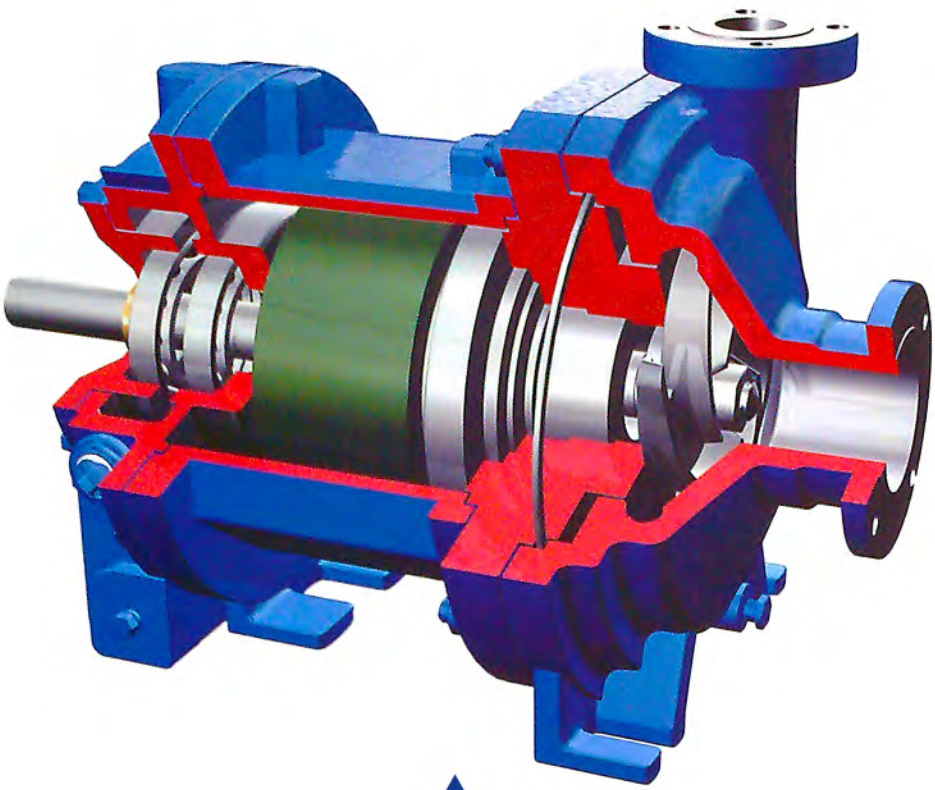
MAP Series

Metallic Magnetic Drive Pump
ASME B73.3

Installation, Operation, & Maintenance Manual



TRUFLO™
QUALITY ○ VALUE ○ SERVICE

A New Vision For Quality Pumps

PREFACE

This manual provides instructions for the Installation, Operation, and Maintenance of the TRUFLO — Magnetic Drive Centrifugal Process Pump (MAP). This Manual covers the standard production and common option that are available. For special options, supplemental instructions are supplied. **This Manual must be read and understand before installation and start-up.**

The design, materials, and workmanship incorporated in the construction of TRUFLO pumps make them capable of giving, trouble-free service. The life and satisfactory service of any mechanical unit, however, enhanced and extended by correct application, proper installation, periodic inspection, condition monitoring and careful maintenance. This instruction manual was prepared to assist operators in understanding the correct methods of installing, operating, and maintaining these pumps.

TRUFLO shall not be liable physical injury, damage or delays caused by a failure to observe the instructions for installation, Operation, and Maintenance contained in this manual.

Warranty is valid only when genuine TRUFLO parts are used.

Use of the equipment on a service other than stated in the order will nullify the warranty, unless written approval is obtained in advance from TRUFLO

Supervision by authorized TRUFLO representative is recommended to assure proper installation.

Additional manuals can be obtained by contacting your local TRUFLO representative or by calling 1-800-789-1864.

THIS MANUAL EXPLAINS

- Proper Installation
- Start-up procedure
- Operation procedures
- Routine Maintenance
- Disassembly

CONTENTS

1. SAFETY

1-1. DEFINITION

This pump has been designed for safe and reliable operation when properly used and maintained in accordance with instructions contained in this manual.

A pump is a pressure-containing device with rotating parts that can be hazardous. Operators and maintenance personnel must realize this and follow safety measures. TRUFLO shall not be liable for physical injury, damage or delays caused by a failure to observe the instructions in this manual.

Throughout this manual the words **Warning, Caution,** and **Note** are used to indicate procedures or situation, which require special operator attention.

⚠WARNING

Warning is used to indicate the presence of danger that can cause severe personal injury, death, or substantial property damage if the warning is ignored.

⚠ CAUTION

Caution is used to indicate the presence of a danger which will or can cause miner personal injury or property damage if the warn is ignored.

NOTE: *Operating procedure, condition, etc. which is essential to observe.*

EXAMPLES

⚠WARNING

Pump shall never be operated without coupling guard installed correctly.

⚠CAUTION

Throttling flow from the suction side may cause cavitation and pump damage.

Note: *Proper alignment is essential for long pump life.*

1-2. GENERAL PRECAUTIONS

⚠WARNING

Personal injury will result if procedures outlined in this manual are not followed.

- Never apply heat to remove impeller, it may explode due to trapped liquid.
- Never use heat to disassemble pumps due to risk of explosion from trapped liquid.
- Never operate pump without coupling guard correctly installed (MAP-B type).
- Never operate pump beyond the rated conditions to which the pump was sold.
- Never start pump without proper prime (sufficient liquid in pump casing).
- Never run pump below recommended minimum flow or when dry.
- Always lock out power to the driver before performing pump maintenance.
- Never operate pump without safety device installed.
- Never operate pump without discharge valve closed.
- Never operate pump without suction valve closed.
- Do not change conditions of service without approval of authorized TRUFLO representative.

2. GENERAL INFORMATION

2-1. PUMP DESCRIPTION

The Model MAP breaks into two types.

Type-A : Horizontal overhung, open impeller centrifugal, Closed coupling type pump.
Type-B : Horizontal overhung, open impeller centrifugal pump that meets requirement of ANSI B73.1.

Casing – The casing is top centerline discharge and self-venting. The gasket is fully confined. An integral foot support is used for maximum resistance misalignment and distortion from piping loads. ANSI flat face serrated and ANSI Class 300 raised face serrated are available.

Impeller – The impeller is fully open and holed on center to assemble to the Inner magnetic shaft.

End Cover – The End Cover has self-flushing hole to protect Sleeve Bearing set from dry working condition.

Sleeve Bearing Assembly – The Sleeve Bearing Assembly consists of two inner sleeve bearings, two outer sleeve bearings, two trust rings and their housing. Inner sleeve bearings are mounted on Inner magnetic shaft.

Rear Containment – Rear containment roles to separate wet-end from dry-end. 316SS is standard material, but Zirconium, Hastelloy C and PPS are used by option.

Magnet – Very strong magnets are used in MAP. Neodymium magnets are used in ambient temperature. Samarium Cobalt magnets are used in high temperature services.

Adapter – The ductile iron frame adapter has machined rabbet fit to end cover.

Bearing Frame (B-type Only) – Oil level is viewed through a sight glass. Flood oil lube is standard. The Bearing Frame is sealed with labyrinth seals.

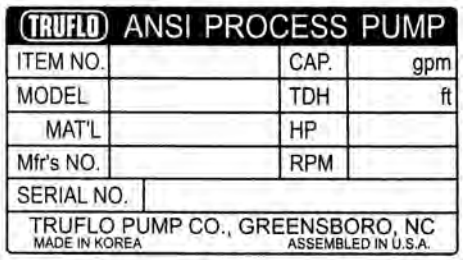
Inner Magnetic Shaft – Stainless steel Shaft with SiC Sleeve Bearing Type is standard.

Outer Magnetic Shaft (B-type Only)– Outer Magnetic assembly and two radial ball bearings are mounted on outer magnetic shaft.

Bearings (B-type Only) – The bearings are shouldered and locked to the shaft and housing to enable it to carry radial and thrust loads. All fits are precision machined to industry standards. The bearings are a single row deep groove ball bearing.

Direction of Rotation – Clockwise as viewed from the driver shaft, looking at the casing.

2-2. NAMEPLATE INFORMATION



Every pump has TRUFLO nameplate that provide information about the pump. The tag is located on bearing frame.

The tag provides information about the pump's characteristics. Note the format do the pump size : Suction x Discharge - impeller diameter in inches. (Example: 3 x 1.5 - 6)

When ordering spare parts you will need to identify pump model, size, serial number, and the item number of required parts. Information can be taken from the pump casing tag. Item numbers can be found in this manual.

2-3. RECEIVING THE PUMP

Inspect the pump as soon as it is received. Carefully check that everything is in good order. Make notes of damage or missing items on the receipt and freight bill. Fill any claims with the transportation company as soon as possible.

2-3-1. Storage Requirements

Short Term: (less than 6 months) TRUFLO normal packing procedure is designed to protect pump during shipping. Upon receipt store in a covered and dry location.

Long term : (more than 6 months) Preservative treatment of bearings and machined surfaces will be required. Rotate shaft several times every 3 months. Refer to driver and coupling manufacturers for their long-term storage procedures. Store in a covered, dry location.

2-3-2. Handling

⚠**WARNING**
Pump and components are heavy. Failure to properly lift and support equipment should result in serious physical injury, or damage to pumps. Steel-toed shoes must be worn at all times.

Be careful when moving pumps. Lifting equipment must be able to adequately support the entire assembly. Hoist bare pump using a suitable sling, under the suction flange and bearing frame. Baseplate mounted units are moved with slings under the pump casing and driver.

3. INSTALLATION

3-1. SITE/FOUNDATION

A pump should be located near the supply of liquid and have adequate space for operation, maintenance, and inspection.

Baseplate mounted pumps are normally grouted on a concrete foundation, which has been poured on a solid footing. The foundation must be able to absorb any vibration and to form a permanent, rigid support for the pumping unit.

The location and size of foundation bolts are shown on the outline assembly drawing, provided with pump data package.

Foundation bolts commonly used are sleeve type and L-type. Bolt designs permit movement for final bolt adjustment.

3-2. LEVEL BASEPLATE

1. Place 2 sets of wedge or shims on the foundation, one set on each side of every foundation bolt. The wedges should extend 3/4 in (20mm) to 1.5 in (40mm) above foundation, to allow for adequate grouting. This will provide even support for the baseplate once it is grouted.
2. Remove water and/or debris from anchor bolt holes/sleeves prior to grouting. If the sleeve type bolts are being used, sill the sleeves with rags to prevent grout from entering.
3. Carefully lower baseplate onto foundation bolts.
4. Level baseplate to within 1/8 inch (3.2mm) over length of the baseplate and to within 0.088 inch (1.5mm) over the width of the base by adjusting wedges.
5. Tighten bolts by hand.

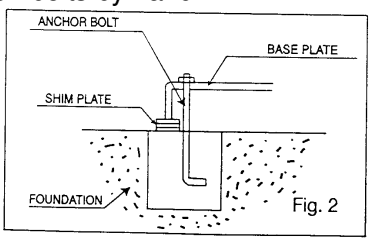


Fig. 2

3-3. ALIGNMENT PROCEDURE (B-type Only)

⚠WARNING
Before beginning any alignment procedure make sure that drive power is shut down. Failure to shut down driver power may result in serious physical injury.

To remove guard refer to coupling guard assembly/disassembly instruction.

The points at which alignment is checked and adjusted are :
Installation Alignment is done prior to operation when the pump and the driver are at ambient temperature.
Final Alignment is done after operation when the pump and driver are at operating temperature.

Alignment is achieved by adding or removing shims from under the feet of the driver and shifting equipment horizontally as needed.

Note : *Proper alignment is the responsibility of the installer and user of the unit.*

Accurate alignment of the equipment must be attained. Trouble free operation can be accomplished by following these procedures.

3-3-1.Alignment Check

Initial Alignment (Cold Alignment)
Before Grouting Baseplate – To ensure alignment can be obtained.
After Grouting Baseplate – To ensure no changes have occurred during grouting process.

After connecting pipe – To ensure pipe strains have not altered Alignment. If changes have occurred, alter piping to remove pipe strains on pump flanges.
Final Alignment (Hot Alignment)
After first run – To obtain correct alignment when both pump and driver are at operating temperature. Thereafter, alignment should be checked periodically according to plant operating procedures.

Note : *Alignment check must be made if a process temperature change, piping changes and or pump service is performed.*

3-3-2.Alignment Criteria

Good alignment is achieved when the dial indicator readings are 0.002 inch (0.05mm) as specified in the alignment procedure.

During the installation phase, however, it is necessary to set the parallel alignment in the vertical direction to different criteria due to difference in expansion rates of the pump and driver. Table 1 shows recommended preliminary (cold) settings for electric motor driven pumps base on different pumpage temperature. Driver manufacturers should be consulted for recommended cold settings for other type of drivers (steam turbines, engines, etc.)

Table 1
Cold setting of Parallel
Vertical Alignment

PUMPAGE TEMPERATURE	SET DRIVER SHAFT
50°F(10°C)	0.002(0.05mm) High
150°F(65°C)	0.001(0.03mm) High
250°F(120°C)	0.005(0.12mm) High
350°F(175°C)	0.009(0.23mm) High
450°F(218°C)	0.013(0.33mm) High
550°F(228°C)	0.017in(0.43mm) High
650°F(343°C)	0.021in(0.53mm) High
700°F(371°C)	0.023in(0.58mm) High

3-3-3.Set Up

1. Mount two dial indicators on one of the coupling halves (X) so they contact the other coupling half. (Y) (Fig.3)
2. Check setting of indicators by rotating coupling half X to ensure indicators stay in contact with coupling half Y but do not bottom out. Adjust indicators accordingly.

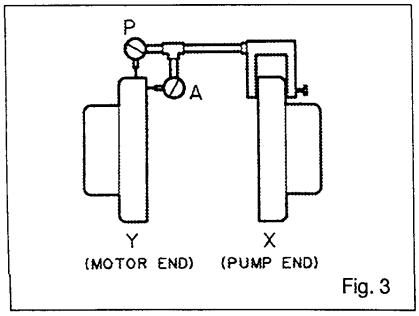


Fig. 3

3-3-4.Measurement

1. To ensure accuracy of indicator readings, always rotate both coupling halves together so indicators contact the same point on coupling half Y. This will eliminate any measurement problems due to run out on coupling half Y.
2. Take indicator measurements with driver feet hold-down bolts tightened. Loosen hold down bolts prior to making alignment corrections.
3. Take care not to damage indicators when moving driver during alignment corrections.

3-3-5.Angular Alignment

A unit in angular alignment is obtained when indicator A does not vary by more than 0.002inch(0.05mm) as measured at four points 90°apart.

Vertical Correction (Top-to-bottom)

1. Zero indicator A at top dead center (12 O'clock) of coupling half Y.
2. Rotate indicator to bottom dead center (6 O'clock), Observe needle and record reading.
3. Negative reading – The coupling halves are further apart at the bottom than at the top. Correct by either raising the driver feet at the shaft end (add shims) or lowering the driver feet at the other end (remove shims).
   Positive Reading – The coupling halves are closer at the bottom than at the top. Correct by either lowering the driver feet at the shaft end (remove shims) or raising the driver feet at the other end (add shims)
4. Repeat steps 1-3 until indicator A reads 0.002 inch (0.05 mm) or less.

Horizontal Correction (Side-to-Side)

1. Zero indicator A on left side of coupling half Y, 90° from top dead center (9 O'clock).
2. Rotate indicators though top dead center to the right side, 180°from the start (3 O'clock), Observe needle and record reading.
3. **Negative Reading –** The coupling halves are further apart on the right side than the left. Correct by either sliding the shaft end of the driver to the left or the other end to the right.

   Positive Reading – The coupling halves closer together on the right side than the left. Correct by either sliding the shaft end of driver to the right or the other end to the left.
4. Repeat steps 1 through 3 until indicator A reads 0.002 inch (0.05mm) or less.
5. Re-check both horizontal and vertical readings to ensure adjustment of one did not disturb the other. Correct as necessary

3-3-6.Parallel Alignment

A unit is in parallel alignment when indicator P (parallel indicator) does not very by more than 0.002inch(0.05mm) as measured at four points 90° apart at operating temperature. Note the preliminary vertical cold setting criteria, Table 1.

Vertical Correction (Top-to-Bottom)

1. Zero indicator P at top dead center of coupling (12 O'clock) half Y (Fig. 6)
2. Rotate indicator to bottom dead center (6 O'clock). Observe needle and record reading.
3. **Negative reading –** Coupling half X is lower than half Y. Correct by removing the shims of the thickness equal to half of the indicator reading under each driver foot.
   Positive reading – Coupling half X is higher than half Y. Correct by adding the shims of the thickness equal to half of the indicator reading from each driver foot.

Note: *Equal amount of shims must be added to or removed from each driver foot, otherwise the vertical angular alignment will be affected.*

4. Repeat steps 1 though 3 until indicator P read within 0.002inch (0.05mm) or less when hot, or per Table 1 when cold.

Horizontal Correction (Side-to-Side)

1. Zero indicator P on the left side of coupling half Y 90° from top dead center. (9 O'clock)
2. Rotate indicators through top dead center to the right side, 180° from the start (3 O'clock). Observe needle and record reading.
3. **Negative Reading –** Coupling half Y is to the left of coupling half X. Correct by sliding driver evenly in the appropriate direction.
   Positive Reading – Coupling half Y is to the right of coupling half X. Correct by sliding driver evenly in the appropriate direction.

Note: *Failure to slide motor evenly will affect horizontal angular correction.*

4. Repeat steps 1 through 3 until indicator P reads 0.002inch (0.05mm) or less.
5. Recheck both horizontal and vertical readings to ensure adjustment of one did not disturb the other. Correct as necessary.

3-3-7.Complete Alignment

A unit is in complete alignment when both indicators A (angular) and P (parallel) do not vary by more

than 0.002 inch (0.05mm) as measured at four points 90° apart.

Vertical Correction (Top-to-bottom)

1. Zero indicators A and P at top dead center (12 O'clock) of coupling half Y.
2. Rotate indicator to bottom dead center (6 O'clock). Observe the needle and record readings.
3. Make corrections as outlined previously.

Horizontal Correction (Side-to-Side)

1. Zero indicators A and P on the left side of coupling half Y, 90° from top dead center (9 O'clock).
2. Rotate indicator through top dead center to the right side, 180° from the start (3 O'clock). Observe needle and record reading.
3. Make corrections as outlined previously
4. Recheck both vertical and horizontal readings to ensure adjustment of one did not disturb the other. Correct as necessary.

Note: *With experience, the installer will understand the interaction between angular and parallel and will make corrections appropriately.*

Table 2
Alignment Trouble Shooting

Problem	Probable Cause	Treatment
Unable to obtain horizontal alignment, angular or parallel	Driver feet bolt bound	Loosen pump hold down bolts and slide pump and driver until horizontal alignment is achieved
	Base plate not leveled properly, probably twisted.	Determine which corners of the baseplate are high or low and remove or add shims at the appropriate corners and realign.
Unable to obtain vertical alignment, angular or parallel	Base plate not leveled properly, Probably tilted	Determine if center of baseplate should be raised or lowered and correct by evenly adding or removing shims at the center of the baseplate.

3-4. GROUT BASEPLATE

1. Clean areas of baseplate that will contact grout. Do not use the oil-based cleaners because grout will not bond to it. Refer to grout manufacturer's instructions.
2. Build dam around foundation. Thoroughly wet foundation (Fig. 4)
3. Pour grout through grout hole in the baseplate, up to level of dam. Remove air bubbles from grout as it is poured by putting, using a vibrator, or pumping the grout into place. Non-shrink grout is recommended.
4. Allow grout to set.
5. Fill remainder of baseplate with grout. Remove air as before. (Fig, 5)
6. Allow grout to set at least 48 hours.
7. Tighten foundation bolts.

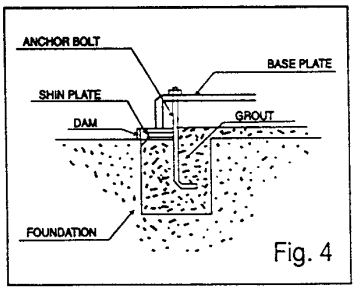


Fig. 4

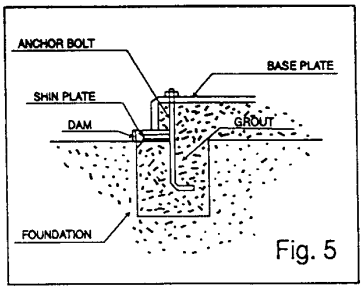


Fig. 5

3-4-1.Alignment Check (B-type Only)

Re-check alignment before continuing, using methods previously described.

3-5. PIPING

3-5-1.General

Guidelines for piping are given in the “Hydraulic Institute, Standards” available from : Hydraulic Institute, 30200 Detroit Road, Cleveland, OH. 44145-1967 and must be reviewed prior to pump installation.

⚠WARNING

Never draw piping into place by forcing at the flanged connections of the pump. This may impose dangerous strains on the unit and cause misalignment between pump and driver. Pipe strain will adversely effect the operation of the pump resulting in physical injury and damage to the equipment.

1. All piping must be supported independently of, and line up naturally with the pump flanges.
2. Piping runs should be as short as possible to minimize friction loss.
3. Do not connect piping to pump until grout has hardened and pump and driver hold-down bolts have been tightened.
4. It is suggested that expansion loops or joints be properly installed in suction and/or discharge lines when handing liquids at elevated temperatures, so linear expansion of piping will not draw pump out of alignment.
5. The piping should be arranged to allow pump flushing prior to removal of the unit on services handling corrosive liquids.
6. Carefully clean all pipe parts, valves and fittings, and pump branches prior to assembly.

3-5-2.Suction Piping

⚠WARNING

$NPSH_A$ must always exceed $NPSH_R$ as shown on TRUFLO performance curves received with order. (Reference Hydraulic Institute for NPSH and pipe friction values needed to evaluate suction piping.

Properly installed suction piping is a necessity for trouble-free pump operation. Suction piping should be flushed before connection to the pump.

1. Use of elbows close to the pump suction flange should be avoided. There should be a minimum of 2 pipe diameters of straight pipe between the elbow and suction inlet. Where used, elbow should be long radius.
2. Use suction pipe one or two sizes larger than the pump suction, with a radius of suction flange. Suction piping should never be of smaller diameter than the pump suction.
3. Reducers, if used, should be eccentric, at the pump suction flange, with sloping side down.
4. Pump must never be throttled on suction side.
5. Suction strainers, when used, must have net “free area” of at least three times the suction pipe area.
6. Separate suction lines recommended when more than one pump is operating from the same source of supply.

Suction lift conditions

1. Suction pipe must be free from air pockets.
2. Suction pipe must slop upwards to pump.
3. All joints must be airtight.
4. A means of priming the pump must be provided, such as a foot valve.

Suction head/Flooded suction conditions

1. An isolation valve should be installed in the suction line at least two pipe diameters from the suction to permit closing of the line for pump inspection and maintenance.

2. Keep suction pipe free from the air pockets.
3. Piping should be level or slope gradually downward from the source of supply.
4. No portion piping should extend below pump suction flange.
5. The size of entrance from supply should be one or two size larger than the suction pipe.
6. The suction pipe must be adequately submerged below the liquid surface to prevent vortices and air entrainment at the supply.

3-5-3.Discharge Piping

Isolation and check valves should be installed in discharge line. Locate the check valve between isolation valve and pump, this will permit inspection of the check valve. The isolation valve is required for priming, regulation of flow, and for inspection and maintenance of pump. The check valve prevents pump seal damage due to reserve flow through the pump when the driver is turned off.

1. Increasers, if used, should be placed between pump and check valves.
2. Cushioning devices should be used to protect the pump from surge and water hammer if quick-closing valves are installed in system.

3-5-4.Final Piping Check

After connecting the piping to pump

1. Rotate shaft several times by hand to be sure that there is no binding and all parts are free.
2. Check alignment, per the alignment procedure outlined previously to determine absence of pipe strain. If pipe strain exists, correct piping.

4. OPERATION

4-1. PREPARATION FOR START-UP

4-1-1.Checking Rotation

⚠CAUTION
Serious damage may result if pump is running the wrong rotation.

1. Lock out power to driver.

⚠WARNING
Shut down driver power to prevent accidental start-up and physical injury.

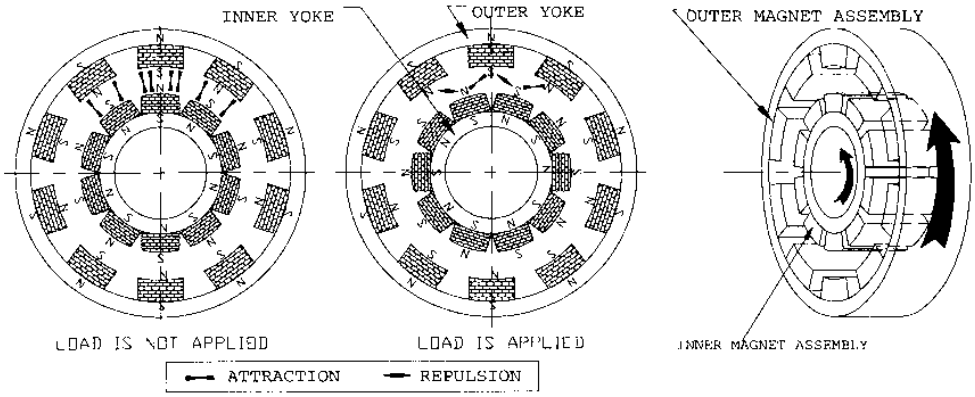
2. Make sure coupling hubs are securely fastened to shafts.
3. Unlock driver power.
4. Make sure everyone is clear. Jog driver just long enough to determine direction of rotation. Rotation must correspond to arrow on bearing housing.
5. Shut down power to driver.

4-1-2. Magnets

⚠WARNING
Persons who are assisted by electronic devices that may contain reed switches should not handle magnetic pumps or their parts. It will cause serious danger.

⚠CAUTION
Do not put magnetic sensitive items such as credit cards, floppy diskettes or magnetic tapes near the magnetic assembly.

⚠CAUTION
Do not use steel or iron tools near magnets. Steel tools such as wrenches and screwdrivers are easily attracted to magnets and can break them on contact.



A magnetic coupling consists of two magnet assemblies. One is the outer assembly (the driver magnet) and the other is the inner assembly(the driven magnet). The outer assembly is connected to a motor and the inner assembly is directly or indirectly attached to a pump impeller. As above diagram shows, at rest, magnet components of the outer assembly are aligned with their counterparts in the inner assembly. When load (torque) is applied, the coupling deflects angularly and the magnets create a force of simultaneous attraction and repulsion. This force is used to transfer torque from the motor to the impeller.

This permanent-permanent magnet coupling creates neither slippage nor induction during rotation. If excessive torque is applied, the magnets will de-couple. The magnets will not re-couple unless the pump is stopped. There is no energy loss in this permanent-permanent coupling unless an electrically conductive containment, eddy-currents will be generated which will cause energy loss.

Prior to starting the pump, check the Magnetic force. The pump efficiency is maintained when the correct magnetic force is applied.

Magnetic force must be over 3700~4000 G.

4-1-3.Couple Pump and Driver

⚠WARNING
Shut down driver power to prevent accidental rotation and physical injury.

A- Type

1. Check the fitting conditions of motor flange and adaptor.

B- Type

1. Install and lubricate coupling per manufacturer's instructions.
2. Install coupling guard.

⚠WARNING
Never operate a pump without coupling guard properly installed. Refer to Appendix ll for coupling guard installation instructions. *Personal injury will occur if pump is run without coupling guard.*

4-1-4.lubricating bearings (B-type Only)

⚠CAUTION
Pumps are shipped without oil.

Oil Lubrication: Fill bearing frame with oil, through filler connection (located on top of bearing frame), until oil level reaches the middle of the sight-glass. High quality turbine type oil, with rust and oxidation inhibitors should be used.

⚠WARNING
Operation of the unit without proper lubrication will cause bearing failure, and pump seizure.

4-1-5. Sleeve bearings and thrust rings

⚠WARNING
Stuffing box must contain the liquids. The pump uses slide bearings that are lubricated by the pumped product. Even short periods of dry running could damage the pump.

Flushing sleeve bearings and thrust rings: The endcover has two internal holes to flush the sleeve bearings and thrust rings. It will help lubricate the silicon carbide matching face and reduce the temperature on the stuffing box.

Air in the stuffing box is vented naturally by endcover holes and an axial shaft hole. One endcover hole is located on the discharge portion of the pumpage and the other is located on the stuffing box. Discharge pressure acts on the endcover hole and flushes out the mass in the stuffing box to the suction portion of the pumpage through the axial shaft hole.

4-1-6.Priming Pump

Never start the pump until it is properly primed. Several different methods of priming are used, depending upon type of installation and service involved.

Suction Supply Above Pump:

1. Slowly open the suction valve.
2. Open air vents on the suction and discharge piping until water flow out.
3. Close the vent valves.

Suction supply below pump: A foot valve and outside source of liquid may be used to prime the pump. Outside source of liquid can come from a priming pump, pressurized discharge line, or other outside supply.

1. Close discharge valve and open air vents in casing.
2. Open valve in outside supply line until only water flows out from the vent valves.
3. Close the vent valves and then the outside supply line.

4-2. STARTING PUMP

1. Make sure suction valve and any re-circulation or cooling lines are open.
2. Fully close or partially open discharge valve as dictated by system conditions.
3. Start Driver.

⚠**CAUTION**
Immediately observe pressure gauges. If discharge pressure is not quickly attained, stop driver, reprime and attempt to restart.

4. Slowly open discharge valve until the desired flow is obtained.

⚠**CAUTION**
Observe pump for vibration levels, bearing temperature and excessive noise. If normal levels are exceeded, shut down and resolve.

4-3. OPERATION

4-3-1.General Considerations

Always vary capacity with a regulating valve in the discharge line. Never throttle flow from the suction side.

Driver may overload if the pumpage specific gravity (density) is greater than originally assumed, or the rated flow rate is exceeded.

Always operate the pump at or near the rated conditions to prevent damage resulting from cavitation or recirculation.

4-3-2.Operating at Reduced Capacity

⚠**WARNING**
Do not operate pump below minimum rated flows or with suction and/or discharge valve closed. These conditions may create an explosive hazard due to vaporization of pumpage and can quickly lead to pump failure and physical injury. Refer to Appendix III.

Damage occurs from:

1. Increased vibration levels – Affects bearings, stuffing box (or seal chamber), and mechanical seal.
2. Increased radial thrusts: Stress on shaft and bearings.
3. Heat built up – Vaporization causing rotating parts to score or seize.
4. Cavitation – Damage to internal surface of pump.

4-3-3.Operating under Freezing Conditions

Exposure of freezing conditions, while pump is idle, could cause liquid to freeze and damage the pump. Liquid inside pump should be drained. Liquid inside cooling coil, if used, should be drained too.

4-4. SHUT DOWN

1. Slowly close discharge valve.
2. Shut down and lock driver to prevent accidental rotation.

⚠**WARNING**
When handling hazardous and/or toxic liquids, proper personal protective equipment should be worn. If pump is being drained, precaution must be taken to prevent physical injury. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.

4-5. FINAL ALIGNMENT

1. Run the unit under actual operating conditions for a sufficient length of time to bring the pump and driver up to operating temperature.
2. Check alignment according to alignment procedure in section 3 while unit is sill in the operating temperature.
3. Reinstall coupling guard. Refer to coupling guard instruction in Appendix II.

5. PREVENTIVE MAINTENANCE

5-1.GENERAL COMMENTS

A routine maintenance program can extend the life of your pump. Well-maintained equipment will last longer and require fewer repairs. You should keep maintenance records, this will help pinpoint potential causes of problems.

5-2.MAINTENANCE SCHEDULE

Routine Maintenance

- Bearing lubrication
- Vibration analysis
- Discharge pressure
- Temperature monitoring

Routine Inspection

- Check level and condition of oil through sight glass on bearing frame.
- Check for unusual noise, vibration and bearing temperature.
- Check for pump and piping leakage.

3 Month inspections

- Check for cracks on the silicon carbide sleeve bearing set and thrust ring.
- Check rear containment shell.
- Check foundation and hold-down bolts for tightness.
- If pump has been left idle, check packing. Replace if required.
- Oil should be changed at least every 3 months (200 hours) or more often, if there are any adverse atmospheric or any other conditions which may cloudy or cause contamination as seen by inspection through the sight glass.
- Check shaft alignment and realign if required.

Annual Inspections

- Check the magnetic force.
- Check pump's capacity, pressure and power. If pump performance does not satisfy your process requirements, and process requirements have not changed, pump should be disassembled, inspected, and worn parts should be replaced, otherwise a system inspection should be done.

5-3.MAINTENANCE OF BEARINGS

5-3-1.Oil Lubricated Bearings (B-type only)

⚠WARNING

Pumps are shipped without oil. Oil lubricated bearings must be lubricated at the job site.

Remove fill plug and add oil until level is at the center of sight glass. Replace fill plug.

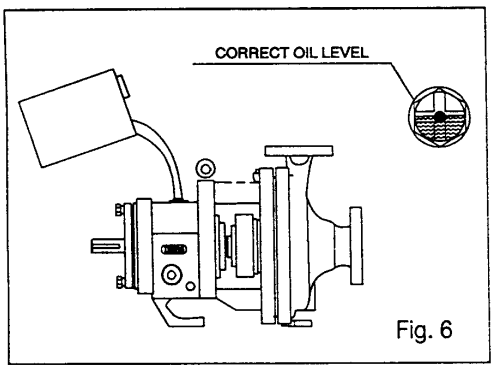


Fig. 6

Change the oil after 200 hours for new bearings, thereafter every 2000 operating hours or 3 months. (Whichever comes first.)

The containing volume of lubricating oil is 0.75pints(300ml).

High quality turbine oil with rust and oxidation inhibitors should be used. For the majority of operational conditions, bearing temperatures will run between 120°F(50°C) and 180°F(82°C). In this range, an oil of ISO viscosity grade 68 at 100°F (40°C) is recommended. If bearing temperatures exceed 180°F (82°C) use ISO viscosity grade 100 with bearing frame cooling. See Table 5. For higher operating temperatures, pumpage above 350°F (177°C), synthetic lubrication is recommended.

Table 5
Lubricating Oil Requirements

	Pumpage temperature below 350°F(177°C)	Pumpage temperature above 350°F(177°C)
ISO Grade	VG 68	VG 100
Approx. SSU at 100°F (38°C)	300	470
DIN 51517	C68	C100
Kinem, viscosity at 100°F(40°C) mm^2/sec	68	100

Some acceptable lubrication is :

Exxon	Teresstic EP 68
Mobil	Mobil DTE 26 300 SSU @ 100°F (38°C)
Sunoco	Sunvis 968
Royal Purple	SYNFILM ISO VG 68 Synthetic Lube

5-4.MAINTENANCE OF SLEEVE BEARINGS, THRUST RINGS

Since sleeve bearings and thrust rings cannot be monitored, it is important to inspect the pump for wear after the initial 500 hours or three months of operation, whichever comes first. Inspect again 6 or 12 months, depending on the results of the first inspection.

5-4-1.Sleeve bearing and thrust ring assembly

⚠**CAUTION**
Before inspecting the wet end, be sure that the pump has first been cleaned of all dangerous liquids.

Note : *Gasket must be reinstalled by new one.*

Check for the cracks in sleeve bearings and thrust rings. If any of the parts have been cracked, replace them.

Check for wear in sleeve bearing. If the wear generation is greater than 0.003inch(0.075mm), replace it. The silicon carbide bushing will not exhibit wear under normal operation. Polishing on silicon carbide surfaces is a normal condition of running and does not require replacement.

Check for slurry. If the pumped liquid contains slurry, it may build up near the back of the main sleeve bearing. This build-up may cause clogging of the journal bearing area of the main sleeve bearing and create a dry-run condition. Estimate the rate of build-up from the first inspection and schedule the unit for future maintenance accordingly.

5-5.MAINTENANCE OF REAR CONTAINMENT SHELL AND INNER SHAFT

5-5-1. Rear containment shell

Check for erosion/corrosion of rear containment shell. If there are any signs of erosion or corrosion, replace it.

Check for slurry. If the pumped liquid contains slurry, it may build up near the corner of the rear containment shell. This build-up may cause clogging of the cooling re-circulation area of inner magnetic assembly and generate the heat to demagnetize it. Estimate the rate of build-up from the first inspection and schedule the unit for future maintenance accordingly.

5-5-2. Inner shaft

Check for slurry. If the pumped liquid contains slurry, it may build up in the center hole of inner shaft. This build-up may cause clogging of the cooling re-circulation area of inner magnetic assembly and generate the heat to demagnetize. Estimate the rate of build-up from the first inspection and schedule the unit for future maintenance accordingly.

5-6.MAINTENANCE OF MAGNETS

⚠WARNING
Persons who are assisted by electronic devices that may contain reed switches should not handle magnetic pumps or their parts. It will cause serious danger

⚠CAUTION
Do not put magnetic sensitive items such as credit cards, floppy diskettes or magnetic tapes near the magnets assembly.

⚠CAUTION
Do not use steel or iron tools near magnets. Steel tools such as wrenches and screwdrivers are easily attracted to magnets and can break them on contact.

Check the magnetic force. Magnetic force must be above 3300~3000G

6. DISASSEMBLY

6-1.DISASSEMBLY

Both the close coupled(A-type) and long coupled(B-type) pumps can be pulled back from the casing. Therefore, if permitted by company regulations, pump disassembly and inspection can be conducted on site.

⚠WARNING
Shut down driver power to prevent accidental rotation and physical injury.

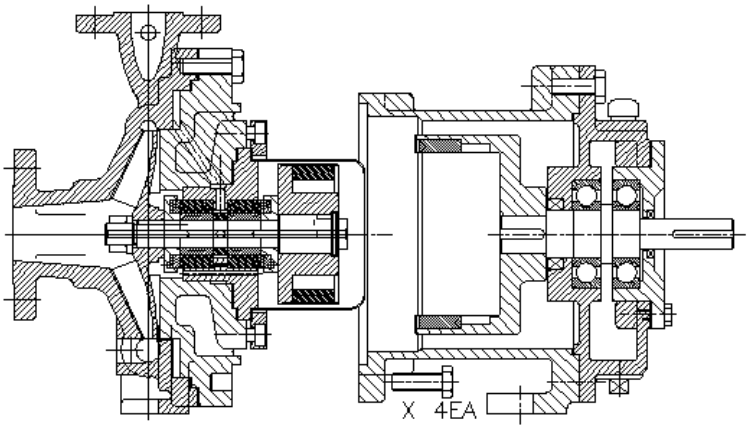
⚠CAUTION

Before disassembling the pump. Be sure that the pump has first been cleaned of all dangerous liquids.

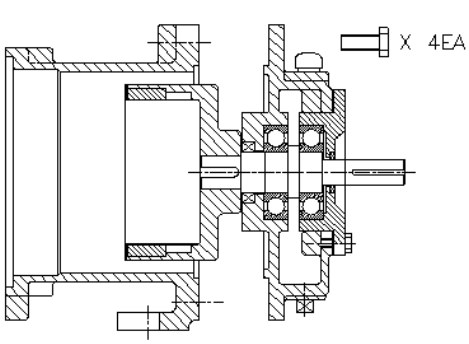
⚠CAUTION

Before disassembling the pump. Be sure to have a spare casing gasket and rear containment gasket on hand to install after inspection is completed.

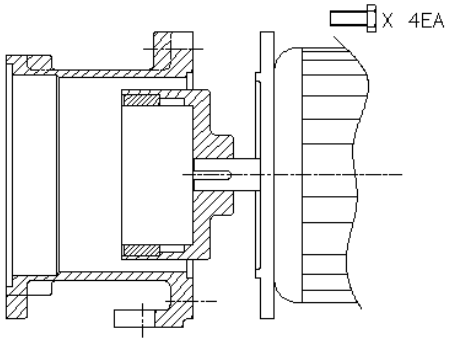
1. Remove the coupling guard (B-type)
2. Remove the coupling(B-type)



3. Remove the adaptor bolts. Separate the magnetic coupling between the drive end and the wet end, then pull back the drive end at least 12”(300mm).



B-type



A-type

4. Remove the bearing frame bolts/motor flange bolts. Separate the adaptor.

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⚠CAUTION

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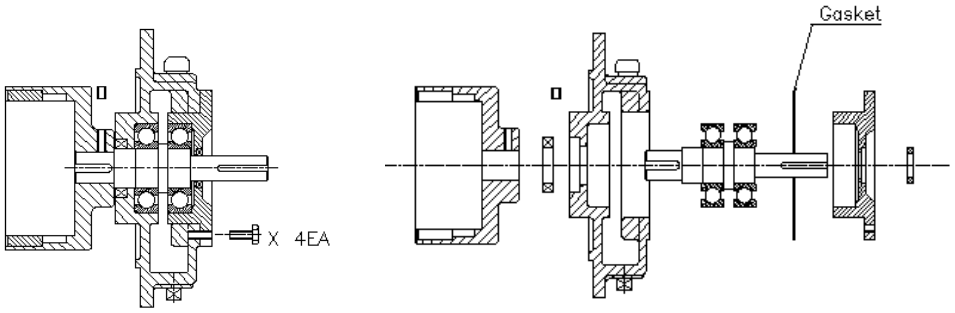
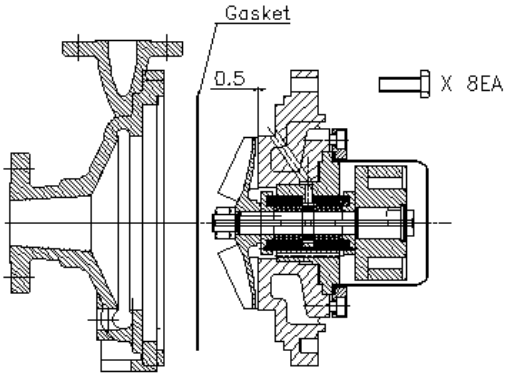
⚠CAUTION

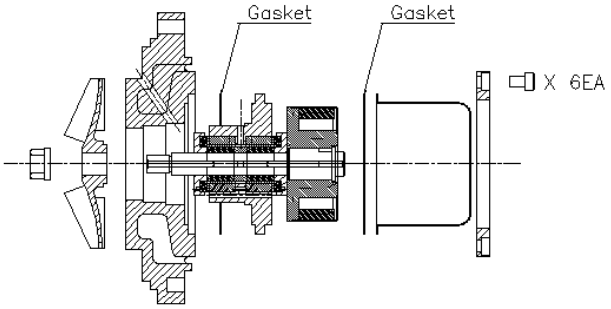
Do not use steel or iron tools near magnets. Steel tools such as wrenches and screwdrivers are easily attracted to magnets and can break them on contact.



5. Remove the bolts on bearing housing and screw on outer magnetic assembly.
6. Remove the outer magnetic assembly.
7. Pull back the bearing housing, then remove the shaft-bearing assembly from the bearing housing.



8. Remove the bolts securing the endcover to the casing, and then carefully pull out the wet end assembly.



9. Remove the bolts securing the rear containment shell to the endcover, then remove the rear containment shell.

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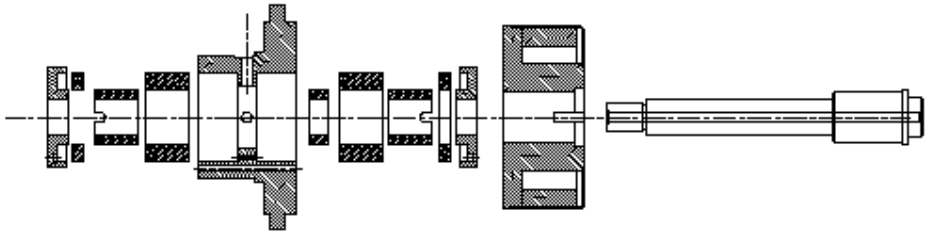
Do not use steel or iron tools near magnets. Steel tools such as wrenches and screwdrivers are easily

attracted to magnets and can break them on contact.

10. Horizontally support the inner magnetic assembly to remove the impeller nut. Once the impeller nut is removed the wet end parts are free. Caution is necessary.

⚠CAUTION

If the silicon carbide bushing is dropped on a hard surface such as concrete, the impact may cause the silicon carbide bushing to break.



11. Hold down the inner magnetic assembly. Pull up the main bushing shell, and then the wet end parts can easily be separated.

6-2.SECTIONAL DRAWINGS

Sectional drawings are attached.
Gasket material and wet end part material can be changed by customer's operating specifications.