

BLACKMER MAGNES SERIES

INSTALLATION OPERATION AND MAINTENANCE INSTRUCTIONS
MODELS: MI3, MS3, MI4, MS4

961801
INSTRUCTIONS NO. 110-A00

Section	110
Effective	Oct 2021
Replaces	Aug 2021

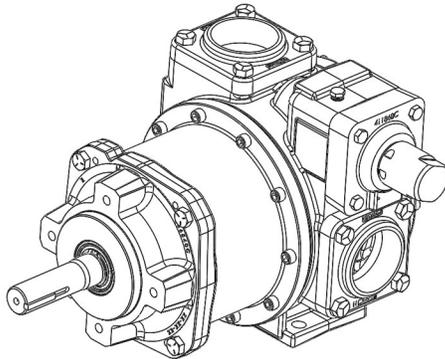


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NOTE: Numbers in parentheses following individual parts indicate reference numbers on Blackmer Parts Lists 110-A01

NOTE: Blackmer pump manuals & parts lists may be obtained from Blackmer's website (www.blackmer.com) or by contacting Blackmer Customer Service

SAFETY DATA



This is a SAFETY ALERT SYMBOL.

When you see this symbol on the product, or in the manual, look for one of the following signal words and be alert to the potential for personal injury, death or major property damage



Warns of hazards that **WILL** cause serious personal injury, death or major property damage.



Warns of hazards that **CAN** cause serious personal injury, death or major property damage.



Warns of hazards that **CAN** cause personal injury or property damage.

NOTICE:

Indicates special instructions which are very important and must be followed.

NOTICE:

Blackmer Seal-Less pumps **MUST** only be installed in systems, which have been designed by qualified engineering personnel. The system **MUST** conform to all applicable local and national regulations and safety standards.

This manual is intended to assist in the installation and operation of the Blackmer Seal-Less pumps, and **MUST** be kept with the pump.

Blackmer Seal-Less pump service shall be performed by qualified technicians **ONLY**. Service shall conform to all applicable local and national regulations and safety standards.

Thoroughly review this manual, all instructions and hazard warnings, **BEFORE** performing any work on the Blackmer Seal-Less pumps.

Maintain **ALL** system and Blackmer Seal-Less pump operation and hazard warning decals.

SAFETY DATA

⚠ WARNING



Hazardous or toxic fluids can cause serious injury.

If pumping hazardous fluids, system must be flushed, prior to performing service or maintenance

⚠ WARNING



Hazardous voltage. Can shock, burn or cause death.

Failure to disconnect and lockout electrical power before attempting maintenance can cause shock, burns or death

⚠ WARNING



Hazardous machinery can cause serious personal injury

Failure to disconnect and lockout electrical power or engine drive before attempting maintenance can cause serious personal injury or death

⚠ WARNING



Strong Magnetic field

Strong magnetic field can cause personal injury or death to individuals with medical implants or other magnetic field sensitive medical conditions

⚠ WARNING



Explosive atmosphere can cause serious injury

Rare earth magnets may create sparks through contact and handling. Never handle rare earth magnets in explosive atmospheres where sparking may ignite that atmosphere

⚠ CAUTION



Strong magnetic field can cause personal injury

Failure to use care when handling magnets can cause personal injury

⚠ WARNING



Hazardous pressure can cause serious personal injury or property damage

Failure to relieve system pressure prior to performing pump service or maintenance can cause personal injury or property damage.

⚠ WARNING



Hazardous pressure can cause personal injury or property damage

Disconnecting fluid or pressure containment components during pump operation can cause serious personal injury, death or major property damage

⚠ WARNING



Do not operate without guards in place

Operation without coupling guard can cause serious personal injury, death or major property damage

PUMP DATA

PUMP IDENTIFICATION

A pump Identification tag, containing the pump serial number, I.D. number, and model designation, is attached to each pump. It is recommended that the data from this tag be recorded and filed for future reference. If replacement parts are needed, or if information pertaining to the pump is required, this data must be furnished to a Blackmer representative.

TECHNICAL DATA

	3"	4"
Maximum Pump Speed	640 RPM	537 RPM
Maximum Operating Temperature	250°F (121°C)	
Minimum Operating Temperature	-30°F (-34°C)	
Maximum Viscosity	2,500 SSU (500 CP)*	
Maximum Differential Pressure	200 psi (13.8 bar)**	
Maximum Working Pressure (Inlet Pressure + Differential Pressure)	225 psi (15.5 bar)	

Technical Data is for standard materials of construction. Consult Blackmer Material Specs for optional materials of construction.

* Conversion is based on a specific gravity of 1.0.

**Consult MOC for pressure limits with certain configurations.

INITIAL PUMP START UP INFORMATION

Model No.: _____

Serial No.: _____

ID No.: _____

Date of Installation: _____

Inlet Gauge Reading: _____

Discharge Gauge Reading: _____

Flow Rate: _____

INSTALLATION

NOTICE:

Blackmer seal-less pumps must only be installed in systems designed by qualified engineering personnel. System design must conform with all applicable regulations and codes and provide warning of all system hazards.



- ▲ Install, ground and wire to local and National Electrical Code requirements.
- ▲ Install an all-leg disconnect switch near the unit motor.
- ▲ Disconnect and lockout electrical power before installation or service
- ▲ Electrical supply **MUST** match motor nameplate specifications.

▲ **Motors equipped with thermal protection automatically disconnect motor electrical circuit when overload exists. Motor can start unexpectedly and without warning.**

PRE-INSTALLATION CLEANING

NOTICE:

New pumps contain residual test fluid and rust inhibitor. If necessary, flush pump prior to use.

Foreign matter entering the pump WILL cause extensive damage. The suction tank and piping **MUST** be cleaned and flushed prior to pump installation and operation.

LOCATION AND PIPING

An improperly designed piping system or improper unit installation WILL significantly reduce pump performance and life. Blackmer recommends the following piping system layout and unit installation.

1. To minimize intake losses, locate the pump as close as possible to the source of supply.
2. Intake piping and fittings **MUST** be at least as large in diameter as the pump intake connection.
3. Minimize the number of intake line fittings (valves, elbows, etc.) and piping turns or bends.
4. It is recommended an intake strainer be installed at least 24" (0.6m) from the pump intake. For viscosities less than 1000 SSU the strainer should have a net open area of at least four times the area of the intake pipe. For viscosities greater than 1000 SSU consult the strainer manufacturer instructions. Strainers must be cleaned regularly to avoid pump starvation.
5. Intake and discharge piping **MUST** be free of all leaks.
6. Expansion joints, placed at least 36" (0.9m) from the pump, will compensate for expansion and contraction of the pipes. Contact the flexible connector/hose manufacturer for required maintenance/care and design assistance in their use.
7. Install vacuum and pressure gauges in the 1/4" NPT ports provided in the pump cylinder to check pump at start up.
8. **ALL** piping and fittings **MUST** be properly supported to prevent any piping loads from being placed on the pump.

9. Check alignment of pipes to pump to avoid strains which might later cause misalignment. See Figure 1. Unbolt flanges or break union joints. Pipes should not spring away or drop down. After pump has been in operation for a week or two, completely recheck alignment.

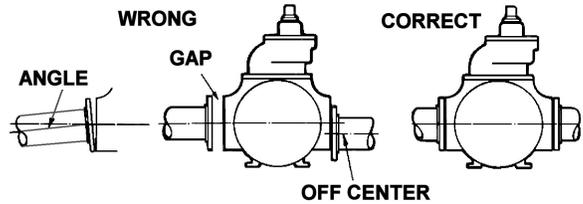


Figure 1

10. When pumping liquids at elevated temperature, provisions should be made to compensate for expansion and contraction of the pipes, especially when long pipe lines are necessary. Steel pipe expands approximately 3/4" (1.9 cm) per 100 feet (30.49 m) per 100°F (37.8°C) rise in temperature.

CHECK VALVES

The use of check valves or foot valves in the supply tank is not recommended with self-priming, positive displacement pumps. If the possibility of liquid backflow exists when the pump is off, a check valve in the pump discharge piping is recommended because the pump can motor in the reverse rotation and create undue stress on all attached components. Never start a pump when it is rotating in the reverse rotation as the added starting torque can damage the pump and related equipment.

PUMP MOUNTING

Permanently mount the unit by securing the base plate with adequately sized anchor bolts to a level concrete floor following recommended industry standards. A solid foundation will reduce system noise and vibration, and will improve pump performance. Refer to ANSI/HI standards or a suitable pump handbook for information on typical pump mounting and foundations.

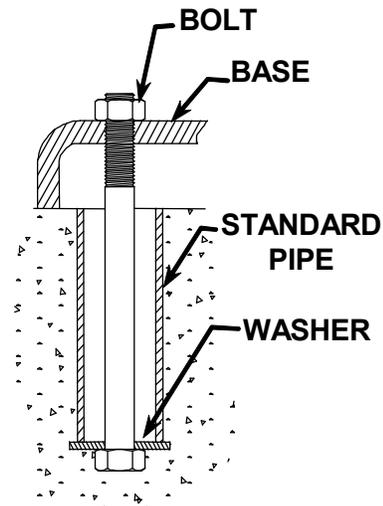
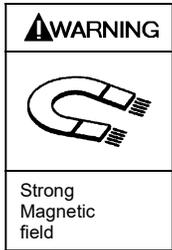


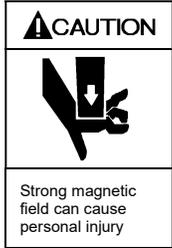
Figure 2

INSTALLATION

COUPLING ALIGNMENT



Strong magnetic field can cause personal injury or death to individuals with medical implants or other magnetic field sensitive medical conditions



Failure to use care when handling magnets can cause personal injury

The pump must be directly coupled to a gear and/or driver with a flexible coupling. Verify coupling alignment after installation of new or rebuilt pumps. Both angular and parallel coupling alignment **MUST** be maintained between the pump, gear, motor, etc. in accordance with manufacturer's instructions. See Figure 3.

1. Parallel alignment: The use of a laser alignment tool or dial indicator is preferred. If a laser alignment tool or dial indicator is not available, use a straightedge. Turn both shafts by hand, checking the reading through one complete revolution. Maximum offset should be less than .005" (.127 mm).
2. Angular alignment: Insert a feeler gauge between the coupling halves. Check the spacing at 90° increments around the coupling (four checkpoints). Maximum variation should not exceed .005" (.127 mm). Some laser alignment tools will check angular alignment as well.
3. Replace the coupling guards after setting alignment.

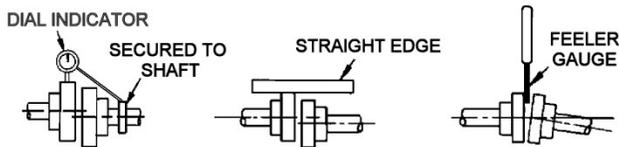


Figure 3 – Alignment Check



Operation without guards in place can cause serious personal injury, major property damage, or death.

HYDRAULIC DRIVE

The MI3 and MS3 pumps may also be driven hydraulically. Hydraulic motors need to be well supported with their shafts parallel to the pump shaft in all respects. Blackmer provides an optional close-coupled hydraulic motor adapter. The adapter

provides for straight alignment of a hydraulic motor drive through a solid coupling connected to a straight key shaft. This coupling connection requires grease lubrication every three months at minimum. Refer to the "Lubrication" section of this manual.

PUMP ROTATION

A right-hand pump rotates clockwise with the intake on the right side, when viewed from the driven end.

A left-hand pump rotates counterclockwise with the intake on the left side, when viewed from the driven end.

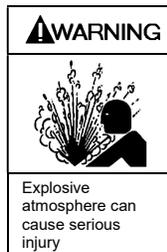
NOTICE:

Confirm correct pump rotation by checking the pump rotation arrows respective to pump driver rotation.

TO CHANGE PUMP ROTATION

To reverse rotation, the pump must be disassembled then reassembled with the shaft on the opposite side of the pump. See the 'Maintenance' section for instructions.

POTENTIAL EXPLOSIVE ATMOSPHERE INSTALLATION



Failure to follow guidelines on safety equipment requirements could result in personal injury, death, or property damage

In addition to the other requirements listed in this document, pumps installed in ATEX Category II of Group II will need to be installed with safety control equipment described below. The safety control equipment must be rated for the same hazardous zone as the pump installation.

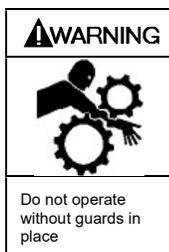
All pumps in Category 2 must be equipped with a thermocouple that monitors surface temperature. The pump unit must be immediately shutdown if the max surface temperature is exceeded.

A strainer should be installed on the pump. See STRAINERS section.

A power monitor must be installed on the pump motor to monitor pump power draw. If the pump power deviates from the expected limits, the motor should be immediately shutdown. This may be a sign of a pump lockup and magnetic decouple. In this scenario, excessive internal heat can be generated by magnetic eddy currents. All equipment must be installed and rated for the same ATEX zone as the pump.

The atmospheric temperature of the installed unit must not exceed 150 °F and all equipment must be electrically grounded.

OPERATION



Operation without coupling guard can cause serious personal injury, death or major property damage



Disconnecting fluid or pressure containment components during pump operation can cause serious personal injury, death or major property damage



Operating pump against a closed valve can cause system component failure, personal injury and property damage



Failure to relieve system pressure prior to performing pump service or maintenance can cause personal injury or property damage.

PRE-START UP CHECK LIST

1. Check the alignment of the pipes to the pump. Pipes should be supported so that they do not spring away or drop down when pump flanges or union joints are disconnected.
2. Inspect complete piping system to ensure all valves and fittings are in their start up or operation positions.
3. Ensure all electrical connections are correct and tight.
4. Jog the pump motor to ensure free rotation, in the correct direction.

START UP PROCEDURES

NOTICE:

Consult the "troubleshooting" section of this manual if difficulties are experienced during start up.

1. Start the motor. Priming should occur within one minute.
2. Check the vacuum and pressure gauges installed on the pump to ensure the pump is operating within the acceptable parameters. Record the gauge readings in the "Initial Pump Start Up Information" section.

3. If possible, check the flow rate to ensure the pump is operating within expected parameters.
4. Inspect piping, fittings and associated system equipment for leaks, noise, vibration and overheating.
5. Check the pressure relief setting of the pump relief valve by gradually closing a valve in the discharge line momentarily and noting the reading on the pressure gauge. This pressure reading should be 10-20 psi (.96 – 1.4 bar) higher than the maximum system operating pressure. **DO NOT run the pump for more than 15 seconds with the discharge valve completely closed.** If adjustments need to be made, refer to "Relief Valve Setting and Adjustment."

PUMP ROTATION

A right-hand pump rotates clockwise with the intake on the right side, when viewed from the driven end.

A left-hand pump rotates counterclockwise with the intake on the left side, when viewed from the driven end.

REVERSE ROTATION

NOTICE:

Magnetic coupled pumps should be operated in reverse rotation for no more than 10 minutes, and only when a separate pressure relief valve is installed to protect the pump from excessive pressure.

It may be desirable to operate the pump in reverse rotation for system maintenance. The pump will operate satisfactorily for a LIMITED time; at a reduced performance level.

FLUSHING THE PUMP

NOTICE:

If flushing fluid is to be left in the pump for an extended time, it must be a lubricating, non-corrosive fluid. If a corrosive or non-lubricating fluid is used, it must be flushed from the pump immediately.

1. To flush the pump, run the pump with the discharge valve open and the intake valve closed. Bleed air into the pump through the intake gauge plug hole or through a larger auxiliary fitting in the intake piping. Pump air for 30 second intervals to clean out most of the pumpage.
2. Run a system compatible flushing fluid through the pump for one minute to clear out the remainder of the original pumpage.
3. To remove the flushing fluid, follow step 1 above.

NOTICE:

After flushing the pump some residual fluid will remain in the pump and piping.

NOTICE:

Properly dispose of all waste fluids in accordance with the appropriate standards and regulations.

OPERATION

PUMP RELIEF VALVE



An external bypass valve and internal relief valve **must** be installed in the system to protect the pump from excessive pressure.

NOTICE:

The pump relief valve is designed to protect the pump from excessive pressure and must not be used as a system pressure control valve.

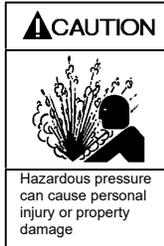
Pumping volatile liquids under suction lift may cause cavitation. Partial closing of the discharge valve WILL result in internal relief valve chatter and is NOT recommended. For these applications, install an external system pressure control valve, and any necessary bypass piping, back to the storage tank.

A system pressure control valve is also recommended when operating for extended periods (more than 1 minute) against a closed discharge valve.

RELIEF VALVE SETTING AND ADJUSTMENT

The factory relief valve pressure setting is marked on a metal tag attached to the valve body. It is recommended the relief valve be set at least 10-20 psi (.69-1.4 bar) higher than the operating pressure or the system pressure control valve setting.

DO NOT remove the R /V Cap OR adjust the relief valve pressure setting while the pump is in operation.



Incorrect settings of the pressure relief valve can cause pump component failure, personal injury and property damage



Relief valve cap is exposed to pumpage and will contain some fluid

1. To INCREASE the pressure setting, remove the relief valve cap (1) and O-ring / gasket (88), and turn the adjusting screw (2) inward, or CLOCKWISE. Install a new R/V O-ring / gasket (88), and re-attach the R/V cap.
2. To DECREASE the pressure setting, remove the relief valve cap (1) and O-ring / gasket (88), and turn the adjusting screw (2) outward, or COUNTERCLOCKWISE. Install a new R/V O-ring / gasket (88), and re-attach the R/V cap.

Refer to corresponding Blackmer pump parts lists for relief valve spring pressure ranges. Unless specified otherwise, pumps are supplied from the factory with the relief valve adjusted to the mid-point of the spring range.

MAINTENANCE

⚠ WARNING



Hazardous voltage. Can shock, burn or cause death.

Failure to disconnect and lockout electrical power before attempting maintenance can cause shock, burns or death

⚠ WARNING



Hazardous or toxic fluids can cause serious injury.

If pumping hazardous fluids, system must be flushed, prior to performing service or maintenance

⚠ WARNING



Strong Magnetic field

Strong magnetic field can cause personal injury or death to individuals with medical implants or other magnetic field sensitive medical conditions

⚠ WARNING



Explosive atmosphere can cause serious injury

Rare earth magnets may create sparks through contact and handling. Never handle rare earth magnets in explosive atmospheres where sparking may ignite that atmosphere

⚠ WARNING



Hazardous machinery can cause serious personal injury

Failure to disconnect and lockout electrical power or engine drive before attempting maintenance can cause serious personal injury or death

⚠ WARNING



Hazardous pressure can cause serious personal injury or property damage

Failure to relieve system pressure prior to performing pump service or maintenance can cause personal injury or property damage.

⚠ WARNING



Do not operate without guard in place

Operation without guards in place can cause serious personal injury, major property damage, or death.

⚠ WARNING



Hazardous pressure can cause serious personal injury or property damage

Disconnecting fluid or pressure containment components during pump operation can cause serious personal injury, death or major property damage

⚠ CAUTION



Strong magnetic field can cause personal injury

Failure to use care when handling magnets can cause personal injury

NOTICE:

Maintenance shall be performed by qualified technicians only, following the appropriate procedures and warnings as presented in this manual.

NOTICE:

Properly dispose of all waste fluids according to state and local regulations.

NOTICE:

Clear the work area of all tools and materials affected by magnets. Non-magnetic work surface recommended.

STRAINERS

Adequately sized system strainers are recommended. Strainers **MUST** be kept clean to ensure adequate fluid flow to the pump. Failure to do so can cause pump cavitation and system damage.

LUBRICATION

Pump sleeve bearings are lubricated by the pumpage. No other lubrication is required. Ball bearings are supplied sealed and lubricated. No other lubrication is required. For motor lubrication, refer to the manufacturer's instructions.

If hydraulically driven, lubricate coupling every three months as a minimum.

Recommended Grease:

Mobil® - Mobilgrease XHP222,

Exxon® - RONNEX MP Grease, or equivalent.

MAINTENANCE

VANE REPLACEMENT

1. Drain the pump and system, as required.
2. For replacement of the vanes ONLY, remove the outboard head(23) by removing capscrews (21).
3. Turn the power end shaft (53) by hand until a vane (14) comes to the top (12 o'clock) position of the rotor. Remove the vane.
4. Install a new vane, ensuring that the rounded edge is UP (facing outward) and that the relief grooves are facing TOWARDS the direction of rotation. See Figure 4.
5. Repeat steps 3 and 4 until all vanes have been replaced.
6. To reassemble, follow steps 3 through 5 in the "Pump Assembly" section of this manual.

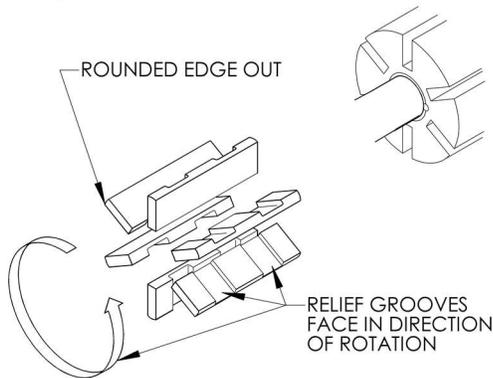


Figure 4 - Vane Installation

PUMP DISASSEMBLY

NOTICE:

Take care when removing the pump foot screws that the power end shaft or bearing housing (106) are supported. The power end shaft will tip down when foot screws are removed.

1. Drain the pump and system, as required.
2. Disconnect the piping from the pump intake and discharge connections.
3. Remove the four bearing cover capscrews (28), the bearing cover (27), and the bearing cover o-ring (26). Discard o-ring.
4. Set the pump on the outboard head, with the shaft facing up. See Figure 5. Provide adequate support to eliminate the possibility of tipping during disassembly/assembly.

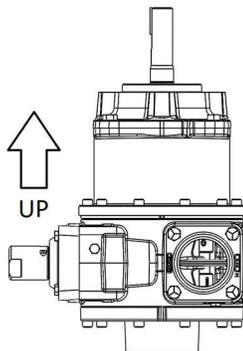


Figure 5 – Disassembly Orientation

5. Remove the four bearing housing capscrews (106D).
6. Install four screws into bearing housing jacking holes. See figure 6 for location.
 - a. 3": 3/8 -16 UNC, 4 inch long (Fully threaded)
 - b. 4": 1/2 -13 UNC, 4.5 inches long (Fully threaded)

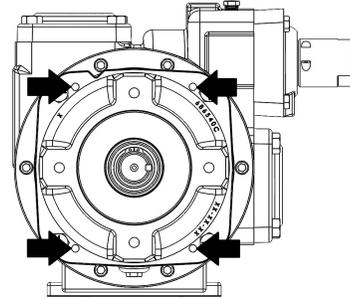
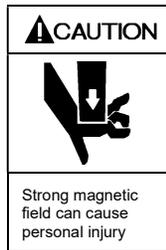


Figure 6 – Jacking Hole Location



Failure to use care when handling magnets can cause personal injury

Strong magnetic field can cause personal injury

7. Slowly turn jacking screws clockwise to separate bearing housing (106) from magnet housing (57). Alternate screw location, while attempting to keep driving magnet assembly as concentric to containment shell (50) as possible.

NOTICE:

Be prepared for strong magnetic attraction between the driving and driven magnet assemblies. Never insert any part of body between magnet assemblies or between magnet and bearing housing.

NOTICE:

Follow all hazard warnings and instructions provided in the "Maintenance" section of this manual.

8. When the jacking screws are fully turned into bearing housing (106), remove the power end assembly (53, 106A/B/C) by pulling up on the power end shaft. It is recommended that a hoist be used. Place assembly on a non-magnetic surface away from other magnetic components.

NOTICE:

The magnet housing may abruptly lift off pump after the head capscrews are removed. Ensure it is supported before all screws are removed and that nothing is above it.

9. Loosen inboard head capscrews (21). Remove magnet housing (57) and containment shell (50), while ensuring the containment shell (50) and inboard head (20) are not damaged. Remove and discard containment shell o-ring (51)
10. Loosen hub capscrew (59) and remove along with washer (58). See Figure 7 for location of screw and washer.

MAINTENANCE

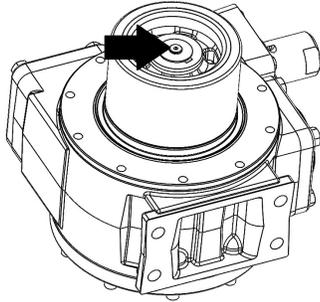
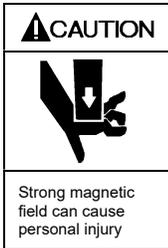


Figure 7 – Location of Hub Capscrew



Failure to use care when handling magnets can cause personal injury

RELIEF VALVE DISASSEMBLY

- Remove the valve cap (1) turn the adjusting screw (2) to relieve the spring pressure.
- Remove the relief cover capscrews (5) and relief valve cover (4)
- Remove the spring guide (7), spring (8), and valve (9) from the relief valve bore.

- Remove driven magnet assembly (52) and key (35A). Set driven magnet assembly on a nonmagnetic surface, away from any magnetic components.
- Slide inboard head (20) up wet end shaft (13) and set aside. Head may require light prying around outer diameter, if it is difficult to remove. Remove and discard o-ring (72).
- Remove vanes (14). And inspect for wear.
- Carefully remove rotor/shaft (13) from the pump cylinder. A lifting lug (5/16-18 UNC thread) can be installed in the end of the rotor/shaft to aid in removal. See Figure 8. Ensure that rotor/shaft isn't damaged and that it doesn't damage the cylinder, bushing, or head.

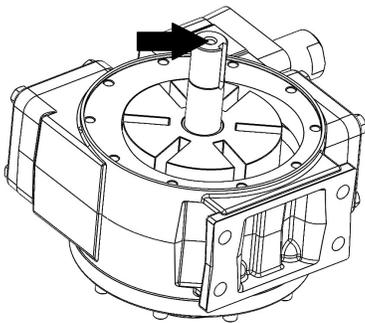


Figure 8 – Location of Rotor/Shaft Lifting Lug

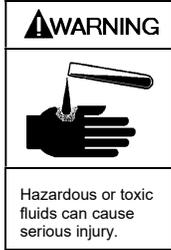
- Flip cylinder over and remove outboard head capscrews (21).
- Remove head (23) and bearing cover (27). Discard head o-ring (72).

MAINTENANCE

PUMP ASSEMBLY

NOTICE:

Follow all hazard warnings and instructions provided in the "maintenance" section of this manual.



Containment shell failure will permit fluid leakage and can cause serious injury.

Before reassembling the pump, all parts should be thoroughly cleaned and inspected for wear, damage, and replaced as necessary. Remove any burrs from the rotor and mating cylinder.

NOTICE:

The containment can (50) must be replaced if any cracking, wear or other damage is present.

1. Begin assembly on the outboard side of the pump, by laying the pump cylinder (12) on a flat surface with the desired outboard side facing up.
2. Inspect both sleeve bearings (24) for damage or wear. If damaged, bearings MUST be replaced. To replace bearings:
 - a. Using an appropriately sized arbor press, remove the old bearing from the head.
 - b. To aid installation and prevent damage, heat the head in an oven to 200°F (93°C).
 - c. Coat the new bearing with a quality grade of bearing grease, and place it on the inside face of the head with the notched end UP. **Align the notch in the bearing with the groove in the head. See Figure 9.**
 - d. Using an arbor press, CAREFULLY press the bearing into the head until it is flush with the inside face of the head. Ensure that the bearing does not become misaligned during the pressing activity.

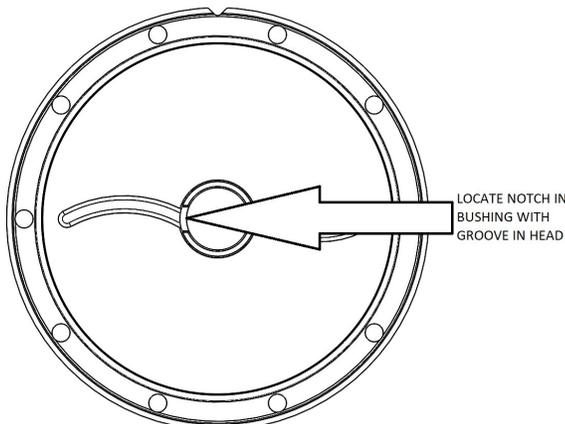


Figure 9 – Bushing Installation Orientation

3. Install the head o-ring (72) into the outboard head (23 o-ring groove). Use a chemically compatible, high viscosity grease to hold o-ring into the groove. Place head onto cylinder (12), with the cast locating notch facing up for right hand built pumps and down for left hand builds. See Figure 10.

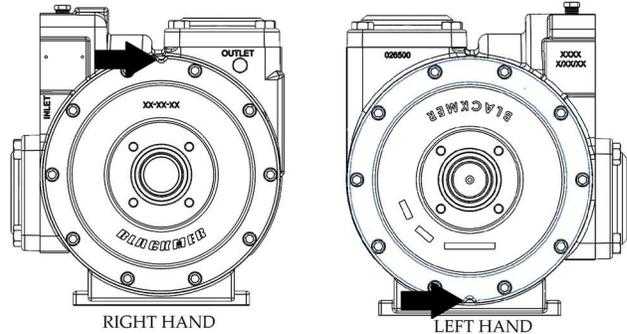


Figure 10 – Outboard Head Orientation

4. Lubricate the outboard head capscrews (21) with a quality grade of anti-seize compound and install and torque to the correct specification.
 - a. MI3: 25 ft-lbf
 - b. MS3: 15 ft-lbf
 - c. MI4: 50 ft-lbf
 - d. MS4: 35 ft-lbf
5. Install a new bearing cover o-ring (26) in the groove in the outboard head. Place the bearing cover (27) on the head. Lubricate the bearing cover capscrews (28) with a quality grade of anti-seize compound and install. Torque to the correct specification.
 - a. MI3: 25 ft-lbf
 - b. MS3: 15 ft-lbf
 - c. MI4: 50 ft-lbf
 - d. MS4: 35 ft-lbf
6. Turn the pump cylinder over so that it rests on the installed outboard head and bearing cover. Provide support to eliminate tipping.
7. Inspect the vanes (14) and push rods (77) for wear and damage, and replace as follows:
 - a. The push rods MUST be installed before installing the rotor and shaft (13) into the pump cylinder. To do so, hold the rotor and shaft vertical, with the non-driven (shorter end) down. See Figure 8 for optional location of lifting lug to aid in installation. Slide the push rods into the push rod holes of the rotor, then insert the rotor/shaft into the open end of the pump cylinder. See Figure 8 for optional location of lifting lug to aid in installation. Do not let rotor/shaft drop or damage bushing. Push rotor towards seal point, while lowering, to help guide the shaft into the bushing See Figure 11.
 - b. Insert new vanes (14) into the rotor slots with the rounded edges outward, and the vane relief grooves facing TOWARDS the direction of rotation. Refer to Figure 4 If necessary, move the push rods with a small screwdriver to install the vanes.

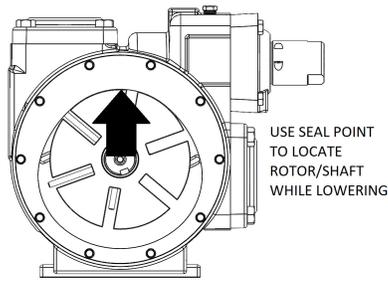


Figure 11 – Rotor/Shaft Installation Tip

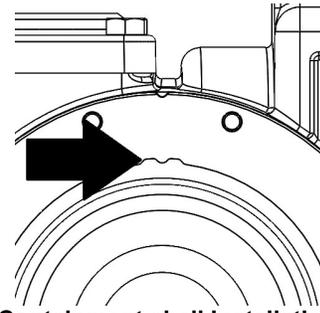


Figure 13 – Containment shell Installation Orientation

NOTICE:

There will be a magnetic attraction between the magnet housing and the containment shell/driven magnet. Take care to only hold magnet housing on the rectangular end, while lowering. Never place hands on round end or between the magnetic housing and containment shell while installing.

8. Install the inboard head o-ring (72) into inboard head (20). Chemically compatible, high viscosity grease can be used to hold o-ring to aid installation.
9. Install the inboard head and bearing assembly (20) on the pump cylinder with the V-notch up, towards the bottom of the cylinder for right hand builds and down for left hand builds. See Figure 12. Ensure the head is fully seated and bolt holes are aligned with threaded cylinder holes.

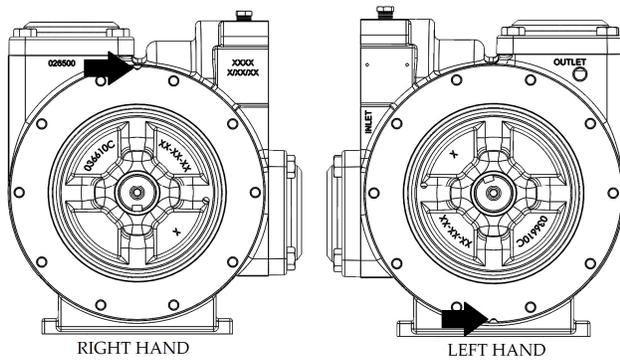


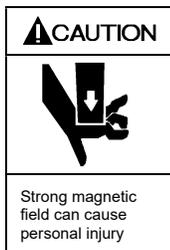
Figure 12 – Inboard Head Orientation

12. Align magnet housing dowel (57) with containment shell (50) and begin lowering magnet housing onto containment shell. Magnet housing may bind on containment shell. Use light taps with a dead-blow hammer to continue until magnet housing moves freely. Ensure locating pin is aligned with containment shell retaining groove and that holes are aligned with inboard head and cylinder holes. Light force may be required to hold magnet housing onto inboard head.

13. Lubricate the Inboard head capscrews (21) with a quality grade of anti-seize compound and install. Torque to the correct specification.

- a. MI3: 25 ft-lbf
- b. MS3: 15 ft-lbf
- c. MI4: 50 ft-lbf
- d. MS4: 35 ft-lbf

14. Install four threaded screws into bearing housing jacking holes. Refer to figure 6 for location. Thread screws all the way into bearing housing.
15. Align driving magnet assembly (53) with magnet housing (57). Ensure bearing housing installation screws are contacting machined pads on magnet housing. See Figure 14.



Failure to use care when handling magnets can cause personal injury

10. Install key (35A) into rotor/shaft (13) keyway. Slide driven magnet assembly (52) onto rotor/shaft (13). Place washer (58) and capscrew (59) onto end of shaft and hand tighten. Torque screw to 12.5 ft-lbf (17 Nm).
11. Install containment shell o-ring into inboard head. Install containment shell (50) onto inboard head dowel (20). Rotate containment shell retaining groove towards the top of the pump as shown in Figure 13. This will align it with the pin in the magnet housing.

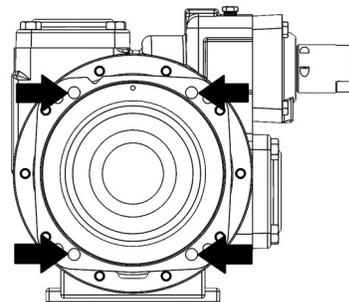


Figure 14 – Magnet Housing Installation Pads



Failure to use care when handling magnets can cause personal injury

Strong magnetic field can cause personal injury

NOTICE:

Be prepared for strong magnetic attraction between the driving and driven magnet assemblies. Never insert any part of body between magnet assemblies or between magnet and bearing housing.

16. Slowly turn jacking screws counter clockwise to lower the bearing housing (106) onto the magnet housing (57). Alternate screw location, while attempting to keep driving magnet assembly (53) as concentric to containment shell (50) as possible.
17. Install bearing housing capscrews (106D) and torque to the correct specification.
 - a. MI3: 50 ft-lbf
 - b. MS3: 50 ft-lbf
 - c. MI4: 100 ft-lbf
 - d. MS4: 70 ft-lbf
18. Rotate power end shaft to ensure free rotation.

RELIEF VALVE ASSEMBLY

1. Insert the valve (9) into the relief valve bore of the cylinder with the fluted end inward.
2. Install the relief valve spring (8) and spring guide (7) against the valve.
3. Attach a new relief valve O-ring (10) and the valve cover (4) on the cylinder.
4. Screw the relief valve adjusting screw (2) with locknut (3) into the valve cover (4) until it makes contact with the spring guide (7).

NOTICE:

The relief valve setting MUST be tested and adjusted more precisely before putting the pump into service. Refer to "Relief Valve Setting and Adjustment"

5. After the relief valve has been adjusted, tighten the Locknut (3) and install the relief valve cap (1) and O-ring (88)

NOTICE:

Follow all steps in the "operation" section of this manual for start up procedures.

TROUBLESHOOTING

NOTICE:

Maintenance shall be performed by qualified technicians only, following the appropriate procedures and warnings as presented in this manual.

PROBLEM	CAUSE
Pump Not Priming See causes 1 through 7	1. Suction/discharge valve incorrectly set.
Reduced Capacity See causes 1 , 2, 3, 6 through 10	2. Leaks in suction piping.
Noisy See causes 1, 6, 7, 8, 9, 11 through 14	3. Incorrect rotation.
Damaged Vanes See causes 8, 11, 16 through 21	4. Broken shaft.
Broken Shaft See causes 7, 11, 13, 16, 17&20	5. Pump vapor locked.
Motor Overload See causes 9, 13, 17, 22 & 23	6. Incorrect pump speed.
	7. Vanes damaged, worn or incorrectly installed.
	8. Cavitation.
	9. Damaged or worn pump or system components.
	10. Excessive piping/system friction losses.
	11. Relief valve incorrectly set, worn or damaged.
	12. Operating against a closed discharge.
	13. Shaft bent or misaligned.
	14. Worn or damaged bearings.
	15. Piping inadequately anchored.
	16. Foreign objects entering the pump.
	17. Viscosity too high
	18. Excessive heat.
	19. Worn or damaged push rods.
	20. Hydraulic hammer - pressure spikes.
	21. Incompatible fluid(s).
	22. Inadequate horsepower.
	23. Incorrect voltage, wiring, phase loss.

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