



Instruction I-440

**INSTALLATION, OPERATION AND
MAINTENANCE INSTRUCTIONS
FOR MAXUM MAG SERIES,
A-FRAME PUMPS**

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I. General Description

A. General Description

The Maxum Mag pump unit consists of a pump, base, coupling, coupling guard and a driver unit. The driver is usually an electric motor, but can be a steam turbine or any other power conversion device that can provide the required horsepower at the proper RPM.

The Maxum Mag pump is supplied with a volute that should always be mounted solidly on an adequate baseplate. No shims should be used under the feet of the volute.

The Maxum Mag pump is designed as a back pullout unit. Therefore it should always be used with a spacer coupling. The spacer width should permit the entire driver assembly to be removed from the driven assembly. Normally the casing should be left in place on the base and remain connected to the suction and discharge piping.

The Maxum Mag pump is design with integral secondary containment. This secondary containment is intended to prevent or reduce fluid or vapor loss in event of a failure in the magnet couple area. This containment is not intended as a means to continue operation of a damaged unit.

This manual is designed to provide sufficient material to properly maintain the total pumping unit. The information as presented should improve your knowledge and understanding of the Maxum Mag pump, thus upgrading the quality of pump maintenance and care.

Variations do exist between configurations, not all parts described will be on your particular configuration. For your configuration, refer to figure 3, the sectional assembly and table 7, the parts list.

The bare pump consists of following major parts and options.

Item 1 - Casing. The casing (1) houses the impeller (2) and wear ring (7) and consists of the suction inlet, discharge volute, and discharge nozzle. The backhead (11) is fastened to the casing (1) with studs (631) and nuts (616) with lockwashers (655).

Item 2 - Impeller. Maxum Mag pumps are equipped with enclosed impellers. The impeller (2) is keyed to the shaft (6) by the impeller key (32) and is locked in

place by the impeller nut (24). The impeller nut (24) contains an insert (200). The impeller nut gasket(s) (30) fit between the impeller nut (24) and the shaft (6). The impeller gasket(s) (38) fit behind the impeller (2) against the back ring (27).

Item 231 - Magcan. The Magcan (231) is the pressure vessel separating the inner "driven" magnet assembly (230) from the outer "driver" magnet assembly (232). The magcan (231) is held to the backhead (11) by socket head capscrews (600) and sealed with o-ring (89D) or gasket (73B).

Item 11 - Backhead. The backhead (11) is held to the casing (1) by studs (631) and nuts (616) with washers (655). The backhead (11) is positioned in the casing bore by a precision rabbet and sealed with an o-ring (89A) or gasket (73A). If gasket (73A) is on pump, o-ring (89A) is used only for testing. The backhead (11) is designed to support the wetted bearing assembly (233), the magcan (231) and the bearing frame (19). The o-ring (89B) between the backhead (11) and the bearing frame (19) is part of the secondary containment of the Maxum Mag pump.

Item 19 - Bearing Frame. The principal function of the bearing frame (19) is to transport power from the power unit to the driver magnet (232). The bearing frame (19) has a radial bearing (16) located in the front end of the house (nearest to the volute) and a thrust bearing (18) in the rear of the housing or frame. This bearing frame (19) is designed to be oil lubricated, which can be accomplished in several ways.

The first method involves the use of a sight glass automatic oiler. The housing or frame is designed so that it can be used with a sight glass automatic oiler. The sight glass maintains the oil level high enough on the higher of the two bearings so that the bearings themselves provide the motivation for the oil to be moved through the races of both bearings.

A second method is to provide an oil flinger which mounts on the shaft and literally flings the oil throughout the bearing frame. An oil view gauge indicator is usually used with this system to make sure that the oil level within the frame can be observed and maintained at the proper level.

A third method is the oil mist system. All Maxum Mag pumps are equipped so that they can be used or can be converted to oil mist units without any field machining or any added parts.

In addition to the oil lube system, the power frame contains the shaft oil seals or oil containment system. The Maxum Mag pump bearing frame is equipped with a magnetic seal assembly (isolator) (169) between the bearing frame (19) and the driver magnet (232) which operates as a mechanical seal when running and becomes a static seal when shutdown or stopped. This is part of the secondary containment of the Maxum Mag pump. A similar seal may be used on the bearing cap (37). It is necessary to use an expansion chamber when the Maxum Mag pump is equipped with the optional magnetic seal device. The Maxum Mag pump can also be furnished with a number of labyrinth seal assemblies being offered on the market.

Items 16 and 18 - Ball Bearings. A deep-groove Conrad-type radial bearing (16) and thrust bearing (18) are housed in the bearing frame (19). The thrust bearing's purpose is to provide axial positioning of the frame shaft (12). The thrust bearing (18) is held in place on the shaft (12) by the bearing locknut (22) and bearing lockwasher (69). The bearings are oil lubricated. Either oil bath lubrication or an oil mist system may be employed.

Item 72 - Plain Bearings. The pump shaft (6) carries the plain bearings (72), sleeve(s) (234), and the optional spacer sleeve (14). Depending upon your configuration your pump may contain the optional spacer sleeve (14) between two sleeve(s) (234). The plain bearings and sleeves rotate in the bearing assembly (233) which in turn transmits the loads to the backhead (11).

Items 6 and 12 - Shafts. The pump shaft (6) carries the torque from the driven magnet (230) to the impeller (2). A coupling connects the frame shaft (12) to the driver shaft. The coupling key (46) holds the coupling in place, causing it to rotate with the shaft (12). The frame shaft (12) of the Maxum Mag pump is designed to transmit the torque from the driver to the driver magnet (232).

Baseplate. The groutable baseplate is designed to provide adequate support for the pump and motor so pump can be operated without baseplate deflection, excessive vibration, or resonance. When properly grouted, the standard baseplate is reinforced with steel supports and contains a built-in drip channel. The frame foot (53) and casing (1) are bolted to the baseplate with capscrews. Grouting of the baseplate is required by Carver Pump Company.

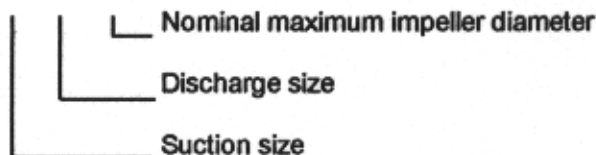
B. Pump Identification

Use the following example for identifying information about your pump model number.

C. Nameplate

A nameplate is attached to each pump. Nameplate data should be furnished to Carver Pump Company or its representative when ordering spare parts or requesting information.

3" x 2" x 10"



D. Safety Precautions

This manual contains descriptions and instructions for installation, operation, and maintenance of your Maxum Mag pump. The pump is of sturdy design and is constructed to give satisfactory service for a long period of time when the instructions outlined in this manual are followed. Failure or neglect to properly install, operate or maintain your pump may result in personal injury, property damage, or unnecessary damage to the pump.

The Maxum Mag pump is designed with an integral secondary containment. This secondary containment is intended to prevent or reduce fluid or vapor loss in event of a failure in the magnet couple area. This containment is not intended as a means to continue operation of a damaged unit.

CAUTION

Always check the secondary containment area for fluid contamination before disassembling the pump halves.

The instructions in this manual are intended for personnel who possess general training in the operation and maintenance of centrifugal pumps. This information does not relieve personnel of the responsibility of exercising normal good judgment in operating and maintaining the pump and its components. All personnel should be guided by basic rules of safety associated with the equipment and the process.

Observe all warning, caution or danger tags attached to the equipment or included in this manual.

WARNING

When exposed, the magnets in this pump may disrupt the operation of anything affected by magnetic interference such as a pacemaker, medical staples, wrist watch or pocket watch. Proper precautions must be taken.

To prevent catching or squeezing your hands and fingers between the very high power rare-earth magnets, do not let your hands and fingers come in between the magnets or the pumping unit halves.

CAUTION

IMPORTANT SAFETY NOTICE

The installation, use, and operation of this type of equipment is affected by various federal, state, and local laws and the regulations concerning OSHA. Compliance with such laws relating to the proper installation and safe operation of this type of equipment is the responsibility of the equipment owner and all necessary steps should be taken by the owner to assure compliance with such laws before operating the equipment.

II. Inspection and Storage

A. Inspection Upon Arrival

Upon receipt of the shipment, unpack and inspect the pump, driver assemblies, and individual parts to insure none are missing or damaged. Carefully inspect all boxes and packing material for loose parts before discarding them. Immediately report any missing parts or damage incurred during shipment to the factory and to the transportation company and file your "damaged and/or lost in shipment" claim with the carrier.

B. Storage of Pump

If the equipment is not immediately installed and operated, fill the bearing frame with oil or fog preservative onto bearings, store it in a clean, dry, well-ventilated place, free from vibrations, moisture, and rapid or wide variations in temperature.

Rotate the shaft several revolutions at least once every two weeks to prevent flat spots on ball bearings.

Consider a unit to be in storage when:

1. It has been delivered to the job site and is waiting to be installed.
2. It has been installed but operation is delayed pending completion of construction.
3. There are long (30 days or more) periods between operation cycles.
4. The plant (or department) is shut down for periods of longer than 30 days.

NOTE

Storage requirements vary depending on the length of storage, the climatic environment, and the equipment. For storage periods of three months or longer, contact Carver Pump Company for specific instructions. Improper storage could damage the equipment and would result in non-warranty covered restoration requirements or non-warranty covered product failures.

III. Installation

A. Location

The pump should be installed as close as possible to the fluid to be pumped. A short direct suction pipe can be used to keep suction losses at a minimum. If possible, locate the pump so fluid will flow by gravity to the suction opening. The discharge piping should be direct with as few elbows and fittings as possible. The total net positive suction head available (NPSHA), which includes the suction lift and pipe friction losses, must be equal to or greater than the net positive suction head required (NPSHR) by the pump.

Pump and driver should be located in an area permitting periodic inspection and maintenance. Head room and access should be provided. Units should be installed in a dry location with adequate drainage.

B. Handling

CAUTION

Do not pick up the complete unit by the driver or pump shafts or eyebolts. Complete units (pump, driver, base-plate) can be lifted by attaching a chain or suitable lifting device to each corner of base structure or by slinging the unit under the baseplate. For lifting pump only (not the complete unit), sling the pump where the bearing frame (19) meets the bearing cap (37) and also immediately behind the suction inlet on the casing (1). Sling pumps with care, making sure that seal lubrication lines (if furnished) will not be bent or damaged when the pump is lifted. The individual driver may be lifted using proper eyebolts provided by the manufacturer, but these should not be used to lift the assembled unit.

C. Foundation

The foundation should be a minimum of 3 to 6 inches wider and longer than the baseplate, have a level surface, and be of sufficient mass to prevent vibration and form a permanent rigid support for the unit. The best foundations are concrete with anchor bolts of adequate size embedded in the foundation in pipe sleeves having an inside diameter 2-1/2 times larger than the bolt diameter. This will allow for accurate positioning of the unit. Keep the concrete surface clean, yet rough to assure the best bond for grout.

D. Leveling the Unit

Lower unit onto foundation, positioning base structure so anchor bolts are aligned in middle of holes in baseplate. Level the baseplate by driving metal wedges or shims under it. The shims or wedges should be spaced close enough to give even support and stability. Adjust metal wedges or shims until baseplate is level. Use a machinist's level to determine levelness. Check that driver and pump shafts are in alignment (see paragraph F, this section on coupling alignment). Piping alignment and leveling corrections may be accomplished by adjusting supports under the base. When proper alignment is obtained, tighten foundation bolts snugly, but not too firmly. Recheck alignment before grouting.

CAUTION

Do not attempt to straighten the base by using the anchor bolts.

E. Direction of Rotation

Before connecting coupling halves, bump start driver and verify that rotation is correct. Correct pump rotation is indicated by an arrow on the pump casing. The standard direction of rotation, viewed from the driver end, is clockwise.

F. Coupling Alignment

NOTE

Coupling alignment must be correct for successful operation of the pump. Flexible couplings can absorb only limited misalignment of the shaft and must not be used to compensate misalignment of the pump and driver shafts.

Check alignment of pump and driver shafts. When a spacer type coupling connects the pump to the driver, a dial indicator should be used to check axial and angular alignment (refer to "Coupling" appendix for specific information on coupling alignment):

1. Remove the extension piece between the coupling halves to expose the coupling hubs.
2. On the pump shaft behind the coupling half, clamp an arm or bracket long enough to extend across the space between the coupling halves.
3. Mount the dial indicator on this arm.
4. Take readings at 90 degree intervals. Angular and axial alignment of the coupling halves must not exceed coupling manufacturer's specifications (or 0.005 T.I.R. max.) (refer to "Coupling" appendix for specific information on coupling alignment). If necessary, bring the unit into alignment by shimming the driver or moving the driver to either side.
5. Mount dial indicator on arm or bracket clamped behind driver coupling half and repeat check of axial and angular alignment. For coupling gap dimensions and other specific information concerning the coupling on your unit, refer to "Coupling" appendix.

G. Grouting

When the unit has been leveled and coupling alignment is complete, the unit should be grouted using a high grade non-shrinking grout (Refer to figure 1):

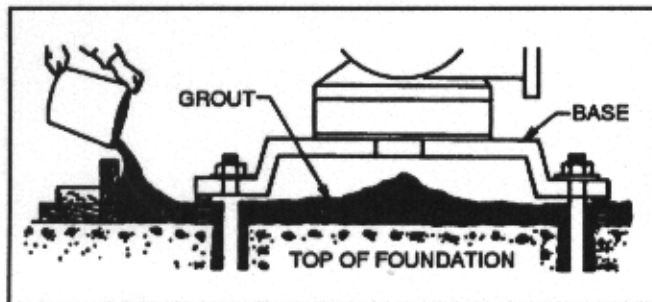


Figure 1. Grouting

1. Build a wooden dam around baseplate to retain the grout.
2. Pour grout through grouting holes provided in baseplate until entire space under baseplate is filled, with no voids or air pockets.
3. Insert a stiff wire through the grouting holes to work the grout and release any air pockets.
4. After the grout has hardened (72 hours) remove the dam and also the shims or wedges under the baseplate, if desired. Fill the holes left by the shims with grout.
5. Loosely tighten foundation bolts. Allow the grout to fully cure before firmly tightening the foundation bolts.
6. Recheck coupling alignment (see paragraph F, this section).

H. Coupling Guard

WARNING

Check safety codes and always install protective guards or shields as required by the various federal, state, or local laws and the regulations concerning OSHA.

Place coupling guard over coupling and bolt to base. Coupling guard may be either a fixed coupling guard or a hinged coupling guard.

I. Piping

All piping should be independently supported near the pump so that a minimum of pipe strain will be transmitted to pump casing.

CAUTION

All piping connections must be made with the pipe in a freely supported state. Do not apply vertical or side pressure to align the piping with the pump flange.

The velocity of liquid should be maintained at a given level, depending on the product being pumped. The higher the velocity of liquid, the greater the friction loss (i.e. loss of head) of the pipe. Use of oversize piping is recommended whenever possible to reduce head loss.

Where the pump must lift the liquid from a lower level, the suction piping should be laid out with a continual rise toward the pump, avoiding high points in the line. The formation of air pockets will thus be prevented.

Never use a straight taper (concentric) reducer in a horizontal suction line because air pockets may form in the top of the reducer and the pipe. Use an offset (eccentric) reducer instead.

Install a check valve and a control valve in discharge line and a control valve in suction line. The check valve helps protect pump from water hammer and prevents reverse rotation. Reverse rotation should be avoided because it can damage the pump. Causes of reverse rotation include failure to close control valve in discharge line when pump is shut down and the event of power failure. Operators should be alert to prevent reverse rotation.

Control valves are used in priming, starting, and pump shutdown. Pump must never be throttled by the use of a valve or other restriction in the suction line.

CAUTION

After all the piping is connected, recheck the coupling alignment.

J. Auxiliary Piping Connections and Gauges

Any auxiliary piping connections and gauges should be installed now. Refer to "Seal Piping Plans" appendix for seal line connections to the seal cartridge.

K. Lubrication of Bearings

CAUTION

Operation of the unit without proper lubrication can result in overheating of the bearings, bearing failures, pump seizures and actual breakup of the equipment, exposing operating personnel to injury.

Pumps are usually shipped with the bearing frames empty of oil. ISO Grade 68 or Grade 100 mineral oils are recommended for proper lubrication of the pump. Refer to table 1 for specific recommended oil types.

If a constant level oiler (125) is to provide bearing lubrication, mount it in place of plug on either side of the bearing frame (19). Connect equalizing tube (404) from base of oiler (125) to bearing frame (19). Equalizing tube (404) provides a closed environment for the bearing frame (19) by accommodating expansion and contraction of vapors without permitting contaminant to enter the bearing frame (19).

If a constant level oiler (125) is used in conjunction with a magnetic face seal or labyrinth (inpro) or bearing isolator (49), the top port of the bearing frame (19) will be fitted with a diaphragm expansion chamber (45), which incorporates an elastomeric diaphragm and constitutes a completely enclosed system. The diaphragm expansion chamber (45) accommodates the expansion and contraction of vapors in the bearing frame (19) without permitting moisture and other contaminants to enter.

Fill constant level oiler reservoir and allow it to fill bearing frame (19). To avoid adding too much oil, never add oil to bearing frame (19) through plug at top of the bearing frame (19). It may take repeated fittings of constant level oiler reservoir to fill oil well. Use constant level oiler's glass sight to check oil level in bearing frame (19).

For more information concerning constant level oiler (125) refer to "Constant Level Oiler" appendix.

If an oil view gauge (143) is used to provide bearing lubrication, fill with oil until the oil level reaches the middle of the sight glass.

The Maxum Mag pump comes equipped with appropriate connections for the installation of an oil mist system by the customer if oil mist lubrication is desired. Oil mist lubrication provides the greatest protection against contamination by dirt and water.

The top port of the bearing frame (19) remains plugged for oil mist lubricated bearings. The plug in the bottom of the power frame should be removed so that condensed oil vapor can be drained and/or removed from the bearing frame (19).

IV. Operation

A. Prestart Cautions

Before starting or operating the pump, read this entire manual, especially the following instructions.

- 1. Observe all caution or danger tags attached to the equipment.
- 2. Before starting the pump, rotate shaft by hand to assure all moving parts are free.
- 3. Before starting the pump, install closed guards around all exposed rotating parts.
- 4. Never run pump dry because the close running fits within the pump are lubricated by the fluid being pumped and dry running may result in pump seizure or bearing damage.
- 5. Before starting the pump, check for proper priming.

Table 1. Recommended Oil Types for Bearing Lubrication

MANUFACTURER	IPSO GRADE 68	IPSO GRADE 100
Royal Purple	Synfilm 68	Synfilm 100
Texas	Regal NO 68	Regal NO 100
Phillips	Magnus 68	Magnus 100
Exxon	Teresstic 68	Teresstic 100
Mobil	DTE 16	DTE 18

6. If excessive vibration or noise occurs during operation, shut the pump down and consult a Carver Pump Company representative.

B. Starting the Pump

1. Fully open the suction valve.
2. Check pump for proper priming and lubrication.
3. Start the pump.
4. Slowly open discharge valve and adjust it to the operating conditions required (see pump nameplate for design point condition).

C. Operating Checks

1. Check for undue vibration or noise. If any occurs and does not stop within a short period of time, turn off the pump. For determination of the cause and its remedy refer to "Troubleshooting" in section V or consult a Carver Pump Company representative.
2. Check that pump is operating within design criteria and perimeters.
3. Check and record bearing temperature. It should not exceed 180 degrees F.
4. Check and record amp draw of the driver.
5. If unit is equipped with a constant level oiler, check oil level in the constant level oiler and refill as required.

D. Stopping the Pump

1. Begin to partially close discharge valve.
2. Tag out and lock power to driver according to OSHA Standard 1910.147.
3. Completely close discharge and suction valves.

E. Indefinite Shutdown

CAUTION

When pump is handling hazardous fluid, extreme care must be taken to ensure safety of personnel when attempting to drain pump. Suitable protection devices should be used and/or protective clothing should be worn.

Remove casing plug to drain casing. Drain all piping if there is a possibility of liquid freezing. Provide pump and driver with a protective cover.

V. Troubleshooting Operating Problems

If you have followed the installation and starting procedures outlined in this manual, the pump should provide reliable service and long life. However, if operating problems do occur, significant time and expense can be saved if you refer to table 2 to eliminate the most common causes of those problems.

NOTE

For driver troubleshooting, refer to "Driver" appendix.

VI. Maintenance and Repair

Generally the pumps do not need continuous supervision. Occasional visual checks are recommended. Data should be recorded for each pump to keep track of maintenance which has been performed and to note operational problems. A maintenance record is provided for this purpose at the back of this manual.

A. Field Inspection (shutdown not required)

Perform field inspection at regular intervals and cover the following procedures.

1. Check that pump is operating within design conditions.
2. Check power input and speed of driver.
3. Check pump for quiet running.
4. Check bearing temperature. Bearing temperatures up to 180 degrees F are normal depending on ambient temperature. Check temperatures by placing contact-type thermometer against bearing frame (19). A sudden temperature rise indicates damage that requires checking.
5. If equipped with a constant level oiler (125), check oil level in the constant level oiler (125) and refill as required. Check condition of oil in bearing frame (19). Any irregular findings which cannot be adjusted during operation require pump shutdown.
6. If equipped with an oil view gauge (143) check oil level. Refill with oil, if oil level is not in the middle of the sight glass.

Table 2. Pumping Unit Troubleshooting

Symptom	Cause	Remedy or Action
Low discharge pressure.	Lost prime.	<ul style="list-style-type: none"> • Open all vent cocks to release trapped air and fill pump and suction pipe completely with fluid.
	Excessive suction lift.	<ul style="list-style-type: none"> • Check pump inlet for clogging. • Check NPSHa.
	Speed too low.	<ul style="list-style-type: none"> • Check motor speed and power supply.
	Pump clogged.	<ul style="list-style-type: none"> • Check impeller for clogging.
	Wrong direction of rotation.	<ul style="list-style-type: none"> • Correct rotation is clockwise when viewed from motor end.
	Air leaks.	<ul style="list-style-type: none"> • Examine suction piping and pump for air leaks. • Check pump gaskets.
	Vapor lock, low NPSHa, poor suction.	<ul style="list-style-type: none"> • Check NPSHa and fluid temperature to ensure that liquid in suction line is not "flashing". • Bleed suction pipe for vapor. • Check that foot valve size is adequate. • Check that suction pipe is properly submerged and in best position.
	Worn impeller or wear rings.	<ul style="list-style-type: none"> • Inspect and replace if necessary.
No discharge or low delivery.	High discharge head.	<ul style="list-style-type: none"> • Check that valves are open. • Check piping for obstructions or blockage. • Check total system head.
	High viscosity or specific gravity.	<ul style="list-style-type: none"> • Fluid viscosity and specific gravity should be consistent with anticipated performance.
Vibration and noise.	Cavitation or running dry.	<ul style="list-style-type: none"> • Check pump operating conditions.
	Unbalanced impeller.	<ul style="list-style-type: none"> • Check for impeller damage, clogging or rubbing contact with casing.
	Non-rigid mount.	<ul style="list-style-type: none"> • Check mounting for rigidity, replace if necessary.
Excessive wear.	Dirt in pump.	<ul style="list-style-type: none"> • Use filter to remove.
	Chemical Attack.	<ul style="list-style-type: none"> • Check that pump materials are compatible with fluid pumped.
	Low delivery.	<ul style="list-style-type: none"> • Check pump operating conditions.
	Crystallization of fluid.	<ul style="list-style-type: none"> • Check concentration and temperature of fluid.
Pump requires excessive power.	Internal friction.	<ul style="list-style-type: none"> • Check for rubbing contact, clogging, foreign matter, etc.
	Tight bearings.	<ul style="list-style-type: none"> • Check bearings.

Table 2. Pumping Unit Troubleshooting (continued)

Symptom	Cause	Remedy or Action
Pump requires excessive power (continued).	High viscosity or specific gravity.	<ul style="list-style-type: none"> • Ensure fluid viscosity or specific gravity is correct for pump.
Bearing Overheating.	Excessive oil.	<ul style="list-style-type: none"> • Remove excess oil.
	Bent shaft.	<ul style="list-style-type: none"> • Replace shaft.
	Rotating element binds.	<ul style="list-style-type: none"> • Replace defective parts.
	Pipe strain.	<ul style="list-style-type: none"> • Check piping alignment and remove piping weight from pump with proper supports.
	Incorrect type of oil.	<ul style="list-style-type: none"> • Refer to section III, paragraph K, for proper maintenance of bearings.
	Contaminated oil.	<ul style="list-style-type: none"> • Change oil according to section III, paragraph K.
	Not enough oil.	<ul style="list-style-type: none"> • Add oil according to section III, paragraph K.

B. Field or Shop Service (shutdown required)

1. Under normal conditions, oil in bearing frame (19) should be changed every 4000 hours. To change oil, remove pipe plug (420 or 423) at bottom of bearing frame (19), drain bearing frame (19) completely, and check waste oil for impurities which might require inspection of bearings and/or oil seals. (Impurities in oil, such as dirt and water, will substantially reduce bearing life.) When bearing frame (19) is completely drained of oil, replace pipe plug (420 or 423). Fill constant level oiler (125) reservoir and allow it to fill bearing frame (19). It may take repeated fillings of reservoir to fill bearing frame (19). Refer to section III, paragraph K, for recommended oil types and specific instructions for filling constant level oiler (125).
2. Refer to a "Driver" appendix for driver lubrication.

C. Disassembly Preparations

During disassembly, match mark parts so they can be fit exactly as before. After disassembly, all parts should be thoroughly cleaned or replaced with new ones if necessary. Sealing faces should be perfectly clean. It is recommended that all o-rings and gaskets be used only once. Follow these steps before disassembling the pump:

1. Read this entire section and study figure 3 before disassembling the pump.

WARNING

Before attempting to disassemble the pump, the driver controls must be locked and tagged in the OFF position to prevent injury to personnel servicing the pump.

The Maxum Mag pump is design with integral secondary containment. This secondary containment is intended to prevent or reduce fluid or vapor loss in event of a failure in the magnet couple area. Care must be taken to insure that there are no hazardous material in this area when disassembling the pump.

2. Stop the pump according to section IV, part D.

WARNING

When pump is handling hazardous fluid, extreme care must be taken to ensure safety of personnel when attempting to drain pump. Suitable protective devices should be used and/or protective clothing should be worn.

Indicates that particular pump configuration may or may not contain part.

WARNING

The Maxum Mag pump is design with integral secondary containment. This secondary containment is intended to prevent or reduce fluid or vapor loss in event of a failure in the magnet couple area. There is a possibility of remaining fluid in the magcan and pump end even if the unit has been flushed before removal. Care must be taken to insure that there are no hazardous materials in this area when disassembling the pump.

3. Drain casing by removing pipe plug (422), if equipped. If necessary, flush pump to remove corrosive or toxic pumpage. Reinstall pipe plug (422) in casing (1) when fluid has completely drained.
4. Disconnect auxiliary piping and gauges.
5. Drain oil from bearing frame (19). If a constant level oiler (125) or oil view gauge (143) provides lubrication for bearings, drain oil from the bearing frame by removing pipe plug (420 or 423) at bottom of bearing frame (19). If bearings are oil mist lubricated, drainage of bearing frame (19) is continuous.

D. Separation of Pumping Unit Halves

1. Remove coupling guard and disconnect coupling halves.

WARNING

When exposed, the magnets in this pump may disrupt the operation of anything affected by magnetic interference such as a pacemaker, medical staples, wrist watch or pocket watch. Proper precautions must be taken.

The Maxum Mag is designed with a secondary containment area between the pump half and the bearing frame. Before separating pump halves, be certain that there is no fluid and/or pressure build-up in the secondary containment area.

To prevent catching or squeezing your hands and fingers between the very high power rare-earth magnets, do not let your hands and fingers come in between the magnets or the pumping unit halves.

2. Remove nuts (615) and lockwashers (656) from studs (630). Using jacking screws (610), carefully back the driver assembly from the driven assembly and take to a suitable work place.

E. Disassembly of Driver Half

WARNING

When exposed, the magnets in this pump may disrupt the operation of anything affected by magnetic interference such as a pacemaker, medical staples, wrist watch or pocket watch. Proper precautions must be taken.

To prevent catching or squeezing your hands and fingers between the very high power rare-earth magnets, do not let your hands and fingers come in between the magnets or the pumping unit halves.

CAUTION

Care must be taken to keep the magnets free from metallic chips, metallic debris and other magnets, for proper operation. The magnets in this pump are very high power rare-earth magnets and will attract any magnetic material as well as other magnets.

NOTE

Do not remove the stationary halves of the shaft sealing devices unless they are to be replaced. Many shaft sealing devices cannot be reused if removed from their press fit locations.

Do not disassemble the driver half unless service is required. When disassembled, it is recommended that the bearings be replaced.

1. Remove locknut (242) and washer (243) from frame shaft (12). Remove the driver magnet assembly (232) from the frame shaft (12) and remove the magnetic seal assembly (isolator) (169) from the magnet (232). Move both the magnet (232) and the seal element to a safe area. Remove o-ring (89C) from shaft (12).

CAUTION

Handle the magnetic seal assembly (isolator) elements (169) with care so as not to damage the sealing surfaces.

2. Remove the coupling half and coupling key (46). Remove o-ring (89B) from bearing frame (19).
3. Remove the capscrews (603) and washers (663) holding the bearing cap (37) to the bearing frame (19). Remove the bearing cap (37) and outboard seal or bearing isolator (49) from the shaft (12) and remove the shaft (12) from the frame (19). Remove gasket (73).

CAUTION

Handle outboard magnetic or labyrinth (inpro) seal or bearing isolator (49) with care. Mishandling could damage the faces of the seal.

4. Uncrimp tang on bearing lockwasher (69). Remove bearing locknut (22) and bearing lockwasher (69).
5. Pull radial bearing (16) from shaft (12).
6. Pull thrust bearing (18) from shaft (12).

F. Disassembly of Pump Half

WARNING

When exposed, the magnets in this pump may disrupt the operation of anything affected by magnetic interference such as a pacemaker, medical staples, wrist watch or pocket watch. Proper precautions must be taken.

To prevent catching or squeezing your hands and fingers between the very high power rare-earth magnets, do not let your hands and fingers come in between the magnets or the pumping unit halves.

CAUTION

Care must be taken to keep the magnets free from metallic chips, metallic debris and other magnets, for proper operation. The magnets in this pump are very high power rare-earth magnets and will attract any magnetic material as well as other magnets.

1. Remove nuts (616) and lockwashers (655) from studs (631) fastening the casing (1) to the backhead (11). Pull the rotating element from the casing (1) and remove to a suitable working area.
2. Loosen setscrews (664) fastening outer rub ring (207) to backhead (11) and remove rub ring (207). Remove capscrew (600) fastening magcan (231) to backhead (11). Remove o-ring (89D) or gasket (73B) from backhead (11).

CAUTION

Fluid may remain in the magcan even when the unit has been flushed and proper precautions should be taken during removal.

3. Remove impeller nut (24). Remove impeller nut gasket(s) (30). Pull impeller (2) from shaft (6) and remove impeller key (32). Remove impeller gasket(s) (38). Note number of gaskets removed. The same number of gaskets must be used when reassembling the pump. Remove bearing backing ring (27) and impeller end plain bearing (72) from shaft (6).
4. Remove the remaining rotating elements from the backhead (11). Remove o-ring (89A) or gasket (73A) from backhead (11). If gasket (73A) is on pump, o-ring (89A) is used only for testing.
5. Remove sleeve(s) (234) and spacer sleeve (14) as applicable from shaft. Remove gaskets (73C) from sleeves as applicable. Remove o-rings (89E) from shaft (6). Remove magnet end plain bearing (72) from shaft (6).

CAUTION

Fluid may remain under the sleeve even when the unit has been flushed and proper precautions should be taken during removal.

6. Remove screws (686) locking the driven magnet (230) to the shaft (6) and remove magnet. Remove key (239) from shaft (6).
7. Remove screw (687) holding bearing assembly (233) to backhead (11) and remove bearing assembly. Use of a hoist with adequate capacity is recommended.

G. Parts Inspection

1. Inspect bearings (16 and 18) for damage and replace if necessary.
2. Inspect for damaged shaft (6) and replace shaft (6) if necessary. Shaft threads should be in good condition and the sleeve and impeller areas should not be corroded.
3. Inspect the inner magnet assembly (230) for corrosion or swelling that may indicate leakage of fluid into the magnets. Replace if damaged.
4. Replace the magcan (231) if it is corroded or damaged.
5. Inspect the bearing assembly (233), sleeve(s) (234), optional spacer sleeve (14), and plain bearings (72) and replace if worn. Refer to figure 2A or 2B.
6. If the impeller (2) shows excessive wear due to abrasion or corrosion and performance cannot be restored, it must be replaced.
7. If the wear ring (7) in the casing (1) indicates excessive wear due to abrasion or corrosion, it should be replaced. Measure the outside diameter of the front impeller hub in three places. Measure the inside diameter of the wear ring (7) in the casing (1) with an inside micrometer in three places. If the difference between the high reading of inside diameter of the wear ring and low reading of outside diameter of impeller hub exceeds double the clearances given in table 3, replace the wear ring according to paragraph H, of this section.
8. Inspect magnetic seal face, gaskets, and o-rings. They must be in perfect condition. Replace if necessary.
9. Inspect magnetic seals and replace if necessary.
10. Inspect equalizing tube or oil mist lines. Check to be sure there are no obstructions in lines.

H. Replacement of Wear Ring

The Maxum Mag pump has a replaceable wear ring (7) inserted in the casing (1). Refer to table 4 for impeller and wear ring matched materials.

The clearance between the wear ring and impeller hub will increase with wear. Internal leakage will result and pump performance will decrease. The allowable clearance and method of measurement is described in paragraph E in this section. The casing (1) must be removed from the base to replace the wear ring (7). To replace the wear ring (7) follow these steps:

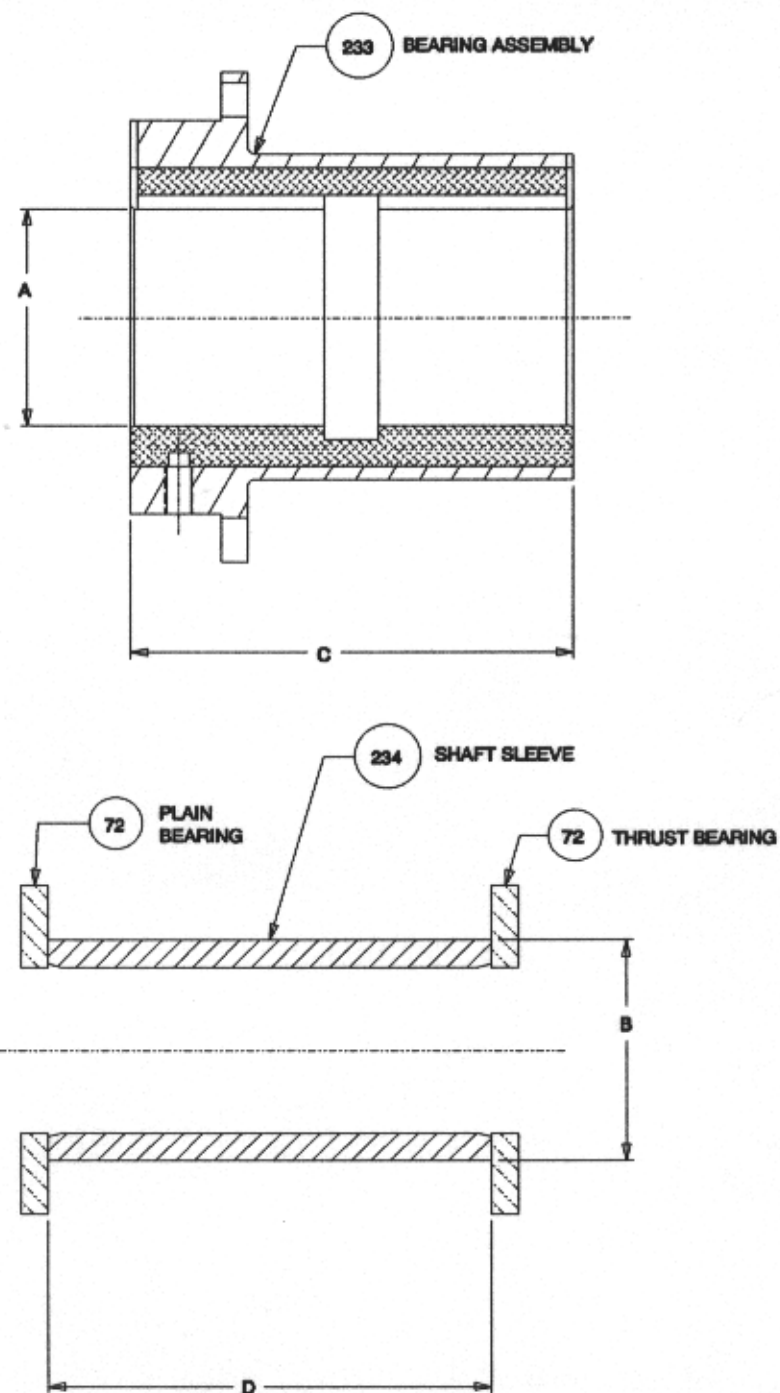
1. Disconnect suction and discharge piping. Unbolt casing (1) from base and take casing (1) and impeller (2) to a work area with access to machine shop equipment.
2. Remove setscrews (667) from wear ring (7). Remove the wear ring (7) from the casing (1). This can best be accomplished on a lathe. Take this work to a machine shop.
3. Inspect the impeller hub for damage.
4. Press the new wear ring (7) into casing (1). The beveled edge of the wear ring (7) is installed towards the impeller (2).
5. Drill and tap two holes 180 degrees apart along edge of wear ring (7). Secure new wear ring (7) to casing (1) by inserting setscrews (667) into these holes.
6. Place impeller (2) on an arbor and mount between centers in a lathe or a grinder. Indicate back of impeller hub to within 0.002 T.I.R. maximum to be sure the arbor and impeller are running square.
7. Turn the wear ring surface of impeller (2) until a 63 RMS or better finish is obtained.
8. Measure the outside diameter of the front impeller hub and record this value. See measurement instructions in paragraph E.
9. Mount the casing (1) with new wear ring (7) installed in a lathe. Indicate male rabbet to within 0.002 T.I.R. maximum.
10. Bore wear ring (7) to within the specified tolerance listed in table 3 over the recorded size of the outside diameter of the front impeller hub.
11. Reinstall casing (1) on base and secure with fastener. Reconnect suction and discharge piping.

I. Reassembly of Pump

WARNING

When exposed, the magnets in this pump may disrupt the operation of anything affected by magnetic interference such as a pacemaker, medical staples, wrist watch or pocket watch. Proper precautions must be taken.

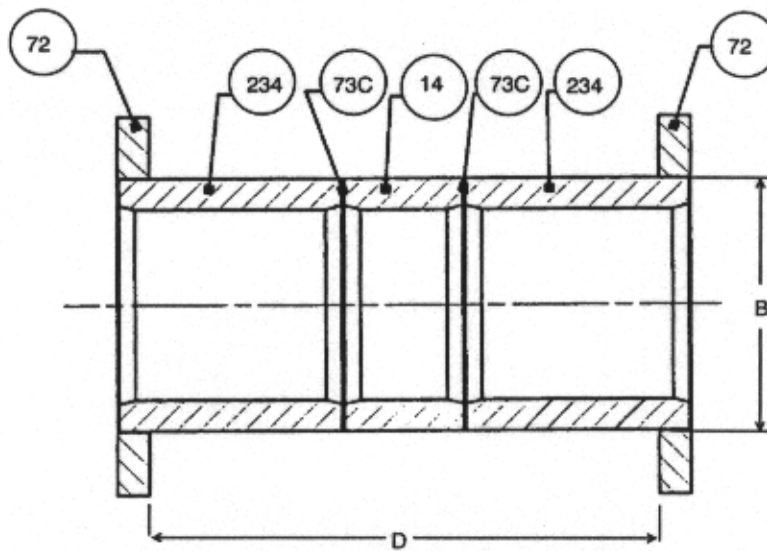
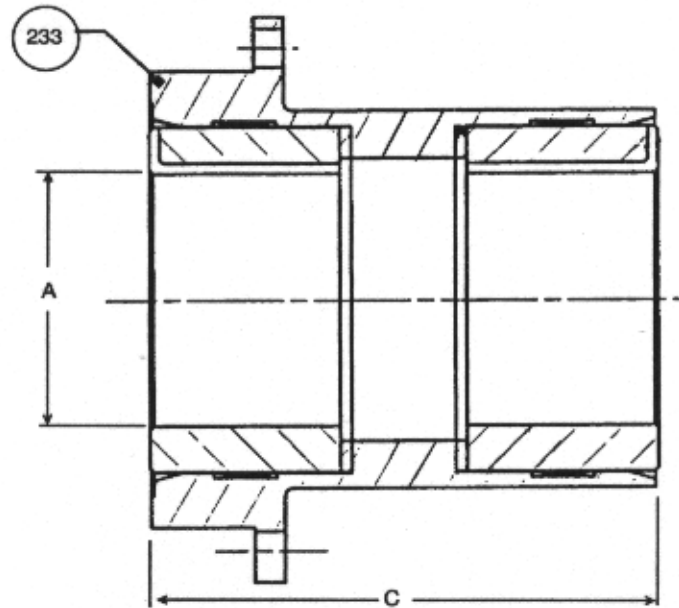
To prevent catching or squeezing your hands and fingers between the very high power rare-earth magnets, do not let your hands and fingers come in between the magnets or the pumping unit halves.



	NEW	MAXIMUM WEAR
A) BEARING I.D.	2.007"/2.009"	2.012"
B) SLEEVE O.D.	2.001"/1.999"	1.997"
C) SHAFT SLEEVE LENGTH (STATIONARY)	4.002"/3.998"	3.995"
D) BEARING ASSEMBLY LENGTH (ROTATING)	4.009"/4.007"	4.012"

Figure 2A. Bearing Clearances for Pumps without Spacer Sleeve (14)

BEARING ASSEMBLY



	NEW	MAXIMUM WEAR
A) BEARING I.D.	2.007"/2.009"	2.012"
B) SLEEVE O.D.	2.001"/1.999"	1.997"
C) SHAFT SLEEVES AND SPACER SLEEVE COMBINED LENGTH (STATIONARY)	4.002"/3.998"	3.995"
D) BEARING ASSEMBLY LENGTH (ROTATING)	4.009"/4.007"	4.012"

Figure 2B. Bearing Clearances for Pumps with Spacer Sleeve (14)

Table 3. Wear Ring Clearance

MODEL (Suction x Discharge x Maximum Impeller Diameter)	FACTORY STANDARD CLEARANCE IN INCHES	
	Minimum	Maximum
1-1/2 x 1 x 6	0.012	0.017
2 x 1-1/2 x 6	0.015	0.019
3 x 1-1/2 x 6	0.014	0.019
3 x 2 x 6	0.016	0.021
4 x 3 x 6	0.016	0.021
1-1/2 x 1 x 8	0.012	0.018
2 x 1-1/2 x 8	0.012	0.017
3 x 1-1/2 x 8	0.014	0.017
3 x 2 x 8	0.016	0.021
4 x 3 x 8	0.017	0.022
6 x 4 x 8	0.017	0.022
2 x 1-1/2 x 10	0.012	0.017
3 x 1-1/2 x 10	0.015	0.019
3 x 2 x 10	0.016	0.021
4 x 3 x 10	0.017	0.022
6 x 4 x 10	0.018	0.023
6 x 6 x 10	0.018	0.023
8 x 6 x 10	0.019	0.024
2 x 1-1/2 x 13	0.016	0.021
3 x 2 x 13	0.016	0.021
4 x 3 x 13	0.017	0.022
6 x 4 x 13	0.018	0.023
6 x 6 x 13	0.018	0.023
8 x 6 x 13	0.020	0.025
8 x 6 x 16	0.020	0.026
10 x 8 x 13	0.021	0.026
10 x 8 x 16	0.022	0.027
10 x 8 x 20	0.022	0.027

Table 4. Impeller and Wear Ring Matched Materials

IMPELLER MATERIAL	WEAR RING MATERIAL
WCB steel	Cast iron
316 stainless steel	17-4PH or Alloy-20
CD4MCU	17-4PH or Alloy 20 or Hastelloy
Alloy-20	Monel or Hastelloy
Hastelloy B	Hastelloy D
Hastelloy C	Hastelloy D

CAUTION

Care must be taken to keep the magnets free from metallic chips, metallic debris and other magnets, for proper operation. The magnets in this pump are very high power rare-earth magnets and will attract any magnetic material as well as other magnets.

NOTE

Only press on the inner race of the ball bearings (16) and (18) when installing on the shaft (12). A bearing heater is recommended for installation.

1. Press thrust bearing (18) on shaft (6). Secure thrust bearing (18) with bearing lockwasher (69) and bearing locknut (22). Crimp tang of lockwasher (69) in groove provided in bearing locknut (22).
2. Press radial bearing (16) on shaft (6).
3. Check that both bearings rotate smoothly and then reinstall shaft (6) in bearing frame (19).
4. Install new bearing gasket (73) on outboard end of bearing frame (19).
5. Press outboard magnetic seal housing (310) (if equipped) into bearing cap (37). Reinstall bearing cap (37) on shaft (12), securing it to bearing frame (19) with capscrews (603) and washers (663).

CAUTION

Handle outboard magnetic or labyrinth (inpro) seal or bearing isolator (49) with care. Mishandling could damage faces of magnetic or labyrinth (inpro) seal or bearing isolator (49).

6. Install outboard magnetic or labyrinth (inpro) seal or bearing isolator (49) in bearing cap (43). See "Magnetic Seal" appendix for instructions concerning magnetic seal.
7. Press inboard magnetic seal assembly (isolator) (169) stationary element in bearing frame (19) and rotating element on driver magnet (232).
8. Install o-ring (89C) on shaft (12) to fit between shaft (12) and driver magnet (232). Reinstall driver magnet key (238) and driver magnet (232) on shaft (12). Secure driver magnet

(232) to shaft (12) with washer (243) and locknut (242).

9. Reinstall bearing assembly (233) in backhead (11) with capscrews (687).
10. Insert key (239) in shaft (6) and install driven magnet (230), securing in place with screw (686).
11. Install o-rings (89E) on shaft (6). Install gaskets (73C) on spacer sleeve (14) as applicable. Install shaft sleeve(s) (234) and spacer sleeve (14) as applicable.
12. Slide a plain bearing (72) over shaft (6) and seat squarely against magnet (230).
13. Carefully slide shaft assembly (6) through bearing assembly (233).
14. Slide the second plain bearing (72) followed by the back ring (27) onto shaft (6).
15. Reinstall impeller key (32) in keyway on shaft (6).
16. Install new impeller nut gasket(s) (30) and impeller gasket(s) (38). Install same number of gaskets as removed during disassembly.
17. Reinstall impeller (2) on shaft (6). Secure impeller (2) with new impeller nut (24).
18. Rotate shaft (6) by hand to insure shaft (6) rotates freely.
19. Install o-ring (89D) or gasket (73B) on backhead (11). Install magcan (231) on backhead (11) with socket head capscrews (600). Install outer rub ring (207) in backhead (11) and secure with setscrews (664).
20. Install o-ring (89A) or gasket (73A) on backhead (11). If gasket (73A) is on pump, o-ring (89A) is used only for testing.
21. Reinstall rotating element in casing (1). Secure backhead (11) to casing (1) with nuts (616) and lockwashers (655) on studs (631).
22. Install o-ring (89B) on bearing frame (19).
23. With jacking screws (610) fully extended align driver assembly with driven assembly. Slowly retract the jacking screws (610), allowing the magnetic attraction to pull the two halves together.

WARNING

The Maxum Mag pump uses very high power magnetic materials. Do not attempt assemble the pump halves without using the jacking screws. Severe damage to the unit or personal harm may be caused by careless handling of these parts.

WARNING

To prevent catching or squeezing your hands and fingers between the very high power rare-earth magnets, do not let your hands and fingers come in between the magnets or the pumping unit halves.

24. Fasten the backhead (11) to the bearing frame (19) using nuts (615) with washers (656) on studs (630).
25. Align coupling according to section III, paragraph F. Reinstall coupling and coupling guard.
26. Remove all tags from valves and switches.
27. Start pumping unit in accordance with section IV, part B.

J. Torque Values

Refer to table 5 for recommended torque values.

**Table 5. Recommended Torque Values
(80% of max. spec. values for low carbon steels)**

FASTENER SIZE	TORQUE (FOOT-POUNDS)
3/8 - 16 UNC	15
1/2 - 13 UNC	30
5/8 - 11 UNC	65

K. Parts Inventory Guide

To avoid unnecessary delays for maintenance, spare parts should be on hand for normal service. Most conditions may be covered if this guide is followed. For every one to three pumps, stock one spare parts set consisting of items listed in table 6. Part numbers listed in table 6 correspond to part numbers on figure 3.

L. Parts Ordering

When ordering replacement parts, please specify:

1. Serial number of pump (located on nameplate).
2. Part name (located in table 7).
3. Part number (located in table 7).
4. Quantity of parts needed (located in table 7).

Carver Pump Company may ship an interchangeable part that is not identical in appearance or symbol. This is done only if the part has been improved. Examine parts carefully upon delivery before questioning factory or representative. Never return parts to the factory without authorization from Carver Pump Company.

If an impeller is ordered, specify diameter across blade tips. Be sure diameter was not trimmed further than diameter shown on Carver Pump Company records.

If a motor or motor parts are ordered, specify name of manufacturer and all other data on driver nameplate.

Table 6. Recommended Spare Parts

QUANTITY	ITEM NO.	DESCRIPTION
1	6	Shaft - Pump
1	2	Impeller
1	7	Wear Ring
1	14	Spacer Sleeve
1	16, 18	Ball Bearings
1	24	Impeller Nut
As Required	30	Gasket - Impeller Nut
As Required	38	Gasket - Impeller
1	49, 169	Bearing Frame Seals or Isolator
2	72	Plain Bearing
As Required	73, 73A, 73B, 73C	Gasket
As Required	89A, 89B, 89C, 89D, 89E, 89F	O-rings
1	200	Insert
1	230	Driven Magnet
1	231	Magcan
1	232	Driver Magnet
As Required	234	Shaft Sleeve