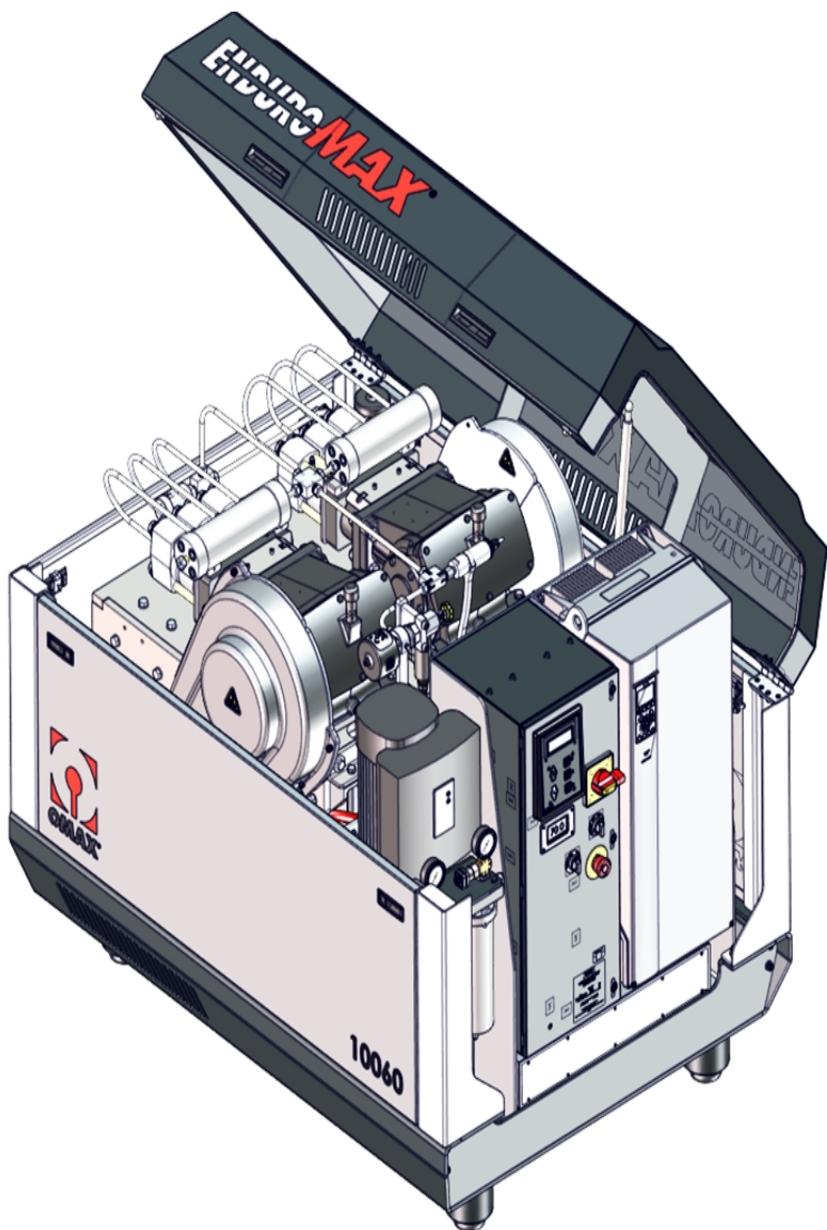


# OMAX® 100 hp EnduroMAX® Pump

## Operator Guide



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# Chapter 1: Safety

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

## **WARNING!**



*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.*

## **WARNING!**



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

## **MANDATORY ACTION!**



### **Lock out power**

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

## **MANDATORY ACTION!**



### **Read the user's guide**

*Read your equipment's user's guide for specific operator instructions and additional safety requirements.*

## **Wear Gloves**



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

## **Eye Protection**



*Always wear approved safety goggles whenever cutting. Regular glasses do not provide sufficient eye protection! Have an eyewash station located near the work area 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. In addition, tank water could contain particles from the material or chemicals irritants.*



## Chapter 2: Introduction

### 100 Hp EnduroMAX Pump

#### External Covers



Figure 1

## Front View

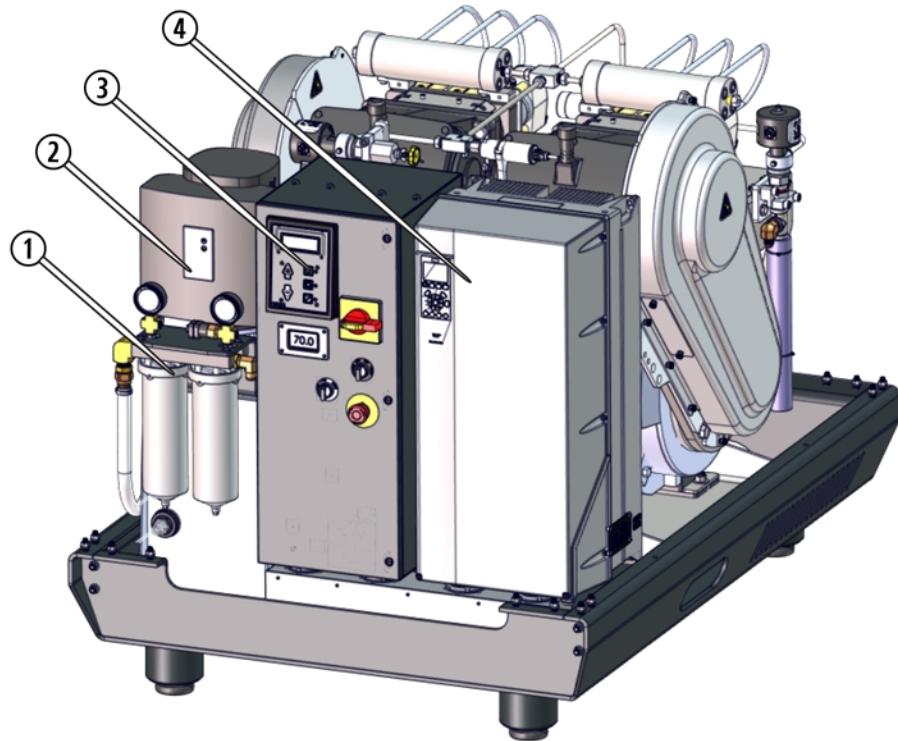


Figure 2

- [1] Water filter assembly      [3] Control panel
- [2] Charge pump assembly      [4] Variable frequency drive (VFD)

## Top View

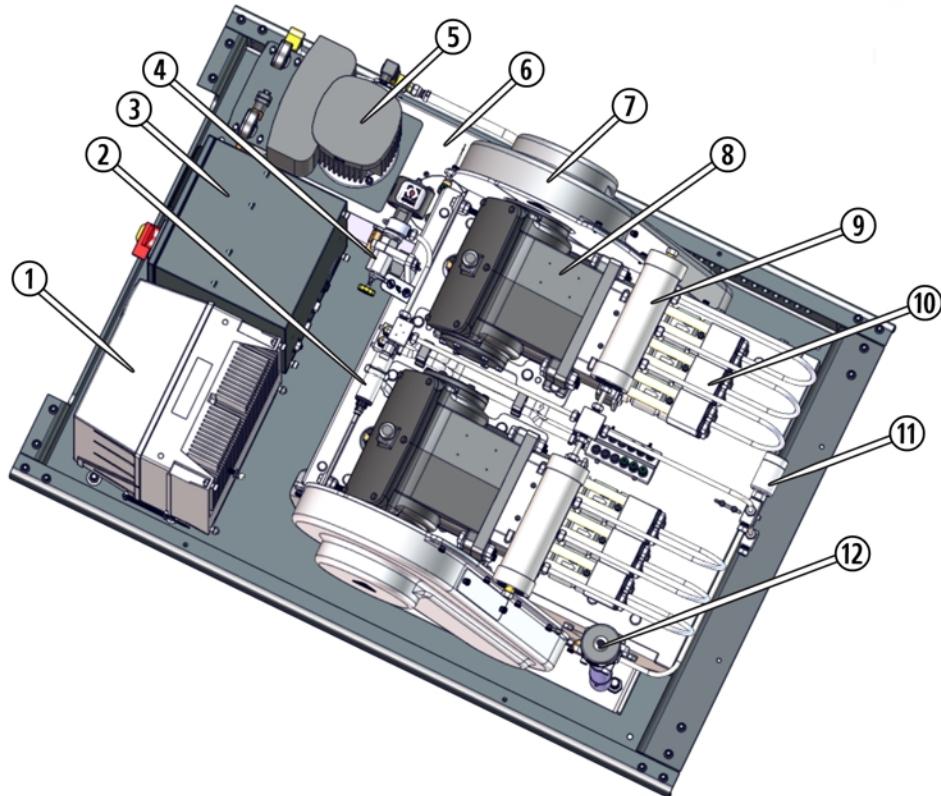


Figure 3

- |                                    |                                 |
|------------------------------------|---------------------------------|
| [1] Variable frequency drive (VFD) | [7] Motor drive belt cover (x2) |
| [2] Pressure transducer            | [8] Motor crankcase (x2)        |
| [3] Control panel assembly         | [9] High-pressure manifold (x2) |
| [4] Adjustable dump orifice (ADO)  | [10] High-pressure wet end (x2) |
| [5] Charge pump                    | [11] Overpressure safety valve  |
| [6] Charge pump water tank         | [12] Fixed dump orifice         |

## Right Side View

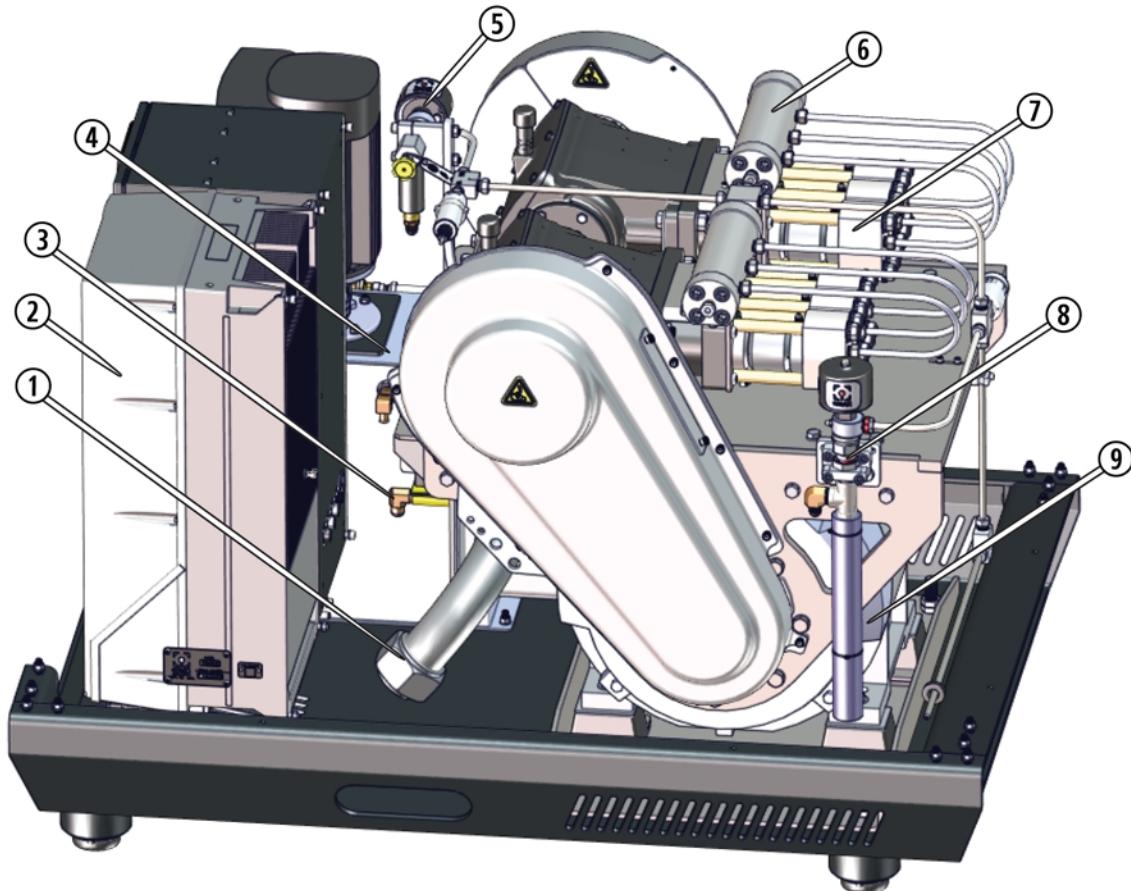


Figure 4

- |                                       |   |
|---------------------------------------|---|
| [1] Electrical conduit for pump motor | [6] High-pressure manifold (x2)         |
| [2] Variable frequency drive (VFD)    | [7] High-pressure wet end (x2)          |
| [3] Temperature control assembly      | [8] Fixed dump orifice                  |
| [4] Charge pump water tank            | [9] High-pressure dual-shaft pump motor |
| [5] Adjustable dump orifice (ADO)     |   |

## Left Side View

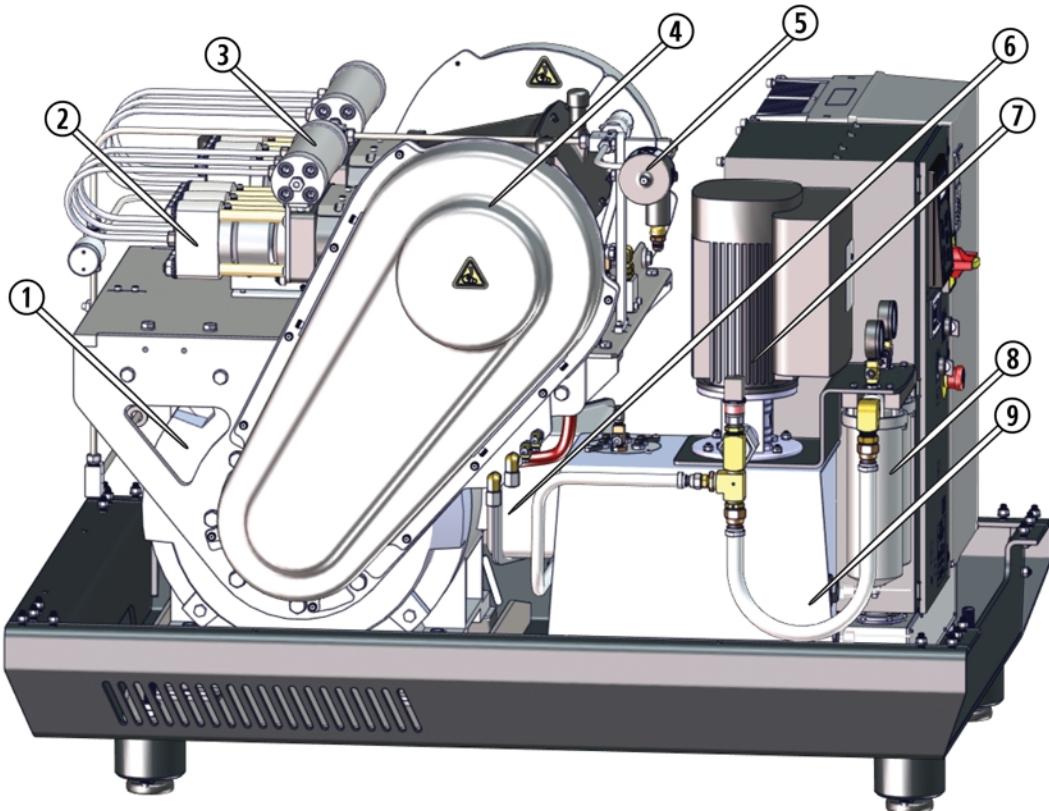


Figure 5

- |   |                              |
|---|------------------------------|
| [1] High-pressure dual-shaft pump motor | [6] Electrical box for motor |
| [2] High-pressure wet end (x2)          | [7] Charge pump motor        |
| [3] High-pressure manifold (x2)         | [8] Water filter assembly    |
| [4] Motor drive belt cover (x2)         | [9] Charge pump water tank   |
| [5] Adjustable dump orifice (ADO)       |                              |

## Rear View

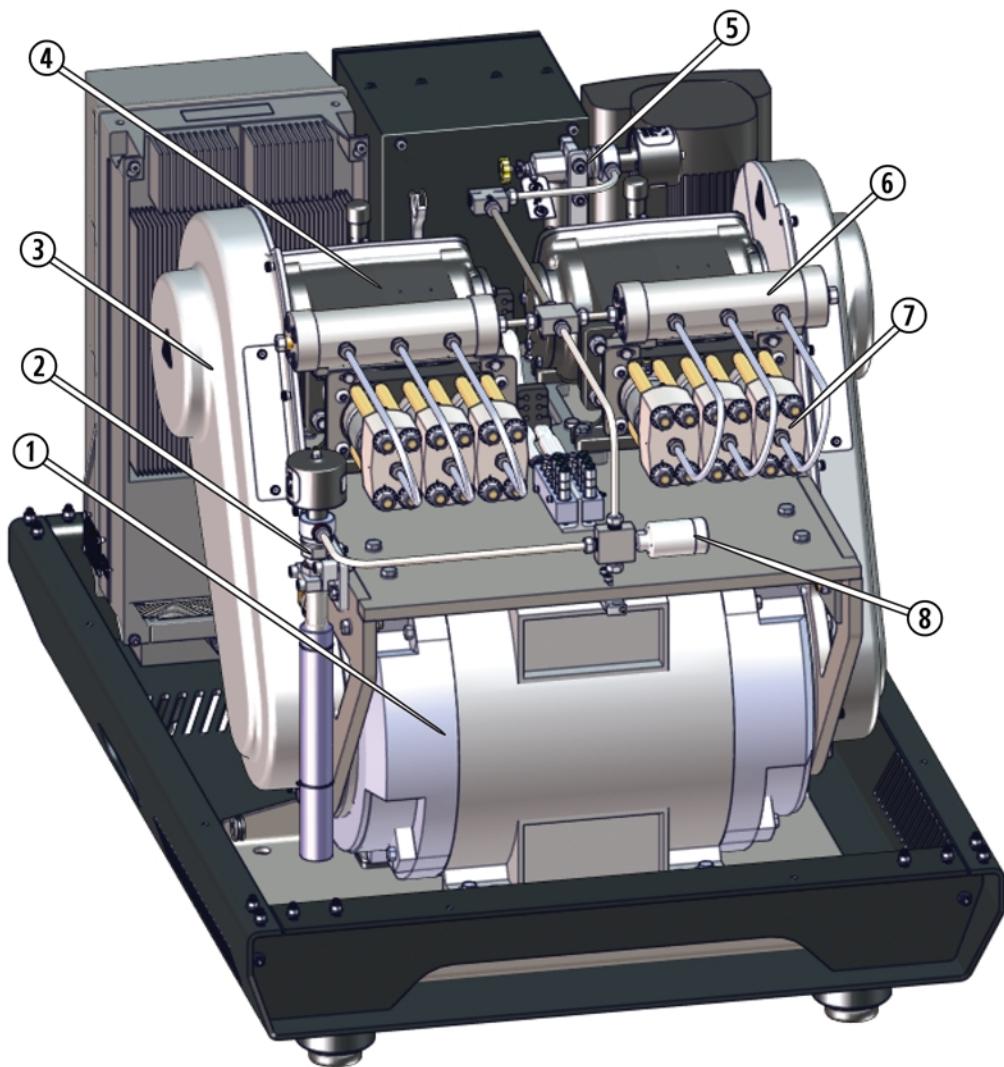


Figure 6

- |   |                                   |
|---|-----------------------------------|
| [1] High-pressure dual-shaft pump motor | [5] Adjustable dump orifice (ADO) |
| [2] Fixed dump orifice                  | [6] High-pressure manifold (x2)   |
| [3] Motor drive belt cover (x2)         | [7] High-pressure wet end (x2)    |
| [4] Motor crankcase (x2)                | [8] Overpressure safety valve     |

# Pump Operator Controls

Operator controls for the 100 hp EnduroMAX pump are located on a front panel that also provides a water temperature display, a 5-button keypad with LCD, pump AC disconnect switch, charge pump on/off switch, ADO+DO/ADO orifice selection switch, and an emergency stop switch (E-stop):

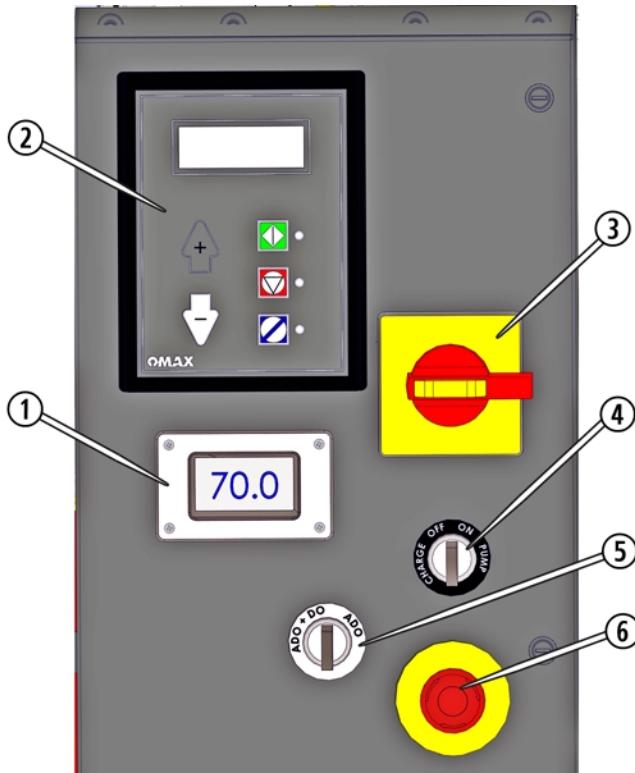


Figure 7

- |                               |   |
|-------------------------------|---|
| [1] Temperature display       | [4] Charge pump on/off switch             |
| [2] 5-button keypad with LCD  | [5] ADO + DO/ADO orifice selection switch |
| [3] Pump AC disconnect switch | [6] Emergency stop switch (E-stop)        |

## Temperature Control Display



The temperature display monitors the charge pump water temperature. When water temperature remains below 70° F (21° C), water returning from the wet end cooling blocks is recirculated in the charge pump water tank. When water temperature rises above 70° F (21° C), a valve opens allowing the higher temperature water to be discharged down the waste water drain, preventing it from being recirculated back into the charge pump water system and potentially damaging the high-pressure seals. When the recirculating water is discharged down the waste water drain, the tank's float switch turns on the incoming water supply, filling the tank to the appropriate level. If the incoming water supply is too warm, the control system may continue to discharge the higher temperature water.

## Keypad

The pump keypad provides five function buttons and a four-line message display screen:

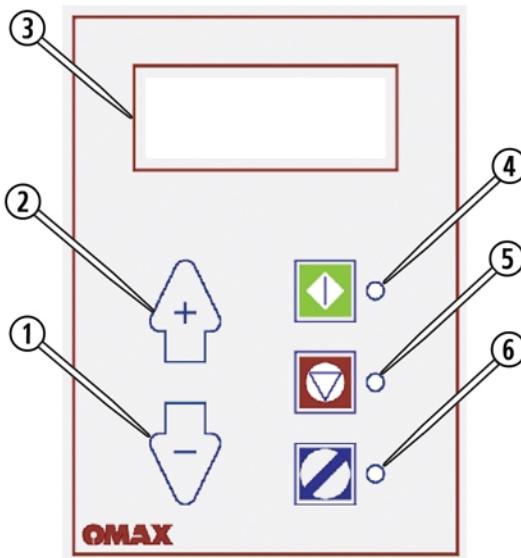
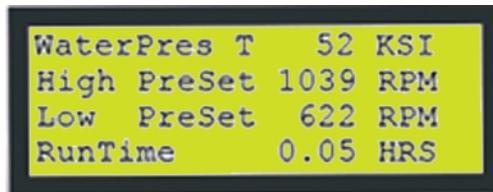


Figure 8

- [1] Pump rpm down button
- [2] Pump rpm up button
- [3] Display screen (LCD)
- [4] Run button with green status LED
- [5] Stop button with red status LED
- [6] Reset button with red status LED

## Display Screen



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

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

A "T" appears with the water pressure information (Water Pres T) and the Run status LED is solid green if a pressure transducer is connected and recognized by the pump controller card. When no "T" appears, the water pressure is calculated by the VFD and the Run status LED flashes green.

If a fault occurs, the pump shuts down and a fault message indicating the type of fault appears on the first three lines of the keypad display.

## Run Button



Starts the pump when pressed if operating when in a standalone mode. When started, the motor rpm (pump pressure) returns to the last value of Hi Pre-Set. The green status LED to the right of this button is lit solid when the pump is in the “run” mode with a pressure transducer connected. Its green status LED flashes when no pressure transducer is connected and the VFD calculates the water pressure.

## 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 button 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 Buttons



Pressing the Up arrow button 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 button at any time decreases pump rpm and pressure down to the minimum rpm.

## Disconnect Switch for Main AC Power Source



This on/off switch controls the AC input power source for pump operation. When **OFF**, all AC power to the 100 hp EnduroMAX pump is disconnected and all pump operations stop; when **ON**, main AC power to the pump is restored allowing pump operation.

## Charge Pump On/off Switch



The charge pump circulates water through the charge pump water tank and cooling lines. This flow flushes warm water from the water 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 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 without the charge pump running, the high-pressure pump will not start and the error message, "Charge Pressure Low", appears on the front panel display screen.

## ADO + DO / ADO Selection Switch



This 2-position switch turns the fixed dump orifice (DO) ON or OFF. When in the ADO + DO position, DO operation is ON and now works in parallel with the Adjustable Dump Orifice (ADO). When in the ADO position, DO operation is OFF with only the ADO functioning.

Fixed dump orifice use is determined by the nozzle orifice size: when operating with a nozzle orifice **larger** than the DO orifice (0.016 in. is default size), you **MUST** operate the pump with **ADO+ DO**. When the nozzle orifice is **smaller** or **equal** to the DO orifice (0.016 in.), use **ADO** only.

Nozzle Orifice Size	Switch Setting
< .016 in.	ADO
= .016 in.	ADO
> .016 in.	ADO + DO

## Emergency Stop Switch (E-stop)



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

When the pump is connected to an OMAX abrasive waterjet system, pushing either the E-stop on the EnduroMAX pump, or the E-stop at the computer controller, immediately shuts down both the pump and the abrasive waterjet.

### **NOTE:**

*When the pump is connected to an OMAX cantilever table, the E-stop circuit on the pump will not shut down the table.*

## Charge Pump Water Pressure Controls

### **NOTE:**

*Charge pump water pressure for the 100 hp EnduroMAX is operator adjustable using the charge pump control panel:*

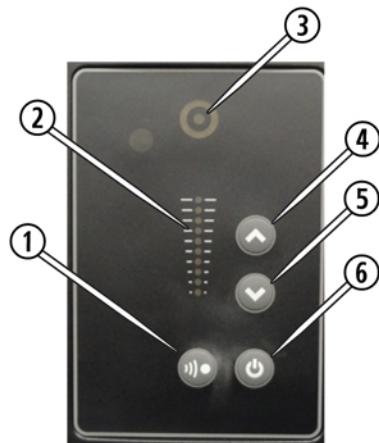


Figure 9

- |                                     |                                   |
|-------------------------------------|-----------------------------------|
| [1] Communication button (not used) | [4] Pressure increase button      |
| [2] LED pressure indicators         | [5] Pressure decrease button      |
| [3] Charge pump status indicator    | [6] Charge pump start/stop button |

Pressing the **up arrow** [4] raises water pressure; pressing the **down arrow** [5] lowers water pressure. Operating pressure should be set at 150-175 psi as read on the pre-filter gauge only.

Pressing the start/start button [6] always stops the charge pump. When the pump is stopped via this button, the "Stop" text to the right of this button illuminates. It is not necessary to use this button to start the charge pump at initial power up. Start up is automatic at that time.



# Chapter 3: Pump Operation

Operating with an OMAX abrasive waterjet, control is shared between the OMAX table controller and the pump keypad. EnduroMAX pumps provide two modes of operation: keypad and remote. Operating as a standalone pump, control is via the pump keypad only.

Before powering up this pump:

- Ensure all operators have access to the required protection devices (safety glasses, ear plugs, and gloves).



- Visually inspect external pump components for damaged parts, leaks, and other conditions that could prevent safe and proper operation.
- Verify the oil level in both pump crankcases is sufficient for operation (3 quarts required in each).
- Ensure that all pump covers are in place and properly secured.
- Ensure the nozzle and mixing tube are the correct sizes and installed properly.
- Ensure you are familiar with the location and function of each operator control.

## Startup Checklist

For OMAX abrasive waterjet machines that use the 100 hp EnduroMAX pump, follow these steps to ensure that operational procedures specific to the 100 hp pump are completed correctly.

1.	Turn power <b>ON</b> at main breaker box
2.	Open air supply valve
3.	Open water supply valve
4.	Ensure the E-stop switch is pulled out
5.	Verify water level in charge pump tank
6.	Turn high-pressure pump power <b>ON</b>
7.	Verify VFD is powered <b>ON</b>
8.	Set ADO selection switch to either <b>ADO + DO</b> or <b>ADO</b> depending upon nozzle orifice size
9.	Turn charge pump power switch <b>ON</b>
10.	Adjust charge pump water pressure to read <b>150 - 175 psi</b> read on the pre-filter gauge if needed
11.	Verify cooling water flows from the cooling return lines. Replace water tank lid
12.	Run water for 15 minutes or until water temperature display reads 70° F (21° C) or less prior to operating the pump at high pressure
13.	Refer to your abrasive waterjet operator guide for any remaining startup procedure specific to your equipment

# Starting the 100 hp EnduroMAX

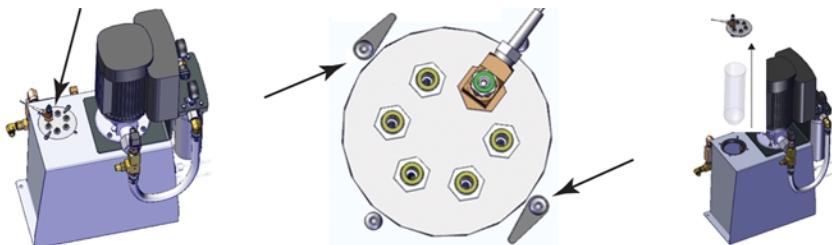
1. Switch the main power breaker **ON**.



2. Open the air supply valve.
3. Open the water supply valve.
4. Ensure **E-Stop switch** pulled out.



5. Verify the water level in the **charge pump tank** is adequate for operation.



6. Turn the **main pump** power **ON**.



7. Verify the **VFD** power is **ON**.

The LED above the **Auto on** button on the **VFD** should be lit. If not, push the **Auto on** button. The LED should now come **ON**.



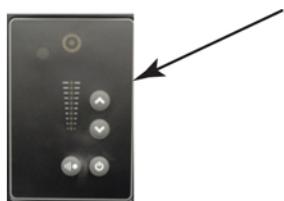
8. Turn the **charge pump** power **ON**.



9. Adjust the **charge pump** water pressure to read 150 - 175 psi on the **pre-filter gauge** if needed:



a. Press the **charge pump Up arrow** to raise pressure (if needed).



b. Press the **charge pump Down arrow** to lower pressure (if needed).



10. Set **ADO selection switch** to either **ADO + DO** or **ADO** depending upon **nozzle orifice** size.

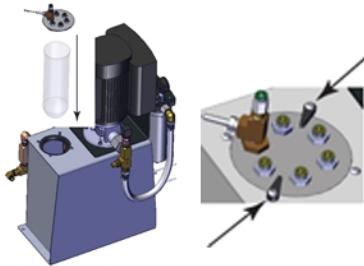


When the nozzle orifice is larger than the DO orifice (0.016 in. default), use the ADO+DO switch position. When the nozzle orifice is smaller or equal to the DO orifice size, use the ADO switch position.

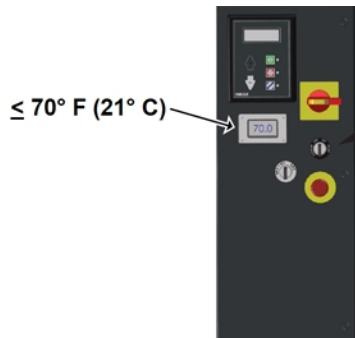
11. Verify cooling water flows from **cooling lines**.



12. Replace the **charge pump tank filter** and **lid**.



13. Run water for 15 minutes or until water **temperature display** reads 70° F (21° C) or less prior to operating the **pump** at high pressure.



## Adjustable Dump Orifice (ADO) Operation

Matching ADO/DO pressure with nozzle cutting pressure is important in preventing damage to ultra high-pressure components.

### Setting the ADO Pressure

ADO pressure requires adjusting anytime the nozzle is changed. It is recommended this pressure be verified during machine startup.

The **ADO** pressure can be 1-2 kpsi below, but never above the nozzle cutting pressure. For example, a cutting head pressure observed at 50 kpsi should see traverse pressures of about 48-49 kpsi. Matching nozzle cutting pressure with ADO/DO pressure is important in preventing damage to ultra high-pressure components.

**To equalize the ADO/DO pressure with the nozzle cutting pressure:**

1. Power up both the **high-pressure pump** and the **table controller**.
2. Lift the **pump top cover** to access the **ADO** [1] and its yellow **adjustment knob** [2].



Figure 10

3. Select the **ADO+DO/ADO** switch position that corresponds to your cutting **nozzle** configuration.

When the nozzle orifice size is larger than the DO orifice (0.016 in. default), select the ADO+DO switch position. When the nozzle orifice is smaller or equal to the DO orifice size, select the ADO switch position.

4. To ensure the **tapered stem** is correctly positioned once the **pump** starts, screw the **wing nut** [2] counter-clockwise towards the **pressure adjustment knob** [4] until the **spring** [3] makes initial contact with both the **wing nut** and **knob**.

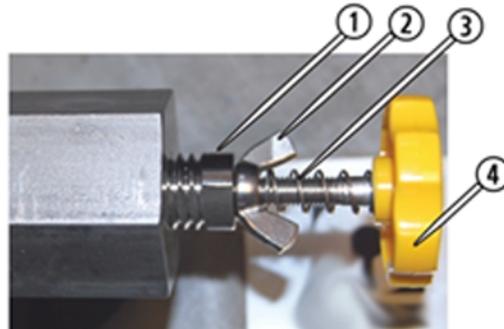


Figure 11

5. Screw the **pressure adjustment knob** into the **ADO body** until the **wing nut** makes initial contact with the **stem adjuster** [1] (Figure 11).

**NOTE:**

*The adjustable dump orifice (ADO) was not designed to close completely as a “needle valve” would. NEVER screw the adjustment knob all the way in clockwise and force the tapered stem into the tapered seat. Doing so may jam the stem into the seat, requiring the ADO be disassembled to unjam the stem.*

6. Hold the **adjustment knob**, preventing it from turning, and screw the **wing nut** back towards the **knob**, leaving approximately a 1/4 in. (0.635 cm) gap [1] between the **stem adjuster** and **wing nut**. This gap provides the necessary adjustment room for the **knob**. If not enough gap is available, the **wing nut** will contact the **ADO body** too soon, preventing the **knob** from being adjusted any further. If this happens, simply unscrew the **wing nut** away from the **ADO body** to allow more adjustment travel.

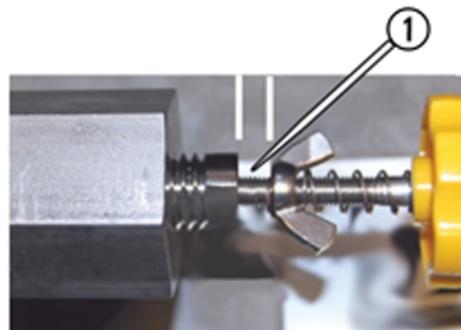


Figure 12

**NOTE:**

*The safety valve may activate and the pump dead head due to excessive pressure if the pump runs with the nozzle shut OFF and the ADO valve pressure too high.*

7. Click the **Test button** and select **Pump Only (Dump Valve open)** and **High Pump Pressure**.

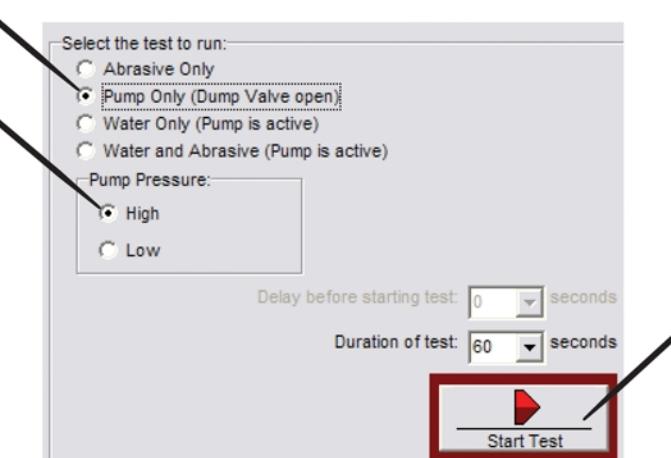


Figure 13

8. Click the **Start Test** button to activate the **pump**.
9. Turn the **ADO pressure adjustment knob** until the pressure indicated on the **pump display panel** is within 1 - 2 kpsi lower than the **nozzle high-pressure valve**. An Allen wrench inserted into the end of the **knob** will assist in fine tuning the **ADO** pressure adjustment.



Figure 14

The ADO pressure adjustment can equal the nozzle pressure, but must never be allowed to exceed nozzle pressure. Also, ADO pressure cannot be more than 2 kpsi below nozzle pressure.



### **WARNING!**

**Never continue unscrewing the adjustment knob until it detaches itself from the ADO body while the water is under pressure.**

10. Once the correct pressure is reached, hold the **adjustment knob** in place to prevent it from rotating, then tighten the **locking wing nut** to set the **knob** in position. This should be done while the **pump** is running at high pressure.
11. Click the **Stop** button to end the test.



Figure 15

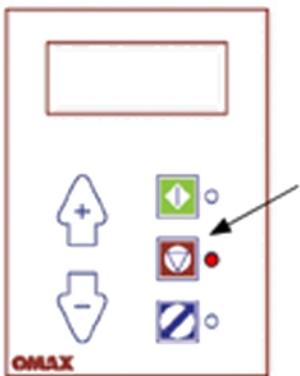
12. Replace the pump **cover**. Adjustment of the **ADO** pressure is complete.

# Stopping the 100 hp EnduroMAX

## **NOTE:**

In an emergency, this pump can be stopped at any time using the E-stop button. Pushing E-Stop immediately shuts down operation of both the high-pressure pump and controller. The E-Stop is disengaged (reset) by manually turning and pulling it back to its original position. The pump cannot be restarted until the E-Stop is reset. The E-stop disables only pump and nozzle operation; the computer remains powered up.

1. Press the **STOP** button on the **pump front panel keypad**.



2. Verify that the red **LED** next to the **STOP button** is **ON**.
3. Turn the **charge pump** power switch **OFF**.



4. Turn the **main pump** power **OFF**.



5. Close the water supply valve.
6. Close the air supply valve.
7. Switch the main power breaker **OFF**.



# Chapter 4: Maintenance

This section contains information supporting proper maintenance of your pump components. Always service at regular maintenance intervals. It is important to continually inspect pump parts for wear or damage and to immediately replace them as required.



## **WARNING!**

*All electrical and maintenance work described in this chapter should be undertaken only by qualified service personnel. Always follow the safety instructions presented in your equipment operation manual.*

The following maintenance activities and schedules are provided to aid in the development of a successful pump maintenance program. In the event of a premature failure, individual pump cylinders can be rebuilt independently; after which, run hours can be recorded and cylinders rebuilt independently according to recommended rebuild schedules.

## Maintenance Schedules

The reference documents listed here provide instructions for performing each specific task. There are also corresponding eLearning videos available on the OMAX Support Site.

### **NOTE:**

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

Task	Frequency	Reference Document
<b>Pump Power-end Maintenance</b>		
Change crankcase oil	After first 50 hours of operation	401073, OMAX, EnduroMAX, MAXIEM Change Pump Crankcase Oil
Lubricate main motor bearings	6 months for continuous high ambient temp; dirty or moist locations; high vibrations Seasonally (each year) if idle 6 months or more Annually if continuous operation Every 3 years if 5,000 hours per year	401075, Maintenance, Lube Pump Electric Motor Bearings
<b>Water Filtration</b>		
Vacuum and clean charge pump water tank	Once a month or more frequently if dirt or debris is present	401106, Maintenance, Charge Pump Reservoir, EnduroMAX Pumps
Replace bag filter on top of charge pump water tank.	Replace the bag filter every 6 months	
Change water filters	Whenever the difference in pressure between the inlet and outlet filter gauges is equal to, or larger than 20 psi	401074, Maintenance, Change Pump Water Filter

Charge pump	Maintain the charge pump per procedures specified by the charge pump manufacturer	
<b>Wet-end Maintenance</b>		
Pump Rebuild If you run the pump at 55 kpsi, the interval increases to 1,000 hours between rebuilds	Rebuild every 500 hrs, alternate Minor/Major rebuild kits	<i>401077, Maintenance, Pump Wet End Rebuild, EnduroMAX</i>
Replace Plunger Assemblies		<i>401077, Maintenance, Pump Wet End Rebuild, EnduroMAX</i>
Replace Cylinders		<i>401077, Maintenance, Pump Wet End Rebuild, EnduroMAX</i>
Replace Check Valve Bodies		<i>401077, Maintenance, Pump Wet End Rebuild, EnduroMAX</i>
Replace Manifolds, Port Adapters, End Caps		<i>401077, Maintenance, Pump Wet End Rebuild, EnduroMAX</i>
<b>Other Pump Maintenance</b>		
Rebuild Safety Valve	Rebuild when leaking occurs; replace if leaking continues	<i>400995, Rebuild OMAX Safety Valve</i>
Replace Air Actuator	The air actuator should be replaced once a year or whenever it fails to operate properly	<i>401060, Installation and Maintenance OMAX Air Actuator</i>
Rebuild Adjustable Dump Orifice (ADO)	The ADO requires rebuilding whenever water leaks are detected	<i>400535, ADO Rebuild Kit Instructions</i>
Clean orifice in Dump Orifice Assembly	When damaged, or if causing the pump to dead-head, or as needed	See <i>Maintaining the Dump Orifice</i> , this document
Rebuild the Fixed Dump Orifice	The fixed dump orifice requires rebuilding whenever water leaks are detected	<i>401008, Operator Guide OMAX Pump</i> , see <i>Maintain the Dump Valve</i>
Post-maintenance flush	OMAX recommends performing a post-maintenance flush any time maintenance is performed on the equipment hardware to prevent damage to pumps and machines	<i>401082, Maintenance, Perform Post-Maintenance Flush</i>
Replace a Tie Rod Stud	Replace when threads are damaged or when bent.	<i>401140, EnduroMAX Stud Replacement</i>

## Consumable Pump Parts

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

Part Description
1 micron, Charge Pump Pre-filter Cartridge
.45 micron, Charge Pump Final-filter Cartridge

## Changing Crankcase Oil

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

See *401073, OMAX, EnduroMAX, MAXIEM Change Pump Crankcase Oil* for detailed procedures on changing the crankcase oil in the EnduroMAX pumps.

# 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 noted in the 100 hp pump's *Maintenance Schedules* section.

See 401075, *Maintenance, Lube Pump Electric Motor Bearings*.

# Cleaning the Charge Pump Water Tank

All types of debris accumulates over time in the charge pump water tank. The tank should be cleaned at every pump rebuild, or more frequently when necessary.

For detailed charge pump water tank cleaning instructions, see 401106, *Maintenance, Charge Pump Reservoir, EnduroMAX Pumps*.

# Rebuilding the Safety Valve

The pump safety valve prevents an excessive build up of water pressure in the system plumbing.

See 400995, *Rebuild OMAX Safety Valve*.

# Maintenance of the Wet-end Assemblies

Procedures for the maintenance of the EnduroMAX pump are available in the 401077 *Maintenance, Pump Wet End Rebuild, EnduroMAX* document. This document details the disassembly and reassembly of the EnduroMAX wet-end components but does not contain procedures that are specific only to the 100 hp pump with dual wet-end assemblies. These additional procedures involve moving the position of the wet-end manifolds to enable the removal/placement of the two wet-end assemblies which are provided below.

## Dual Wet-end Manifold Configuration

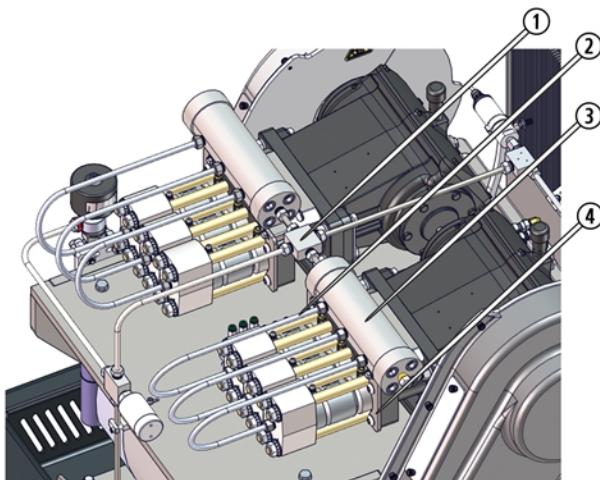


Figure 16

- |                                 |                       |
|---------------------------------|-----------------------|
| [1] Cross fitting               | [3] Manifold assembly |
| [2] High-pressure tube assembly | [4] Manifold bracket  |

Removal of the wet end for a 100 hp pump requires removal of the manifold nipple [2] located between the cross fitting [1] and the manifold [3]. Its removal requires moving the manifold horizontally away from the cross fitting to provide the space required for disassembling the manifold nipple.

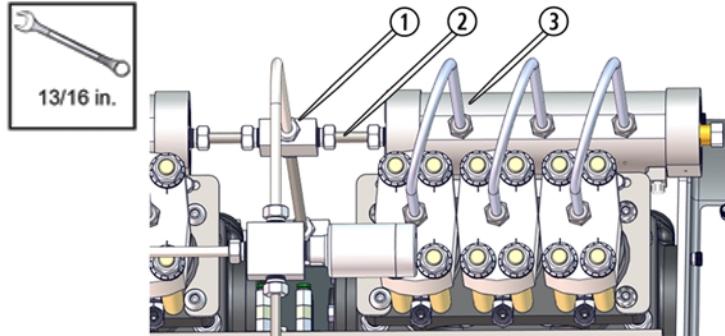


Figure 17

## Removing the Manifold Nipple

### **NOTE:**

*These procedures work for either wet-end assembly in the 100 hp pump.*

1. Unscrew both **manifold nipple gland nuts**.

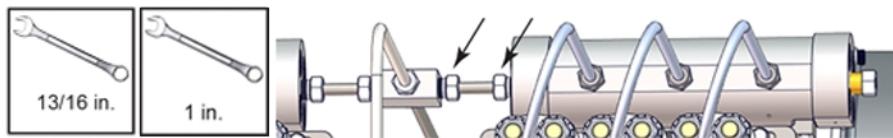


Figure 18

### **NOTE:**

*When removing the nipples and fittings, use two wrenches to avoid binding or twisting the high-pressure plumbing and components.*

2. Alternately loosen in small increments the top and bottom **gland nuts** on all three **high-pressure tube assemblies** until they can be turned by hand.

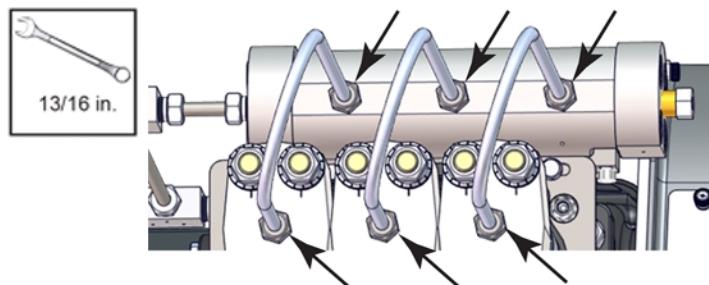


Figure 19

### **NOTE:**

*A large open-end wrench (e.g., 1 in.) can be used to support the **high-pressure tubes** during loosening:*

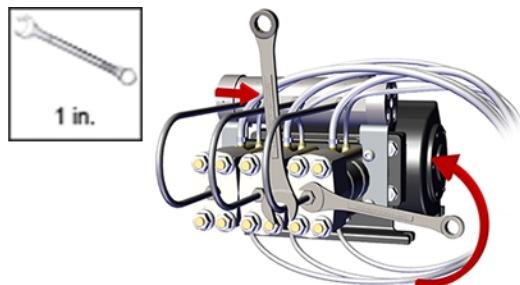


Figure 20

**NOTE:**

Gland-nuts may be difficult to loosen. If required, gently move the high-pressure tube back-and-forth. If binding occurs, check to ensure the manifold assembly and end caps are squarely installed and the high-pressure tubes are not bent. If binding continues, alternate hand-turns between the top and bottom gland nuts. Continue alternating turns until both nuts can be easily turned by hand.

3. Loosen the three screws securing the **manifold brackets** (bracket on both sides of the **manifold**). The top screw [1] allows horizontal **manifold** movement; the two bottom screws [2] allow up/down movement.

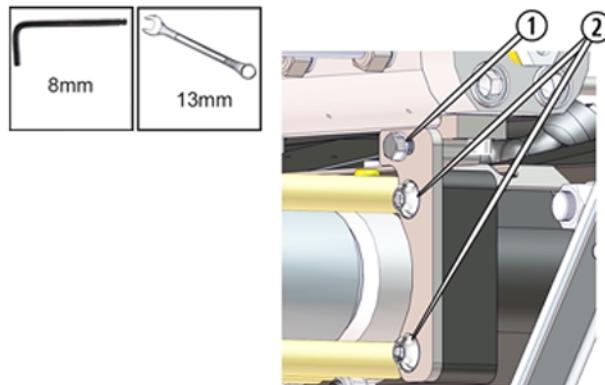


Figure 21

4. Loosen the two screws [1] (located on both sides of manifold) securing the **manifold supports**. These screws allow in/out **manifold** movement.

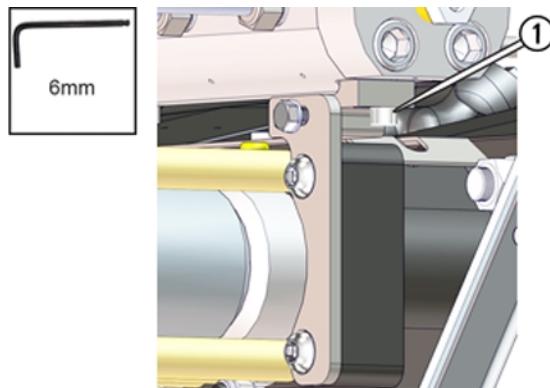


Figure 22

5. Slide the **manifold** away from the **manifold nipple** being removed until sufficient clearance for its removal is obtained.

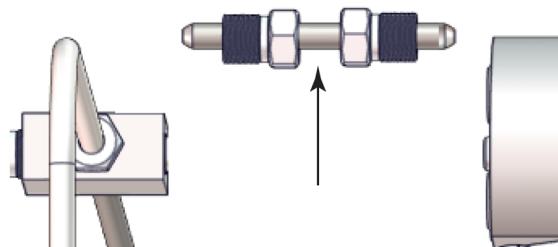


Figure 23

## Reinstalling the Manifold Nipple

### NOTE:

Prior to installing the manifold nipple, ensure that wet-end installation is totally complete except for securing the manifold and associated high-pressure plumbing. If both wet-end assemblies were rebuilt at the same time, both must be completely installed except for the two manifolds and associated high-pressure components.

1. Ensure the mounting hardware for both the **manifold brackets** and **manifold** supports are sufficiently loosened to allow **manifold** positioning adjustments.
2. Ensure the **manifold high-pressure tubing assemblies** are sufficiently loosened to allow **manifold** movement.
3. Slide the **manifold** horizontally away from the **cross fitting**.

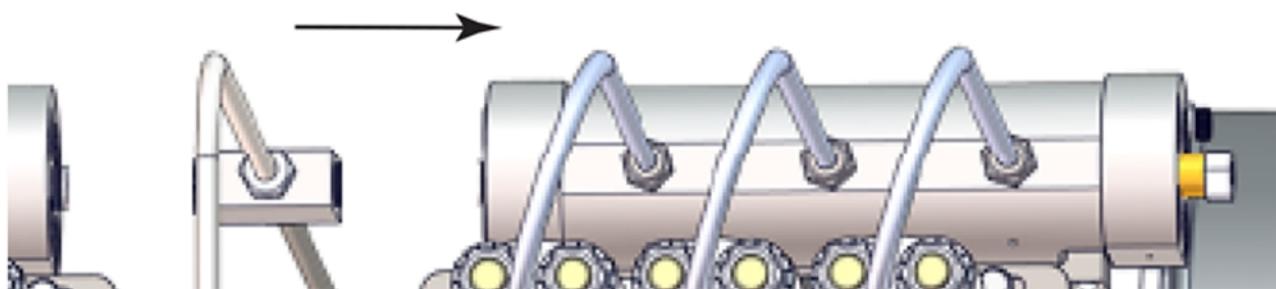


Figure 24

4. Position the **manifold** to enable the insertion of the **manifold nipple** with **gland nuts**, **collars**, and **slotted collets** installed to fit between the **cross fitting** and the **manifold port adapter**.

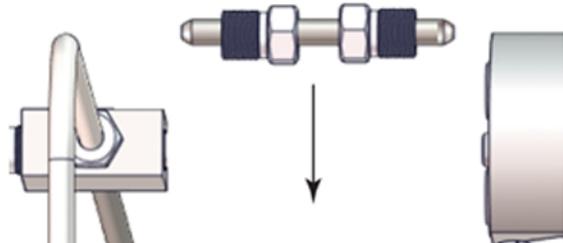


Figure 25

### NOTE:

Always apply Blue Goop to all high-pressure components as necessary. See document, 401044, High Pressure fittings .375 in. Tubing, or 401081, High Pressure Fittings Document .25 in. Tubing.

5. Screw both **gland nuts** into the **cross fitting** and **manifold port adapter**. Ensure that the **manifold nipple** is correctly aligned to the **cross fitting** and **manifold port adapter**.

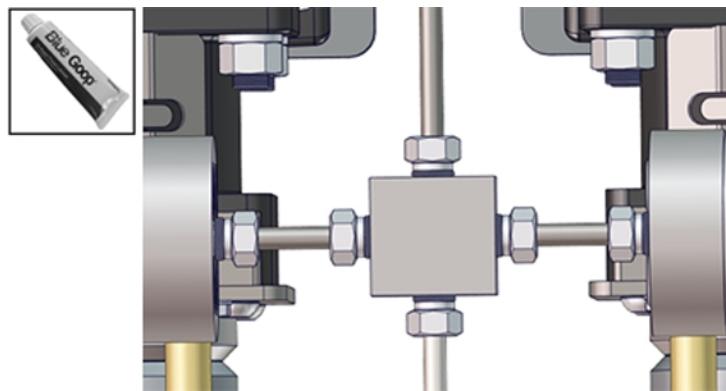
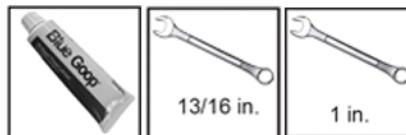


Figure 26

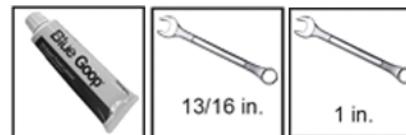
6. Tighten both **gland nuts** per high-pressure plumbing specifications. See document, 401044, *High Pressure fittings .375 in. Tubing* or 401081, *High Pressure Fittings Document .25 in. Tubing*.



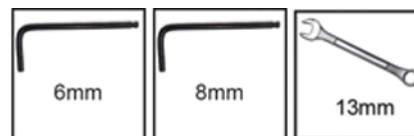
**NOTE:**

*If both wet ends are being installed, ensure that manifold nipples are installed and torqued at the same time for both wet ends.*

7. Torque all **manifold high-pressure tube assemblies** per specifications. See document, 401044, *High Pressure fittings .375 in. Tubing* or 401081, *High Pressure Fittings Document .25 in. Tubing*.



8. Tighten all screws securing the **manifold brackets** and **manifold supports**.



9. Verify that no high-pressure components or **manifold** mounting screws remain untightened.

## Replacing a Tie Rod Stud

Replacing a tie rod is typically only necessary in situations where it becomes damaged due to cross threading or being bent.

See document, 401140, *EnduroMAX Stud Replacement*, for procedures that detail the removal and replacement of a tie rod stud in the adapter block.

# Maintaining the Dump Orifice

To ensure maximum cutting efficiency, the **orifice** [2] in the **dump orifice assembly** [1] should be removed and cleaned or replaced as needed.

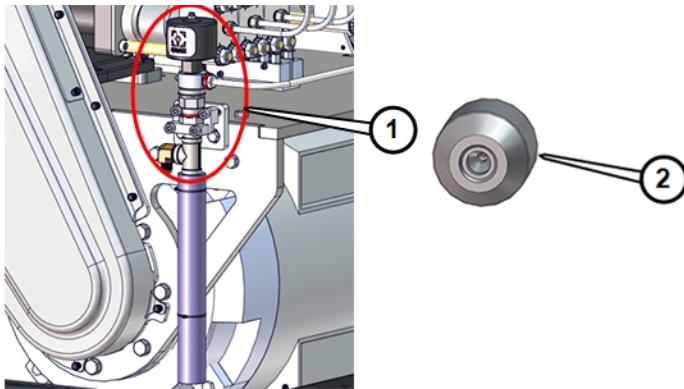


Figure 27

## Remove the Orifice for Cleaning

1. Turn the main AC power to the **table** and **pump OFF** and place a "lockout tag" on the power disconnect to alert others that maintenance is in progress.



2. Turn the water and air supply **OFF**.
3. Bleed all residual air pressure from the **pump hoses** by disconnecting the main air source.
4. Ensure the **high-pressure water lines** have zero pressure.
5. Remove the pump **side covers** to expose the **dump orifice assembly**.

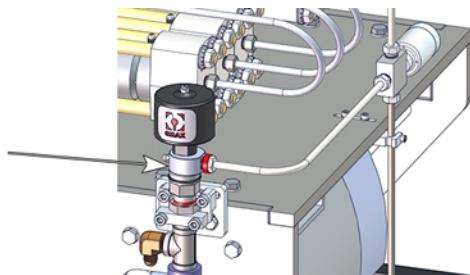


Figure 28

Remove the **pneumatic tube** from the **push-in fitting** on top of the **air actuator**.



Figure 29

6. Loosen the **gland nut** [2] from the **on/off valve fitting ring** [1].

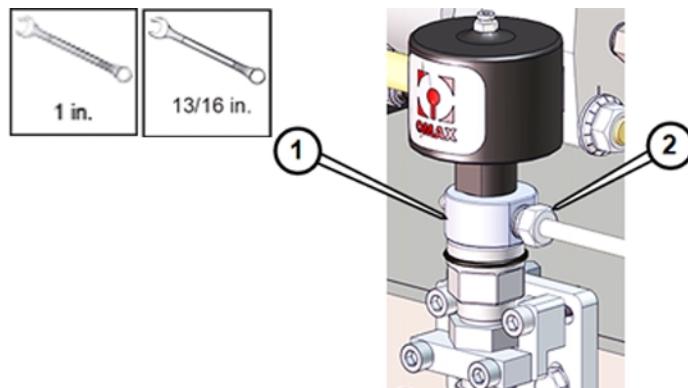


Figure 30

**NOTE:**

*When removing the nipples and fittings, use two wrenches to avoid binding or twisting the high-pressure plumbing and components.*

7. Loosen the gland nut [2] from the **cross fitting** [1].

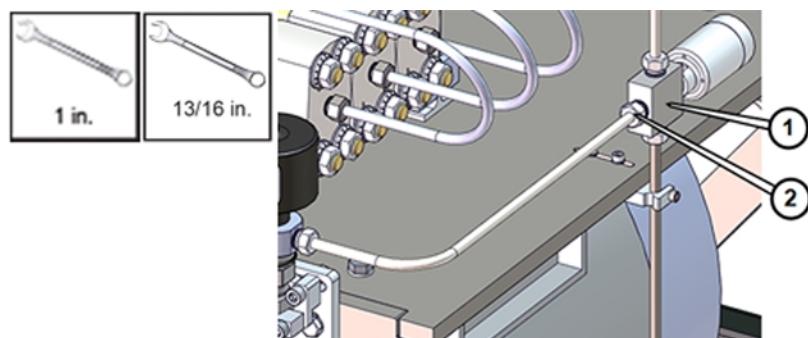


Figure 31

8. Completely unscrew the **gland nuts** from the **on/off valve fitting ring** and the **cross fitting**, then remove the entire **L-shaped nipple assembly** and set it aside.



Figure 32

9. Unscrew the **valve gland nut** [1] from the **dump valve adapter** [2].

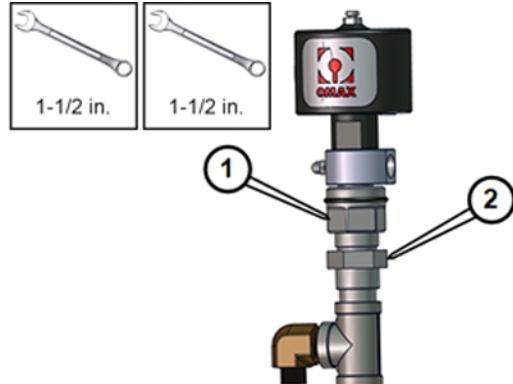


Figure 33

10. Lift the **on/off valve assembly** from the **dump orifice body**, exposing the **valve seat** [1].



Figure 34

11. Remove the **valve seat** and set it aside.



Figure 35

12. Remove the **orifice assembly** for cleaning.



Figure 36

## Clean the Orifice Assembly

1. Submerge the **orifice assembly** into an ultrasonic cleaner filled with white vinegar.



Figure 37

2. Run the ultrasonic cleaner for 3-5 minutes or until the **jewel orifice** is clean.
3. Rinse the **orifice assembly** with clean water prior to reinstalling.

## Replace the Cleaned Orifice Assembly

1. Apply a light coat of Blue Goop to the conical surface of the **orifice assembly**, then place it in the **dump orifice body** with conical side down.

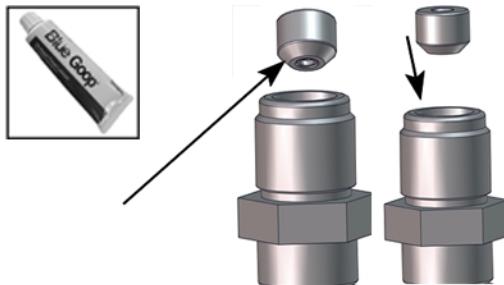


Figure 38

2. Apply a light coat of Blue Goop to the base and conical surfaces of the **valve seat** and insert it into the **dump orifice body** with the conical side up.

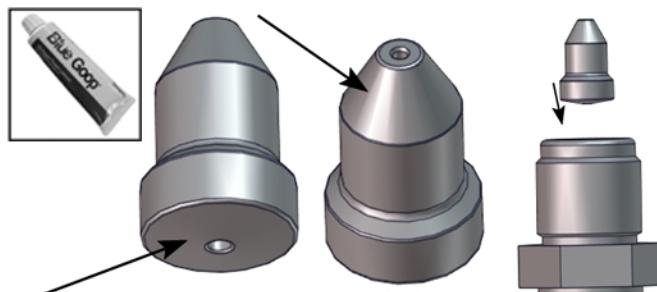


Figure 39

3. Place the **dump orifice assembly** onto the **dump orifice body** and finger tighten the **valve body nut**.

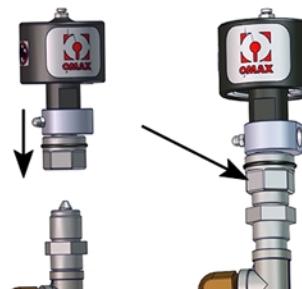


Figure 40

4. When installing the tubing and gland nut into the dump orifice assembly, rotate the **fitting ring** [1] and **dump orifice assembly** to align the threads of the **fitting ring** with the **water inlet hole** [2] in the **dump valve assembly**.

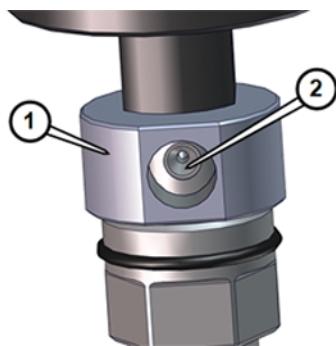


Figure 41

5. Re-install the **L-shaped nipple assembly** onto both the **cross adapter** and **fitting ring** and finger tighten the **gland nuts**.

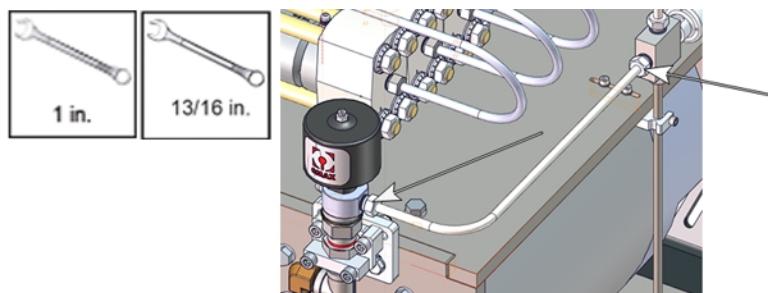


Figure 42

6. Tighten the **gland nut** on the **cross fitting**.

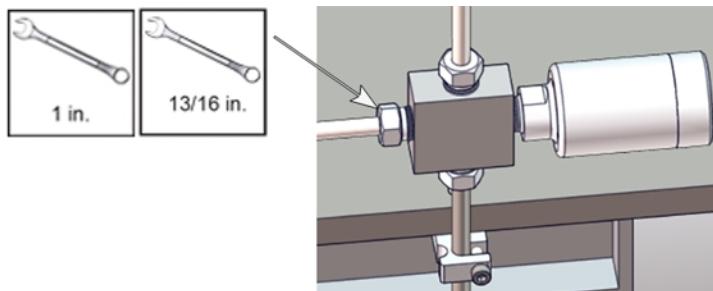


Figure 43

**NOTE:**

To prevent side twisting of the dump orifice assembly, ensure that the bulkhead adapter is held firmly in place and not allowed to rotate while tightening the valve body nut.

7. Tighten the **valve body nut** [1] to the **bulkhead adapter** [2].

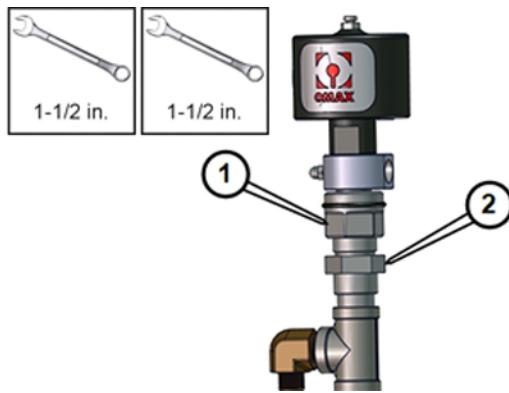


Figure 44

**NOTE:**

*To prevent side twisting of the dump orifice assembly, ensure that the bulkhead adapter is held firmly in place and not allowed to rotate while tightening the valve body nut.*

8. Tighten the **gland nut** to the **fitting ring**.

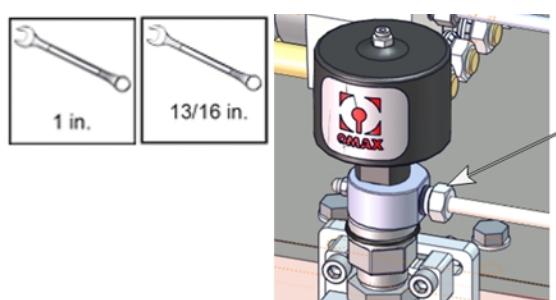


Figure 45

9. Connect the **pneumatic tube** to the **air actuator fitting**.



Figure 46

10. Install the **pump cover(s)**.

11. Turn **ON** the main AC power breaker.



12. Turn **ON** both the water and air supplies.
13. Run OMAX **Make** and test dump orifice operation.

# Chapter 5: Troubleshooting

## Pump Fault Messages

All fault messages, except those related specifically to the Variable Frequency Drive (VFD), appear on the 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 display. When a fault condition during pump operation occurs, the pump shuts down with one or more of the following messages appearing in the first three lines of the keypad display.

**Note:**

*The fourth line on the keypad always displays the cumulative run-time pump hours. The number of hours is not editable.*



Figure 47

### Charge Pressure Low

Water pressure immediately downstream of the water filters is less than 100 psi.q

### Charging Pump Contactor

The charge pump contactor did not close or opened for some reason. It generally occurs along with the message “Charge Pressure Low.”

### Dead Head

Reported when pump output pressure equals or exceeds 63,000 psi.

### Variable Drive Fault

There is an issue with the Variable Frequency Drive.

- Before the pump can be restarted, any 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.

## General Pump Problems

Problems covered in this section include:

- Low or Fluctuating Pump Output Pressure
- No AC Power at Pump Unit
- Pump Does Not Start
- No Keypad Display

### Low or Fluctuating Pump Output Pressure

#### **NOTE:**

*Never run the EnduroMAX pump once pressure at a given rpm for a given nozzle drops more than 2 - 4 kpsi. 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 **charge pump water tank** is sufficient, that the water source is turned **ON**, and the **inlet filter** to the **charge pump** 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 both **filter cartridges**.
4. Check the **pressure safety valve** for leakage. If the **valve** leaks more than one 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**. If leaking, remove and disassemble the **wet end**, inspect and clean all parts. Always replace both components when leakage occurs between them.
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. Rebuild the **cylinder assembly** by replacing the **check valve body**.
7. If the **nozzle 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 hoses that run into the **charge pump 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**.
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 Technical Support for a replacement **plunger assembly**. Replace all the **high-pressure seals** before reassembling the **pump**.

## 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. Voltage should be 460 VAC  $\pm 10\%$  (380 or 415 VAC  $\pm 10\%$  for international). 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.

### **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 switched **ON**.
4. Check that the **ON/OFF** switch on the **pump** unit is **ON** and that the **ON/OFF** switch on the **computer controller** is **ON**.
5. Check that the **E-stop** switches on the **pump** unit and the **computer controller** are reset.

## 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 **computer 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 **keypad display**. 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 **keypad** to clear the **display** and re-enable the **pump** unit.
5. Check if the pump **keypad display** is lit. If it is not, see *No Keypad Display*.

## No Keypad Display

The display on the EnduroMAX 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 **computer 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 AC terminals **L1**, **L2**, and **L3**.