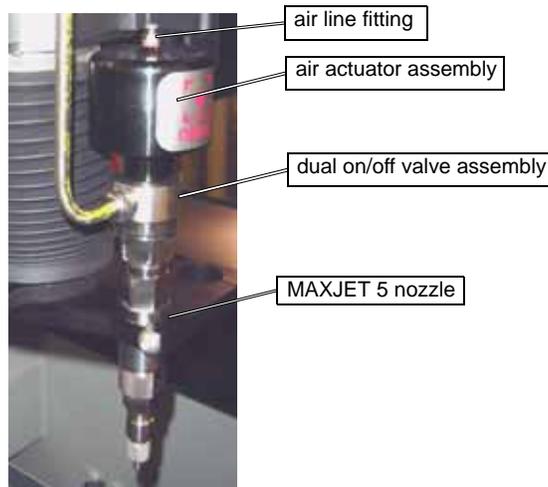


Figure C-1: Dual On/Off Valve with the MAXJET 5 Nozzle

### To remove the Dual On/Off Valve assembly:

1. Switch Off the AC power for both the pump and table. Disconnect their main AC power breaker. Attach an "Out of Service" tag on this breaker and observe all applicable electrical safety procedures.
2. Remove the air line from the **air line fitting** on top of the **air actuator assembly** (Figure C-2) and move it out of the way.

**WARNING!** *Before removing the air line, you must first power Off the pump! Once the air line controlling the on/off valve is removed, the nozzle becomes active.*

3. Remove the **air actuator assembly** from the **valve body** using a 1 3/8" open end wrench.

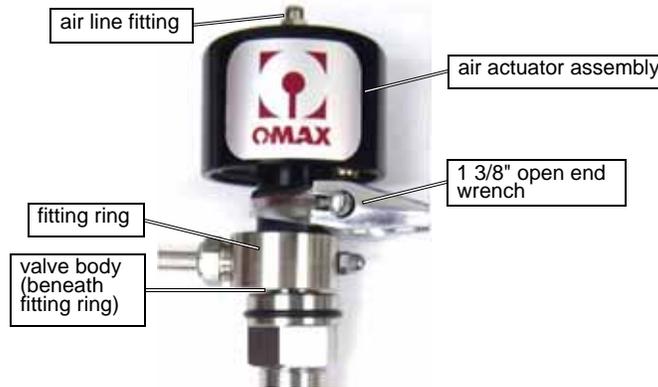


Figure C-2: Removing the Air Actuator Assembly

4. Remove the **retaining screw** from the **valve body** using the 1/4" open end wrench.



Figure C-3: Removing the Retaining Screw from the Valve Body

5. If possible, leave the UHP tube tightened in the **fitting ring** until the valve **gland nut** is loosened. After that, remove the UHP tubing from the fitting ring.

**Caution:** *Always use two wrenches when removing a gland nut!*

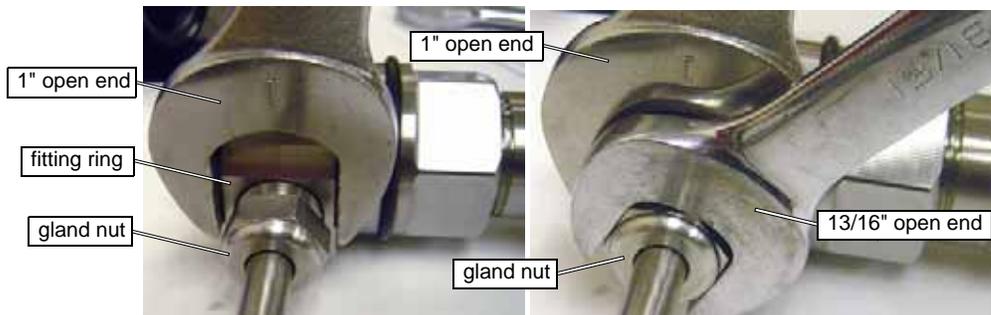
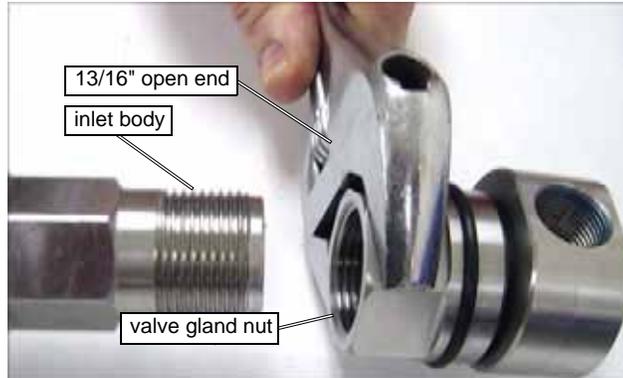


Figure C-4: Loosening the Valve Gland Nut using Two Open End Wrenches

6. Loosen the **valve gland nut** from the **inlet body** by placing a 13/16" open end wrench on the **valve gland nut**.



*Figure C-5: Removing the Valve Gland Nut from the Nozzle Assembly*

7. Rotate the **On/Off valve assembly** away from the high pressure nipple and remove the **valve gland nut**.
8. Remove the **gland nut** from the fitting ring (Figure C-4) and carry the **Dual On/Off Valve Assembly** to a clean work area for rebuilding.

**Caution:** *The on/off seat is not secured in the valve body at this point and may fall out when carried.*

## Disassembling the Dual On/Off Valve

**Caution:** The on/off valve and its rebuild location must be thoroughly cleaned prior to rebuilding.

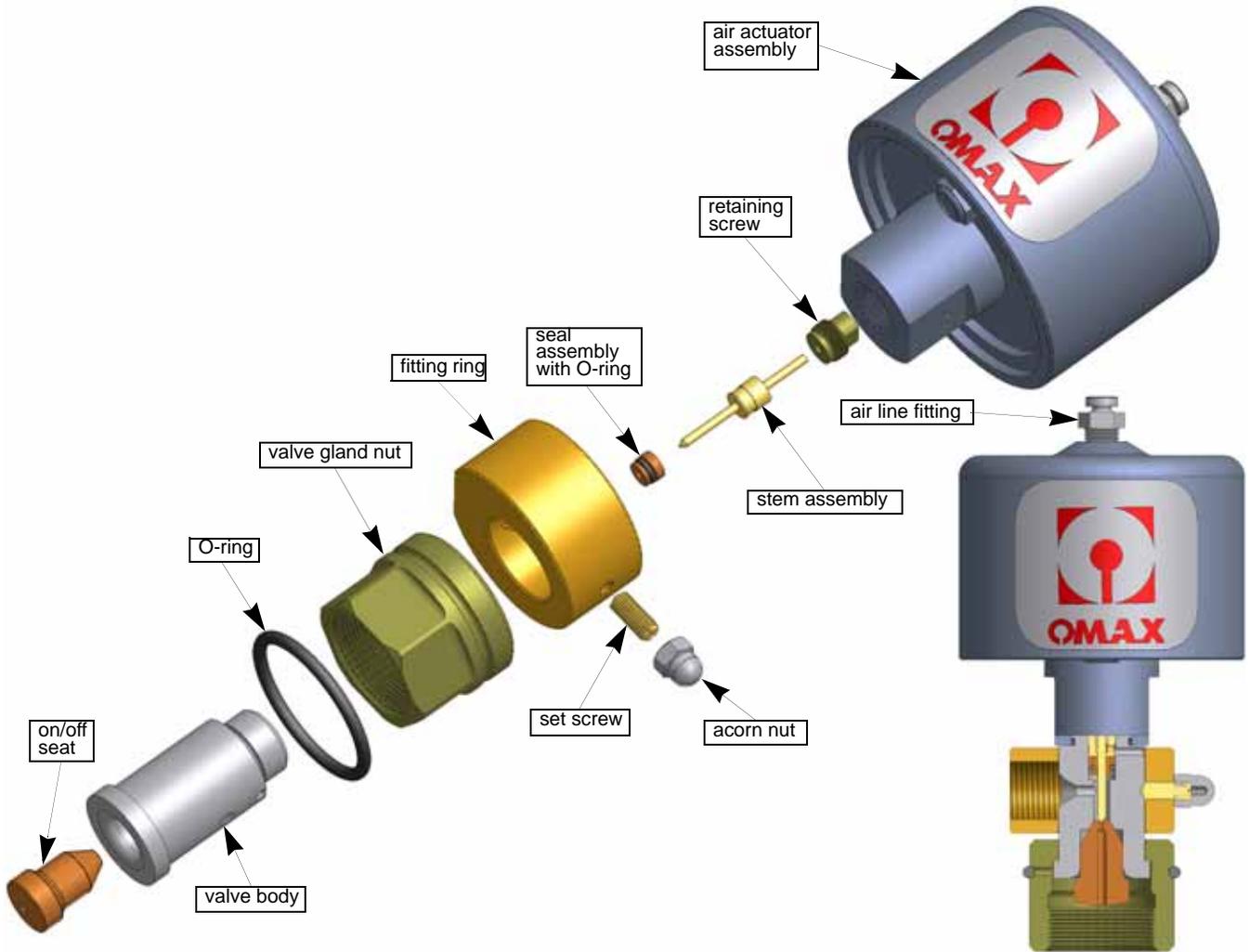


Figure C-6: Components of the OMAX Dual On/Off Valve

1. Ensure that your working area for rebuilding this assembly is clean with all required **tools** and **materials** available (see page D-1 for list).
2. Pull the **fitting ring** and **valve gland nut** from the **valve body**.



Figure C-7: Components of the Dual On/Off Assembly

- Use the needle nose pliers to remove the **stem assembly** from the **valve body**.

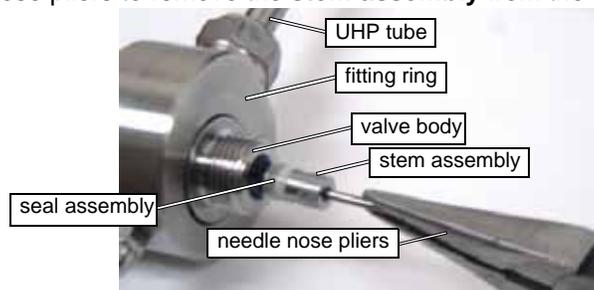


Figure C-8: Removing the Stem Assembly from the Valve Body

- If the seal assembly remains in the valve body, use the end of an Allen wrench (or other long tool approximately 3mm in diameter) to push the **seal assembly** out of the **valve body**.

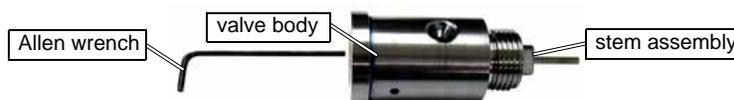


Figure C-9: Pushing the Seal Assembly from the Valve Body

- Clean all parts not being replaced in the repair kit. Discard the used **on/off seat**, **seal assembly with O-ring** and **stem assembly**.



Figure C-10: Discard the On/Off Seat, Seal Assembly, and Stem Assembly

**Note:** All items included in the Dual On/Off Valve Repair Kit (P/N 301927) must be used. Do not reuse any parts that are provided in the repair kit. Reusing these parts will decrease the life of your rebuilt on/off valve assembly.

- Carefully inspect the **valve body** for cracks and other defects. Cracked and damaged parts must always be replaced.

## Reassembling the Dual On/Off Valve

- From the on/off valve repair kit, locate the **on/off seat**, the **seal assembly with O-ring**, and the **stem assembly**.
- Slide the **seal assembly** onto the **stem assembly** shaft with the **O-ring** facing towards the **valve body** (Figure C-12). Ensure that the seal assembly slips over the **pointed end** of the stem assembly.
- Lubricate both the **seal assembly O-Ring** and the **stem assembly** with Lubriplate grease:

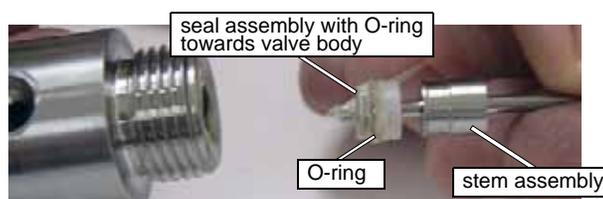


Figure C-11: Apply Lubriplate to Seal and Stem Assemblies

4. Lightly coat the **valve body** bore down past the threads to the internal lip with Lubriplate grease:

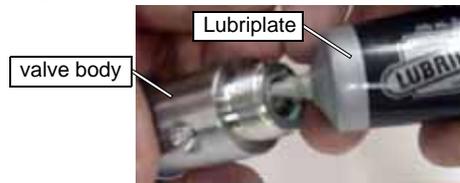


Figure C-12: Apply Lubriplate to Valve Body Bore

5. Tightly grasp the **stem** assembly with the **seal assembly** installed and gently push them down into the lubricated **valve body** bore:



Figure C-13: Insert the Stem and Seal Assemblies into the Valve Body

**Note:** If the stem assembly body resists insertion into the valve body because of the seal assembly O-ring, push the stem assembly body in using the end of an Allen wrench (or equivalent long tool) until the internal threads of the valve body are exposed.

6. Apply some **Blue Goop** onto the threads of the **retaining screw** and install it in the **valve body** using the ¼" open end wrench.

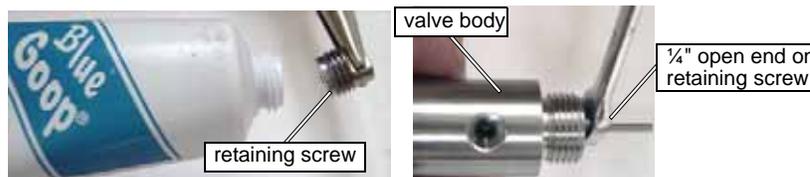


Figure C-14: Applying Blue Goop and Installing the Retaining Screw

7. Apply **Blue Goop** to each end of the **on/off seat** where it will contact the **valve body** and also where it will contact the bulkhead adapter. Insert it into the **valve body** (or place it in the inlet body).



Figure C-15: Insert the Stem Assembly into the Valve Body

8. Slide the **valve gland nut** and **fitting ring** onto the **valve body** (refer to step #2 in the disassembly instructions).

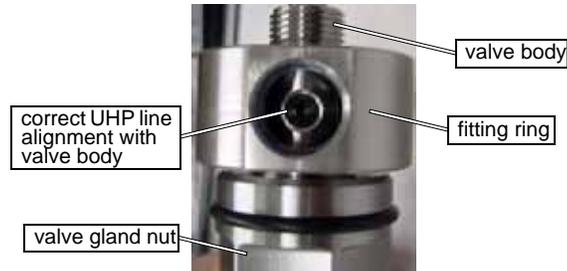


Figure C-16: Sliding the Valve Gland Nut and Fitting Ring onto the Valve Body

9. The repair of the Dual On/Off Valve is complete.

## Installing the Dual On/Off Valve

1. Verify that the on/off seat remains in the valve body. Hand tighten the **valve gland nut** onto the nozzle inlet after rotating the **valve body** so that the UHP line is in alignment with the opening in the **fitting ring**:



*Figure C-17: Align the UHP Line with the Opening in the Fitting Ring*

2. **Insert the UHP input line** into the **fitting ring**. Ensure that the threads on the high-pressure line have been applied with anti-galling compound (Blue Goop) and that three threads are showing (see Three Thread Rule, page 4-4):



*Figure C-18: Applying Blue Goop and Ensuring Three Threads Show*

3. Tighten the UHP input line using the 13/16" and 1" open end wrenches. Tightened to 50 ft. lbs. (no greater than 75 ft. lbs. Refer to Figure C-4.

**Note:** When tightening the gland nut, ensure that the on/off valve remains square to the UHP line to eliminate stress on the UHP line.

4. Apply a small amount of anti-galling compound (Blue Goop) to the threads of the **valve body**.



*Figure C-19: Applying Blue Goop to the Valve Body Threads*

5. Reinstall the **air actuator assembly**. Use the 1 1/8" crows foot to torque it at 250 in-lbs (28.2 Nm). Refer to Figure C-2.
6. Re-attach the air line to the **air line fitting** on top of the **air actuator assembly**. Refer to Figure C-1.

- Prior to use, remove the nozzle body (1" open end wrench) and jewel. Flush the system for at least 5 minutes using the **Test** nozzle command in Make. Select **High** pressure, **Water** only.

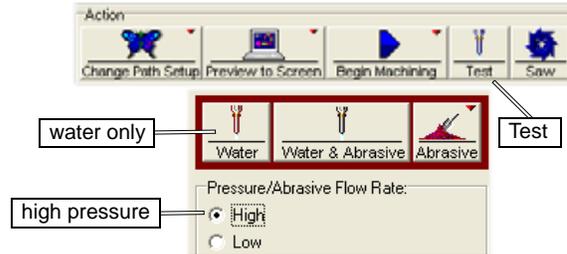


Figure C-20: Flushing the System with Water Only at High Pressure

- After five minutes of flushing, re-install the nozzle body and jewel. Torque the Dual On/Off Assembly to the nozzle body at 30 - 40 ft. lbs. (40.6 - 54 Newton-meters).
- Following installation, test nozzle operation using high-pressure water only. Refer to Figure C-20.

**Note:** During a high pressure condition, check for visible leaking from the weep holes. If water leaking is present, the sealing is not complete between UHP fittings. Refer to Servicing the High-pressure Plumbing System on page 4-2.

## For Assistance

### Contact:

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